Nile Basin Initiative
Eastern Nile Subsidiary Action Program
(ENSAP)

Final Report
Eastern Nile Irrigation and Drainage Studies
Cooperative Regional Assessment
Phase 3: Finalization and Conclusion Report

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EASTERN NILE IRRIGATION AND DRAINAGE STUDY

COOPERATIVE REGIONAL ASSESSMENT

FINALIZATION REPORT

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List of acronyms

ADLI	Agriculture Development Led Industrialization (Ethiopia)
BCEOM	Bureau de Conseil et d'Etudes Outre-Mer (France)
BCM	Billion Cubic Metre
BCWUA	Branch Canal Water Users Association (Egypt)
BoARD	Bureau of Agriculture and rural Development (Ethiopia)
BoWR	Bureau of Water Resources (Ethiopia)
COMESA	Common Market for Eastern and Southern Africa
CPO	Cooperative Promotion Office (Ethiopia)
CRA	Cooperative Regional assessment
CSA	Central Statistical Agency (Ethiopia)
DIU	Dam Implementation Unit (Sudan)
ENIDS	Eastern Nile Irrigation & Drainage Study
ENSAP	Eastern Nile subsidiary Action Program
EPADP	Egyptian Public Authority for Drainage Projects
FAO	Food and Agricultural Organization (of the United Nations Organization)
FTC	Farmers Training Centre (Ethiopia)
GDP	Gross Domestic Product
GM	Green Mobilization Program (Sudan)
GWS	Ground water Sector (Egypt)
ha	Hectare
HADA	High Aswan Dam Authority (Egypt)
ID	Irrigation Department (Egypt)
IIMP	Irrigation Improvement and Management Project (Egypt)
IIP	Irrigation Improvement Project (Egypt)
IIS	Irrigation Improvement Sector (Egypt)
IOGD	Irrigation Operation General directorate (Sudan)
IS	Irrigation Sector (Egypt)
IWC	Irrigation Water Corporation (Sudan)
IWMU	Integrated Water management unit (Egypt)
MALR	Ministry of Agriculture and Land Reclamation (Egypt)
MDGs	Millennium Development Goals
MED	Mechanical and Electrical Department (Egypt)
MoARD	Ministry of Agriculture and Rural Development (Ethiopia)
MoWR	Ministry of Water Resources (Ethiopia)
MWRI	Ministry of Water Resources and Irrigation (Egypt, Sudan)
NBI	Nile Basin Initiative
NWD	Nile Water Directorate (Sudan)
NWRC	Nile Water Research Centre (Egypt)
O&M	Operation and Maintenance
PASDEP	Plan for Accelerated Sustainable Development and Eradication of Poverty (Ethiopia)
PBDAC	Principal Bank for the Development of Agricultural Credit (Egypt)
PS	Planning sector (Egypt)
RBO	River Basin Organization
SDPRP	Sustainable Development and Poverty Reduction Program (Ethiopia)
TVET	Technical Vocational Educational Centre (Ethiopia)
TWRO	Technical Water Resources Organ (Sudan)
USAID	United States Agency for International Development (United States of America)
WCU	Water Communication Unit (Egypt)
WUA	Water Users Association

Introduction

The Cooperative Regional Assessment (CRA) analysis report showed that all Eastern Nile countries have ambitious plan for irrigation development that created challenges in terms of water resource availability and allocation, policies governing irrigation investment, institutional building and technology.

The aim of this report is to formulate proposals for regional processes and activities that would contribute to the shared vision of the Nile Basin initiative: *"to achieve sustainable socioeconomic development through the equitable utilization of, and benefit from, the common Nile basin water resources;"* and to the more specific objectives of regional cooperation in the irrigation sector: (i) avoidance of conflict over water resources since irrigation is the major water user in the basin, (ii) greater productivity and sustainability of irrigation development and (iii) generate synergies and economies of scale through cooperative activities.

Content of this report

Section 1 is a summary of the main findings of the analysis phase with regard to challenges and opportunities for irrigation development.

Section 2 draws a general picture of agriculture development in the Eastern Nile basin and reviews the essential elements of the general policy for agricultural/ rural development with a particular focus on the irrigation sector.

Section 3 identifies regional capacity building needs by analyzing the essential functions of irrigation development and management based on national policies objectives, challenges described in the CRA analysis report of this present study and the specific objectives of enhanced regional cooperation to determine regional capacity building needs. The essential functions of irrigation development and management are:

- Planning of irrigation projects
- Irrigation Water management
  - Technologies and water allocation rules for efficient water management
  - WUAs and public or private irrigation management autonomous entities
- Resources mobilization: cost recovery of investments and O&M.

Section 4 reviews the existing institutions of the Eastern Nile countries dealing with irrigated agriculture and propose the required institutional and legislative reforms for greater productivity and sustainability of irrigated agriculture. It also proposes a medium to long term p addressing the main challenges for irrigation development identified during the analysis phase of this present study as well as the capacity building needs discussed in section 2.

Section 4 proposes a framework of the institutional processes toward cooperative transboundary water management and utilization in the Eastern Nile.

1. Section 1: Summary of the main challenges and opportunities for irrigation development in the Eastern Nile basin.

1.1 THE CHALLENGES

1.1.1 Water resources and scope for new irrigation development

Each Eastern Nile country has unilaterally prepared strategies for new irrigation development based on Basin Master Plans or National Water Resources Plan. The total area of the planned irrigation expansion projects in the Eastern Nile basin amounts to 3.8 million hectares. The total irrigation water requirement of these projects is 49 BCM. Obviously it will not be possible to meet the demand of all the existing and planned expansion projects let alone other water uses. This is the main challenge.

Table 1: Irrigated area and irrigation water requirements in the Eastern Nile basin.

Country	Egypt	Ethiopia	Sudan	Total
Existing irrigated area (million ha)	3.5	0.1	1.9	5.5
Existing irrigation water requirement (BCM/year)	58.0	0.7	15.0	73.7
Planned irrigation projects (million ha)	1.1	1.5	1.2	3.8
Irrigation water requirements of planned projects (BCM/year)	20.0	17.0	12.0	49.0
Projected irrigated area after expansion (million ha)	4.6	1.6	3.1	9.3
Projected irrigation water requirements after expansion (BCM/year)	64.0*	17.7	27.0	108.7

Projected irrigation water requirements in Egypt assume the success of the on-going activities for improving overall water use efficiency indicated in Egypt National Water Resource Plan. In Ethiopia and Sudan, the figures in the above table are obtained by simply adding the water demand of existing and planned projects.

Figures indicated in table 1 were extracted from the countries' plans and strategies: Egypt's National Water Resources Plan (2002 – 2017), Master plans for the Abay, Baro-Akobo and Tekeze basins in Ethiopia; Nile and Blue Nile Water Studies in Sudan. The consultant did not assess the validity of these figures. However, most of the irrigation projects have been under consideration for many years and their water requirements have been estimated several times Irrigation water requirements in Sudan are lower than in Egypt although evapotranspiration is higher in Sudan. The obvious explanation is that cropping intensities in Sudan hardly reach 100% compared to 180% in Egypt.

Related sub-challenges are:

- Unilateral, uncoordinated planning of expansions and Lack of "no-borders" analysis /basin-wide perspective for irrigation development
- Lack of policy harmonization that would take into account disparities in level of socio-economic development amongst Eastern Nile countries;
- High evaporation losses in reservoir of dams in the downstream part of the basin (High Aswan dam, Roseires dam, Merawi dam)
- No regional coordination of operation rules of dams in the basin dams
- Low agricultural water productivity in Ethiopia and Sudan both in the rain-fed and irrigated sector;

- Increased frequency of extreme hydrological events such as drought and rainstorm due to climate change and thus increased variations of flow in the Eastern Nile river system and increased risk of crop failure in the rain-fed sector;

- Insufficient knowledge of water use for irrigation and of water availability for further development at the basin level;

- Sedimentation of reservoirs in Sudan limiting water availability for winter crops and thus economic viability of irrigation projects;

- Egypt plans to meet water demand of irrigation expansion project by reducing water amount/ha diverted for irrigation and reducing flow to the sea. This bears the risks of reduction of yields and cropping intensity and negative environmental impacts (pollution, salinity and pollution) in the Delta and loss of functions of the coastal environmental system. Ethiopia and Sudan water management policies consider that the basin has and will continue to have unlimited water resources. There are no adequate basin wide water demand forecasts.

1.1.2 Irrigation and agricultural technology

Outdated irrigation infrastructures
Large scale irrigation schemes in Egypt and Sudan are equipped with water control devices such as manually operated gates and moveable weirs that are difficult to operate properly even by well trained government agencies staff. In Ethiopia recent feasibility study of new irrigation schemes (i.e. Koga, Arjo Didessa, Humera) also recommend the same type of old technology which was developed in the first half of the 20th century. Irrigation technology for new irrigation development or modernization of existing schemes should respond to the need to increase productivity by lowering risk and uncertainty, but also more generally, to the necessity to increase and facilitate control over flows by users.

Low productivity of irrigated agriculture in Ethiopia and Sudan
There are clear evidences that yields obtained by irrigating farmers in Ethiopia and Sudan are significantly below achievable benchmarks. In Ethiopia yields obtained in traditional or modern small scale irrigation schemes are not significantly higher than in the rain-fed sector, however productivity of irrigated state farms is very high. This is due to a number of factors which are described in the Analysis Report of the present study.

The above is the main challenge, related sub-challenges are:

- Poor economic viability of irrigation development mainly in Sudan and Ethiopia;

Inefficient and/or ageing (in Sudan) existing water management and infrastructure
Lack of transfer of technology and best practices namely from Egypt to Ethiopia and Sudan;

- Poor irrigation management and water use efficiency / productivity

- Difficulties in implementation of O&M cost recovery policy let alone capital costs, farmers are likely to be reluctant to pay O&M charges they were not paying in the past, poor collection will lead to poor O&M and then even greater reluctance to pay;

- Difficulties in transferring management of existing schemes to WUAs and other autonomous public or private management entities. Farmers are likely to be reluctant to form WUAs and take the burden of irrigation management from governments.

1.1.3 Policy related challenges

- **Lack of regional strategy for irrigation development**

The Eastern Nile countries plan irrigation development based on land and water availability within the country and on projections of the national demand and supply concept of economic sectors

such as agriculture, demand of agro-industries and domestic consumption. In Egypt and Sudan, estimates of water availability refer to the limitations imposed by the 1959 Nile Water Sharing Agreement between both countries. Ethiopia does not recognize the 1959 agreement and the country plans for irrigation expansion are based on physical limitations (land suitability and water resources) only. Hence the main challenge is shifting from unilateral to basin level planning of irrigation development. The formulation and enforcement of a tripartite agreement on the use of the Eastern Nile waters would be a major achievement of regional cooperation under the auspices of the Nile basin initiative.

Cost recovery policy

All Eastern Nile countries want to implement institutional and legislative reforms aiming at recovering at least irrigation O&M costs. The challenge lies in the definition of effective mechanisms for assessing, collecting and adequately using the O&M fees. A related sub-challenge is the risk that irrigation bureaucracy over emphasizes on water issues while the key factors of success of cost recovery policy may well be related to alleviating non-water constraints such as improving irrigation performance through better market and inputs access by irrigating farmers.

Irrigation management transfer policy

Governments of the Eastern Nile countries will remain in charge of planning, financing and supervising civil works of major irrigation infrastructures. However in each country the trend is to shift irrigation management responsibilities from government to users and the greater involvement of the private sector. Related challenges include:

- Formulating new regulations or regulatory frameworks for equitable and sustainable use of land and water resources by large and small scale farmers.
- Defining adequate water supply procedures or water rights at different levels and different categories of users; a prerequisite is quantification of water supplies, water delivery and uses. Without quantification, it is not possible to establish workable water rights. River basin agencies are often proposed as a key solution, but well orchestrated institutional development between existing public agencies can be as effective.

1.1.4 Institutional challenges

Weak capacity of existing institutions in charge of planning irrigation development and designing irrigation infrastructures with particular respect to:

- The definition of the types of irrigation projects, technology, cropping systems, and irrigating farmers to favour for new development and rehabilitations by sub-basins or agro-ecological zones and the criteria for selecting new or rehabilitation projects.
- The lack institutional measures and capacity building activities for improved irrigation management and the transfer of responsibilities to users group or financially autonomous private or public institutions.
- The lack of institutional measures and capacity building activities for improving on-farm productivity of irrigated agriculture;
- The lack of well defined options for recovery of O&M and capital costs according to types of schemes, farmers and cropping systems;
- The lack of institutional measures for monitoring and evaluation of irrigation performance and environmental impacts
- Minimal institutional cooperation between and within Eastern Nile countries
- Lack of institutionalized basin wide information sharing system

- Inadequate integration of irrigation and drainage with other agricultural activities: management of water in rain-fed agriculture, livestock, fisheries, agro-processing and environmental protection.

Difficulty in establishing strong and effective Water users associations mostly due to:

- Lack of or inadequate legal framework for WUAs resulting in unclear sharing of roles and responsibilities between WUAs and the public authorities;
- Resistance of water users to take the burden of irrigation management and pay for O&M given the poor performance of existing irrigation projects;
- Transfer of irrigation infrastructure without prior improvement and adaptation to users
- Lack of adequate capacity building activities for WUAs members and supporting irrigation staff.
- Weak involvement of the private sector in irrigation development and management mostly due to the absence of adequate framework for Public-Private partnerships and poor attractiveness of the irrigation sector compared to other economic sectors.

1.2 OPPORTUNITIES

1.2.1 Water allocation

Development of a concerted strategy for irrigation development at basin level
The NBI and ENSAP are an opportunity for developing a program for irrigation development acceptable by the three riparian countries. Information and tools generated by the Nile Decision Support System and the Eastern Nile Planning Model projects can support the development of such a program.

Increase irrigated area cropped by high value crops
Further studies should explore the domestic and export demand and market prospects for high value crops with a view of increasing areas cropped with high value crops and thus farmers income.

Continuous cooperation and dialog on water allocation under the overall objectives of the Nile basin Initiative.

1.2.2 Augmentation of water supply

1.2.2.1 Improving operation of existing dams

The Jebel Awlia dam is located on the White Nile approx 30 Km upstream of Khartoum. It was built in 1937 to supply water to Egypt during the low-flow summer months, but since the completion of the High Aswan Dam in 1971, it is no longer needed for this purpose. Today, the level of Jebel Awlia reservoir is maintained to reduce the pumping costs of the White Nile pump schemes, this brings about approx 3.5 BCM of water losses through evaporation from the reservoir. Lowering water level of the reservoir of the dam is a possible option for saving water but it would

increase pumping costs of the White Nile pump schemes. Further studies are needed to determine the costs and benefits of this option.

The current operation of the High Aswan dam is based on a fixed annual release of 55.5 BCM pursuant to the 1959 Agreement. However the annual Nile supply at Aswan varies considerably from one year to another; over the period 1870 – 2000, the record low was 42 BCM in 1913/14 and the record high 150 BCM in 1878/79. An alternative dam operation would be a variable annual release depending on the reservoir level. Larger releases at high level would (i) increase water availability in Egypt, (ii) reduce evaporation losses by lowering Lake Nasser level and (iii) reduce the spill to the Tushka depression. At low reservoir level, the release should be reduced.

1.2.2.2 Water storage in the upstream part of the basin

- **Blue Nile sub-basin**

Preliminary designs of a cascade of four multipurpose dams on the Blue Nile (Abay) in Ethiopia Abay were made during the Blue Nile Study Plan (USBR 1964) and the Abay Basin Master Plan (BCEOM 1999). ENSAP Joint Multipurpose Programs will comprehensively address this opportunity in line with NBI principles for projects: "win-win", "no regret" and "no harm". Potential benefits include:

- Hydropower production (potential 5,570 megawatts)
- Flow regulation that would provide Sudan with ability to irrigate large areas in the cold season when the Blue Nile flow is naturally low;
- Reducing the areas inundated by flow peaks in Sudan and water losses through evaporation in the river system;
- Reducing sedimentation in Roseires and Marawi dams in Sudan;
- Reducing the need for water storage in Roseires and Marawi dam thus saving water through reduction of evaporation losses;
- Increasing hydropower production in Roseires and Marawi dams through much increased flow during the dry season;
- Reducing the need for storage at Aswan and thus saving considerable amounts of water through reduction of evaporation losses. At present evaporation losses from Lake Nasser are in the range of 10 to 14 BCM per year depending on the lake level;
- Reducing sedimentation in Lake Nasser.

- **Tekeze- Atbara sub basin**

Concerned irrigation projects are the existing New Halfa irrigation scheme (180,000 ha) and the planned projects of upper Atbara (99,000 ha) in Sudan; Humera (60,000 ha), Angereb (16,500 ha) and Metema (11,600 ha) in Ethiopia. All these projects are dam dependant and involve the newly constructed Tekeze dam in Ethiopia and subsequent construction of the Humera irrigation scheme and further construction of dams on the Goang and Angereb rivers in Ethiopia and on the Atbara River (Rumela dam) and Setit River in Sudan to provide water for the future Upper Atbara scheme and the existing New Halfa scheme which depends of the now silted up Khashm El Girba dam.

ENSAP is an opportunity for joint investments projects which offers the following potential benefits:
Water saving through reducing evaporation losses by storing water in the upstream part of the basin
Economy of scale since construction of dams in Sudan will be no longer needed or the size of dams could be significantly reduced.

1.2.2.3 Water conservancy projects

Identified potential water conservancy projects are located in Sudan where an estimated 50 BCM of water evaporates each year from swamps.

Completion of the Jonglei canal: This old and much talked about project involves a 300 km long canal between the confluence of the Sobat River and the White Nile near the town of Malakal and the village of Bor on the Bahr al Jabal thereby diverting the water entering the Sudd, a gigantic swamp where 50% of the water is lost through evaporation. Because of many political, social and environmental reasons, implementation of the project is very unlikely in the foreseeable future.

Sobat and Machar marshes: For the same reasons as in the case of the Jonglei canal, implementation of the project is unlikely in the next future. Furthermore, to determine whether engineering works to drain water from the marshes are feasible, one needs to know whether the majority of the water in the marshes comes from rainfall or from river spills. If most of the water comes from channel spills then engineering works such as rising river banks, river dredging and upstream reservoirs to prevent water from spilling into the marshes are feasible. But if water comes largely from rainfall, much more complex and costly works would be needed as the marshes would have to be drained and water to be pumped into the Sobat. The Baro-Akobo basin study under ENTRO should tell whether or not conservancy projects for the Machar marshes can be implemented.

1.2.3 Making better use of available water

1.2.3.1 Rehabilitation and modernization projects

Enhanced regional cooperation under the auspices of the NBI and through ENSAP projects is an opportunity for rehabilitation or modernization of the existing irrigation schemes. Objectives of such projects should be: (i) improvement of irrigation efficiencies; (ii) improving technical capacity for measuring and monitoring water abstraction and water distribution and (iii) increasing on-farm productivity and farmers' income, (iv) facilitate the establishment of WUAs and other autonomous management entities and (v) define modalities for assessing, collecting and using irrigation fees for O&M.

1.2.3.2 Improving water distribution

In the Eastern Nile basin there is a continuum from poor irrigation management and non constraining water resources (mostly in Ethiopia) to much stricter water management and water scarcity (Egypt). In Sudan water control is stricter for winter crops because of higher water scarcity for the winter irrigation campaign. In Ethiopia, there are about 100,000 ha of traditional or small scale irrigation schemes in the Ethiopian part of the E.N basin. Many surveys have shown that productivity of irrigated agriculture is not significantly higher that rain fed agriculture, hence water use efficiency/productivity is low.

Water management can be significantly improved by an effective rules and procedures for water allocation in bulk and water distribution at the lower levels of the irrigation systems, as well as clear rotational rules and procedures to cope with water shortage in deficit years.

1.2.3.3 Upgrading rain-fed farming

Comparisons between actual farmers' yields in Ethiopia and Sudan to reasonable benchmarks show clear evidence than yields can be improved. The key opportunity is to reduce risk related to rainfall volatility combined with alleviating constraints such as poor credit and inputs access, poor market access, inadequate extension services, poor involvement of the private sector and so on.

1.2.3.4 Joint activities on the Establishment of WUAs and other autonomous management entities and cost recovery of O&M

All Eastern Nile countries want to transfer irrigation management of existing irrigation systems to the users. Joint activities should address the strategy and process for establishing WUAs and other autonomous public or private irrigation management entities as well as modalities for assessing, collecting and using water charges for O&M.

All the above listed actions would require capacity building activities and experience sharing among countries for successful implementation. Concerned stakeholders are research institutions, extension services and farmers' organizations.

During the CRA Consultation workshop held in Alexandria (31 October and 1 November 2009), the participants identified a number of challenges and opportunities; they are presented in table 2 next page. Most of them are discussed in this section.

Table 2: Challenges and opportunities identified during the CRA Consultation Workshop

Key issues	Challenges	Opportunities
1. Water availability	1 Imbalance between planned expansion and water availability 2 Lack of appreciation of the finite nature of water resources 3 Unilateral planning of expansions 4 High evaporation losses 5 Lack of "no borders" analysis 6 Operating rules for cascade of dams 7 Low agricultural productivity of water in Ethiopia & Sudan 8 Climate change	**1. Joint planning of future expansions** Identification of safe expansion schemes Identification of joint projects **2. Increasing water use efficiency of existing schemes** Modernization of existing irrigation & drainage systems Increasing farm productivity through research and extension services Transfer best practices Conjunctive use of surface and groundwater (but noting the differences between shallow and deep groundwater) Recycling drainage water Precede expansion by water use efficiency **3. Increasing water availability** Upstream conservation projects (water storage, Jonglei, Machar marshes) environmental, political and social challenges needs to be resolved Reduce evaporation losses from existing dam reservoirs (Aswan, Jebel Awlia) **4. Watershed management schemes** Enhance rainwater harvesting

Key issues	Challenges	Opportunities
2. Policy coherence in ensuring predictable water availability for all	1 Finalization of the CFA, specially the issues of existing agreements 2 Lack of policy harmonization taking into account disparities in development levels	Advance existing EN cooperation through joint initiatives including projects on the ground Harmonize water and agriculture related policies
3. Technology	1 Inefficiency of existing water management and infrastructure 2 Lack of inter EN countries transfer of technology and best practices 3 Inadequacy of time framed, basin wide water forecasts	Capacity building Experience sharing
4. Finance & investment	1 Lack of financing source for new investments (investing in each other) 2 Lack of finance for O&M 3 Lack of joint investment projects	Promoting / increasing EN private sector involvement (from region or elsewhere?) Promotion of EN public- private partnerships in irrigation Scoping for investment studies

Key issues	Challenges	Opportunities
5. Institutions	1 Lack of participatory management of schemes 2 Limited capacity of WUAs 3 Limited capacity of national regulatory and water management institutions 4 Lack of synergy between EN institutional studies 5 Lack of institutionalized information sharing in irrigation and drainage 6 Inadequate integration of irrigation & drainage with other agricultural activities (fisheries, livestock, agro-processing) 7 Lack of integration of irrigation with other regional initiatives to unlock water productivity (e.g. trade of virtual water). 8 Absence of EN professional body to set irrigation-related standards 9 Lack of EN wide differentiated irrigation and drainage strategy to leverage each country's unique potentials and address constraints	Strengthening WUAs Promoting regional trade of agricultural commodities and processing industries Information sharing Capacity building

2. Section 2: Review of general policies regarding rural/agriculture development in the Eastern Nile countries

2.1 MAIN FEATURES OF THE AGRICULTURAL SECTORS

2.1.1 Egypt agricultural sector

Egypt's agriculture is an intensive peasant irrigated agriculture characterized by high inputs use and high cropping intensity. The totality of the 3.7 million ha agricultural lands is irrigated with a cropping intensity of 180%. The average farm size of the approx 5 million Egyptian farming households is 1.5 feddan (0.63 ha) and 80% of holdings do not exceed 3 feddans (1.26 ha). Private commercial farming is limited to the reclaimed desert land.

The crop production can be divided in five categories: (1) cereals, (2) Fodder, (3) pulses, (4) industrial crops and (5) horticultural crops. Cropping patterns in the Delta and Upper Egypt are identical with the exception of sugar cane grown in Upper Egypt only and rice cultivated in the Delta only. Rice cultivation in the Delta is seen as one of the means to control salinity and is perhaps the last opportunity to use water before it flows to the sea.

Cereals occupy 2.7 million ha, 45% of the cultivated area. Main cereals are wheat (1.1 million ha), rice (640,000 ha) and maize (860,000 ha). Other cereals grown in Egypt are sorghum (160,000 ha) and barley (90,000 ha).

Pulses are grown of 160,000 ha; they include beans, lentils and chickpeas.

Industrial crops are grown on 640,000 ha. They include cotton (250,000 ha) the main Egyptian crop for export, sugar cane (135 000 ha), sugar beet (65,000 ha) and oil crops (soybeans 26,000 ha, sunflower 15,000 ha, sesame (30 000 ha) and groundnut (60,000 ha).

Horticultural crops are grown on approx 1.1 million ha. They include vegetables (750,000 ha) and Fruit trees, mainly citrus and bananas, occupy 350,000 ha. Medicinal plants, flowers and spices are a small but rapidly growing farm business. Horticultural products are sold for the domestic markets and provide some surplus for export. Cash crops are predominant on reclaimed desert lands.

Livestock production

Livestock is integrated in the irrigated farming for the production of meat and dairy products. Fodders are grown on 1.2 million ha. Berseem (*Trifolium alexandrinum*) is the main forage crop and occupies (1.1 million ha) and alfalfa occupies 100,000 ha. Berseem is grown in winter either over 3 months with 2 cuts as a soil improver (short berseem) usually preceding cotton, or over 6-7 months, either with 4-5 cuts as a fodder crop or grazed by tethered cattle (long berseem). There is also an extensive production system of goats and sheep in the desert range lands.

There is a large population of ruminants (table 2). The average numbers of adult livestock per farming households are 1.02 buffalo, 0.94 cows, 1.14 sheep and 1.06 goats.

Table 3: Livestock in Egypt (number of heads)

Type	Number of heads
Water buffalo	4 105 000
Cattle	4 500 000
Sheep	5 470 000
Goat	4 200 000

Source FAO AQUASTAT (2005)

2.1.2 Ethiopia agricultural sector

Ethiopian agriculture is a rain-fed peasant agriculture; commercial farming and irrigated agriculture represent so far an insignificant part in term of contribution to the national production. Ethiopian peasant agriculture is often termed as "subsistence agriculture" since common characteristics of peasant farming systems are low inputs- low outputs production. Another characteristic is the concentration of farming activity in the highly populated and now saturated highlands while some of the lowlands offer considerable and little developed potential for both rain-fed and irrigated farming. The total cultivated area in the country is approx 14 millions ha of which less than 3% is under irrigation.

The peasant highland mixed farming system is based on cereal production; it is practised on about 45 percent of the country land in areas at more than 1 500 m above sea level. Livestock production is an integral part of the system, but is increasingly being restricted to stall feeding of animals due to scarcity of land. Animal traction (oxen) is used for land preparation to produce mainly cereals: barley (only above 2500 masl), teff, sorghum, wheat and maize; pulses and oil seeds. Land holding size is generally small, between1 and 2 ha. Saturation of the system due to high population density, deteriorating soil fertility and rainfall volatility are the biggest challenges facing this production system which is largely dominant in Ethiopia both in term of area and population. Agriculture productivity is low (1.4 ton/ha for cereals in average).

The peasant highland maize-sorghum and perennial crops farming system is located in the highlands of the Southern and Western part of the Nile basin which are sparsely populated and highly forested compared to highland mixed farming systems. The system area benefits of year round rains except from December to February. It encompasses various cropping patterns such as maize-wheat; sorghum-teff-wheat; maize-enset and maize-teff-coffee[1]. Although livestock is typically integrated in this system, hoe culture is reported in some areas for enset and tuber cultivation. It is also practiced in khat and coffee fields with intercropping. The major production constraint is the fluctuation of the international market prices of coffee. Seasonal labour shortages are frequently reported during coffee harvest. Thus farmers hire casual labour, mostly landless farmers and farmers who move from other areas (Highland mixed farming system) for this purpose.

The peasant lowland crop-livestock production system is located in low-lying plains, valleys and mountain foothills, which include the northern parts of the Awash and the rift valley with elevations of less than 1 500 m. These areas mainly produce drought-tolerant varieties of maize, and sorghum along with some oil seeds and pulses. Oxen are used for providing traction power and communal grazing lands and crop residues are used for livestock rearing. Off-farm activities such as sale of firewood and charcoal are widely practised.

The peasant lowland shifting cultivation system is located in the Western and southern lowlands of the country. The major crops are sorghum, maize and millet, sorghum becoming dominant when rainfall declines toward the Sudanese border. The population in this farming system is sparse (less than 10 persons / km^2). Slash and burn is the main soil fertility management practice and plots are cultivated for one or two years then the farmer moves to another plot. The yield in this system is low (0.6 – 1 ton/ha for cereals). Despite surplus feed, livestock is little integrated in the system; this could be accounted to the prevalence of the tsetse fly in some areas. In response to the rapid population growth due to the government resettlement program and spontaneous population migration from the saturated highland mixed farming system, this system is likely to evolve into a crop-livestock production system.

Commercial farming is very limited in Ethiopia. It mostly consists of public or recently privatized **irrigated farms** producing the country's bulk of industrial crops (sugar, cotton, tobacco) and horticulture crops. There are also **State owned rain-fed farms** mostly in the region of the highland maize-sorghum and perennial crops (Bale) farming system and the rapidly growing private **cut-flower business** located in the vicinity of Addis Ababa and the rift Valley. A number of large scale farm projects are at various stages of advancement recently initiated by **foreign investors** from Brazil, China, India, Pakistan, Saudi Arabia for production of food crops, industrial crops (sugar cane) and bio-fuel.

[1] Source : Bourn, D 2002. Farming systems and natural resource management. Ministry of Agriculture, Addis Ababa, Ethiopia

Peasant irrigated farming is usually operated on a small scale. Small scale irrigation of fruits and vegetables (onion, potato, cabbage, etc) complements the livelihoods of rain-fed peasant farmers by providing cash incomes. Small scale traditional or modern irrigation is integrated into the farming systems (highland mixed system, lowland crop-livestock system) and cannot be considered as a separate farming system. There are also a number of large scale irrigation schemes under construction (Koga in Lake Tana watershed) and under study: Megech, Ribb and Anger in the Nile basin which are part of the Easten Nile fast track projetcs and Humera in the Tekeze basin.

Livestock

Ethiopia and Sudan have the highest number of livestock in Africa.

In the highland farming systems, animals provide inputs (draught power, transport, manure) to other parts of the farm system and generate consumable or saleable outputs (milk, manure, meat, hides and skins, wool, and eggs). The area available for grazing is determined by population density and cultivated area in the highland mixed farming system, and in the highland maize-sorghum and perennial crops farming system by the area planted with perennial crops, i.e. coffee and enset (pseudo- banana, a food crop.

The pastoral system supports the livelihood of approx 10 percent of the total population living in the Afar, Somali and Borena regions. Livestock is the major source of livelihood of these populations that are highly mobile in search of water and grazing. Camels are the most important animals serving as both food and means of transport. Some lowland varieties of maize, sorghum and other cereals are also cultivated on flood plains or as rain-fed crops.

Table 4: Livestock in Ethiopia (number of heads)

Type	Number of heads
Cattle	40 500 000
Sheep	26 000 000
Goat	21 700 000
Camels	2 400 000

Sources FAO AQUASTAT and Central Statistic Agency (2005)

2.1.3 Sudan agricultural sector

There are three main farming systems in Sudan namely the peasant irrigated farming, the semi-mechanized and the peasant rain-fed farming systems. The total cropped area in the country is about 18 million ha of which 9 millions ha are cultivated by small scale farmers under rain-fed condition. The irrigated area amounts to 10% of the total cropped area. Irrigated farming produces 100% of cotton, 70% of vegetables, 80% of wheat and 15% of sorghum.

The Rain-fed peasant Farming: The peasant rain-fed farming system exists in Kordofan, Darfur, Sennar, and the Blue and White Nile areas. The total cropped area in this system is estimated at 9 million hectares, with small farmers typically having 10 to 15 feddans (4.2 to 6.3 hectares). In addition to the staple food crops (sorghum and millet), the system is also largely involved in the production of oil seeds (sesame (15 percent), groundnuts (25 percent). Some farmers have recently stated to integrate livestock in their production plans. The peasant rain-fed agriculture in Sudan supports the bulk of the rural poor, estimated at 70 percent.

The Rain-fed Semi- Mechanized Farming: This system covers about 6 million hectares in rainfall areas ranging between 400-800 mm annually in Gedaref, Blue Nile, White Nile, Sennar and Southern Kordofan (Nuba Mountains) areas. Land preparation, seeding and most threshing on these farms are mechanized, while weeding and harvesting are done by seasonal labour. This system produces sorghum, sesame, sunflower and little of short stable cotton. Livestock is not integrated in this farming system.

The peasant Irrigated Farming: It consists of the Gezira irrigation scheme which started operation in the 1920's and other large public irrigation schemes constructed in the 1960's and 1970's such as for example the Rahad, El Suki, New Halfa irrigation schemes and the Managil extension of the Gezira scheme. The cumulated area of the public schemes with small holder farmers is approx 1.7 million ha. Main crops grown by this sector are sorghum, cotton, wheat, groundnut and vegetables. All the public schemes were developed based on the model of the Gezira scheme with the Ministry of Water and Irrigation in charge of O&M and tenant farmers cultivating typical farms of 15 to 20 feddans (6.3 to 8.4 ha).

Most tenant farmers and farm labourers in public irrigation schemes own cattle, especially small ruminants. Livestock, although less important than crops, are a supplementary source of income, which is used to hire labour for agricultural work before the harvest. Animals depend heavily on crop residues, industrial by-products and the grazing of limited areas of fallow and the sides of canals. Intensive cow's milk production is becoming more common within the large irrigation schemes, and these areas are seen as promising for future expansion of livestock production. Cattle are not used for land preparation. Beside this, there are also systems of contract between tenant farmers and nomadic pastoralists involving exchange of manure for crop residues or fodder, and grazing of tenants' livestock with transhumance livestock herders.

Commercial irrigated farming: It is represented by the public Kenana and New Halfa sugar estates and recently developed private irrigated farms. This sector covers approx 200,000 ha and grows sugar cane, wheat, sunflower, vegetables and fruit crops. Livestock is not integrated in this system.

Livestock production systems

Ethiopia and Sudan have the highest number of livestock in Africa. The Sudanese livestock sector is composed mainly of cattle**,** goats, sheep and camels that contribute to live animal exports, meat, hides and skins and dairy products for domestic and export markets. The spatial distribution of livestock throughout the country is largely associated with climate variability and presence of natural pastures. In general, the distribution of animals is as follows: Eastern Sudan (mainly camels); Central Sudan (cattle concentrated in the savannas); Western Sudan (sheep and cattle); Southern Sudan (mainly cattle and goats). The number of livestock heads given in the table below is approximate since there is no regular census of the livestock population in Sudan.

Table 5: Livestock in Sudan (number of heads)

Type	Number of heads
Cattle	40 000 000
Sheep	49 800 000
Goat	42 500 000
Camels	3 960 000

Source: Ministry of Agriculture of Sudan (2005)

In the northern part of the country, camels and sheep, with some goats, are raised by nomadic herders on natural rangelands. Households move with their animals and have no permanent base on which to grow crops. They spend the rainy season in the northern, semi-desert zone and during the dry season, move further south into the savannah. Income is derived from the sale of animals, meat and milk in the form of white cheese.

The transhumant agro-pastoral system is located in the Western, Central and Eastern states. In this system, households depend mainly on livestock, mostly cattle, with some sheep and goats, although there is some cropping. In western Sudan, households migrate north during the rainy season and return south to the savannah during the dry season. In the central and eastern states, migration is towards the Nile during the rainy season and back during the dry season.

An agro-pastoral system is found in Southern Sudan, where livestock are raised in traditional rain-fed agricultural systems in settled villages. Livestock are moved away from the White Nile in the period of flooding and back when the floods recede.

2.2 IMPORTANCE OF AGRICULTURE IN THE NATIONAL ECONOMIES

Egypt has the most advanced and diversified economy relying on three pillars: industry (including oil and gas), services (tourism, Suez Canal revenues, others), and agriculture. Egypt's economy is also the most integrated to the world economy with imports and exports amounting respectively to 44% and 38% of the GDP. The manufacturing sector has also important backward and forward linkages with agriculture, namely for the production of fertilizers, sugar and processed food and textile. Despite dramatic increase in crop yields and cropping intensity, agriculture share of GDP has dropped from 30% in the early 1970's to 14% today. However, agriculture still employs approx 30% of the workforce within the 5 millions of farming households cultivating small farms of 1.5 feddan (0.63 ha) in average.

Agriculture has been the main driver of economic development in **Sudan** and despite the rapid growth of the oil-sector over the last decade; agriculture is still a key sector in Sudan for economic growth and poverty alleviation. The share of agriculture in Sudan's GDP has declined from 42% in 2000 to 26% in 2008 (table 5). However, agriculture still employs today approximately 40% of the workforce. The manufacturing sector depends on agriculture for provision of raw material in form of grains, oilseeds, fruits and vegetables, sugar, cotton, leather, animal feed, animal products (meat, dairy and poultry products), and tobacco.

"Agriculture is the mainstay of the Ethiopian Economy"; this statement has almost become a cliché in Ethiopia. Today agriculture accounts for 43% of Ethiopia's GDP (down from 75% in the 1960's). Manufacturing only contributes to approx 5% as does the construction sector. Services account for about 40%. In addition, agriculture provides 85% of employment and it is the primary source of income for 87% of the rural population (or 73% of the total population). In short, Ethiopian economy is based on the labour of the millions of Ethiopian small scale farmers and the services concentrated in Addis Ababa. Irrigated state farms provide the bulk of industrial crops (sugar cane, cotton, tobacco) for the agro-industry.

Table 6: Structure of the economy of the Eastern Nile countries in 2000 and 2007

Years	2000			2007		
Economic indicators	**Egypt**	**Ethiopia**	**Sudan**	**Egypt**	**Ethiopia**	**Sudan**
GDP (billion USD)	99.84	8.18	12.37	162.82	19.39	58.44
GDP growth (annual %)	5.4	6.1	8.4	7.1	11.3	8.3
GDP per capita (USD/year)	1422	125	354	1997	328	1413
Agriculture value added (% GDP)	17	50	42	14	43	26
Industry value added (% GDP)	33	12	22	36	13	34
Service value added (% GDP)	50	38	37	50	45	40
Total exports (% GDP)	16	12	15	38	12	23
Total imports (% GDP)	23	24	18	44	29	22

Source World Bank country data profile

The livestock sector contributes for approx 30% of the agricultural GDP of Egypt and Ethiopia and for approx 50% of the agricultural GDP of Sudan.

2.3 PERFORMANCE OF AGRICULTURE

2.3.1 Performance of Egypt's agriculture

Land availability and harvested areas.

There are three categories of arable lands. The "old lands", oasis and the "new lands" or reclaimed desert lands. The "old lands" are located in the Nile Valley and the Delta and have been cultivated for several centuries if not millenniums; they cover a total area of 2.25 million ha and are characterized by alluvial (Ethiopian) clay to loamy soils deposited by the Nile over thousands of years and until the construction of High Aswan dam. The oasis area is approx 75,000 ha. The program of desert land reclamation started in the 1980's. They are located on the western and eastern sides of the delta, the Sinai region (El Salam canal project) and west of the Nile valley in Upper Egypt (Toshka project). In 2005, 2.3 million ha of desert land had been reclaimed and under cultivation.

Table 7: Evolution of arable land in Egypt 1980 – 2005 (million ha)

Years	1980	1985	1990	1995	2000	2005
Old land and oasis	2.3	2.3	2.3	2.3	2.3	2.3
New lands	-	-	0.4	1.0	1,0	1,4
Total	**2,3**	**2,3**	**2,7**	**3,3**	**3,3**	**3,7**

Source: FAO STAT.

Cropping intensity is 180% today, meaning that approx 6.8 millions ha are harvested annually. The high cropping intensity was made possible after the completion of the high Aswan dam in 1971 and through improved water management and cultivation of early maturing varieties.

Over the period 1990- 1995, the area under horticulture crops have increased by 30% due to the dominance of crash crops in new reclaimed lands and the removal of government control on production in the mid 1993. The cereal production on old lands has increased while the production of cotton has slightly declined. This reflects the policy trend of limiting Egypt's dependency on imports of cereals rather than promoting cotton, the main export crop; world market price of wheat and cotton also play an important role. Since the early 2000's, the government of Egypt tries to limit the area grown with high water consuming crops such as rice and sugar cane in order to save water and permit further reclamation of desert lands.

Table 8: Areas under main crops in Egypt 1990 - 2005
(Average by 5 years periods in thousands of ha)

Periods	1990-95	1995-2000	2000- 05
Wheat	938	1 045	1 144
Rice	513	624	636
Maize	710	716	856
Cotton	358	258	247
Sugar cane	120	132	135
Horticulture	829	997	1 086

Source FAO STAT

Yields

Egypt has high average crop yields that can be explained by the combination of the following factors:

- The favourable climatic conditions for crop growth especially in the Delta;
- Adequate and reliable water supply in most areas of the irrigation system managed by a strong irrigation bureaucracy at no cost for farmers ; and the effective dissemination of adequate technology packages (i.e. fertilizers, agro-chemicals and improved varieties);
- Investments in irrigation and drainage infrastructure: all the irrigated area of Egypt is drained, rehabilitation and improvement of the existing infrastructures at almost no cost for farmers;
- Dissemination of green revolution technology packages including improved crop varieties and animal breeds, fertilizers and pesticides;
- Efficient Public agricultural research centres and extension services at no charge for farmers.

Table 9: Yields of some major crops in Egypt 1990 - 2005 (average per five years period)

Periods	1990 - 1995	1995- 2000	2000 - 2005
Wheat (quintal/ha)	53	59	64
Rice (quintal / ha)	77	86	96
Maize (quintal/ha)	60	70	80
Cotton (quintal/ha)	21	23	25

Source: FAO STAT and Ministry of agriculture

Livestock production

Egypt is self sufficient for milk and its overall meat production covers approx 75% of the country's needs. The main constraints on production are the shortage of local feed resources, particularly in summer.

Buffalo cows generally have a longer productive life than the native or "Baladi" cows. Under good management, milk production ranges between 1000 and 3000 kg per lactation, two to three times higher than that of native cows. Milk yield of the native cows is low, about 800 kg per lactation, and is used mainly for nursing the calf. Because of increased demand for milk, Friesian cows were introduced to study their performance in local conditions and investigate the effects of cross-breeding on milk production. It was found that the cross-bred cows lactate longer and have a shorter dry period.

2.3.2 Performance of Ethiopia's agriculture

Cultivated area

The cultivated area increases a steady rate in Ethiopia. Between 1995 and 2005 the total cultivated area raised from approx 10 millions ha in 1995 to 14 millions ha in 2005 or by 40%. The main driver behind area increase is population growth. It is worth noting here that between the two last population census of 1994 and 2007, the population of Ethiopia has increased from 53 to 74 millions or also by 40% meanwhile the proportion of population in rural areas has remained stable at approx 85% of total population. There is scope for further expansion of agriculture namely in the western and southern parts of the country with relatively low population density and favourable agro-ecological conditions. Harvested area has fluctuated because of recurrent droughts resulting in crop failures every four to five years.

Cereals are largely predominant but between 2000 and 2005, there was a significant increase of area sown with pulses and oil crops of 21% and 43% respectively which can be explained by the opening of market opportunities.

Table 10: Harvested area for major crops in Ethiopia
(Average by 5 years period in ha x 1,000)

Period	1995-2000	2000-2005
Teff	1 330	1 415
Maize	1 560	1 805
Sorghum	965	1 260
Barley	1 010	1 045
Wheat	980	1 350
Pulses	1 050	1 270
Oil crops	460	660

Source Central Statistics Agency

Yields

Average Crop yields have increased because the distribution of fertilizers and supplies of improved seeds have improved and yields increases have more contributed to production growth than the expansion of cultivated lands. However agriculture in Ethiopia is still characterized by low inputs use and low outputs or in other words, it remains subsistence agriculture. In the saturated highland mixed farming system which represents 45% of total cultivated area, farming households cultivate less than one ha and can hardly produce enough food for food self-sufficiency even in good years. Given the erratic rainfall and failed harvest every 4 to 5 years, these smallholders are trapped in a low productivity trap.

Table 11: Average yields of major cereals in Ethiopia (quintal/ha)
(Average by 5 years period)

Period	1995-2000	2000-2005
Teff	9	11
Maize	15	18
Sorghum	12	14
Barley	9	10
Wheat	13	14

Source Central Statistics Agency

Livestock production

Ethiopia produced 350,000 tons of cattle meat and 1.5 million tons of milk in 2007 (source CSA). Despite the large number of cattle and small ruminants, the country exports little livestock products (meat and skins) officially but there is an important illegal cross boarder trade of live animals to Sudan.

The main constraint of livestock husbandry in the highland mixed farming system is the shrinkage of pasture land areas due to increase of cropped area driven by population pressure.

The constraints in pastoral areas are recurrent droughts and limited water sources, and limited veterinary support capacity. Due to the recurrent cycles of droughts, many pastoralists are no longer able to sustain their livelihood and poverty indicators in pastoralist areas are worse than elsewhere in the country. Market issues are also important especially for increasing income to the pastoral sector. This requires improving infrastructure (mostly roads), and ensuring that the trading system runs efficiently and transparently.

2.3.3 Performance of Sudan's agriculture

Harvested areas

The general trend shows an increase of cultivated area from 12 millions ha for the 1990-95 period to 18 millions ha in the period 2000 – 2005. The increase occurred in the rain-fed sector this is reflected by the increase of areas cropped with sorghum, millet and sesame; the later benefited of favourable export opportunities which were mainly addressed by farmers in the semi-mechanized farming system. There was no significant irrigation development since the end of the 1970's. Harvested area has fluctuated in the rain-fed farming systems because of recurrent droughts resulting in crop failures every four to five years. In the irrigated farming system, harvested area also fluctuates mainly because of difficulties in the maintenance of canals (removal of silt) and variations in water availability for winter crops.

The area of (irrigated) wheat dropped significantly from 268,000 hectares in 1990-1995 down to 126,000 hectares in 2000-2005 due to the liberalization policy that allowed imports of low priced wheat from abroad. Cotton area dropped in the period 1995-2000 and began to shrink again in 2006-2008 to less than 100,000 ha as a consequence of the removal of government's control on cropping patterns in public irrigation schemes. Inefficiencies in the institutional arrangements for processing, and marketing cotton and delays in payment to farmers are reasons often said for lack of farmers' interest in growing cotton.

Table 12: Trends in harvested areas for major crops in Sudan from 1990 to 2005 (Average by 5 years periods in ha x 1,000)

Periods	1990 - 1995	1995-2000	2000 - 2005
Total harvested area	12 200	13 660	18 200
Sorghum	3 902	4 620	4 853
Millet	1 540	2 253	2 165
Wheat	268	180	126
Cotton	240	178	186
Sesame	979	1 749	1 764

Source: Computed from FAO STAT

Yields

Crop yields in Sudan have remained low and stagnant over the period 1990 – 2005 with the exception of sesame which is mainly grown in the semi-mechanized farming system. Agriculture production growth can then be attributed to expansion of cultivated areas only.

In the rain-fed sector, poor soil fertility management practices (shifting agriculture with short fallow periods), absence of formal institution for seasonal credit and recurrent droughts preventing farmers to invest in improved technology packages are the main reasons put forward to explain the poor productivity.

In public irrigation schemes, tenant farmers rely on hired labour for their crops. Because of financing problems, farmers must economize on this cash expense. Hired labour used for supplementary land preparation, weeding and harvesting must be curtailed, which depresses yields. For cotton, farmers are supposed to receive cash advances from their Agricultural Corporation to cover the costs of hired labour. Agricultural Corporations also provide farmers with mechanized land preparation, seeds, fertilizers and pesticides. The costs associated with all these services are deducted from the tenant's individual account after the cotton is sold and the proceeds net of marketing costs and export tax are received from the Sudan Cotton Company. The current situation is that because of financing problems, the Agricultural Corporations can no longer finance inputs and labour cash advances in a sufficient or timely manner. Fertilizers procured by the Agricultural Corporations often arrive too late for planting, or in insufficient amounts; farmers have to finance an increasing part of the labour costs. The same service was offered for other crops but this has been discontinued and farmers have to deal with private inputs suppliers and money lenders.

Table 13: Average yields of major crops in Sudan (Quintal / ha)

Crop	1990-95	1995-2000	2000 - 2005
Sorghum (rain-fed)	6.1	5.7	6.4
Sesame (rain-fed)	4.2	7.6	7.0
Wheat (irrigated)	16.4	18.7	24.2
Cotton (irrigated)	13.1	11.6	14.4

Source: Ministry of Agriculture of Sudan.

Livestock production

In spite of the great potential of livestock and Sudan's self-sufficiency in meat and other livestock products, several constraints deprive the country from realizing the full potential of this sub-sector. In 2005, Sudan produced 350,000 tons of cattle meat and 5.5 million tons of cow milk making the country self sufficient for these products; Sudan exports live animals and meat mainly to the Arab Gulf countries. The following constraints on production are important:

- Overgrazing in some areas, particularly around settlements, while vast areas are under-grazed because of lack of water for the animals;
- The great distances that animals often have to walk from water points to graze;
- Expansion of agriculture, particularly mechanised farming, into traditional grazing land, which has led to reduction in grazing areas and in many instances to the blocking of traditional migration routes and water points, causing conflicts between transhumant and settled farmers;
- Seasonal nutritional deficiencies;
- Prevalence of disease leading to early culling of cattle;
- Poor veterinary services;
- Poor husbandry;
- Poor integration of livestock in the rotation of arable crops including quasi absence of fodder in the rotation;

- Difficulty of marketing and processing milk due to the remoteness of grazing areas far from the centres of consumption;
- Lack of services and infrastructure such as research, extension, roads, health services and livestock markets.

2.4 TRADE OF AGRICULTURAL COMMODITIES

2.4.1 Egypt trade of agricultural commodities

Dependency on wheat imports is a major concern of the government of Egypt. Egypt's population has consumed approx 13 millions tons of wheat in 2007 of which 6 millions had to be imported. Meat and vegetable oil are other major food imports of Egypt. Imported maize is mainly used to feed livestock. Main agricultural exports are rice, fruits and vegetables and cotton. There is a good prospect for increasing exports of fruits and vegetables either fresh or processed.

Table 14: Main agricultural imports & exports of Egypt (2007)

	Value ('000 dollars)	Volume (tons)
Imports		
Cereals	2 506 713	10 384 738
Wheat	1 566 617	5 911 036
Maize	940 096	4 473 702
Meat	489 211	253 358
Vegetable oil	1 024 887	5 112 956
Exports		
Fruit and vegetables*	407 383	n.a
Rice	379 958	1 123 494
cotton	152 969	128 335

*Source FAO STAT (2007) * Fresh or processed products*

2.4.2 Ethiopia trade of agricultural commodities

Even in good years, Ethiopia does not reach food self-sufficiency and the country has to rely on food aid since it has not the economic power to purchase its food needs on the international markets. For instance in 2007, which was a good year, Ethiopia imported 17,000 tons of cereals and received 480,000 tons as food aid. Exports revenues depend essentially on coffee which is by far the main export commodity. There was a significant increase of pulses and oil seeds (mainly sesame) over the past few years. Despite the large number of cattle heads, exports revenues of the livestock sector are limited, strategic interventions could boost the production and exports of livestock products. Exports of cut-flowers has been rapidly growing, there were inexistent in 2000.

Table 15: Main agricultural exports of Ethiopia (2007)

	Value ('000 dollars)	Volume (tons)
Coffee	416 783	158 234
Pulses	87 882	130 429
Oil seeds	152 601	163 030
Live cattle	24 350	n.a
Skin and hides	28 065	451 693
Cut flowers	24 000	n.a

Source FAOSTAT and CSA (cut flowers)

2.4.3 Sudan trade of agricultural commodities

Sudan is increasingly dependant on imports for wheat. Wheat is becoming the main staple food of the Sudanese population while wheat sown areas have decreased over the last 15 years. In Sudan, wheat can be grown only in winter under irrigation in the River Nile State and the Northern State where the winter is relatively cold. Wheat imports represent more than 50% of the country consumption. Other major food imports of Sudan are sugar and vegetable oil although the country exports sesame seeds. The main exports are sesame seeds, live animals and cotton. Alike in Ethiopia, well targeted strategic intervention in the livestock sector could boost production and export of livestock products.

Table 16: Main agricultural imports and exports of Sudan

	Value ('000 dollars)	Volume (tons)
Imports		
Wheat	286 895	1 116 328
Sugar	153 777	267 954
Vegetable oil	119 000	149 454
Exports		
Sesame seeds	86 834	105 464
Live animals	45 840	n.a
Cotton	34 409	22 699
Fruit and vegetables	10 629	n.a
Meat	4 941	2 630

Source FAO STAT (2007)

2.4.4 PROSPECTS OF REGIONAL TRADE, EXAMPLE OF WHEAT

- **Current situation**

Egypt population consumes over 14 million tons of wheat every year. The country is able to produce approx 8 million of tons and the rest (6 million tons) has to be imported making Egypt is the second largest wheat importer in the World.

Sudan wheat annual consumption is 2.2 million tons of which 1.2 million tons (55%) is imported. Wheat planted area and domestic production has sharply declined since the mid 1990's while at the same time economic growth and urbanization has increased the demand for wheat. Without strategic intervention aiming at increasing wheat production, the country' dependency on imports may become critical.

In May 2008, **Egypt and Sudan** have announced they are going to partner for developing 2 million feddans (820,000 ha) of land to cultivate wheat. The land is located near the border town of Wadi Halfa, 700,000 feddan (274,000 ha) are in Egypt territory and 1.3 million feddan (546,000 ha) in Sudan.

Annual consumption of wheat in **Ethiopia** is approx 4 million tons while the country production is 2.8 million tons. Demand for wheat is rapidly increasing with urbanization and the number of low income urban consumers[2]. In 2008, as the world price of cereals increased sharply, the government through the Ethiopian Grain Trading Enterprise distributed 100,000 tons of wheat to poor urban consumers as a price stabilization exercise.

[2] Teff has now become the staple food for higher income urban groups.

- **Prospects for wheat consumption in 2020**

It is likely that wheat consumption will increase in proportion of population growth. Figures in table 2 are therefore conservative for Ethiopia and Sudan as wheat consumption is also driven by urbanization.

Table 17: Current and projected wheat consumption for the years 2006 and 2020 (million tons).

Year	current	2020
Egypt	14.091	17.589
Ethiopia	3.928	5.473
Sudan	2.173	2.883
Total	20.192	26.746

Source: FAO Spreadsheet "AGRICULTURE TOWARD 2015/30" (2004).

- ***Prospects for increasing wheat production***

Increase in wheat production may come from expansion of harvested area, increased yields or a combination of both.

Egypt
Egypt's National Water Resource Plan (2002 – 2017) envisages an expansion of agricultural lands from the current 3.4 Million ha to 4.6 million ha in 2017 (or by 35%). It can be assumed that wheat cropped area will increase proportionally from 1.3 million ha to 1.7 million ha.

Wheat yields in Egypt are already high (6.4 ton/ha in average). With the ongoing increased use of high yielding cultivars and incentive measures for wheat growers, an average yield of 7 tons/ha can be reasonably envisaged for the year 2020.

Ethiopia
Ethiopia's relatively under-populated lowlands constitute a huge potential of land in agro-ecological zones suitable for wheat production both under irrigation and rain-fed condition.
The National Plan for Sustainable Development and Eradication of Poverty (PASDEP) targets an increase of irrigated area by 480,000 ha in 2010. It is likely that the target will be reached after 2010. The government is currently undertaking integrated rural development programs in the lowlands which include infrastructure and social service development, promotion of commercial farming, population resettlement and irrigation development. Concerned areas in the Eastern Nile basin are the South-West part of the Abay basin, Baro-Akobo sub-basin, Beles sub-basin and the lower part of the Tekeze sub-basin. These areas are or will be road- connected to Sudan and are suitable for rain-fed and/or irrigated wheat production. In this context, an increase of wheat planted area by one million ha can thus be reasonably envisaged at the year 2020 horizon.

Intensification of agriculture through the use of integrated inputs including improved seeds, fertilizers, effective pest control and better management practices is at the top of the Ethiopian agricultural policy agenda. In this context and increase of average wheat yields from the current 1.8 ton/ha to 3.5 ton/ha in 2020 is a reasonable target.

Sudan
The area under cultivation of wheat fell sharply since the mid 1990's from 630,000 ha in 1996-97 to 250,000 ha today mainly because of poor productive performance in the Gezira and New Halfa irrigation schemes. With a combination of rehabilitation and modernization of the existing irrigation schemes, improvement of credit and market access to wheat growers, and new irrigation development, a planted area of one million ha in 2020 is a reasonable target.

Wheat yields in the Gezira agricultural research station are in the order of 4.8 ton /ha. With appropriate technology packages provided by the research and extension services average yields of 3.5 ton/ha by 2020 are a reasonable target. Particular attention should be given to the use of heat

resistant cultivars in central Sudan. In Sudan, wheat is a winter crop but the Sudanese "winter" (November – March) may be not cold enough in central Sudan as yields of most wheat varieties are negatively affected when average daily temperatures are above 25°C.

Table 18: Prospects for wheat production and consumption in the year 2020

	Area harvested (million ha)	Average yield (ton/ha)	Production (million ton)	Consumption (million ton)	Balance (million ton)
Egypt	1.7	7.0	11.9	17.6	-5.7
Ethiopia	2.5	3.5	8.8	5.5	3.3
Sudan	1.0	3.5	3.5	2.9	0.6
Total	5.2	4.6	24.2	26.0	-1.9

Figures in table 17 indicate that:

- Sudan could achieve self sufficiency in wheat in 2020.
- Ethiopia could also achieve self sufficiency and even become a net exporter of wheat.
- Egypt imports of wheat in volume in 2020 will remain the same as in 2006. In other words, gains of production would just match increased demand due to population growth.
- External dependency of the Eastern Nile basin on wheat imports could decrease significantly from 8.5 million tons in 2006 to 2 million tons in 2020.

- ***Implications in terms of legislative and institutional reforms***

Ethiopia and to a lesser extend Sudan could export more than three millions tons of wheat to Egypt provided agreements between the three countries are defined. Such agreements should deal with (i) reducing barriers to regional trade, (ii) Egyptian technical assistance to Ethiopia and Sudan for increasing productivity and (iii) facilitating Egyptian investments in Ethiopia.

Reducing barriers to regional trade
The three Eastern Nile countries are among the 19 member countries of the Common Market for Eastern and Southern Africa (COMESA). One pillar of COMESA strategy is the establishment of a custom union with duty free and quota free trade amongst member countries. So far only Sudan has joined the custom union. Therefore, specific agreements on tariff for wheat trade should be established between the Eastern Nile countries without prejudging of the adhesion of Egypt and Ethiopia to the global COMESA custom union.

In addition to the alleviation or elimination of tariff barriers amongst Eastern Nile countries for wheat trade, the agreement should also aim at reducing non tariff barriers by including:

- Simplification and harmonisation of customs legislation and procedures and;
- Development of regional standards and a common classification for trade of wheat grains and flour.

Egyptian technical assistance to Ethiopia and Sudan
It is well known that capacity and skills are unevenly distributed among the Eastern Nile countries. Ethiopia and Sudan could benefit of the expertise gained during the implementation of the Egypt National Campaign for Wheat Improvement, namely the diffusion of high yielding varieties and incentives for farmers to grow wheat. The campaign was launched in 1986 and average wheat yields rose from 3.4 in 1986 to 6.4 ton/ha today. This implies the establishment of cooperation agreements between the relevant research and extension services of the three countries.

Egyptian investments in Ethiopia

Private land ownership is prohibited in Ethiopia, but the Government can lease to a private domestic or foreign firm the right to use the land. The Government leases the land to private firms that have already secured investment permits from the Government. Most of the land potential in Eastern Nile basin is located in the lower part of the Abay basin in Ethiopia, namely in Oromya National State (East and West Wellega zone) and in Benishangul-Gumuz Regional State. The Abay Master Plan Study (1999) estimated the area of non-cropped suitable land at more than 5 million ha. Ethiopian law provides income tax and custom tax holidays for investors, including investors in agro-industrial activities and investors establishing new enterprises in the country.
This context offers several win-win opportunities for Egypt and Ethiopia in the following fields:

- Establishment of large commercial farms through Egyptian investments or joint ventures
- Provision of agricultural support services to individual farmers under contract farming agreements or to cooperatives such as:
  - Storage and processing facilities
  - Marketing services
- Provision of agricultural inputs such as seeds and fertilizers;
- Training of farmers, extension service and research personal
- Design, construction and O&M of irrigation schemes.

2.5 AGRICULTURAL / RURAL DEVELOPMENT POLICY IN EGYPT

2.5.1 Policy objectives

Agricultural / rural development in Egypt relies on various policy documents relating to agriculture development and water resources.

2.5.1.1 Agricultural policy

Until the mid 1980s, Egypt's agricultural policy framework was dominated by the role of government. Significant reforms began in the mid-1980s and continued to date. High agricultural sector growth has been achieved as a result of the significant policy changes and emphasis on research and technical innovations. The principal objective of Egypt's reform programme was the transition from a highly interventionist and controlled economy to one that is more decentralized and market oriented. The reform programme included the removal of crop area assignments and delivery quotas, abolition of feed and fertilizer subsidies, promotion of the private sector, liberalize land rents, privatization of public agricultural production companies and liberalization of agricultural produce prices. There have been increases in the production of many crops as farmers have proved very responsive to new technology and price incentives. As a result, agriculture is now one of the most liberal and progressive sectors of the Egyptian economy.

In the 1990s, the aim was to continue and complete the reform process in order to increase agricultural production and income, and to raise agricultural productivity per unit of water and land. This was to be done in a framework that recognized the need for growth with equity, took account of the need for further rural poverty reduction, and targeted women and the landless. Agricultural development challenges in the early 1990s were summarized in a joint report of the GOE and the World Bank[3]. The underlying themes of the strategy were: efficient and environmentally sustainable management of the natural resources; emphasis on market development and further promotion of the private sector.

The most recent strategy document is The Strategy of Agriculture Development in Egypt until the Year 2017 prepared as a joint effort between MALR and FAO and published in May 2003. This strategy continued the reform process that started in the 1980s but made even clearer than before the importance of both the farm and off-farm sectors to the rural economy and the value of a competitive environment.

2.5.1.2 Water resource policy

The fundamental document for water resources development and management is the National Water Resources Plan for the period 2002-2017. The plan was prepared under the coordination of the Ministry of Water Resources and Irrigation in close consultation with other in line ministries for agriculture and land reclamation, health, industry and others.

The general objectives of the Water Resources Management Plan are derived from the national development goals and policies. The national development goals related to water and agriculture are:

1) To increase economic growth and employment.
2) To increase the inhabited areas outside the Nile Valley and the Delta by
   - Developing new cities
   - Developing the Eastern Delta and Sinai (El Salam canal)
   - Developing new valley areas (Toshka project)
3) To provide safe drinking water and adequate sanitation facilities.
4) To protect the Nile and other fresh water resources from pollution.

The overall objective of the water resources management plan is "*to support the socio-economic development of Egypt on the basis of sustainable water resources use (surface water and ground water), while protecting and restoring the natural environment.*"

The four specific objectives are:

1) The supply of drinking water and the provision of sanitation services, according to the standards and target of the ministry of health, on a cost recovery basis but taking into account the right of basic requirements of all people;
2) The supply of water for industrial purposes and the provision of sewage treatment facilities;
3) The supply of water for irrigation based on a participatory approach and cost recovery of operation & maintenance;
4) The protection of the water system from pollution based on a polluters-pay principle and the restoration of water systems, in particular the ecological valuable areas.

The current policy is a major change compared to past policies as it shifts from:

- A supply-oriented and engineering-based approach to a demand-oriented and multi sector approach to meet the demands of the full range of water users and taking into account environmental issues. In other words Egypt has now adopted the integrated water resources management approach.

- A highly centralized and top-down approach of water management to a participatory approach through initializing a process of decentralization and privatisation.

[3] An agricultural strategy for the 1990' ; World bank 1993.

- High level of government subsidies to adoption and implementation of the "users pay" and "polluters pay" principles.

Major challenges of water resources management in Egypt are:

- Increasing water scarcity water and low potential for increasing water supply;
- Increasing water demands due to population growth and development efforts for food production and raising the standards of living;
- Deterioration of water quality, i.e. pollution and salinity due to the disposals municipal and industrial effluents, agriculture drainage as well as decreasing flow in the system.

The National Water Resources Management plan is based on a strategy called "facing the challenges" which has three pillars:

1) Developing additional water resources

It includes continuing the cooperation with the Nile riparian states within the framework of the NBI for implementation of water conservation projects in Southern Sudan (i.e. Jonglei, Machar marshes) to increase the supply of Nile water. Other options are the development of deep fossil groundwater in desert areas, rainwater harvesting on the Mediterranean cost and sea water desalinization (for domestic use and supply water to the tourist resorts on the Red Sea shore). Increasing Nile water supply from conservation projects being very hypothetical, it has been included in the most optimistic scenario only. Deep fossil groundwater withdrawal can be increased from 0.9 to 4 BCM per year for municipal and agriculture use although this is not a sustainable solution. Other options would have a very limited impact in terms in increased annual additional volume of water. The strategy also includes improved management of shallow renewable groundwater of the Nile aquifer, however it cannot be considered as an additional source of water since shallow groundwater is recharged with Nile water.

2) Making better use of existing water resources

The pillar includes demand management and progressive tariff structure for municipal water and, in the agricultural sector, increasing water use efficiency, irrigation expansion, and improving water allocation and distribution. Average annual water diversion for agriculture will decrease from 17,000 to 13,800 m3/ha between 1997 and 2017. Outflow to the Mediterranean Sea will be reduced from 13 to 10 BCM per year.

3) Protecting public health and environment

The strategy includes a set of measures in a logical order: (i) prevention of industrial and agricultural pollution, (ii) treatment of wastes that cannot be prevented and (iii) control of situations where emissions cannot be prevented or treated.

2.5.2 Strategic priorities for agricultural production

Compromise between food security and export earnings

Egypt seeks to find a balance between export earnings and the self sufficiency goals in the agricultural sector. Although the growth of cash crops achieves a higher return per ha and per drop of water; Egypt's wants to limit its dependency on other countries for basic food supplies. Consequently, the implementation of the agricultural strategy results in:

- Continuing the land reclamation program depending on water savings in the old lands for production of horticulture crops for the domestic and export markets.

- An increase of wheat production on old lands while the production of cotton will remain stable, for the old lands the strategy seeks increasing self sufficiency in wheat rather than promoting cotton. International prices of wheat and cotton also play a role.

- The limitation of rice and sugar cane for reducing water allocation. Sugar beet was introduced as a substitute to sugar cane.

Outsourcing agriculture production

Since the bread crisis in the spring of 2008, the government of Egypt has announced two projects for outsourcing its agricultural production in order to limit its food security dependency (mainly in cereals but also meat) on international market and to protect itself from the general trend of rising food prices.

In May 2008, Egypt and Sudan signed an agreement to start a joint project close to the border town of Wadi Halfa, to help both countries become self-sufficient in wheat. The land allotted to the projects amounts to up to 2 million feddans (840,000 ha). In August 2009, the government of Egypt has announced its intention to sign an agreement with Uganda for the lease of land in various parts of the country to grow wheat and maize and produce beef meat. The deal involves Egyptian agri-business private firms and offers Uganda infrastructure (i.e. slaughter house), irrigation equipment) and employment. Egypt will also provide technical and financial assistance, as well as the experts and seeds necessary for the project.

These two projects offer a sustainable and much better solution than the short-term measures (increase bread subsidizes and salaries in the public sector) the government had to take during the food crisis in 2008. There are plans to launch similar operations in other African countries including in Ethiopia.

2.5.3 Main elements of rural/agricultural strategies in Egypt

2.5.3.1 Public Investments in Infrastructures development

According to the policy, public investments will address the three pillars of the "facing the challenge strategy" as per the National Water Resource Plan.

Water conservation projects

For Egypt, the main option for increasing water supply is the completion of conservation projects such as the Jonglei canal and draining the Machar marshes in Sudan. However, because of the numerous constraints facing these projects, they are only envisaged in the most optimistic scenario.

Studies for possible change in the operation of the High Aswan dam will be implemented. It is considered that shifting from a fixed annual release (55 BCM) to a variable annual release would reduce water spill and lower the average level of Lake Nasser reducing the evaporation losses. At low reservoir level the amount of supplied water to Egypt would be reduced. On the long term average water availability from Lake Nasser would increase by 2 BCM/year.

Deep groundwater tapping

The plan envisages deep groundwater development in the desert east and west of the Delta and in the Sinai. Being fossil water, this is not a sustainable solution and will therefore be carefully monitored.

Rain water management

Potential for utilization of rainfall as an additional source of water is extremely limited in Egypt. Small scale rain water harvesting projects will be implemented along the Mediterranean coast and in the Sinai combined with flood protection projects.

Irrigation rehabilitation/ modernization

Many projects contributing to this objective are already ongoing and will be continued. Examples are the Irrigation Improvement Project (IIP), the Integrated Irrigation Improvement and Management Project (IIIMP) and various drainage improvement projects. Other types of investments include rehabilitation of existing barrages and control structures on the Nile and main canals aim to improve water control in the irrigation system, canal lining and laser land levelling. On a long term and due to salinity problems gendered by drainage reuse, it is envisaged to reach high water use efficiency in every part of the system so that there is no longer need for drainage reuse.

Irrigation expansion

Since water availability is limited to the country's share of the 1959 Agreement (55 BCM), the required additional water will come from improvements of the overall agricultural water use efficiency. The Plan projects the irrigated area to increase from about 8 million feddans (3.4 million ha) in 1997 to 11 million feddan (4.6 million ha) in 2017 through reclamation of desert lands. The government will make the complementary investments in economic and social infrastructures needed for population resettlement such as roads, health care and education centres are also planned.

2.5.3.2 Public Investments in Support services

Research and Extension services

Agricultural research in Egypt is rated highly but it comes from a large network of overlapping institutions, most of them funded by the public sector. The strategy recommends more institutional focus, greater responsiveness to the private sector and export-oriented activities through more research and extension on commodities with export potential (i.e. horticulture) and developing the role of the private sector for extension role (i.e. contract farming).

At national level, the role of the Ministry of Agriculture and Land Reclamation (MALR) emphasizes on planning agricultural extension strategies (including with the private sector), methodologies, and providing training and linkages between research and extension institutions. The strategy also recognizes the need for MALR and MWRI to address land and water management issues jointly and adapt them to new cropping patterns under the control of farmers. At the governorate level, the strategy calls for the integration of the various field-level extension services, improve training, recruit more women agents and promote programmes relevant to the needs of rural women.

Marketing

With respect to marketing, the agricultural strategy aims at:

- Better and timelier provision of information on trade to exporters;
- Designing a mechanism for floor prices to protect farmers from exceptionally low prices plus the provision;
- Improving the quality of horticulture products to meet international standards for production, handling and packaging, and to integrate small producers into the export market through strengthening farmers' associations;
- Enforcing laws and regulation with respect to product standards and quality assurance.

Credit

The strategy for developing rural finance focuses on the state-owned PBDAC (Principal Bank for the Development of Agricultural Credit). In the 1990's, PBDAC provided 75% of total lending to agriculture but its lending to agribusiness was limited, its lending to non-agricultural rural businesses was insignificant, and its coverage of disadvantaged groups and women was minimal. Since then, the strategies recommend that PBDAC mobilizes more deposits, and diversify from agricultural lending to overall rural sector lending to reflect the increasing share of off-farm activities in rural households' income. The strategy also recognizes the need to remove restrictions on other banks from entering the rural sector and to create a more competitive environment in rural financial markets. However, PBDAC is also encouraged to keep its lending rates below market rates and provide low-cost credit for farmers to offset the "low returns and high risks".

2.5.3.3 Private sector involvement

The agriculture sector is fully liberalized

The reforms which started in the mid 1980's are still in process today have fully liberalized the Egyptian agricultural sector. Production, marketing, imports and exports of agricultural commodities and farm inputs are under the control of the private sector, i.e. farmers, farmers' associations, private traders and private manufacturing companies. The agricultural sector also provides demand for local services provided by rural households and small and medium-sized enterprises which account for more than 40% of rural employment[4].

Incentives for investment in the new lands

The government provides private national and foreign investors with land at incentive cost and water supply at no cost and complementary economic and social infrastructures needed for population resettlement such as roads, health care and education centres.

Irrigation management transfer and O&M cost recovery

At present, the ministry of Water Resources and irrigation has established some 6,000 Water User Associations at mesqa (field canal) level and approximately 800 Water User Organisations at district and branch canal level to take over local water management tasks.

The establishment of water user associations (WUAs) was initiated at the *mesqa* level as a component of the Irrigation Improvement Project. The project includes an investment component to improve infrastructure, and an institutional component to transfer management to farmers. Single point lifting pumps replaced individual farmer's pumps, and *mesqa*s were raised, lined or piped. The WUAs control their own pumps, and have to operate and maintain them. Irrigation legislation was amended (Law 231/1994) to regulate establishment of WUAs, thereby giving them a legal status, and to specify their responsibilities. Their basic functions are limited to irrigation at the *mesqa* level.

At the branch canal level, which typically serves a command area of between 500 and 850 hectares, Water Boards or Branch Canal Water Users Associations (BCWUAs) are being introduced since 1995 based on the model of the Fayoum Water Management Project and the Water Boards Project.

[4] Source "The Strategy of Agriculture Development in Egypt until the Year 2017" Ministry of Agriculture and Land Reclamation and FAO. Cairo, May 2003).

Water Board's assembly has representatives from the agricultural, residential and industrial sectors so that they may expand their tasks beyond providing irrigation services. Procedures have been developed to guarantee broad representation in the assembly and in the water board executive committee of the agricultural, residential, commercial and industrial interests. Agriculture sector representatives come from the head, middle and tail reaches of a canal to give a say to those who are usually disadvantaged. The Water Boards' tasks include allocation of water at the branch canal level, performing maintenance, resolving conflicts, and formulating annual improvement plans, which are negotiated with the MWRI for implementation with the funds coming from the Ministry. The water boards established at the branch canal level would then form the base units of the future District Water Boards. The district level has been identified as the most effective to facilitate equal level dialogue between the users and the MWRI, since the district is the lowest level of the Ministry's representation.

Unlike Water Boards, the basic units of the BCWUAs are the Water User associations established in improved meskas. They focus only on irrigation water supply, maintenance and conflicts resolution. Interests of domestic and industrial water users are not part of their activities. Their mandate and representative system would need to be revised in order to open up branch canal water user associations for multi-task water management.

It is assumed that the two types of user organizations at the branch canal level are not exclusive. Either water boards or BCWUAs may assume responsibility for multiple tasks. Water boards and BCWUAs need support to build skills for management, accounting, billing procedures and levying charges.

Mesqa level WUAs charge, collect and spend money on the operation, maintenance and administrative costs for their members. Under the present cost recovery arrangements the costs of mesqa improvements are shared between the Government and beneficiaries. Farmers, in proportion to their landholding size, repay on individual basis the cost of the mesqa pump through instalments over three years, and the mesqua improvement through instalments over 20 years, no interest charge is levied; this means that mesqa improvement is largely subsidized.

At present, farmers in the old lands are not required to pay O&M, system rehabilitation or improvement costs for public irrigation and drainage systems. However, farmers owning three feddan (1.26 ha) or more pay land taxes to the Ministry of Finance Land Tax Authority, the money collected flows into the general budget, hence it is not earmarked for irrigation and drainage.

2.6 AGRICULTURAL /RURAL DEVELOPMENT POLICY IN ETHIOPIA

2.6.1 Policy Objectives

2.6.1.1 Agricultural policy

The Plan for Accelerated Sustainable Development and Eradication of Poverty (PASDEP, September 2006) defines Ethiopia's overall strategy for development for the period 2006-09. The ultimate goal of the PASDEP is eradication of poverty and it endorses the scaling-up of efforts to achieve the Millennium Development Goals (MDGs) by 2015.

Compared to the previous development policy[5], a major emphasis is placed on economic growth to be achieved mainly through shifting from subsistence to a market-oriented agriculture following a geographically differenced strategy considering "three Ethiopia": (i) regions with adequate rainfall; (ii) moisture stress areas; and (iii) pastoralist areas.

[5] Agriculture Development Led Industrialization (ADLI). Sustainable Development and Poverty Reduction Program (SDPRP 2001-2005).

In regions with adequate rainfall, the PASDEP objective is improving infrastructure and basic input and market systems to facilitate the growth of agricultural productivity and private sector investment in commercial farming.

In drought-prone regions, the objectives are food security, reduction of production volatility, diversification away from reliance on food crop production, increasing off-farm income opportunities, and, where appropriate, voluntary resettlement to more productive areas.

In pastoral areas, which were almost totally ignored in former policy documents, the objectives are the development of infrastructure and social services and tailoring research and extension to the needs of dry land livestock production.

2.6.1.2 Water resources policy

The overall objective of Ethiopia's Water Resources Policy is "to enhance and promote all national efforts towards the efficient, equitable and optimum utilization of the available water resources of Ethiopia for significant socio-economic development on a sustainable basis."

The general water resource development and management policies are to enhance integrated water resources management at basin level. For doing so and as river basins are to be used as the unit for water development and management, water resources development and management activities will be guided by the overall socio-economic development objectives at the Federal level and by those of concerned Regional states in the various basins for consistency between the hydraulic units and the administrative boundaries.

Integrated management means that fragmented approach should be avoided by recognizing that water resources development, utilization and conservation go hand in hand and by ensuring that all water-related activities such as water supply and sanitation, irrigation and drainage, watershed management are addressed in unison. Furthermore water management should also be integrated with other natural resources development (i.e. land, forestry) and other sector development goals such as hydropower, health, mining, agriculture, transportation through basin development plans.

The main supporting strategies are:

1. Give priority to identification and implementation of multipurpose water development projects for maximizing benefits and reducing costs.
2. Update and take follow-up action on completed Integrated River Basin Master Plans, including the master plans for Abay, Tekeze and Baro-Akobo, the three river basins that constitute the Eastern Nile basin in Ethiopia. Complete master plan studies so that they cover all river basins of the country.
3. Establish effective institutions for water management, in particular river basin management institutions and water users associations.
4. Co-ordinate the development and enforcement of appropriate mechanisms and standards to prevent pollution of water resources.
5. Promote appropriate watershed management practices.
6. Develop and implement capacity building programs at all levels in all the relevant areas of water resources management and water-related technologies.
7. Formulate appropriate and essential water legislation required to expedite water resources development and management.

2.6.1.3 Irrigation policy

The overall objective of the irrigation policy is "*to develop the huge irrigated agriculture potential for the production of food crops and raw materials for agro industries, on efficient and sustainable basis and without degrading the fertility of the production fields and water resources base".*

The policy is based on a two-pronged approach. The first pillar is centralisation (and top-down) driven by the logic of integrated water resources management whereby irrigation development has to be integrated within the overall framework of the country's socio-economic development goals,

more particularly the Agricultural Development Led Industrialization (ADLI), and shall be based on projections of the country's needs for food and the requirements of raw materials for agro-industries. The second pillar is decentralization (and bottom-up) through involvement of regional governments, NGOs and the private sector in irrigation development as well as farmers' participation in all phases in planning, studies, implementation, and operation and maintenance of irrigation schemes. It can be argued that the main challenge of successful implementation of the irrigation policy is to harmonise these two opposite and, at first sight, contradictory approaches.

As for all water development and management activities, funding for irrigation projects will come from the government budget, external support agencies, the private sector and payments of water fees by irrigation water users.

Ethiopia's irrigation sector is little developed whereas the supporting strategies deal with four major issues for successful irrigation expansion:

1) Initiate the planning and implementation of a comprehensive, well coordinated and targeted irrigation development program,
2) Improving the preparation and design of irrigation projects including environmental and social impact assessment,
3) The formation and capacity building of the institutions needed to ensure long term productivity and sustainability of irrigation systems, and
4) Economic aspects: increase of government's budget allocation for irrigation development, establishment of norms and procedures for financial viability of irrigation schemes, promotion of credit facilities and bank loans for irrigation development and definition of appropriate cost recovery mechanisms for all irrigation schemes.

2.6.2 Strategic priorities

The aim of the agricultural development is achieving food security and increase commercialization of commodities for agro-industries and export earnings. From review of the PASDEP, three strategic priorities are implemented: (i) intensification, (ii) diversification and commercialization and (iii) voluntary resettlement. Large scale irrigation development program and commercial farming contribute to these three strategic pathways.

Intensification

This strategy follows the conventional "inputs – outputs" model of agriculture intensification through enhancing farmers' access to fertilizers, improved seeds, animal draught power and credit as well as dissemination of technology packages through extension programs. It is combined with investments in rain water management and small scale irrigation as well as in pest management.

Diversification and commercialisation

This strategy consist in the promotion of diversification out of low-value cereals, mainly for the households' own consumption, and into higher value crops such as horticultural crops, oilseeds and various cash crops, both for the domestic and export market. This pathway is supported by investments in roads, markets, post harvest processing and improvements of the agricultural marketing systems. In addition to oils seeds and pulses, an emphasis is also put on coffee and niche markets such as horticulture, spices and honey in selected high potential areas.

Voluntary resettlement

The voluntary resettlement program aims at increasing food security through the rationalization of natural resources use. It consists in population transfer from the saturated food insecure highland farming system to the currently little utilized lowlands with sufficient rainfall. Resettlement is on a purely voluntary basis, and each settler household is guaranteed a package of assistance that includes provision of up to 2 hectares of fertile land, seeds, oxen, hand tools, utensils, and food rations for the first eight months. Settlers are also provided with access to essential social infrastructures: water supply, health post and feeder roads.

Large scale irrigation development

Recurrent droughts every 4 to 5 years and increasing volatility of rainfall attributed to global climate change are considered the main constraints for the implementation of the above strategy and are therefore the main driver behind the recent emphasis on large scale irrigation development. Approx 160,000 ha of large irrigation schemes are at various stages of implementation, Koga irrigation schemes the fist scheme of this kind in Ethiopia will start operation soon. Irrigation projects in the lowlands involve population resettlement and/or commercial farmers.

Development of commercial farming

Commercial farming is considered as a strong mean for agricultural intensification and diversification. The government's agricultural Investment Agency will make available a total of 3 million ha of land; 2 millions are already secured and 1 million is under negotiation with the regional states.

Over the last few years, private investments in high value agriculture, namely horticulture and floriculture for export have been springing up within a 100 km radius around Addis Ababa. Investments involve foreign investors often working with Ethiopian entrepreneurs. Indian companies: have invested in 340,000 ha plantation of palm trees for bio-fuel in Gambela State and 10,000ha near the town of Bako in Oromya State for rice and other food crops production for export to India and Europe. A Pakistanis company has recently started operating a 30,000 ha sugar cane estate in the Didessa valley. Saudi Star Agriculture Development is producing rice in the Gambela State (water comes from the Awero dam) and has invested in meat production in the Rift Valley. Saudi Star's long term plan is to invest for a total of 500,000 ha in various parts of Ethiopia; the company has recently requested the Ethiopian government 250,000 ha of land in Amhara Region (Awi zone) to grow sugar beet. China has shown interest for oil seeds production in Ethiopia.

A total of more than 9,000 private companies have received a license for commercial farms in Ethiopia of which 1,300 are foreign according to the government's Agricultural Investment Agency. Almost all commercial farming projects are located in high-potential areas such as fertile river valleys or large under-exploited and potentially productive areas.

2.6.3 Main element of rural and agriculture strategy in Ethiopia

2.6.3.1 Public investments in infrastructure

Roads

Since the early 1990's the length of classified roads has dramatically increased from 23, 000 km to 37,000 km in 2004/05. The policy will continue the efforts and the PASDED targets the construction of 20,000 km of new roads (90% in rural areas) until 2010. It is considered that road construction has a positive impact on transport costs and access to markets and services by the 85% of the Ethiopian population living in rural areas. Road construction efforts will be combined by measures to increase the national construction capacity and improve the maintenance of existing roads.

Market infrastructures

During the PASDEP period, 12 additional new slaughter houses will be constructed to cater for export; 11 cold storage facilities will be constructed for fruits and vegetables and the existing 7 cold storage and packing facilities will be upgraded.

Rural welfare

Despite progress to date, coverage of the health care system remains inadequate, and the quality of services available, especially in rural areas, is variable. The focus under PASDEP will continue to be towards primary health care and preventative services especially in rural areas. The target is to reach universal primary health care by having one equipped and staffed health centre in each Kebele (approx 3,000 inhabitants in average).

With regard to water supply, the target during the PASDEP is to raise the rural population with access to potable water within 1.5 km from 44% to 80%. A particular attention is also given to ensuring that appropriate community management structures are in place for routine operations, and small-scale community financing mechanisms, to raise the funds for maintenance of the water supply schemes.

The Government of Ethiopia launched a twenty-year education sector indicative plan, to implement the 1994-2015 National Education and Training Plan. The main goal of the plan is to improve educational quality, equity, and relevance with special emphasis on primary education for all children by 2015.

Rural electrification is considered essential for irrigation development (pumping) and the promotion of agribusinesses in small and medium sized towns. A major rural electrification program is being undertaken so that by the end of the program period it is expected that 50% of the population will have potential access to electricity, compared to about 16% by the end of 2004/05. A major element of the program will be the launch of a large scale rural electrification program, called the Universal Electrification Access Program. Over 6,000 rural towns and villages are identified for electrification in all regions of the country. At the moment, the access to electric power in rural areas is almost nonexistent. Power supply will be increased with the targeted construction of 5 new large dams.

2.6.3.2 Irrigation expansion

Irrigation development is considered as a major mean for agricultural growth and for coping with the increasing volatility of rainfall. The PASDEP plans the development of approx 430,000 ha of new irrigation schemes by the year 2010. Ethiopia's irrigation sector is little developed whereas the supporting strategies deal with four major issues for successful irrigation expansion:

- Initiate the planning and implementation of a comprehensive, well coordinated and targeted irrigation development program,
- Improving the preparation and design of irrigation projects including environmental and social impact assessment,
- The formation and capacity building of the institutions needed to ensure long term productivity and sustainability of irrigation systems, and
- Economic aspects: establishment of norms and procedures for financial viability of irrigation schemes, promotion of credit facilities and bank loans for irrigation development and definition of appropriate cost recovery mechanisms for all irrigation schemes.

2.6.3.3 Rain water management

The plan seeks a better utilization of rain water through soil and water conservation. Priority is given to "moisture stress areas" i.e. in the peasant highland mixed farming system (covering the Eastern part of the Abay basin) and arid pastoralist areas. Soil and water conservation activities within the Ethiopian part of the Blue Nile basin have been carried out since the 973-74 drought largely under the auspices of the Ministry of Agriculture and often in association with the World Food Program (food for work activities). Construction of check dams, cut-off drains, hillside terraces, soil bunds, stone bunds, water harvesting ponds and rural roads were the major soil and water conservation activities. More recently, the practice of rehabilitation of degraded lands through area enclosure is emerging, for example in the Koga project in Lake Tana watershed.

2.6.3.4 Public Investments in support services

Research and extension

The number and capacity of extension agents is being increased through the operation of Agricultural Technical Vocational Educational Centres (ATVET); more than 25,000 extension agents have been trained to date in the ATVET. The majority (80%) of trained extension agents provide direct support to farmers while the remaining 20% are equally shared to provide veterinary services or support cooperatives. Thousands of Farmers Training Centres (FTC) is being established to disseminate improved agricultural technology packages to farmers. The objective of the extension program is to support food self sufficiency at farming household level and intensification of marketable products. Technology packages for agriculture and livestock production will be adapted according to the main agro-ecological zones of the country.

The public research system (at federal and regional states level) focuses on the production of improved cultivars of both traditional food crops and high value crops such as vegetables and spices. The research centres multiply pre-basic seeds and seedlings of improved varieties. Research is also conducted on livestock (breeding, health care and forage) and in soil sciences to better assess the amount of fertilizers required by different types of soils and crops. A new emphasis is put on pastoralist areas.

The existing research – extension – farmers council will be strengthen by designing better linkage strategies; the objective being to establish an integrated process of technology development, transfer, utilization and feedback.

Marketing

The main policy elements for marketing of agricultural inputs and products are the following:

- Increase supply of inputs (fertilizers and seeds) and set the modalities for imports and distribution of fertilizers and encourage improved seed productions on farmers' plots;
- Strengthening cooperatives and establishment of new ones;
- Develop commodity exchange centres: in Ethiopia commodity exchange is undertaken in 10 centres and focus on six crops (teff, wheat, maize, sesame seed, haricot beans and coffee); expansion activity will be undertaken based on studies;
- Develop guidelines for contract farming;
- Design and implement an export strategy for agricultural commodities;
- Improve quality control of products especially for the export market.

Coffee will remain Ethiopia's main export commodity. However, in order to reduce dependency on coffee exports, it is planned to have significant export increase of pulses, oil seeds (sesame) and livestock products (meat and live animals).

Credit

Today only approx 25% of small scale farmers have access to seasonal credit. To increase the use of fertilizers and improved seeds, they will be channelled to farmers through revolving credits managed by the cooperatives or micro finance institutions.

State-owned micro finance institutions are playing a significant role in expanding financial services to low-income groups, entrepreneurs and traders, who cannot borrow from commercial banks. Improvements have been witnessed not only in terms of number but also in operational efficiency as well as coverage. The number of clients served reached about 1 million by the end of 2004/05 fiscal year, compared to 460,000 in 2001/02. Loans have increased from 308 million Birr in 2001 to 1.4 billion Birr over the same period.

2.6.3.5 Private sector involvement

Privatisation and state owned enterprises.

Since 1992, market liberalisation and major privatisations have been undertaken to make the economy private-sector-led. As a consequence of privatisation as well as private sector growth, the share of State Owned Enterprises (SOEs) in industrial output declined from 86% in 1996 to 51% in 2005. While pursuing privatisation, the government continues to establish and develop new enterprises, and as a consequence the (net) number of medium and large industrial state owned enterprises has increased over the past ten years. There are foundations that often engage in rural development and in areas of little interest for the private sector, e.g. agricultural inputs, storage and processing, and transport, banking and rural microfinance. The largest endowment companies are region-based and focus on rural development of a particular region. Competition of the informal sector is considered as a major impediment of private sector development in Ethiopia.

Irrigation management transfer and cost recovery

Irrigation cooperatives have been established at least formally in modern small scale irrigation schemes. This arrangement has not been found satisfactory by the government and the Ministry of Water Resources is currently preparing a law to establish Irrigation Water Users Associations IWUAs) as financially autonomous legal entities. IWUAs will be in charge of 0&M of small scale irrigation schemes and in large scheme of irrigation sectors. For future large schemes it is envisaged to establish autonomous private or public entities for O&M of the main hydraulic infrastructure and users will have to support the cost.

Incentives for private sector involvement in agricultural production

The government leases land on nominal rent to foreign or national private sector companies for a period of up to 50 years at rates ranging from 5 to 11 dollars/ha/year (70 – 140 birr). The allotment of land takes place with no dispute with former users since in Ethiopia, the land is owned by the state. The government also offers incentives investors, including tax holidays depending on export levels, duty-free import of assets and inputs and grace periods of up to five years on land rents. Availability of cheap labour constitutes another incentive for investors. The major constraint for private sector involvement in agricultural production is the lack of land in the densely populated highlands.

Incentives for foreign investors provided by the Ethiopian government are declared by the Council of Ministers Regulation No. 84/2003 and Regulation No. 146/2008. The Regulations stipulate that:

- Foreign investors can hire non-Ethiopians on top management positions without any restriction upon obtaining the prior consent of the Ethiopian Investment Agency.

- Foreign investors producing for export have priority to get loan from the Development Bank of Ethiopia and they are also allowed to obtain loan from foreign countries and are permitted to repay the principal and interest in convertible foreign currency.

- Guarantees for foreign direct investments include full repatriation of capital and profits. This encompasses profits, dividends, interest payments on foreign loans, asset sale proceeds and technology transfer payments.

- Investors in all sectors of the Ethiopian economy including foreign investors who will be engaged in agricultural activity are exempted from the payment of custom duties and other taxes levied on imports of all capital goods (machinery, equipment and accessories) and construction materials necessary for the establishment of new projects or expansion/upgrading of the existing ones. However, these capital goods and construction materials shall be superior in quality, quantity and price compared to the ones made locally.

2.7 AGRICULTURAL / RURAL DEVELOPMENT POLICY IN SUDAN

The Sudan Agricultural Green Mobilization Program (GM) for the period 2007-2010 is the guiding framework for agricultural and rural development sector. It was announced in July 2006 by the President of Sudan.

2.7.1 Policy Objectives

2.7.1.1 Agriculture policy

The Green Mobilization Program, also referred as the Agriculture Revitalization Program, aims at achieving sustainable and balanced economic and social development to reduce poverty and achieve the welfare of the people of Sudan through the development of the country's huge natural resources. Provinces of Southern Sudan are not included in the Green Mobilization program since they beneficiate of special funds for reconstruction.

The specific objectives of the Green Mobilization Program are the following:

- Achieving food security;

- Reducing poverty by 50% by the end of 2010, provide employment opportunities and increase individual income;

- Achieving balanced development for all the regions of the Sudan to encourage stability in the rural areas;

- Development and protection of the natural resources for sustainable production;

- Increasing and diversifying agricultural exports of plants and animals;

- Maximizing value added in the agriculture at the production stage and in the backward (inputs) and forward (marketing) economic chains.

2.7.1.2 Water resources policy

The goal of Sudan's Policy on integrated Water Resources Management is to *"lay the foundation for a rational and efficient framework to sustain the water needs of national economic development, poverty alleviation, peace, environmental protection and social well being of the people through sustainable water resources management"*

The general objectives of the policy are:

- Equitable, sustainable, economically viable and efficient water management and water utilization based on strategic planning. The strategic planning shall recognize (i) the linkages between water resources development and utilization with the economic development framework at federal and states level of government and (ii) that water resources development, utilization and conservation go hand in hand and by ensuring that all water-related activities such as water supply and sanitation, irrigation and drainage, watershed management are addressed in unison.

- Equitable management and utilization objective relates to the distribution of water between the different States and users and the promotion of national unity through balanced utilization of the water resources and due consideration to poverty alleviation and food security.

- Economic objectives relate to increase of investments in essential water infrastructure and the establishment of financing mechanisms for the management functions.

- Sustainability objectives relate to the preservation of the environment and "disaster management" (flood and droughts) through appropriate water management practices and essential infrastructure development.

- Efficient management objectives relate to the development and capacity building of human resources, the promotion of water users organizations and the private sector for water services.

Main supporting strategies are:

1) Set up mechanisms for continuous assessment of surface and groundwater resources availability and quality, monitoring and dissemination of water data using modern and efficient technology.
2) Prepare strategies and plans based on the concept of integrated water resources management
3) Enhance cooperation between the States
4) Develop economic criteria for balancing costs and socio-economic benefits of water utilization
5) Empowerment of water users groups and promotion of stakeholders participation
6) Control pollution of ground water and surface waters
7) Strengthen water conservation measures to enhance water availability for environmental purposes and for pastoralists and rain-fed agriculture (water harvesting);
8) Address the problem of sedimentation in dams and irrigation structures;
9) Enlargement of existing reservoirs (i.e. Roseires) and construction of new dams on the Nile, the Atbara sub-basin and on seasonal streams (wadis).

2.7.1.3 Irrigation sector policy

The overall objective of the irrigation sector policy is *"to develop the huge irrigated agriculture potential for the production of food crops and raw materials needed for agro-industries, on efficient and sustainable base and without degrading the fertility of the production fields and water resources base."*

Like in Ethiopia Sudan's irrigation policy has adopted a two-pronged approach: centralization as irrigation development should be fully integrated with the overall framework of the country's socio-economic development plans and decentralization through the promotion of the participation of Water Users Associations in all phases of the policies, planning studies, implementation and operation & maintenance of all irrigation schemes.

The supporting strategy is mainly based on supply management and it includes:

1) Implementation of new dams and heightening of the Roseires dam to achieve horizontal and vertical expansion of irrigated agriculture.

2) Implementation of new irrigation schemes, such as Upper Atbara, Rahad phase 2 and Great Kenana on the Blue Nile, Aweel rice on the White Nile and rehabilitation of public irrigation schemes to improve water use efficiency.
3) Increase utilization of pumps to expand production of winter crops, mainly wheat along the Main Nile.
4) Utilize the renewable groundwater and harvest wadis for livestock and agriculture.
5) Adopt mitigation measures to minimize sedimentation in dams.
6) Promote the participation of farmers in the Gezira irrigation scheme and other public schemes through the establishment of Water Users Associations.

2.7.2 Strategic priorities for agriculture

Since 2005, the government has removed all governmental control on cropping patterns adopted by farmers. However, the government pays a particular attention to the production of cotton, a major export crop, in irrigation schemes and to wheat production for food security. An indirect form of governmental control on cropping patterns may be exercised through attaching credit provision to government-recommended technology packages.

Increasing productivity in the rain-fed sector

The small farmers in the rain-fed sector constitute the majority of producers in the agricultural sector and suffer from having access to agricultural services and inputs. The strategy consists in establishing extension centres in each village and improving access of small farmers to good seeds, fertilizers and credit when and where needed combined with investments in rain water management infrastructures.

Wheat production

High priority is given to increasing the production of wheat since it is becoming the main staple crop for the people of Sudan particularly in urban areas. Sudan does not want to risk dependence of its food security on the increasingly unpredictable international market and especially in case of sudden drop of oil prices. This concern is shared by many other countries who want to cope with the problem of rising food prices and the world financial crisis. Saudi Arabia, the Arab Emirates, Libya, Japan, China, India, South Korea and Egypt are among these countries. Sudan has devised an incentive policy to attract either national or foreign investors to grow wheat in Sudan.

Wheat is the main crop using available water in winter. Wheat production potential is located in the Main Nile valley, where the weather is more favourable for wheat production due to relatively cold winters. The expansion of wheat production is planned to take place in this region and to depend on surplus water from the Nile, and from tapping the Nubian aquifer

Unleashing the potential of livestock production

Strategic intervention in the livestock sector is considered of strategic importance for agriculture growth and increase of export earnings. Interventions for raising the productivity of the sector include:

- Rehabilitation of the natural pastures through collection and spreading of seeds of appropriate fodder plants
- Improvement in the management of pasture lands by harvesting the natural pastures during the rainy season and storing it for feed during the summer months, reducing overgrazing and conflicts between farmers and pastoralists, opening of new stock routes.
- Introduction of feed crops in the rotation of irrigation schemes
- Expansion of extension and veterinary services

- Increasing the number of drinking water points along the routes of the pastoralists.
- Improving livestock market and market information services.

Irrigation expansion

The driver of irrigation expansion is the rainfall variability affecting the rain-fed sector, growing concerns about dependency on wheat import and irrigated fodder production. Required water for irrigation expansion will come from the full utilization of Sudan's share of the 1959 bi-lateral agreement with Egypt, the water savings expected from the modernization of existing irrigation schemes or reallocation of water from the non-functioning schemes and from the development of groundwater namely the Nubian aquifer.

Commercial farming

Development of commercial farming is considered as a major strategic option for agriculture growth. Main projects involve foreign investors, namely from South Korea (690,000 ha for wheat), the United Arab Emirates (378,000 ha for wheat, maize and feed crops), Saudi Arabia (10,000 ha for wheat and vegetables); these projects are at various stages of implementation. In May 2008, The Egyptian government has announced that Egypt is to partner with Sudan to develop up to two million feddan (840,000 ha) to grow wheat in an area close to the border town of Wadi Halfa; this project also envisages to raise livestock. Most if not all commercial farming projects require irrigation.

2.7.3 Main elements of rural/agriculture development strategies in Sudan

2.7.3.1 Public Investments in infrastructures development

According to the policy, public investments will address roads, rural welfare, markets, irrigation and water harvesting.

Roads

The upgrading of national roads and construction of new ones as well as the opening of rural roads, construction of bridges on rivers and increasing the number of ferries which are considered to be important for the supply of agricultural inputs and the transport of agricultural products. Over the past few years, the government has completed a number of supporting infrastructures including Khartoum-Dongola road, Khartoum-Kosti-El Obeid road, Dongola Bridge on the river Nile, Kosti Bridge on the White Nile, Hasaheisa Bridge on the Blue Nile and running river Barge-transportation across the banks of the River Nile. Out of the targeted construction of 522 km of rural roads in 2008, 250 km have been completed.

Rural welfare
The Green Mobilization program includes the development of education and health services, drinking water supply and electrification in rural areas to increase rural welfare.

Markets
The policy seeks the development and improvement of the existing agricultural markets particularly for livestock and meat. It includes the rehabilitation of the existing markets and the establishment of new marketing centres equipped with the necessary services of water, feed, shade, electricity and sanitation.

Irrigation expansion

Sudan wants to fully use its share of the Nile water concluded by the 1959 bilateral Agreement with Egypt. It is estimated that out of the 18.5 billion cubic metres allocated to Sudan, 3 billions cubic metres are currently unutilized. The plan for public investments in irrigation expansion includes:

- Implementation of new dams (i.e. the Setit dam) and heightening of the Roseires dam to achieve horizontal and vertical expansion of irrigated agriculture.
- Implementation of new irrigation schemes, such as Upper Atbara, Rahad phase 2 and Great Kenana on the Blue Nile, Aweel rice on the White Nile and Merowe on the main Nile.
- Increase utilization of pumps to expand production of winter crops, mainly wheat along the Main Nile.

Further investments in irrigation expansion would be made feasible from reallocation of the water previously allocated to the non-operational irrigation schemes of the White Nile and Blue Nile Pump schemes, and from saved water resulting of improved irrigation efficiency of operational schemes. Sudan will also invest in groundwater development for irrigation.

Rehabilitation & modernization of irrigation schemes

The policy focus on the adoption of modern technologies in all aspects of irrigated farming for increasing water use productivity and efficiency. This includes (i) modernization/ rehabilitation of hardware in irrigation canals for better control and monitoring of water, (ii) land levelling, and (iii) adoption of modern agricultural practices such as precision farming. So far most of the rehabilitation work consisted in silt removal of irrigation canals.

It is also envisaged to group the pump-fed irrigation schemes on the White Nile upstream of Jebel Awlia dam, the Blue Nile in Sennar State and the main Nile together with electrification of pumping stations. Projects for doing so have recently started.

Rain water management

The policy seeks a better utilization of the rain water through:

- Constructing small dams across seasonal streams *"wadies"* for use as supplementary irrigation and drinking for livestock in the grazing areas. It is estimated that not less than one hundred million cubic meters of water will be harvested annually in each state by building dams in the Wadies.
- Digging of water harvesting ponds *"hafeer"* for livestock along the stock routes.

Implementation of the planned projects has started in 2008.

2.7.3.2 Public Investments in support services

Extension services

It is envisaged to have one extension agent and/or veterinary assistant in each village of 100-300 farmers. This personal will be selected among the village residents then trained by the Ministry of Agriculture. The tasks of the extension agent will include:

- Dissemination of modern technology packages. The packages include the promotion of zero tillage farming in rain-fed agriculture, integrated pest management and expanding mechanization for all agricultural operations.

- Management of credit to small scale farmers: seasonal credit for agricultural inputs and investment credit for mechanization and farming equipments;
- Assisting semi-mechanized farmers with their dealing with banks for credit, more particularly credit access will be linked to the adoption of the recommended technology packages; and
- Participation to literacy campaigns and educational programs.

Research

For agricultural research the policy focuses on:

- Establishing new research centres to meet the needs of the rain-fed and livestock sectors
- Designing a research strategy with defined priorities and participation of the producers in the formulation of the priorities.
- Decentralization of the management of research by giving the states a role in funding and orientation of research towards addressing local problems and to contribute to financing.
- Increasing the numbers of well trained researchers and devising a system of incentives for them to work in the rural areas.

Education

The agricultural education curricula will be revised and improved to produce the highly demanded medium level cadres and technicians. This will be coupled with the agricultural graduate's policy which aims at enhancing the facilities for agricultural graduates to act as pioneers of the application of modern technologies and to present investment models in the different agricultural sub-sectors.

Marketing

Marketing boards will be established in each state. These boards will be composed of representative of farmers, traders and agri-businesses, credit institutions, researchers and representatives of the government. The boards will study supply and demand in the local and international markets and formulate commercial strategies. The government would play an important initial role in the establishment and activation of these boards. The roles of government will gradually diminish in favour the private sector.

The policy also wants to establish of cooperative societies or village marketing groups to provide the agricultural inputs and / or marketing the production to create economy of scale and increase farmers' bargaining power. Establishment of such organizations will be supported by the extension agents.

Credit

The government has practically returned to the custom of direct lending to farmers as it used to do before the 1990s since it considers that the Sudanese commercial banks cannot be relied upon to finance small scale farmers especially in the rain-fed sector. Provision of credit by the government or by commercial banks for commercial farming will be attached to the implementation of the government-recommended technology packages.

2.7.3.3 Private sector involvement

Development of market infrastructures

Marketing boards will be established boards in each state. These boards will be composed of representative of farmers, traders and agri-businesses, credit institutions, researchers and representatives of the government. The boards will study supply and demand in the local and international markets and formulate commercial strategies. The government would play an important initial role in the establishment and activation of these boards. The roles of government will gradually diminish in favour the private sector.

The policy wants to develop and support the existing and currently poor export infrastructures for livestock and meat and the establishment of new ones through encouraging the private sector to invest in this area. These export infrastructures include silos, quarantine and slaughter houses, cooling services and packaging.

Contract farming

Contract farming is considered as a pathway for increasing incomes of small farmers. Private sectors companies already engaged in commercial activities with farmers. For instance one private company enters agreements with farmers mostly in the rain-fed areas of Damazine, South Kordofan and irrigated areas of the White Nile supplying them with sunflower seeds, technical supervision and buying their production. Another company provides post harvest credit and packaging material to banana growers in Sennar State and buys their produce for export to Saudi Arabia and the United Arab Emirates.

Development of agriculture-related manufactures

Another area for private sector involvement is the local manufacture of fertilizers, farming equipments and feed concentrates which is seen as a mean to reduce production costs and increase competitiveness of Sudanese products on the international markets. One manufacturer (GIAD) has stated production of ploughs and other farming equipments.

Irrigation management transfer and O&M cost recovery

The policy plans intensifying and expanding the experiments of the establishment of Water User Associations in all of the large irrigated schemes, namely the lessons learnt from the Gezira irrigation scheme.

It is also envisaged to group the pump-fed irrigation schemes on the White Nile upstream of Jebel Awlia dam, the Blue Nile near Sennar and the main Nile in the North together with electrification of pumping stations. These groups of schemes will be managed by the private sector.

Kenana Sugar Company, one of the world largest integrated sugar companies will take over Rahad and New Halfa irrigation schemes for all aspects of production including entering contract farming agreements with small scale farmers. Kenana Sugar Company, in a profit-sharing scheme with farmers, will improve irrigation and farming technology and introduce new crops including fodder. It is expected that the output will increase dramatically. Kenana will take 40 percent of profits, with 50 percent going to the farmers and 10 percent towards social investments such as building hospitals and schools. Kenana is part-owned by the governments of Sudan and Saudi Arabia and the Kuwait Investment Authority, hence it is not properly said a private sector firm.

Incentives for private sector involvement in agricultural production

The policy aims at allocating land on nominal rent to foreign or national private sector companies for long period of 50 to 99 years, at incentive rates varying from one place to another within the state and among states and the exemption of all taxes including profit taxes. Foreign or national investors are also exempted for all imported assets and agricultural inputs from customs tariffs, with designated quantities and quality being decided in the feasibility study of the investment

project evaluated and approved by the Department of Agricultural Investment of the Ministry of Agriculture and Forestry.

The allocation of land is made after the government ensures absence of land dispute, and when there is dispute based on usufruct practices, the investor is requested to reclaim 25 percent of the allotted land with provision of irrigation water services to the owners of the land. Such arrangements usually take place in irrigated areas of the central states such as those of the Gezira, the White Nile, the Blue Nile and Sennar. In the Northern State and the River Nile State, the land allotment takes place with no dispute since these lands are government lands. Investors do not have to pay for water; however, they have to construct the pumping station site and the irrigation systems. Foreign direct investments have the highest share of the distributed land.

2.8 LINKAGES BETWEEN THE POLICIES AND THE CHALLENGES AND OPPORTUNITIES

2.8.1 How the policies address the needs for increasing agricultural productivity and incomes of smallholder farmers.

2.8.1.1 Egypt

Egypt's reform program of the 1990s has been judged a macroeconomic success by all commentators. On the social front good progress has also been made, but rural poverty and some social indicators still remain major concerns. The United Nations 2003 Human Development Report shows that Egypt made good progress in human development between 1996 and 2001. The Human Development Index (HDI) rose from 0.59 to 0.68. This increase takes Egypt out of the category of low level of human development to that of the medium category. However, the report shows a widening urban-rural gap as well as regional disparities between the North and the South of Egypt. Overall, the number of Egypt's poor is about 10.7 million. Of these, 29% are urban poor and 71% rural poor, with an urban poverty rate of about 9% and a rural poverty rate of about 22%. However, the sharpest distinction in poverty rates is between Egypt's urban areas and Lower Egypt on the one hand and Upper Egypt on the other. Governorates in rural Upper Egypt contain the highest concentration of Egypt's poor people. The cause of the poverty gap between Lower and Upper Egypt is due to the less favourable agro-ecological conditions in Upper Egypt and to the higher level of economic growth that has taken place in Lower Egypt and Egypt's metropolitan areas in the 1990s. Growth in Lower Egypt was not only higher in construction, trade and manufacturing but also in agriculture. Lower Egypt now accounts for approx two-thirds of the production value of Egypt's agriculture while employing less than half of the agricultural labour force. This suggests crudely that agricultural productivity is higher in Lower Egypt and rural underemployment higher in Upper Egypt.

The two well established trends of Egypt rural/agricultural policy since the 1990's are: reclamation and settlements on new lands and improving agricultural productivity of the old lands. Under pressure from population growth and the need to create employment opportunities and increase agricultural production, Egypt is continuing to expand new lands and new settlements are started before several other sites are mature. As a result, many settler families live in poor conditions for long periods before their lands become productive and the social service needs of their communities are met. It is a matter of trade off in resource allocation that needs to be addressed. A greater attention should be given to the growing gap between Upper and Lower Egypt. Furthermore the supply of irrigation water in sufficient and timely amounts is a key factor of the high agricultural productivity and with the reduction of water allocation for agriculture there is a risk that yields and cropping intensities and hence farmers' income will drop if day to day on-farm water supply becomes too stretched. Encouraging the specialization of farming households with high labour force/ land holding size ratio in high value labour intensive crops is an option worth to be considered for reduction of rural poverty.

2.8.1.2 Ethiopia

Poverty and food insecurity are pervasive and persistent in Ethiopia: the country is not self sufficient in food and its overall economy is too weak to purchase food on the international market to meet its needs; many Ethiopians are too poor to buy food even when it is available; and Ethiopia's rain-fed agriculture depends on highly variable and increasingly unpredictable weather condition. The country has been chronically receiving food aid for many years.

Four to six million people are chronically food insecure and depend on food aid for survival. These are people who have no capacity to produce or to buy food even under satisfactory weather and market conditions. If agriculture production would ensure food self-sufficiency and availability through markets at national level, the main food security issue would be access to food arising from lack income.

Another ten millions people are vulnerable, with a weak resilience to any shock. Under any adverse circumstances, these people are very likely to be dependant on food aid for survival; most of these people live in the area of the densely populated highland mixed farming system. There were also reported cases of "green famine" in the coffee growing areas due to dramatic drop in coffee price on the international markets.

The Welfare Monitoring Survey of 2006 (World Bank, 2006) shows a global prevalence of 37% undernourished. Malnutrition prevalence is higher in rural areas than in urban areas. This reflects the difficulty of many subsistence farming households to satisfy their food needs with their own production.

The PASDEP focuses on diversification based on agro-ecological zones and commercial farming. This is the major contrast with ADLI and the previous sustainable Development and Poverty reduction Program (SDPRP). PASDEP also makes specific provisions for rural-urban linkages, a theme that was lacking in SDPRP and ADLI. These include integrating markets, opening up the flows of labour, increasing access to income-earning opportunities between towns and surrounding rural areas, moving away from dependency on coffee exports. The specific instruments to achieve this include improved rural access roads, building up of small rural towns, improved telecommunication access, the continued spread of general education and technical-vocational training, development of micro finance schemes, improvements of market information system, the major program of rural electrification and the promotion of large scale commercial farming.

Recent evolution of macro economic indicators tends to indicate that the current policy is right. Increased agricultural production during the last four years has resulted in nominal and real GDP growth of 111.7% and 48.3% between 2002/03 and 2005/06 fiscal years and the main engine of GDP growth has been agriculture. Such growth is of critical importance. It reflects an increase in the real purchasing power of the population, with two significant consequences. First, the increased purchasing power will result in increased demand, which will raise the domestic prices of commodities and thus farmers' income. Secondly, the ability of Ethiopia to afford the purchase of food commodities on the international market has increased. However, further increases of GDP will be required before the country can look to international markets for food security. The recent impressive increases of cultivated areas and exports of oils seeds and pulses are also an indication that a viable strategy is followed.

An obvious implication of the promotion large scale commercial farming for production of field crops or bio-fuel in Ethiopia is that private national or foreign investors are now allowed to lease large pieces of land (compared to floriculture) and will require numerous labourers to work on it. A specific attention must be given to (i) the sustainable use of natural resources (land and water) by commercial farmers, (ii) salary rates and welfare of farm workers, (iii) the promotion of contract farming between commercial farmers and smallholders to generate income and technology dissemination, and (iv) avoiding unfair market competition between large and small farmers. With respect to foreign investors, the land leasing agreements should also include provisions for that a part of the production must be sold on the domestic market, export of all the production to the investor' country of origin in time of food crisis in Ethiopia would be socially and politically unbearable.

The weakest link of Ethiopian agriculture will remain the saturated highland farming system where chronically food insecure households cultivate less than one hectare and cannot produce enough food for self-sufficiency, even in a good year. Given the certainty of erratic weather and crop failure every four to five years, these smallholders are unable to adopt improved technology packages and when they do, they often end up indebted. One may conclude they have no prospect of escaping poverty through intensification or diversification of agricultural production. The policy recommendations of increasing off-farm income opportunities and voluntary resettlements are relevant but it will take time to bear fruits given the present situation.

Given the potential of livestock production for agricultural growth and export earnings, there is a need to develop a stronger production and marketing strategy for the different types of livestock and livestock production systems in Ethiopia.

2.8.1.3 Sudan

Regarding poverty alleviation the government strategy is to develop the traditional farming system because it is the only means for increasing income of the small producers and households of the rural community.

In 2008, the first year of implementation of the Green Mobilization Program, Sudan government spent heavily on rehabilitating irrigation schemes and subsidizing growing of wheat, hence the budget was not equally shared by the small farmers in the rain-fed farming systems[6]. The irrigated sector received the bulk of the 2008 budget spending and with the transfer the pump-fed irrigation schemes of the Blue Nile and White Nile to the private sector and large public schemes (Rahad and New Halfa) to Kenana Sugar Company, it is expected that productivity of irrigated farming and farmers' income will increase dramatically. Currently, the Ministry of Irrigation and Water is carrying out a study about water harvesting in the country. The study covers the development of adequate data base on resources of rain-water supply along wadies and hafeers (water harvesting ponds) for human and animal drinking, food and cash crops, and green fodder production purposes. Further monitoring will tell if the policy is implemented according to plan and whether or not it has responded to the needs of smallholders in the rain-fed sector.

A number of advisory commodity marketing boards have been established. These boards are expected to provide guidelines for the promotion of the agricultural commodities and for increasing their competitiveness in the domestic and international markets through removal of technical, financial, marketing, and legislative and management constraints. The boards are composed of non-committed non-regularly paid members who attend meetings when their time allows. They lack supporting mechanisms for data collection and market analysis. Their advices are thus based on scattered experiences and educated guesses. The private sector members are not keen to give whole-heart information for keeping the secrecy of their businesses. Therefore, the meetings are not in quorum, becoming circles of futile brain storming exercises. There is need for organized officially assigned staff strengthened with professional experts and advisors in the area of the commodity under question, who can undertake serious studies and formulate good policies and remunerative plans and projects.

2.8.2 How the policies address the limiting factor of water supply

Water supply as defined in the 1959 Agreement remains the central and may be non negotiable element of the water development and management policies of Egypt and Sudan which revolve around three major strategic options: (i) increasing water supply, (ii) improving water use efficiency and (iii) water allocation. In Sudan a number of new large scale irrigation schemes have been in the pipeline for some years but their implementation would require using more water than the country's share as per the 1959 Agreement. So far Ethiopia has not entered in any agreement with the Nile downstream countries and its huge water potential is almost untapped. Hence the limiting factor of water supply is not a pressing concern for Ethiopia. However, its water management policy stresses the need for efficient utilization of water.

[6] Source: « Performance Report of the Executive Program for agricultural Revival » Higher council for Agricultural Revival Secretariat; March 2008 – March 2009.

2.8.2.1 Increasing water supply

The Nile is the **Egypt's** only source of water and the amount is limited to 55 BCM/year as per the 1959 Agreement. Water for the planned irrigation expansion by1.2 million ha over the period 1997-2017 will come from reduction from annual outflow to the Mediterranean Sea from 13.1 to 9.7 BCM (or by 26%) by 2017. In Egypt, outflow to the sea has several functions: diluting polluted water, controlling salinity intrusion, and sustaining coastal ecosystems. These functions might have been overlooked in the National Plan which does not make any mention of environmental flow requirements. Considering the many uncertainties about upstream water conservation projects, increase of Nile water supply at Aswan has rightly not been included in the basic National Water Resources Plan.

Sudan estimates that out of its share of 23 BCM of the Nile water within context of the 1959 Nile Water Agreement, 3 BCM are unutilized and hence available mainly for irrigation expansion. There are a number of new large schemes in pipeline, such as Rahad phase 2, Great Kenana and Upper Atbara projects their expected water requirement amounts to approx 8 BCM. In the foreseeable future, these projects, which have been of the agenda since the mid 1970's, have little chance to be feasible due to lack of water. Availability of irrigation water is also a limiting factor of wheat production and private sector investments in agriculture (beside the risks of political instability).

In **Sudan**, additional water would have to be supplied from reallocation of the water of poorly functioning pump-fed schemes of the White Nile and Blue Nile. With respect to reallocation of irrigation water, The Ministry of Irrigation and Water Resources carries out regular monitoring of water usage and calculates the saved water from the different irrigation schemes, and allocates it to the best alternative uses. Though the government has the legal right to take the correct decision about non-functioning schemes, yet the law is not well enforced due to resistance of the concerned farmers who do not want to loose the water which has been allocated to them for decades.

Sudan would also turn into investment for abstracting groundwater. Beside the high cost of groundwater abstraction compared to surface water, groundwater in the Nile valley cannot be considered as an additional source of water since it consists of seepage from the river. In the Northern State and the River Nile State irrigation expansion is conceived through supply of water from the Nubian Aquifer. This aquifer lies beneath the ground of Sudan, Egypt, Libya and Chad; it is one of the largest fossil water aquifer in the world with an area of 2 million km^2 and a water reservoir estimated at 150,000 BCM. Libya has already started pumping substantial amounts of water from the Nubian aquifer for the so-called "Great Man Made River Project". Whatsoever, more detailed studies are needed and to understand how the aquifer works to build up a program for the rational utilization of this resource shared between four countries. More particularly research studies should tell whether or not the supply from the aquifer can meet the demand for new irrigation projects in the log term. Saudi Arabia developed effective irrigation systems from ground water during the past four to five decades, this experience could be transferred to Sudan. By the early 1990s, the Kingdom had managed to become the world's sixth-largest wheat exporter. But then its leaders started paying attention to the warnings of environmentalists, who pointed out that irrigation was draining a non-renewable supply of underground freshwater. Saudi Arabia now plans to phase out wheat production by 2016, which is one reason it is looking to invest in other countries to fill its food needs.

2.8.2.2 Improving water use efficiency

In **Egypt**, increase of irrigation efficiency through the continuation of the Irrigation improvement Program will save only a marginal amount of water because most of the irrigation water "lost" in the fields is reused through the drainage system but it has potentially a strong impact on water quality through reduction of the need for mixing low quality drainage water and fresh water for irrigation in the Delta and the new lands. Modernization/rehabilitation of water control in the main system will allow allocating water within regions based on a fixed amount per feddan. Reform of water distribution is now necessary as farmers were given the free choice of crops. Formerly water was allocated according to the cropping patterns prescribed by the Ministry of Agriculture.

In **Sudan**, a significant amount of water can be saved by improving water use efficiency through modernization of existing schemes. However, outcomes of the massive investments in rehabilitation in the 1980's were almost negligible because they were not associated with the needed managerial and institutional reforms. Financial limitations also prevent Sudan to invest in irrigation modernization, approx 60% of the budget of the Ministry of Irrigation and Water Resources is used to tackle the problem of sedimentation in irrigation canals. The Ministry of Irrigation and Water Resources began to group the pump schemes of the White Nile and Blue Nile State for transfer to the private sector and plans to transfer Rahad and New Halfa schemes to Kenana Sugar Company. This may well be the best option of improving irrigation technologies in the existing irrigation schemes.

Sudan policy also includes investments to improve the management of rain water: construction of rain water harvesting ponds and small dams across seasonal streams (or "wadies") for supplemental irrigation and livestock drinking. It is estimated that the additional water available will amount to 100 millions cubic annually in each state.

2.8.2.3 Water allocation

Egypt's agricultural policy seeks to limit the area under thirsty crops such as sugar cane and paddy rice. Limitation of rice cultivation may face some resistance from farmers with small land holdings as rice generates a high rate of return per unit of land. Egypt's labour force grows by 2.7% annually, and about 500,000 job-seekers enter the job market every year[7]. Unemployment is becoming a more pressing concern than water scarcity. High rates of labour intensive growth in agriculture and non-farm rural employment are essential if unemployment and poverty are to decline. Policies promoting labour intensive crops such as fruits, vegetables and cotton would be helpful to reduce unemployment and improving incomes of the millions of smallholder farmers. Hence it would be appropriate to review both the labour and water required for examining crop production alternatives together with opportunities for international trade and outsourcing agricultural production.

In **Sudan**, additional water would have to be supplied from reallocation of the water of poorly functioning pump-fed schemes of the White Nile and Blue Nile. The Ministry of Irrigation and Water Resources carries out regular monitoring of water usage and calculates the saved water from the different irrigation schemes, and allocates it to the best alternative uses. Though the government has the legal right to make decision about non-functioning schemes, yet the law is not well enforced due to resistance of the concerned farmers who do not want to loose the water which has been allocated to them for decades.

The **Sudan's** agricultural policy does not offer real alternative options in terms of winter crops beside wheat. The opportunity cost of growing wheat in winter should be measured against alternative crops or even leaving the land fallow. Investment in science and technology, associated with policy reforms and institutional restructuring, could expand farmers' options for winter crops. As with respect to the competitiveness of growing wheat in Sudan, average yields are low and this needs improvements which require investment in human and technical institutions to raise the productivity of the Sudanese farmers. Transfer and adaptation of Egypt's expertise could be a strong option to raise the average productivity in Sudan to the level of the best wheat growers.

2.8.3 How the policies address irrigation management transfer and cost recovery issues.

In **Egypt**, the involvement of farmers in the operation and maintenance of the system is considered as essential. Water Boards or Branch canals Water users associations (BCWUAs) are currently being established to take the responsibility of O&M in the branch canals. It is expected that the O&M will improve because of increased social control over water distribution. Within the

[7] Source: World Bank (2001) "Toward Agricultural Competitiveness in the 21st. Century: An Agricultural Export-Oriented Strategy" Rural Development, Water and Environment Department of Middle East and North Africa Region. Washington, DC. December 2001.

mesqa units WUAs are being established within the framework on the on-going Irrigation Improvement Project.
So far positive impacts of establishment of Water boards and WUAs are:

- Improved communication between farmers and the administration and among farmers.
- Better planning and carrying out of maintenance work (at the expense of the government)
- Alleviation of the burden of district irrigation engineers who can better focus on technical work rather than dealing with farmers' complaints about water.

The MWRI recommends changes to improve the present cost recovery arrangements for *mesqa* and new cost recovery mechanisms for public irrigation and drainage systems.

To improve the collection rates for *mesqa* improvement costs, the individual *mesqa* WUAs, rather than the individual landholder, should be the unit charged assuming that the *mesqa* WUAs are able to develop agreed-upon lists of their members and their holdings. The WUAs would allocate the costs among their members based on the size of the landholdings.

Since farmers' contributions toward the cost of public irrigation and drainage systems is one of the elements of the MWRI's reform strategy, it is recommended that recovery of selected public irrigation and drainage system costs be included at the lowest level of the public system, the branch canal. The Branch Canal Water Users Organizations would actually collect the charges and make collective payments to the Land Tax Authority, which would merely become a transfer agent.

The implementation of the recommended cost recovery mechanisms entails a number of new responsibilities and changes in the distribution of current responsibilities, the discussion and evaluation of which are outside the scope of this study. However, *mesqa* water user associations and branch canal organizations need to be institutionally strengthened by making them the legal units of assessment and they should be allowed to make payments in the name of their members.

Whether non-agricultural users should contribute toward cost recovery should be investigated. So far, municipal, industrial or other users do not pay for the water and drainage services. To charge other than non-agricultural users for receiving services, and to allocate costs among them, might be considered an option to improve the financial basis of the water sector.

In **Ethiopia** the Ministry of Water Resources is currently preparing a law enabling WUAs to have a legal status. The law will be supported by a set of model of contract agreements defining the roles of WUAs and other stakeholders. Next step should be defining a strategy for capacity building and empowerment of WUAs and their supporting institutions. The water Management Policy envisages full cost recovery in irrigation schemes and establishment of water permits and water fee for all users. So far nothing is in the place on the ground.

In **Sudan**, the 2005 Gezira Act was issued on the basis of the World Bank studies on reforming the Gezira Scheme. The Act gives new responsibilities to water users associations (WUAs) and the private sector while significantly reducing the role of the public sector. It also guarantees free crop choice to farmers and refocuses the Sudan Gezira Board on agricultural research and technology transfer. The Act has major implications on O&M of the scheme as well as marketing, credit, input supply and ultimately, on agricultural productivity. In addition, Gezira reforms would act as a model for reforms of the entire public irrigation sector. So far, implementation of the Act has got mixed results and farmers and there are reservations within the Ministry of Irrigation and Water Resources on the reforms in the Gezira. This may be the may reason why the government has now decided to transfer the management of irrigation schemes to the private sector or to Kenana Sugar Company for all aspects of production.

In public irrigation schemes, the collected O&M charges is meant to cover the cost of maintenance of irrigation equipments, buildings and irrigation canals, payment of salaries and wages of government employees and labour. These water rates and fees differed among States and O&M charges differ among States but are generally based on land size and type of crops. More often than not farmers, supported by their powerful unions, refuse to pay for the costly maintenance of canals where large amounts of sediments accumulate. The cost of sediments removal in irrigation canals represents 60% of the budget of the Ministry of Water and Irrigation.

Conclusion and recommendations

So far, the national water and agricultural policies do not take into consideration the regional aspects with the exception of the 1959 Agreement between Egypt and Sudan. Since this agreement does not consider Ethiopia's interests it can no longer be considered as a pillar for regional cooperation. Regional policies and strategies in the water and agriculture sector should be formulated to assure basin wide cooperation and integration. Such reforms should address challenges and opportunities in an integrated manner. The following issues should be considered.

Increasing basin wide water supply

The major opportunity for increasing water supply in the Eastern Nile basin is the construction of large dams on the Blue Nile in Ethiopia. Institutional reforms should seek to maximize the advantages of such huge investments by defining agreements between countries regarding the ownership of the dams, patterns of governance and operation rules, which are acceptable to all countries. Joint or coordinated management of future dams in Ethiopia and the already existing dams on the Eastern Nile implies either a basin level institution or effective cooperation mechanisms between the national institutions in charge of water resource management. Tapping shallow groundwater does not provide an additional source of water since shallow groundwater comes from seepage of the river system, shallow aquifers should also considered as buffers to cope with water scarcity in drought periods and increase the flexibility of water supply. Tapping fossil groundwater is by nature an unsustainable strategy; further studies are needed to consider abstracting water for irrigation from the huge reservoir of the Nubian aquifer. Conservation projects in Southern Sudan should be ruled out in the foreseeable future or included only in the more optimistic scenarios.

Improving water use efficiency

This implies designing a strategy for investment in modern irrigation equipment, improved water control and precision water application, raising yields and improving post-harvest marketing chains. This could be supported by the provision of technical cooperation from Egypt as the country enjoys a large pool of experts in these different fields. Institutional reform should also prepare the ground for reliable data availability and transparency on performance of irrigation in the Eastern Nile to define priority interventions for improving water use efficiency. Improving water use efficiency has a strong potential to save water in Sudan. In Egypt, where the overall water use efficiency is already very high, the main benefit of this strategy would be improvements in water quality through diminution in the use of brackish drainage water.

In the rain-fed agriculture sector, the key challenge in the Eastern Nile (Ethiopia and Sudan) is to reduce water-related risks posed by high rainfall variability rather than coping with an absolute lack of water. There is generally enough rainfall to significantly increase production but it is available at the wrong time, causing dry spells and water losses. Apart from water, upgrading rain-fed agriculture requires investments in soil, crop, and farm management. However, to achieve these, rainfall-related risks need to be reduced, which means that investments in rain water management are the entry point to unlock the potential in rain-fed agriculture. Several technical options for improving water efficiency in rain-fed agriculture are currently implemented or planned in Ethiopia and Sudan. They include water harvesting, watershed management, supplemental irrigation, and conservation agriculture and so on with so far limited impacts. Policies should emphasize more on investments in human capacity, supporting research and specific technologies. A new set of extension services with staff trained to support farmers in managing water for rain-fed agriculture should be established. Institutional reform is also required to bridge the divide in governance of water resources, agriculture, and the environment.

Water allocation

National water management policies in the Eastern Nile countries are designed for allocating surface water from the Nile and its tributaries (and other large rivers in Ethiopia) mainly for irrigation. Regional cooperative activities should seek to plan investments and allocate water for agriculture at the most appropriate scale ranging from the small tributary scale where runoff often flows only during short periods of time to large scale irrigation. It would widen the scope of water management policies by including water used in micro dams and other water harvesting structures, seasonal steams diversion and their impacts on surface water availability downstream. This implies devising new mechanisms of water allocation in the Eastern Nile basin instead of the outdated 1959 Agreement.

Agricultural policies of Ethiopia and Sudan offer opportunities for Egypt's investments in Ethiopia to grow food for its requirement. This would allow Egypt to concentrate more on cash crops, off-farm employment in rural areas, industry and tourism which have a higher economic return and less water consumption. At the same time Ethiopia and Sudan would get capital investment and transfer of technology in their agricultural sector. For this to be a truly win-win arrangement, it is imperative it includes provisions for sustainable utilization of natural resources, protection against labour abuses and guarantee on food security of the recipient countries.

Regional trade

In the current situation, the potential for regional trade is extremely limited, for instance all Eastern Nile countries have a deficit in cereals. However with strategic interventions the basin offers a huge potential for regional trade. Strategic interventions should aim to increase agricultural production in Ethiopia and Sudan through expansion of cultivated lands and above all through increase of agricultural productivity. Joint investment agricultural projects, Egyptian technical assistance to the upstream countries, reforms to reduce barriers to regional trade and co-investments in the logistic and transportation aspects can increase food security in the basin and boost regional trade.

3. Section 3: Identification of regional capacity building needs

3.1 PLANNING OF IRRIGATION DEVELOPMENT

The related challenge described in the transboundary analysis of the present study is the risk of mismatch between water resources and water requirements due to unilaterally planned irrigation projects.

3.1.1 National contexts

- **Ethiopia**

In Ethiopia, The Ministry of Finance and Economic Development (MoFED) has the overall responsibility of economic development planning. The main supporting document is the PASDEP that, for the irrigation sector, targets the development of 487,000 ha of new irrigated lands over the period 2007/06 – 2009/10. The MoWR (Irrigation department) is responsible of the implementation of large and medium irrigation projects while the Bureaus of Agriculture of the regional states are responsible for small scale irrigation. The ministry of agriculture has also the mandate to encourage and support small scale irrigation development in liaison with the regional governments.

The "planning and implementation of a comprehensive, well coordinated and targeted irrigation development program" indicated in the irrigation sector strategy has yet to come. So far, irrigation development has been carried out without general scheduling and on a project basis with information generally extracted from the various River Basin Master Plan documents with little integration with other sector programs. The decision to go ahead with a particular project is driven both by cost-benefit analyses during feasibility studies and policy objectives namely food self sufficiency, poverty alleviation and employment creation, equitable development among the regional states. Water availability is not considered as a major constraint in Ethiopia. For instance according to the Abay Master Plan the maximum irrigation development scenario concerns 565,000 ha and will reduce the average annual volume of the Blue Nile flow at Ethio-Sudan border by approx 10% only.

One of the main roles assigned to the future River Basins High Councils and Authorities is precisely to build up basin plans by adopting, updating and improving the river basin master plans. Since the adoption of the River Basins High Council and authorities Proclamation in July 2007, significant progress has been made in the establishment of River Basins Organizations (RBOs). The Abay River Basin Organization is the most advanced one and will soon be operational.

- **Sudan**

The Ministry of Irrigation and Water Resources (MIWR) and the Ministry of Agriculture have jointly formulated a 25 years strategy (2002 – 2027) which projects an irrigated area of 3.15 million ha in 2027 compared to a current area of 1.9 million ha and an increase of irrigation water requirements from 15 BCM to 42.5 BCM (Table 18). The consultant was not able to get a copy of the 25 years Strategy document at the MIWR. These figures are quoted in Sudan Policy on Integrated Water Resources Management and it is indicated that it would not be possible to meet the demand (Table 19). Major changes in the policy regarding water allocation and choices between the possible irrigation expansion projects will need to be made. However the strategy does not reflect this need.

Table 19: Surface and ground water demand projections (in BCM) according to Sudan 25 years strategy

Year	Irrigation	Other uses*	total
2010	27.1	5.0	32.1
2020	32.6	7.0	39.6
2025	40.3	7.8	48.0
2027	42.5	10.1	52.6

Source: Country Policy on Integrated water Resources Management (2007)
* Municipal, industrial and livestock uses.
Figures do not take into account evaporation losses from proposed dam development projects.

Table 20: Surface and ground water available to Sudan

Surface and ground water resources	Amount (BCM)
Sudan's share of the Nile water at Central Sudan (1959 Agreement)	20.5
Wadi waters	5 to 7
Renewable groundwater	4
Current Total	29.5 to 31.5
Expected from conservation projects*	6
Expected future total	35.5 to 37.5

Source: Country Policy on Integrated water Resources Management (2007)
* Reclamation of swamps in Southern Sudan. These projects are highly hypothetical for many reasons.

Getting an adequate picture of planned irrigation development and a clear understanding of the criteria used for selecting a particular project may well be a complicated exercise since two distinct institutions seem to be in charge: the MIWR (Planning Department) and the Dam Implementation Unit (DIU), a separate entity working under direct supervision of the office of the President of the Republic of Sudan. DIU supervises the ongoing feasibility studies of major dams (heightening of Roseires, Setit dam) and irrigation projects (Upper Atbara, Great Kenana, Rahad phase 2 and Merowe).

Egypt

The MWRI (Planning sector) has taken the lead in developing the 20 years National Water Resources Plan (1987 – 2017) and has further defined its implementation process detailing the activities, the role and responsibilities of the various stakeholders and a budget breakdown. The Plan is derived of and translates into action the overall policy goals, namely (i) "*to increase economic growth and employment*" and (ii) "*to increase the inhabited areas outside the Nile Valley and the Delta*."

The Plan projects the irrigated area to increase from about 8 million feddans (3.4 million ha) in 1997 to 11 million feddan (4.6 million ha) in 2017. The required additional water will come from improvements of the overall agricultural water use efficiency. This is well illustrated by comparing Egypt's water balance in 1997 and projected water balance in 2017.

Table 21: Comparison between water balance of the Nile system in Egypt in 1997 and projected balance in 2017

years	1997			2017		
Inputs & outputs in BCM/year	Supply	Demand	Consumed	Supply	Demand	Consumed
Evaporation from Lake Nasser			10 - 14			10-14
Release from HAD*	55.5			55.5		
Effective rainfall	1.3			1.3		
Agriculture		57.8	39.3		63.6	41.9
Industry		7.5	0.7		18.7	0.9
Municipal		4.7	0.9		6.6	1.6
Fisheries		1.3	0.4		0.6	0.2
Navigation		0.2	(0.2)**		0.2	(0.2)**
Open surface evaporation			2.4			2.5
Outflow to sea			13.1			9.7
Total	56.8	71.5	66.8- 70.8	56.8	89.7	66.8- 70.8

Source: National Water Resources Plan for Egypt, MIWR (2006)

*High Aswan Dam. ** Included in "Outflow to sea".

Water demand is the water diverted for a particular use. Consumed water is the fraction of diverted water which is definitely lost by the system; it corresponds to evaporation, evapotranspiration and water flowing to sea and deserts. The difference between water demand and consumed water is the amount of recycled water within the system such as drainage water reuse, renewable groundwater abstraction (seepage from the Nile) and treated waste water reuse.

Comparison between water balance in 1997 and 2017 illustrates the strategy implemented in Egypt. Firstly, to cope with increasing water demand, annual outflow to the sea will be reduced from 13.1 to 9.7 BCM (or by 26%) by 26%. In Egypt, outflow to the sea has several functions: diluting polluted water, controlling salinity intrusion, and sustaining coastal ecosystems. These functions might have been overlooked in the National Plan which does not make any mention of environmental flow requirements. Considering the many uncertainties about upstream water conservation projects, increase of Nile water supply at Aswan has not been included in the basic National Water Resources Plan.

Another measure to increase the Nile water availability from Lake Nasser is to change the reservoir operation. The present operation of the Lake Nasser reservoir is based on a fixed annual release of 55.5 BCM. An alternative reservoir operation could be to change the fixed annual release to a variable annual release, depending on the reservoir level. Larger releases at high reservoir levels would (i) reduce the spill to the Toshka depression and (ii) lower the average reservoir level for reducing evaporation losses. At lower reservoir levels the release should be reduced. Assuming a moderate 10% release reduction at lower reservoir levels the long term average water availability from Lake Nasser would increase by some 2 BCM/year according to the MIWR.

Secondly, the amount of water diverted for irrigation per ha will decrease (table 21) by approx 20%. Projected irrigation water consumption per ha will also decrease by approx 20% (Table 21). This would be achieved by minimizing the production of high water consuming crops such as rice and sugar cane. However, there is a risk that yields and cropping intensities will drop if day to day on-farm water supply becomes too stretched. The millions of Egyptian small scale farmers in the old lands may also become very reluctant to pay for O&M if they find the water service unsatisfactory.

Finally, the system will reach its limits after (or even during) the completion of the Plan. Further adaptations would require re-allocation of water from agriculture to municipal and industrial uses.

Table 22: Comparison of diverted and consumed water for irrigation between 1997 and 2027 in Egypt

	1997	Projected 2027 (% reduction)
Water diverted (BCM /year)	57.8	63.6
Water consumed (BCM/year)	39.3	41.9
Irrigated area (million ha)	3.4	4.6
Water diverted (m^3/ha/year)	17.0	13.8 (-19%)
Water consumed (m^3/ha/year)	11.6	9.1 (-21%)
Ratio water consumed / diverted	68%	66%

3.1.2 Regional capacity building needs

There is no regional planning exercise of irrigation projects and there is no global assessment of the compatibility of the unilaterally planned national irrigation projects with basin-wide water resources availability and existing uses. The resulting challenge is the acute risk of future mismatch between water availability and irrigation water requirements let alone water requirements for other users and the environment. Prerequisites for regional planning irrigation projects are (i) extensive information on water resources (rainfall, surface, and ground water), water users and planned new projects, (ii) effective and transparent sharing of this information, (iii) analytical models for processing this information and (iv) effective regional institutional arrangements for developing and assessing irrigation scenarios at the basin level by using the analytical models. These prerequisites are currently largely missing although there have been positive signs of improved regional cooperation since the launching of the NBI in 1999.

ENTRO will soon launch the Eastern Nile Planning Model (ENPM) Project (ENPM); the project is part of the ENSAP. The objective of the ENPM Project is the adoption by the Eastern Nile countries of a decision support modelling framework to identify water-related investments and evaluate them in a regional context. It is expected that the modelling framework will include:

- An appropriate knowledge base and analytical tools for systematic evaluation of investments in the Eastern Nile basin by all concerned stakeholders;
- Strong institutions at regional and national levels with adequate capacity to be a focal point for knowledge and analysis on water investments on the Eastern Nile, and
- Effective mechanisms for information dissemination and establishment of partnerships and synergies among Eastern Nile countries.

The Eastern Nile planning Model deals with outputs at three levels: (i) political, (ii) technical and (iii) community level. In particular, the project wants to promote the process of addressing regional capacity building needs for planning irrigation development and create adequate awareness among different levels of stakeholder groups. The community level output would be in the form of a web-based knowledge system with maps and awareness materials that could facilitate the involvement and interaction of the wider community of stakeholders in the process of decision making.

With respect to regional planning of irrigation investments it must be noted that:

- So far ENSAP projects have dealt with power trade and watershed management. The present study is the first one addressing water specific issues. The issue of regional irrigation development planning is likely to "wake up" sentiments of national sovereignty that often override the principle of "reasonable and equitable use of water" in shared basins worldwide eliciting unilateral actions in the name of economic development and poverty alleviation.
- Irrigated agriculture requires more than 80% of water requirements in the Eastern Nile basin. Furthermore, the characteristics of water use in irrigation set it apart in many ways from municipal and industrial uses. The amount of water diverted for a particular use is

always higher than the fraction which is actually consumed. Typically, irrigation water consumption (evapotranspiration) accounts for 40 – 60 % of water diverted and it rises to nearly 70% in Egypt due to repeated reuse (table 21). In contrast municipal water withdrawals are mainly used for washing and cooking and domestic diversions largely return – often in a polluted form- to the water system. Similarly, industrial diversions are mainly for cooling and diluting of wastes rather than for incorporation in products. Therefore, water consumed in irrigation is much higher than in other uses. As an example, water consumed in the irrigation sector in Egypt was 39.3 BCM in 1997 compared to only 1.6 BCM in municipal and industrial uses (table 21).

- It is envisaged that the ENPM will include a suite of simulation, optimization and multi-criteria analytical tools to help analyzing the economic, environmental and social aspects of investments and to evaluate alternative scenarios of the future. In other words, the ENPM wants to enhance a dialog based on facts and science amongst riparian countries to plan and manage future development scenarios. However, the rationale for irrigation development is strongly linked to policy objectives such as economic development, food security and poverty alleviation. In practice, large scale irrigation expansion in the Eastern Nile has been and is still is largely driven by political strategic interests reflecting these objectives. The recent decision by Egypt and Sudan to develop up to two million feddans (840,000 ha) of new irrigated land to grow wheat in an area close to the border town of Wadi Halfa is a good illustration of an irrigation investment driven by national interests. Combination of national interests and the fact that irrigation water consumption is so much higher than in other uses is a major constraint of enhanced regional cooperation. Emphasis should be placed on dialogue at all levels, including the political level, to agree on a basin wide plan for irrigation expansion and in the longer term to negotiate a water sharing treaty among the three countries ensuring "equitable and reasonable use of water." A treaty securing water supply to each country may well be a prerequisite for formulating joint investments scenarios and a strong incentive for improving irrigation water management. The dialogue may be facilitated by introducing issues unrelated to water such as regional trade.

- There is minimal public awareness, transparency and stakeholders' participation in the planning of irrigation development.

In summary, capacity building activities should address:

- Increased information on water resources and existing irrigation water uses to fuel a dialog among riparian countries based on facts and science.

- Well informed dialogue and common thinking at all levels to put in practice the principle of "equitable and reasonable use of water" for assessing the consistency of new irrigation projects with water resources availability, followed in longer term by negotiating a water sharing treaty among the three countries. Analytical tools developed by the ENPM Projects will be of great help to the dialogue.

- Increase public awareness of the merit of enhanced regional cooperation and stakeholder's participation in the planning of irrigation projects.

- Training of the personals of water institutions on identification, assessment and implementation of irrigation projects with a particular focus on the opportunities for joint investment irrigation projects.

3.2 WATER MANAGEMENT

Water management refers to allocation of water among irrigation schemes as well as to water distribution within irrigation schemes. The related challenges described in the transboundary analysis of the present study are the institutional challenges: (i) changing role of governments and (ii) the creation of water users associations and challenges related to irrigation technology.

3.2.1 National contexts

Ethiopia

So far there is no enforced rule for water allocation and users feel free to use as much water as they like. The amount of water entering a particular irrigation scheme is thus limited by the capacity of the intake and the canal network. In farmer–managed small scale irrigation schemes, water tends to be supplied continuously at or close to full supply level though rotations can be necessary if the main canal capacity is a constraint. Irrigation efficiency is generally low. Occasional tail-end effects occur due to ill discipline or poor maintenance especially in dry years. Minimal data on rainfall, flow and land use are collected. The schemes are equipped with poor flow control and measurement structures and farmers are seldom trained to use them properly. Irrigation water management in Ethiopia reflects that irrigation is still in its infant stage and the fact that the country's water resources are very little used. Until recently irrigation policy was oriented solely toward development of irrigated area, not on water management.

With the proclamation 197/2000, Ethiopia has opted for a water allocation mode whereby the Supervising Authority[8] issues permits and prices water administratively according to formal rules – the legislation- and on a volumetric basis. Currently, these prerequisites are only partially met. It should also be noted that traditional irrigation is a major water user in Ethiopia. Since this activity is exempted from permit and water charges, it can be argued that the cumulative impact of the many traditional irrigation schemes on water resources may not be properly measured.

According to the new policy and legislation, water allocation will be one of the mandates of the future River Basin Organizations, while Agricultural Water Users Associations (AWUAs) will be established in all irrigation schemes. For large and medium scale irrigation schemes, AWUAs will be in charge of water distribution at least at the lowest level of the canal network while public or private management entities will be in charge of the main hydraulic infrastructure. The MoWR has recently initiated the preparation of a specific regulation for establishing AWUAs.

Sudan

The irrigation season extends from May to March and has two parts: summer season from May to November and winter season from November to March. A meeting in April of each year bringing together representatives of the MIWR (Irrigation Operation Directorate), the hydropower corporation, Federal States, agricultural corporations and farmers unions, decides on cropping patterns and irrigated areas for each crop. Agreements are increasingly difficult to reach due to increasing demands of the regional states and farmers' unions. These demands are not mutually consistent or clearly stated. Once an agreement is reached, the MIWR estimates the water allocation for each scheme based on crop water requirements and water conveyance efficiencies. A steering committee meets every month to monitor water allocation. Problems occur in deficit years for winter crops and "typical Sudanese arrangements" are made to reduce the cropped areas. With the planned new irrigation projects water scarcity will develop and water allocation may become increasingly difficult.

Water distribution is carried out by the MIWR in the main canal systems (main, branch, major and minor canals). Water flows continuously in the canal network though minor canals (tertiary level) that were designed to store water at night as irrigation was to be carried out during daylight only but this is not longer practiced. Water distribution is adjusted according to rainfall and cropped

[8] The Supervising authority is the MoWR or the future RBOs.

areas on a daily basis during the summer season and on a weekly basis during the winter season based on rainfall and land use. Flow in the canal network is regulated by various manually operated control structures.

Tail-end effects are recurrent in Sudan irrigation schemes both in the summer season because farmers refuse taking water after a rain causing flooding at the tail-end and because of water shortage during the winter season. Irrigation efficiency is considered as satisfactory by the MIWR because percolation losses are minimal in the heavy clay soil of Sudan's irrigated plains. However, significant losses can occur due to lack of farmers' supervision of on-farm water application; excess water not entering the soil stands freely at the surface and eventually evaporates.

Sudan's irrigation policy is intended "to promote water users participation in the Gezira scheme and other public schemes". So far the experience of introducing WUAs in the Gezira scheme had mixed results. Farmers complain that they don't have the financial capacity to pay for water services and maintenance and the skills for managing water. The latest issue is linked both to irrigation technology and capacity building of the WUAs.

- **Egypt.**

The completion of the High Aswan dam (1971) and the rapid adoption by Egyptian farmers of motorized pumps in the 1970's and 80's in replacement of the traditional water lifting machinery such as the famous "sakia" (water wheels) have led to a dramatic increase in the irrigated area and cropping intensity. Therefore water allocation is an essential task of the Ministry of Irrigation and Water Resources (MIWR).

Until the liberalization reforms in 1993, water allocation was based on the cropping patterns that were administratively controlled under the form of production quotas by the Ministry of Agriculture. The irrigation water demand was estimated for each district, directorate and then in the various reaches of the Nile up to the High Aswan Dam. Allocation water mode continued after the reforms of 1993 with increasing uncertainties on actual cropping patterns and difficulties due to the tendency of farmers to increase the area cropped with rice. To overcome the problems, Egypt Water Resources Development plan wants to allocate water within region on a fixed amount per feddan basis.

The MIWR controls water distribution in the main water system and down to the intakes of the Meskas through a highly centralized pyramidal organization through irrigation districts, directorates and regions. The irrigation improvement project has established WUAs at meska level in charge of O&M; establishment of WUAs was combined with infrastructure improvement: rising of meskas and single pumping points in marwas (sub-branch canals). WUAs have the social, technical and financial responsibilities for dealing with O&M. The Irrigation Advisory Service provides the WUAs with capacity building, training of farmers and technical assistance. Conflicts among farmers and between farmers and the administration were reduced with the establishment of WUAs.

On-farm irrigation efficiency is considered as low by the MIWR but overall water use efficiency is high due to repeated drainage and seepage water reuse (table 21). The irrigation system is characterized by a single source of supply, Lake Nasser, and a lag time of up to 12 hours between the High Aswan Dam and the Delta. Therefore, water distribution is hardly flexible. However, some level of flexibility is provided by the possibility of water storage variation behind the Nile dams and the various forms of arrangements reached between farmers and district irrigation engineers. Water shortages and tail-end effects occur and farmers respond by conjunctive use (tapping drain and shallow groundwater), in some cases by stealing water and by bringing pressure on district irrigation staff.

Within the framework of decentralisation and privatization policy, it is envisaged to establish Water Boards at district level. This is an ambitious and immense task that would revolutionize irrigation water management in Egypt which has been centrally managed for millenniums. Infrastructure rehabilitations and improvements for better water control will be implemented in parallel.

3.2.2 Needs for regional capacity building

Regional capacity building needs to be related to (i) the shift from pragmatic water management to volumetric water management and (ii) decentralization of water management through establishment of WUAs and autonomous public or private management entities. All Eastern Nile countries are addressing these issues in their irrigation policy and legislation. Implementation on the ground is unevenly distributed. Egypt has already undertaken the establishment of WUAs and is increasingly strictly controlling the volumes of water diverted by implementing its National Plan. Sudan is trying to establish WUAs in the Gezira irrigation schemes but so far little results have been achieved. Ethiopia has recently elaborated a comprehensive irrigation policy and ad hoc legislation, implementation is just starting.

Shifting from pragmatic to volumetric water management

Pragmatic water management is flexible and responsive, managers respond to demands from farmers as best as they can. As scarcity develops water allocation and distribution often becomes increasingly chaotic. This classification simplifies real world diversity. In the Eastern Nile basin there is a continuum from poor irrigation management and non constraining water resources (mostly in Ethiopia) to much stricter water use control and water scarcity (Egypt). Annual variations in water management also occur in Sudan where there is stricter control and higher water scarcity for winter crops irrigation.

In contrast, with volumetric water management a stronger control is achieved. Water is allocated in bulk at scheme intakes and at lower levels of the canal system. Rotational rules are clear and predictable. Procedures to cope with water shortage in deficit years are clearly defined. Security in supply tends to make farmers willing to pay for O&M costs and often invites to complementary on-farm investments (fertilizers, improved crop varieties, farm machinery).

The difference between pragmatic and volumetric water management corresponds to a "quantum leap". Many reforms fail because they assume lightly that shifting from the former to the later is only a matter of good will and capacity building, whereas it is linked not only to the degree of water scarcity, but also to irrigation design and technology, managers incentive and farmers incentive structure and the wider institutional context. The prerequisites for volumetric water management are:

- Sound knowledge of the resource in time and space and of existing users;
- Better knowledge and monitoring of irrigation water requirements through for instance establishment or modernization of meteorological stations in strategic locations
- Means to control effective diversions and abstraction and to prevent non allowed increased water use, and
- Technical capacity to allocate water volumetrically and mechanisms to adjust these volumes in deficit years.
- Development of participatory approach and tools to improve communication between irrigation staff and farmers and their organizations
- Training of irrigation staff and farmers aiming at providing irrigation management tools such as performance indicators, by-laws for WUAs, irrigation scheduling, worksheets for maintenance, bookkeeping systems, mechanisms for assessing and collecting water use fee, procedures for conflict resolution and so on.

Currently these prerequisites are partially and unevenly met in the Basin.

- **Water Users Associations and other autonomous public or private irrigation management entities**

The strategy for formation and capacity building of WUAs should address the issues of assets and legal status. To perform their activities, WUAs need assets: office space and equipment, means of transport and communication, operating capital, and so on. A legal status enables WUAs or other management entities to have well defined objectives, internal rules and regulations and relationships with the administration. Moreover, 'they can sue and can be sued'

The process should be participatory by involving farmers and other stakeholders that are concerned by O&M at various levels. Starting the process with a stakeholder analysis will allow to identify these stakeholders and to assess the inputs they can provide at various stages of the process.

During the operation phase, the process should involve a progressive reduction of technical support by the state. However, the state must inevitably retain supervisory powers on financial management and O&M standards and in this regard, it is often the lack of government capacity rather than the lack of farmers' awareness that is the main obstacle to establish self sufficient management entities. **To be viable, autonomous water services must be based on reliable and measurable provision of water or in other words on volumetric water management**.

Training at all levels is needed to provide WUAs with efficient and locally adapted irrigation management tools such as by-laws, performance indicators, irrigation scheduling, worksheets for maintenance, bookkeeping systems, mechanisms for assessing and collecting the water fee, procedures for conflict resolution and so on. When policies call for investment of public money in irrigation development and transfer of irrigation management to users, efficient and sustainable WUAs becomes a matter of public interest.

3.3 RESOURCES MOBILIZATION AND COST RECOVERY OF O&M.

Cost recovery of O&M in irrigation schemes is on the agenda of the three Eastern Nile countries. This relates to the challenges and opportunities of irrigation policies described in the Transboundary Analysis of the present study.

3.3.1 National contexts

- **Ethiopia**

The irrigation policy and related legislation intends to establish efficient cost recovery mechanisms in all irrigation schemes and to collect additional water charges on a volumetric basis for financing the future River Basin Organizations. So far these reforms have not been implemented.

- **Sudan**

Previous attempts for collecting irrigation charges from farmers in public irrigation scheme have not produced the expected results. The ongoing experiment of establishing WUAs in the Gezira irrigation scheme has got mixed results: farmers refuse to pay for the costly maintenance of the minor canals where most of the sediments accumulate. Currently O&M costs are subsidized by the Government. O&M costs represent 80% of the budget allocated for irrigation management which in turns represents 60% of the total budget of the MIWR.

Egypt

The WUAs established at meska level in the course of the Irrigation Improvement Project have the financial responsibility of O&M. The policy is to continue the establishment of WUAs and further establish Irrigation Boards at district level which would be technically and financially responsible of O&M of public irrigation and drainage in their district. Furthermore, it is envisaged to establish progressively recovery of O&M costs and investments for infrastructure improvements in the main system.

3.3.2 Regional capacity building needs

Regional capacity building should address the practicalities for charging O&M costs to users in the Eastern Nile context characterized by small farm units, numerous and poor farmers and surface irrigation dominated by food crops.

Activities should involve sharing of experience among Eastern Nile countries, organization of study tours for irrigation professionals and leaders of farmers' organizations, and real world experimentation on the following topics.

Types of O&M charges modalities

The following options are possible:

- *Uniform user charge*: users are assumed to have equal access to water and to be charged evenly. Even if the level of use varies, differences cannot be or are too costly to be assessed.
- *Area based charge*: users are charged according to the irrigated area based on land rights or area actually cropped (declared by the farmer or assessed by the management entity).
- *Area + crop based charge*: the charge is based on area and the type of crop. Differentials may be justified by policy priorities (e.g. cereals for food security) or water consumed by crop or its value. This is the modality used in Sudan public irrigation scheme.
- *Volumetric charge*: water is charged on basis of actual diversions to a user or a group of users. Metering is necessary but volumes may be represented by time and numbers of irrigation turns, provided discharges are more or less stable and predictable.
- *Quotas at fixed charge*: Water quotas may be uniform (based on area) or vary according to the type of crops. Water charges can be proportional to the nominal volume or vary by crops. This option seems well adapted to Egypt where water allocation will be allocated on a fix amount per feddan basis (=quota).

Each method has its advantages and disadvantages notably with respect to the ease with which charges can be calculated, justified and collected. Transaction costs associated with charges collection should be carefully assessed when selecting a modality. The most common forms are area-based or crop + area-based, notably in Sudan, Turkey, India, Indonesia, Pakistan, Vietnam, Japan, Argentina and Greece. Volumetric charging is usual in North Africa and the Middle East (e.g. Tunisia, Jordan and Iran) and in countries such as Mexico, the USA and in Southern Europe. Volumetric charging is often associated with a quota and defined at bulk rather than individual level.

Some countries impose a resource charge in addition to an irrigation charge. This may be simply an administration fee for registering a water permit, but can also be a contribution to basin management cost. This is the case in South Africa, Spain, France and in the future Egypt and Ethiopia.

- ***Assessment, collection and utilization of O&M charges.***

As for types of charge, many options are available. According to the policy and strategy of the Eastern Nile countries, assessment, collection and spending of irrigation charges will be shared at different levels. WUAs will collect irrigation charges from farmers and retain a pre-assigned share for its functions (e.g. O&M of field delivery canals), transferring the balance to an irrigation agency for O&M at scheme level which in turn will transfer a balance to the State or a basin organization in exchange of water supply. This should be paralleled by contractual arrangements made for bulk allocation and schedule at each level, i.e. between the state or the basin organization and the scheme management entity and between the scheme management entity and WUAs.

Cost estimation and hence the level of cost recovery implied is not straightforward. Maintenance costs are often estimated as a percentage of investments costs. However, common sense dictates that farmers should not pay for over-elaborate "gold plated" design, incompetent expensive construction costs, cost overruns due to poor scheduling of construction activities and the like. Moreover should ideal or actual maintenance costs be considered? And how should ideal maintenance costs (and maintenance level) be defined?

Similarly with respect to operation costs, farmers should not be asked to pay for overstaffing, poor management and corruption. ICID surveys on funding of operation, maintenance and management costs in 82 irrigation and drainage systems in Asia[9] found an average of 38% of O&M costs spent on salaries with a maximum of 80% and a minimum of only 10% in Northern Vietnam. In the State of Victoria, Australia, when farmers were requested to pay the full costs of O&M, increased scrutiny of the supply agency led to a 40% reduction of O&M costs. More generally, while farmers tend to have short term view of what is required, often in the hope that the state will in due course rehabilitate the system or eventually cover the O&M costs (like in Sudan public irrigation schemes) they also usually have a much better idea of what is required than an unaccountable public irrigation agency.

- ***Recovery rate of O&M charges***

Problems of recovery rate have plagued many irrigation systems. Recovery rates tend to be higher (i) in countries under authoritarian government, (ii) if supply is cut-off for non payment, (iii) if charges represent a low percentage (typically less than 10%) of gross farm revenue, (iv) if charges are collected before the irrigation season, (v) where users decide of the use of charges, and (vi) when water supply is reliable.

Incentives and accountability are crucial questions with respect to recovery rates. Promotion of volumetric water management and thus security in water supply is no doubt a strong incentive for good recovery rate. Other interesting examples of incentives include the Philippines where commissions are paid to the WUAs that are successful in recovering the O&M charges and China where managers are given performance incentives. Involving farmers' participation in O&M decisions strengthens accountability and ensures they are aware of management constraints related to actual available financial resources; the aim being to shift farmers' role from "passive clients" to co-managers of the irrigation scheme.

[9] See (6) in bibliography.

4. Section 4: Review of institutional framework and processes towards cooperative, transboundary water management in the Eastern Nile Irrigation and Drainage Sector

4.1 REVIEW OF THE EXITING INSTITUTIONAL FRAMEWORKS RELATED TO WATER RESOURCES DEVELOPMENT AND MANAGMENT

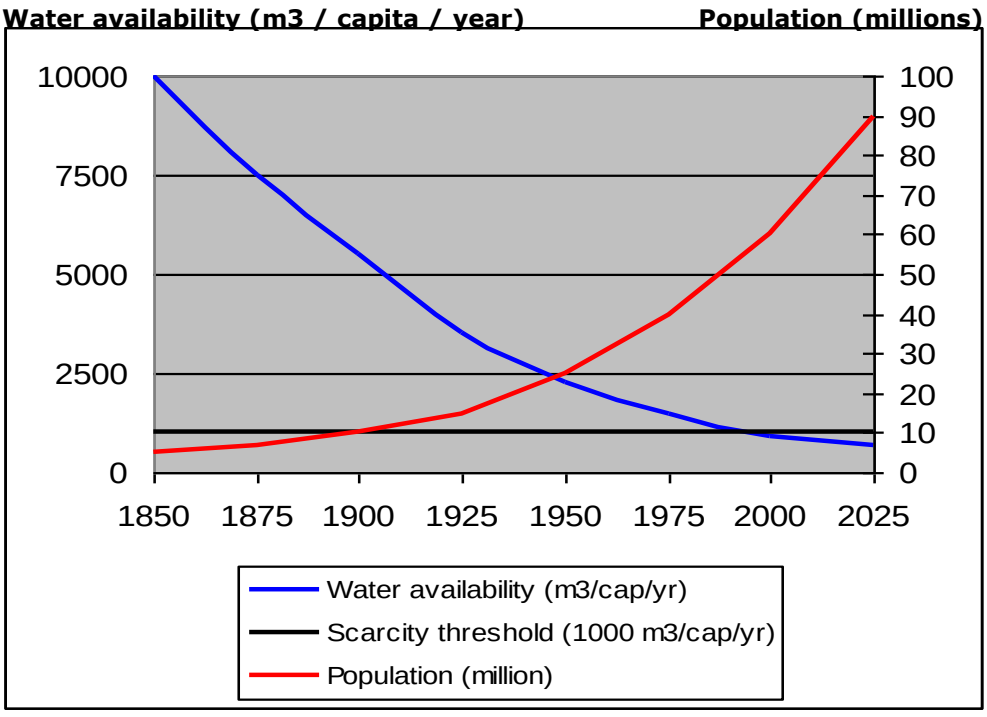
4.1.1 Institutional framework in Egypt

4.1.1.1 Context and background: Increasing water scarcity and the need for integrated water resource management.

Until the 1990's, Egypt managed its water resources as if it has and will continue to have plenty of water. In the late-1980s, Egypt shifted from a policy of controlling cropping patterns to a market-driven policy in which farmers are free to grow whatever crops they wish. Egypt's irrigation authorities' management objectives were to provide sufficient water to all farmers to fully meet the demand, whatever the crops grown. Demand was calculated using increasingly unrealistic estimates of the likely cropping pattern at the beginning of each season. Additional allocations were made when farmers complain about shortages and demand additional water. Such a management objective presupposed the availability of sufficient water. At the same time, the Egyptian government continued to invest in expanding the irrigated area. Between 1960 and 2005 total irrigated agricultural land increased from 2.5 million ha to 3.7 million ha.

The demand for fresh water resources has hence steadily increased over the years, along with the population growth thus reducing the per capita share. Egypt recently became a water scarce country (i.e. less than 1,000 m3/capita/year).

Figure 1: Evolution of the per capita water availability in Egypt



The Ministry of Water Resources and Irrigation (MWRI) has the overall responsibility of the development and management of water resources. Traditionally, the MWRI's role has chiefly been to ensure that all users (irrigation, domestic and industrial needs, navigation, energy production) receive enough and timely water resources to address their needs. In the irrigation sector, the MWRI's management objective was to provide sufficient water to all farmers to fully meet the

demand, whatever the crops grown. Demand was calculated using increasingly unrealistic estimates of the likely cropping pattern at the beginning of each season. Additional allocations were made when farmers complain about shortages and demand additional water. Such a management objective presupposed the availability of sufficient water. But facing the challenge of increasing water demands with limited options to increase the supply, the MWRI has taken steps towards concepts such as decentralization, geographic and cross-sector integration, water users participation, water quality and quantity monitoring, water use efficiency, have been promoted and implemented, with the support of donor agencies.

4.1.1.2 The centralized and fragmented organization of the MWRI poses a challenge for integrated water resource management reform.

Today the MWRI is divided into several departments, authorities, sectors and units. The main ones are:

- Irrigation Department (ID), which manages irrigation is subdivided into several sectors, some of these being: the Irrigation Sector (IS), responsible for canal O&M; the Irrigation Improvement Sector (IIS), implementing irrigation improvement projects (IIP); and the Ground Water Sector (GWS), monitoring groundwater resources;

- Planning Sector (PS), formulating and evaluating long and short term water management plans;

- Egyptian Public Authority for Drainage Projects (EPADP), originally responsible for implementing drainage projects, but which over the years has taken over the entire O&M of drains;

- Mechanical & Electrical Department (MED), in charge of the maintenance and operation of all pump stations (irrigation, drainage, drainage reuse);

- National Water Research Centre (NWRC), with its twelve specialized research institutes, conducts applied research on irrigation and water management; and

- The High Aswan Dam Authority (HADA), which operates and maintains the Aswan dam and reservoir.

In addition to these large entities, there are a number of small units with specific responsibilities and functions, such as the Central Directorate for Irrigation Advisory Service (CD-IAS), the Integrated Water Management Unit (IWMU), the Institutional Reform Unit (IRU), the Water Quality Unit (WQU), the Water Communication Unit (WCU), etc.

The Nile water sector is the unit in charge of transboundary water management, its responsibilities are:

- Implementation of the agreement of Optimal Utilization of the Nile Water, signed between Egypt and Sudan in November 1959;

- Carrying out full studies on future projects that may be undertaken by the riparian countries on the Nile or any of its tributaries to identify the potential effects of such projects on Egypt's water resources;

- Monitoring the operation of the Owen Falls Dam in Uganda, according to the agreement signed between Egypt and (British) Uganda in 1953;

- Affirmation and conservation of Egypt's rights to the Nile Waters through participation in international conferences and seminars;

- Measuring, collecting, recording and analyzing the Nile water levels, discharges and rainfall to forecast the Nile yield to enable decision makers to adopt the appropriate water policy;

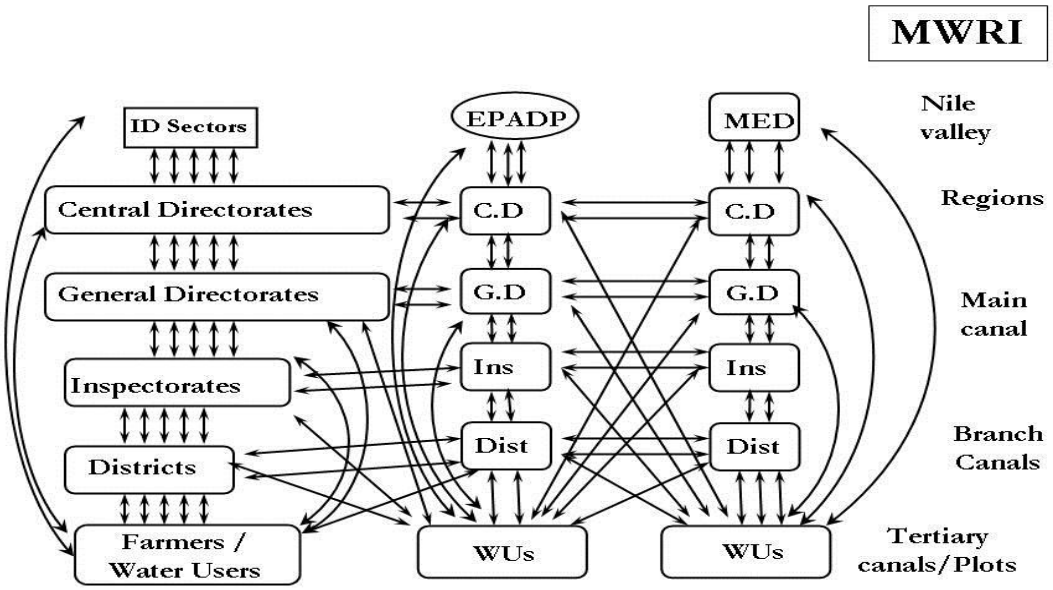
- Identifying, studying and preparing the Nile Water Conservation Projects for the purpose of increasing the Nile yield and decreasing its losses;

- Introducing technical and financial assistance to the riparian countries.

At central level, each main agency (EPADP, MED, ID, HADA and NWRC) reports only to the Minister and thus operates quite independently. The yearly planning of activities of each entity is carried out based on sound technical criteria but social, environmental and cost-efficiency criteria are marginally considered. There is also limited, if any, consideration for the planning of other entities, and consequently limited cross-sector or geographic integration.

At regional level, the country is divided into central directorates, each headed by an undersecretary. This MWRI undersecretary has nominal supervision over all MWRI activities. The various MWRI central departments, sectors and authorities function however separately with their own local delegations such as general directorates, inspectorates and districts. The boundaries of these do not generally match (at directorate level or below) from one sector/department/agency to another. The most significant example of this fragmentation is the Egyptian Public Authority for Drainage Projects (EPADP). Originally established in 1973 as the implementing unit for the first of the World Bank-funded series of National Drainage Projects, the EPAPD has steadily grown over the years and extended its responsibilities. In the late 1980s, the EPADP thus became responsible for not only building (open and sub-surface) drains but also for maintaining existing drains all over Egypt. To fulfil this mission, the EPADP has thus established its own parallel administration, with regional Directorates divided into local districts. Field staffs from both the Irrigation Department and EPADP do their level best to coordinate, as if they were belonging to two separate Ministries, with their own separate policies and budgets.

Figure 2: The regional and local institutional setup of the MWRI in Egypt



4.1.1.3 Institutional change process followed in Egypt

Although the concept of Integrated Water Resources Management (IWRM) is being promoted by managers of the MWRI, the challenge is outlining a concrete process to implement IWRM; the main issue is how to define how "integration" relates to "management".

Most institutional change efforts focused on the district level (about 20,000 ha), in order to promote decentralization, empower water users and get them involved in water management.

Since 2002 with support from a project funded by USAID, approx 40 Integrated Water Management districts (IWMD) have been established to consolidate all water resource management functions and implement water projects under their jurisdiction. In parallel, Branch Canals Water Users Associations were established to involve the stakeholders in the management of water resources. On average 25 BCWUAs (each covering 500 to 850 ha) were formed in each IWMD; it is planed to establish district level Water user boards. IWRMD were also equipped with a district data base compiling data about cropping patterns, water level in irrigation canals, water quality and complaints of water users.

Several significant institutional benefits from the establishment of IWMD have been identified and acknowledged by MWRI staff:

- Pooling of resources, equipment and skills at district level mainly through the consolidation of irrigation & drainage functions;
- Streamlined communication channels; and
- Decentralized and simplified decision-making.
- Even more importantly, from the water users' perspective, the IWMD became the "single window office" for irrigation matters.

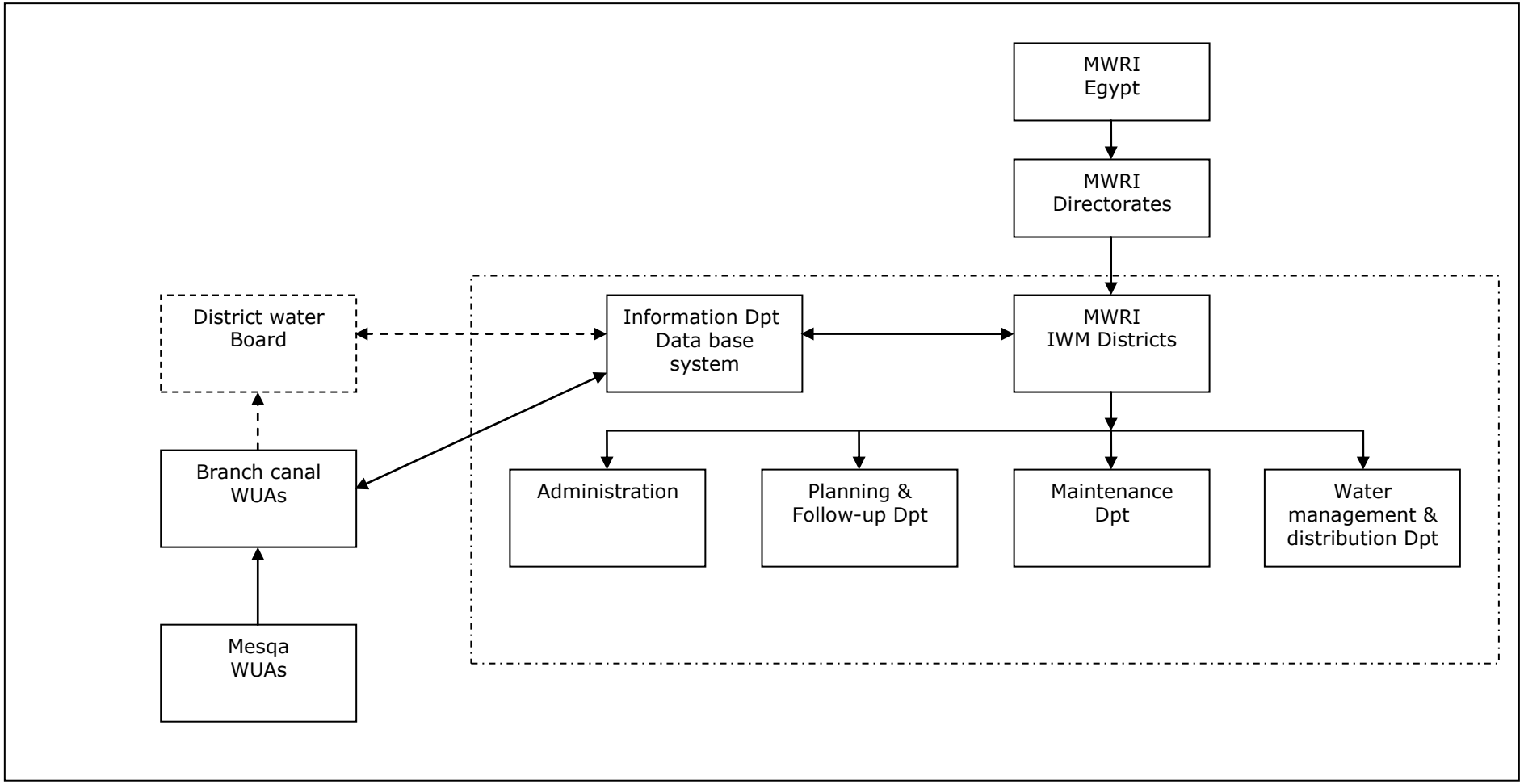
Benefits from District data systems are:

- Improved data-based decision making through access of IWMD managers to routine and reliable data.
- Water users' awareness and participation supported by the provision and explanation of water data.
- Mechanism for allocating water by volume at District level.
- Improved matching of water demand and supply resulting in water savings at District level.
- Development of District water resource inventory and integrated water management plans, taking into account surface water, groundwater, and drainage reuse as supply sources.

Further steps are also being considered, such as:

- The establishment of Water Users Boards at district-level; two district water boards have recently been established in the Western Delta; and
- The integration of all irrigation and drainage functions at the directorate level.

Figure 3: The re-organized institutional setup at district level in Egypt



4.1.1.4 Pending institutional issues

There is a strong need for empowerment of Water Users Organizations if they are to assume greater responsibilities with respect to water distribution and maintenance of the irrigation infrastructure. The high policy priority assigned to reclamation of new lands in the desert makes restriction on water allotments in the old lands inevitable. As a consequence Water Users Organizations will have to have the skills and management tools to perform effectively perform their tasks such as allocating and using water in an efficient manner. For doing so coordination between the advisory services of the Ministry of Agriculture and the MWRI should be strengthened.

Absence of enabling law for BCWUAs and district Water boards is a major constraint of the ongoing institutional reforms. An enabling law should provide Water Users Organizations with a legal status and by-laws; it would also define long term legal rights of Water Users Organizations to water and the use of the irrigation and drainage infrastructures they are responsible for. If a Water User Organization does not have such rights, then how can it deliver water to its members? And how can users have any belief in their organization? More specifically the pending issues with respect to Water Users Organizations are the following:

- Tasks: irrigation and drainage only or inclusion of non agricultural water uses, should tasks include environmental protection and drainage reuse?
- Membership: the standard is compulsory membership but it can be voluntary. Shall a distinction be made between land owners and tenants? Shall members be only the mesqa Water Users Associations or shall membership expanded to other users?
- Establishment: compulsory or voluntary establishment, who takes the decision to establish a WUO, the government or the users?
- Rights and duties of members with respect to access to a fair share of water, control of operation and accounts, participation to collective works, payments of fee levied by the organization etc.
- Internal structure of organizations: role and responsibilities of the general assembly and the various committees, mode of designation/removal of office holders, etc. More specifically, votes allocated to each member can be equal for all or weighted according to landholding size or amount of water used.
- Financial management: procedures for assessing, collecting and using the various charges collected by the organization from its members if they are to participate to the O&M costs of the public irrigation system;
- Regulation: supervisory role of the state with respect to O&M standards, protection of public interest (public infrastructure and environment), auditing of accounts, gender issues, others.
- Substantive rights: long term water rights and rights of using the water works, powers to impose sanction and to call on the relevant court of justice for arbitrating conflicts that cannot be solved internally.

4.1.2 Institutional framework in Ethiopia

4.1.2.1 Context and background

The dominant strategy in the irrigation sector consists of the expansion of irrigation systems to achieve food security, poverty reduction and related social and environment conservation objectives. In other words, Ethiopia recently entered the era of construction of dams, reservoirs and canal distribution networks and faces all the financial constraints it implies. According to the irrigation policy, irrigation systems will be managed by WUAs or jointly managed by WUAs and public or private irrigation agencies for the larger schemes. Contrary to Egypt and Sudan, Ethiopia has very little experience in irrigation development, especially large scale irrigation. The first large scheme with smallholders (Koga: 6,000 ha) is not yet fully operational. Ethiopia is a federal state divided into nine largely autonomous regions. Thus there are institutions for irrigation development at the federal and regional levels.

4.1.2.2 Institutions related to irrigated agriculture

Federal level

The Ministry of Agriculture and Rural Development (MoARD) has the mandate of promoting the expansion of rapid and sustainable agricultural and rural development as well as encouraging and assisting the provision of agricultural extension services to farmers and pastoralists. It is clear that this overarching function applies also generally to irrigation. The MoARD also has the specific function of encouraging and supporting the expansion of small scale irrigation schemes.

The Ministry of Water Resources (MoWR) has the powers and duties to prepare plans that help to properly utilize water resources for development purposes and supervise their implementation upon approval. The MWR is divided into several departments: the Irrigation & Drainage Department, the Policy Development, Cooperation and External Relations Department, the Basin Development & Water Utilization Control Department, the Dams and Hydropower Design Department, the Hydrology Department, the Women Affairs Department, Water Resources Administration & Urban Water Supply & Sewerage Department, the Rural Water Supply Department, the Water Resources Information, Natural Resources and Environmental Meta Data Base Centre. Although most of Ethiopian river basins are transboundary, there is no specific unit dealing with transboundary waters within the MoWR.

The MoWR supervises the Water Works Design Enterprise as well as the Water Works Construction Enterprise whose respective functions include the planning and design as well as the construction operation of irrigation schemes. The MoWR supervises also the Awash Basin Water Resources Administration Agency which has both regulatory functions as well as functions related to construction, operation and maintenance of irrigation. Thus, although it is not clearly stated, the MoWR and the autonomous organs under it can be deemed to be responsible for large scale irrigation development and in practice the MoWR is in charge of large scale irrigation development.

Business Process Reengineering (BPR) at the federal level was carried out to clarify the role and responsibilities of the different ministries, improve inter-ministry cooperation, create synergies and save on public spending. However, there is still a need to clearly delimit the respective mandates of the MoWR and the MoARD with respect to irrigation development. One possible option is that the MoWR concentrates on the design, construction and O&M issues while the MoARD focus on agricultural production related aspects.

Regional level

Alike the MoARD the regional bureaus of Agriculture and rural Development (BoARD) have the mandate of agriculture development within their regions. It includes encouraging and supporting the expansion of irrigation schemes, no reference is made to the scale (small or large) in the Board's mandate.

The powers and duties of the regional Bureaus of Water Resources Development (BoWRD) do not include specifically functions regarding irrigation schemes. However the powers and duties of this Bureau are to prepare water works designs on its own imitative or upon request by others or causing the preparation of such designs by others can be interpreted to include irrigation schemes as well. There is nothing provided regarding ownership and the responsibility of operation and maintenance of major irrigation works be it small, medium or large scale in the laws that establish the BoWRD.

Business process reengineering was carried out in the Ethiopian regions to clarify the roles and responsibilities of the various regional bureaus. As a result, delimitation of mandates between BoARD and BoWR for irrigation development has become clearer in most regions, namely Amhara, Oromya and Tigray. BoARD provide agricultural extension services to irrigating farmers as well as advisory services for routine maintenance and operation of irrigation schemes and the development of primary industries which may be necessary for processing farm products.

BoARD are now responsible only for extension activity including providing technical support in its various forms and packages as well as extension service for irrigated agriculture irrigation extension. The role of the BoWR is to design and construct irrigation infrastructures and bring the water to the farmer's fields and then carry out major maintenance work and ensure that routine maintenance (canal cleaning) is carried out by farmers. In most regions BoARD and BoWR have now started to coordinate their activities. BoARD plans for the development of irrigation and the BoWR implements design and construction according to the plan after checking whether or not the proposed irrigation schemes are technically feasible. In practice, activities of regional institutions are limited to small scale irrigation development.

Irrigation cooperatives (scheme level)

Once the construction work is completed, small scales irrigation schemes are handed over to the BoARD for the operational phase. The Cooperative Promotion Office (CPO), which in most regions is under BoARD, is then called upon to organise the Irrigation Cooperative. The objectives and functions of irrigation cooperatives are barely different from any other agricultural cooperative or indeed from any other cooperative in a fundamental way. Therefore the term "Cooperative for Irrigated Agriculture" is more appropriate than "Irrigation Cooperatives" to qualify them. Such cooperatives are primarily meant to carry out the procurement of inputs for their members and the sale of their products but an "irrigation committee" is set up for O&M functions. As per the internationally recognized principles for cooperatives, they have to issue shares to be bought by individual members on a voluntary basis. Very often, only few farmers accept to join the Irrigation Cooperatives because (i) farmers do not see any distinct advantage in joining the cooperatives, (ii) membership and registration fees and capital shares are too high and (iii) negative experience with cooperatives during the Derg regime.

In most schemes water management by the "irrigation committee" has led to a complex situation where cooperative members try to prevent non-members from getting water during periods of water shortage giving the priority to cooperative members and the answer given to complaints filed by non-cooperative members, with the local authorities, is that Irrigation Cooperatives are legally recognised organizations and hence have all the legal rights to manage the scheme and attribute water in priority to their members. This kind of answer has little legal basis and is clearly meant to force recalcitrant farmers to join the Irrigation Cooperatives.

In many up-graded traditional irrigation schemes[10], farmers have decided to return to the traditional water management system leaving the cooperative as a "paper organization". The traditional water authorities were taken back on board by the farmers who organised elections in the traditional way and have restored the traditional water system without any legal recognition. There are also cases where there is stiff competition between the irrigation cooperative and the traditional authority cohabiting in the same scheme.

Failure of most the Irrigation Cooperatives in carrying out the tasks related to irrigation management and O&M and the ongoing development of large scale irrigation projects have led the MoWR to prepare very recently a new legal framework for the establishment of Irrigation Water Users Associations (IWUAs) for the sustainable development and management of irrigation and drainage infrastructure. This legal framework includes:

- A Proclamation which provides for the establishment of IWUAs as self-governing, non-profit legal entities that shall, in the public interest, manage irrigation and drainage system. All other support services to agricultural production such as marketing and inputs supply are excluded from the purpose and tasks of IWUAs. The text of the Proclamation will be debated by the Parliament;

- Model of bye-laws of AWUAs with respect to the IWUA Proclamation;

- Model Agreements and/or Contracts between AWUAs and other parties such as public or private entities in charge of irrigation water supply in bulk, O&M of the main water infrastructure of large irrigation schemes, service provision for maintenance work as well as agreements between IWUAs and their members for irrigation water supply.

4.1.2.3 Institutional reform

The Proclamation 534/2007 provides for the establishment of river basin organizations for Ethiopian river basins. It lays down the objectives and powers and duties of River Basin High Councils and the Authorities designed to serve as the executive entity /secretariat of the High Councils policies and directives. The accountability of the High councils shall be determined by the Council of ministers. The river basin authorities are accountable to their respective High Councils with respect to issues falling under the provisions of Article 6 of the Proclamation under discussion and to the Ministry of Water Resources with respect to other issues falling under its jurisdiction.

The objective of establishing the High Councils and Authorities is to promote and monitor the integrated water resources management process in the river basins falling under their jurisdictions with a view to using of the basins' water resources for the socio-economic welfare of the people in an equitable and participatory manner, and with out compromising the sustainability of the aquatic ecosystems.

Budget for RBOs will come from funds allocated by the Government and from users through the collection of permit fees and water charges.

[10] Many traditional schemes were built by rural communities without external assistance.

The powers and duties of the High Councils are as follows:

Planning

- Provide policy guidance and planning oversight to ensure high level of coordination among stakeholders for the implementation of integrated water resources management in the basin;
- Direct the preparation of the river basin plan and submit same for approval by the Government;
- Examine and decide on the appropriateness and prioritization of constructing major water works in the basin;

Water allocation and charging for allocated water

- Examine and decide on water allocation rules and principles in normal times and in times of water shortage as well as in times of drought or flooding;
- Manage water use disputes between Regional States in the basin;
- Propose to the Government the rate of the water charges to be paid by water users in the basin;

Transboundary waters

- Provide information and advisory support to the body in charge of negotiating with neighbouring countries with respect to the basin where the basin is part of a trans-boundary basin;

Others

- Establish standing or ad-hoc committees necessary for discharging specific activities.

The powers and duties of Basin Authorities are as follows:

Formulating basins' plan

- Prepare, and submit the basins' plan to the Basin High Council;
- Initiate and submit to the Basin High Council policy measures needed to create a conducive environment for the implementation of an integrated water resources management process within the basin; and follow up the implementation of same upon approval;
- Develop and use a river basin model in order to guide and support its basin water resources strategic planning and water administration functions;
- Collect, compile, analyze and disseminate information for proper planning, administration and steering of water resources in the basin;
- Undertake studies, surveys and researches that are deemed necessary to carry out its functions;

Monitoring and facilitate basins' plan

- Monitor the implementation of the basin's plan upon approval;
- Follow up the implementation of the policy measures to create an enabling environment for integrated water resources management upon approval by the High Council;
- Undertake activities necessary for, and facilitate, the implementation of integrated water resources management in the basin;
- Ensure that projects, activities and interventions related to water in the basin, are in their content, schedule, impacts and management are in line wit the integrated water resources management process;
- Set up a forum for effective networking among stakeholders.

Allocating water and collecting water charges

- Without prejudice to the power given to the Regional State by law, issue permits applicable to the basin's water use and water works in accordance with Part IV of the Ethiopian Water Resource Management Proclamation (Article 11 et seq.) and Part II of Ethiopian Water Resource Management Regulation (Article 3 et seq.), and ensure that the terms of the permits are complied with;
- Give advice and technical support to the Basin High Council and the Ministry on disputes resolution in relation to the allocation and use of water resources in the basin;
- Collect water charges from users;

Transboundary waters

- On the basis of instructions of the Basin High Council, prepare and provide necessary information for the concerned body in charge of negotiations with other countries concerning trans-boundary river basins;

Others

- Own property, enter into contracts, sue and be sued in its own name;
- Carry out other functions necessary for the implementation of its objectives.

The Abay Basin Organization is the most advanced one and is starting operation for integrated water development in the Lake Tana and Beles sub-basins. For doing so a subsidiary office or a sub-basin organization was established in Bahir Dar. The subsidiary office is undertaking all the above duties at the sub-basins level.

4.1.2.4 Institutional issues related to irrigation development

Large scale irrigation

From experience of the Koga irrigation scheme main institutional issues for large scale irrigation development are:

- The need to establish an autonomous public or private irrigation management entity in each large scheme for O&M of the main water works. Several types of public/private partnerships for large scale irrigation management are under consideration.

- The need to have a specific public body in charge of the general coordination of Large Scale Irrigation development linked both to the federal and regional level. Roles and responsibilities of such a body should include supervising and monitoring the project cycle including aspects related to environmental and social impact assessment, beneficiaries participation, compensation and resettlement plans for negatively affected population, monitoring and when under operation, evaluation of performance and managing a maintenance funds to cover the likely financial gaps during first years of operation. This need is not yet addressed. This public body can be established by strengthening the Irrigation & drainage department of the MoWR, expanding its roles and responsibilities and improve coordination with other institutions in charge of agriculture development and environmental protection.

- A clear separation of the roles and responsibilities among the participants at two levels: First between the scheme owner (MoWR) and the management entity, second between the management entity and the water users. This separation should be stipulated in contracts. This need is currently addressed with the preparation of legislation for WUAs.

- A clear separation of the support services to agricultural protection (role of cooperative for instance and the irrigation functions, the role of WUAS. This separation should be stipulated in contracts. This need is currently addressed with the preparation of legislation for WUAs.

- There is a major need for capacity strengthening for irrigation management entities, WUAs and the coordination body given the lack of experience of large scale irrigation development in Ethiopia.

Small scale irrigation

Lack of coordination between the regional bureaus (BoARD, BoWR) was a major impediment for small scale irrigation development, this constraint has bee addressed in most regions by the business process reengineering. It is expected that the future law for WUAs will solve the problems related to the inappropriate status of irrigation cooperatives for managing irrigation schemes. However it is a major need that BoARD and BoWR define a common strategy for formation and capacity building of WUAs

Research and extension services

The research and the extension services in Ethiopia are almost exclusively oriented toward rain-fed agriculture and livestock development. With irrigation development they will have to respond to the demand created by the development of widespread irrigation in the following areas:

- Diversification of irrigated agricultural production;

- Optimization of technology packages specific to irrigated agriculture, cropping patterns and crop rotations;

- Improving on-farm water management;
- Storage and processing of farm products

The stakeholders involved are the Ethiopian Institute for Agricultural Research (EIAR), regional research centres, the Bureau of Agriculture, the Bureau of Water Resources (for water management aspects) and possibly private sector organizations such as inputs providers and agro-industries.

Credit and inputs supply

The development of irrigation will increase the needs for investment credit for farming and irrigation equipment, transport means, plantation of perennial crops (fruit trees), etc. Simultaneously, the use of agriculture inputs will also increase. So far the main stakeholders involved in credit provision to farmers are micro finance institutions and cooperatives. Contract farming with agro-industries or traders, and devising mechanisms and incentives for greater participation of commercial banks are required. A strong development of the private sector is predicted and desired in the economic sector in order to fill the currently deficient inputs supply services.

4.1.3 Institutional framework in Sudan

4.1.3.1 Federal level

The Ministry of Irrigation and Water Resources (MIWR) is the federal body in Sudan legally responsible for all water affairs. It offers technical advice and assistance to water projects within the states and the private sector. It undertakes its task in coordination with the relevant sectors, departments and technical offices (agriculture, industry, foreign, electricity, and investment, etc). It has the following responsibilities:

- Satisfaction of the water requirements of the various users through the country;
- Water resources planning, management and development;
- International and regional cooperation concerning the shared water sources;
- Planning, design, execution, operation and maintenance of the different irrigation schemes;
- Control of water abstraction;
- Construction of new irrigation works;
- Operation and maintenance of all large-scale irrigation structures and drinking water facilities;
- Provision of the means for hydropower generation and protection of the water-related environment.

The National Council for Water Resources is the high level decision making body for policies and legislation and has representatives of all the water related ministries, the state governments and stakeholders in the water sector. There are also two National Coordination Committees for the Blue Nile and Atbara which advice the senior MIWR decision makers about the operation of dams. Stakeholders are also represented in these committees.

The Technical Water Resources Organ (TWRO) is the executing arm of the National Council of Water Resources. The TWRO is responsible for the preparation and review of the country water resources policies, strategies, and master plans. These policies and plans have to consider issues relevant to other countries sharing surface and groundwater with Sudan. Therefore, the TWRO is also responsible of all matters related to bilateral and multilateral agreements, cooperation issues dealing with shared water resources. It represents Sudan in negotiations with the other Nile riparian countries for the realization of joint projects related to the Nile water and for agreements to share the mutual benefits.

The MoIWR is divided into several operational units, the main ones are:
The Projects General directorate is responsible of the construction of public water works projects including irrigation schemes

- The Dams and Dams Control Directorate is responsible for the operation and maintenance of dams and water control structure.
- The Mechanical and Electrical Works Directorate is in charge of the maintenance and operation of all public pump stations
- The Irrigation Operation General Directorate (IOGD) is responsible for water supply and maintenance of the four large national irrigation schemes: Gezira, New Halfa, Rahad and El-Suki, with total gross area of 1.3 million hectares representing about 75% of all the irrigated area in the country, the balance of 25% is operated by other public and private enterprises. Water supply to the four large public schemes is based on cropping patterns, crop water requirements and estimates of conveyance efficiency.
- The Planning general directorate is responsible of the efficient use of irrigation water, feasibility studies of irrigation projects and the coordination of irrigation development with the regional states.
- The Nile Water Directorate (NWD) is responsible for the establishment and operation of all the hydrometric and sediment discharge monitoring stations on the Nile and its tributaries as well as the analysis and dissemination of relevant information. The NWD also monitors the use of the Nile water by the various water users including public or private irrigation schemes.
- The Ground Water and Wadi Directorate is responsible for exploration, assessment and evaluation of the Wadies and ground water resources. The Directorate also designs schemes for rainwater management (water harvesting).

The Ministry of Agriculture is responsible for the implementation of the agricultural policy, agricultural research and extension services and supervises the Agricultural Corporations that manage the large irrigation schemes. The ministry is also in charge of evaluation and monitoring private investments in the agricultural sector and issuing licenses for tax and tariff exemptions.

The Dam Implementation Unit (DIU), formerly the Marawi Dam Implementation Unit, was established to supervise the Marawi dam project. The Unit is currently in charge of major water projects in Sudan such as the heightening of the Roseires dam, Great Kenana and Rahad phase 2 irrigation projects. These functions obviously overlap with those of the MWRI. The DIU reports only to the Office of the President.

4.1.3.2 Regional state level

The Water Resources Departments of the regional States are responsible for water supply and maintenance of small and medium irrigation schemes within the state boundary. The MIWR Dams and Planning Directorates have jointly established five technical offices that provide technical assistance to

the Water Resources Departments of the Regional States. Technical offices have been established for the White Nile, the Blue Nile, the Upper Nile and two for the Northern Nile. The Technical Offices are responsible for giving technical support to the planning process between the Regional State Government and the various stakeholders.

With respect to private irrigation development, the investor has to prepare a pre-feasibility study and present it to the Department of Investment of the Ministry of Finance in the relevant Regional State for approval of the land allocation. After that, the investor is expected to prepare a more detailed feasibility study including the technical, financial and marketing aspects of the investment. In this respect he is supposed to make, among others, a detailed analysis of water requirements and irrigation technology use. Water is allocated upon approval from the MIWR / Planning Directorate. On implementing the project, the investor has to present the final detailed feasibility study to the Federal Ministry of Investment, which transfers it to the Department of Investment of the Ministry of Agriculture and Forestry for evaluation and monitoring. The Department looks into the list of inputs and assets as stipulated in the feasibility document, and issues the appropriate licenses for importing them with exemption from custom tariffs, taxes and fees for the specified period in the Investment Promotion Act of 2008.

4.1.3.3 Institutional reforms in public irrigation schemes

Irrigation water Corporations.

In 1995, as part of the liberalization of the economy, the Government withdrew from financing the cost of irrigation services. Farmers were left to pay irrigation fees to the newly established Irrigation Water Corporations (IWCs) a financially independent public institution, which used these fees directly to provide water supply services to the farmers. Instead of the IWCs setting up their own mechanism for collecting the fees directly from the farmers, it relied on the Agricultural Corporations managing the schemes to collect the fees from the farmers. Irrespective of the fixed rates, the amount to be paid was based on the harvest rather than the cropped area and determined by the Agricultural Corporations Field Inspectors; no water charge was levied if crops failed. As a consequence rates of water charges collection rates varied with agricultural production and did not exceed 60% and water charges did not cover maintenance costs let alone operation costs. Furthermore as the Agricultural Corporations were also facing considerable financial difficulties, part of the water fees collected did not reach the IWCs and part of the collected fees paid to IWCs was delayed for sometime as it was used for financing other urgent activities. The result of this was the inability of IWCs to have the required budget to provide its services in a sustainable manner. This led to the accumulation of sediment in the irrigation canals, deterioration of the water regulation structures, machinery and pumps. By the year 2000 the IWCs were dissolved. At present, the MIWR is again responsible for the O&M of the large public irrigation schemes irrigation up to the minor canals off-takes and the Agricultural Corporations for the lower levels of the irrigation systems; and Regional State governments became again responsible for the O&M of medium and small scale public irrigation schemes.

The 2005 Gezira Act.

On the basis of the recommendations from the World Bank study "Options for sustainable development of the Gezira scheme" in 2000, the Federal Parliament adopted the new Gezira Act in July 2005, which gave new responsibilities to Water Users Associations and private sector while reducing significantly the role of the Government. The Act guarantees free crops choice, transfers title and long-term lease deeds to farmers, privatises marketing activities and re focuses the Sudan Gezira Board on agricultural research and technology transfer. The Act has major implications on marketing, credit input supply, water management and maintenance of the irrigation assets. Main features of the Gezira act are:

- The legal opportunity for tenant farmers to buy and sell tenancies

- Freedom of crop choice by farmers within the constraint of reasonable agricultural practice. A Crop Choice Committee is established to assess whether or not the preferences of farmers can be met. Members of the Committee are representatives of the Ministry of Agriculture, MIWR, the Sudan Gezira Board (the Agricultural Corporation of the Gezira scheme), The Agricultural Research Corporation and Farmers' Union.

- The MIWR (IOGD) continues to deliver water to the scheme up to the minor canals

- Establishment of Water Users Associations (WUAs) for operation and maintenance of minor canals and lower levels. WUAs would pay for supply of irrigation water in bulk to the service area they are responsible for.

- Progressive transfer of marketing and credit activities from the Sudan Gezira Board to private operators

- The Sudan Gezira Board is expected to provide leadership for the implementation of the reforms.

It was expected that reforms in the Gezira will serve as a model for the other large public irrigation schemes. However, there is increasing scepticism about the implementation of the Gezira Act within the Ministry of Agriculture and the Ministry of Irrigation and Water Resources. There was no positive change in agricultural productivity, the ultimate goal of the reforms. One may say that establishment of WUAs was hastily made as there were already approx 1,700 WUAs in the Gezira scheme by the end of 2007. Too little time was allowed for preparing involved stakeholders in such a radical change, dialoguing and verifying the positive and negative implications of the reforms. Other difficulties faced by the implementation of the Act are:

- Sedimentation in canals: most sediment accumulates in the minor canals under the responsibility of WUAs which are reluctant to pay the high cost of sediment removal;

- Resistance of farmers: Pushed by the political power of the Farmers Union, farmers demand heavy subsidizes and total freedom of crop choice. The later is not appreciated by the Ministry of Agriculture, which sees the importance of following the technical crop rotation specifications to avoid spread out of pests and diseases, and soil exhaustion. Moreover, the Ministry considers the cultivation of cotton is the best choice, which is evaded by farmers who prefer other crops.

4.1.3.4 Institutional issues related to irrigation development

Reservation about the reform in the Gezira irrigation scheme led Sudan government to plan the transfer of the management of Rahad and New Halfa large public irrigation schemes to Kenana sugar Company. In parallel pump-fed schemes on the Blue Nile and White Nile will be grouped and transfer to the private sector after rehabilitation. It is very unlikely that Kenana or private companies will deliver irrigation water individually to farmers. Therefore there is a need for legislative and institutional reforms for establishing strong, effective and sustainable WUAs associated with the relevant strategy for formation and capacity building of WUAs using the lessons learnt from the Gezira.

Until to date, the relationship between private investors or Kenana company one hand and farmers on the other hand for the supply of irrigation water is not clear. Water supply contract agreements should be prepared by the government and negotiated between the concerned stakeholders. Moreover irrigation transfer agreement should include provisions with respect to the question of water rights from the Nile and environmental safeguards.

Irrigation transfer to the private sector is likely to raise uncertainties amongst the farming communities regarding their future land rights: how much land will be allocated to the investors. On the other hand private investors are likely to prefer supplying water to the land that belongs to them rather than neighbouring farmers.

4.1.4 Conclusion and recommendations

Public institutions of Egypt, Ethiopia and Sudan have long been and still are predominant actors of the irrigation sector. For the government of the three countries, one negative outcome of many years of state monopoly regarding investment and management of the irrigation sector is high public expenditures and lack of strong farmers' organizations which effectively undertake the irrigation management tasks. Since the 1990's, the governments of Egypt and Sudan actively advocate and implement reforms emphasizing a reduced role for the public administration and a larger one for farmers and the private sector. Ethiopia Water Sector policy for the irrigation sub-sector advocates the establishment of "*appropriate institutional structures for the implementation and management of irrigated agriculture*". The interest of governments of the three Eastern Nile countries rests in large part on their desire to reduce expenditures in the irrigation sector and promoting irrigation management transfer to WUAs.

Integrated Water Resources Management (IWRM) has been high on the agenda of water managers in the Eastern Nile countries and elsewhere, it is often a challenge to propose a practical translation of the concept. Many earlier institutional reform efforts focused on central administrative levels striving to improve coordination and information flows, clarifying roles and responsibilities, providing standards and guidelines for technical and human resource management. More recently, most institutional change efforts in the Eastern Nile basin seem to focus on the local level. Examples are the integrated water management districts in Egypt, National Coordination Committees for the Blue Nile and Atbara and the five decentralized joint technical offices of the MWRI Planning and Dams Directorates in Sudan, the decision to establish a subsidiary office of the Abay Basin Organization in Bahir Dar for integrated water development of the Lake Tana and Beles sub-basins. However in all countries, the frameworks for integrated water resources management concentrates primarily on allocation and management of blue water in rivers, groundwater, and lakes. More "integrated integration" in Ethiopia and Sudan should also focus on investment options for water management in rain-fed agriculture and considers the continuum from rain-fed agriculture – water harvesting – small scale irrigation – large scale irrigation.

There is also a need for better delimiting the respective roles and responsibilities between the "water institutions" and the "agriculture institutions".

In short, institutions of the three Eastern Nile countries share the same concerns and this provides opportunities for regional cooperative activities on the following issues:

Irrigation management transfer and cost recovery: Exchange of experiences across the Eastern Nile countries can help better defining the strategy and the process for establishment of strong and efficient WUAs.

Public / private partnership: Regional cooperation can help defining the procedures for establishment and monitoring public/private partnerships

Decentralization of integrated water management: Through exchange of experience, dialogue and harmonization of regulatory frameworks, regional cooperation can contribute to (i) define procedures for decentralization and delegation without loosing the focus on basin-wide issues and (ii) enhance water management for rain-fed agriculture and bridge the gap between irrigated and rain-fed agriculture.

Bridge the divide between agriculture and water institutions: through exchange of experience and consultations regional cooperation can fuel institutional reforms aiming at better delimiting the duties of the existing institutions dealing with the various aspects of irrigation development and management: design, construction, O&M, extension services, inputs supply, credit, processing marketing and so on.

Objectives of the above activities should be:

- Support decentralization and delegation;
- Empower water users, and get them involved in the management process;
- Bridge the divide between development and management of water for irrigated and rain-fed agriculture and water institutions;
- Bring direct benefits to irrigating and rain-fed farmers.

4.2 INSTITUTIONAL PROCESS TOWARD COOPERATIVE TRANSBOUNDARY WATER MANAGEMENT IN THE EASTERN NILE IRRIGATION & DRAINAGE SECTOR

The Cooperative Regional Assessment carried out during the second Phase of the Eastern Nile Irrigation and Drainage Study included an ***Institutional Analysis***[11] which was intended to identify and examine the institutional implications of cooperative, transboundary water management and utilization in the basin. It took place[12] on the agreed assumption that the overall objectives of regional cooperation are as follows[13]:

- Greater productivity and sustainability of irrigation development.
- Synergies and economies of scale as a result of regional cooperation.

And more generally:

- Enhanced cooperation and conflict avoidance amongst the Eastern Nile countries.

Initial work by the consultant resulted – *inter-alia* – in the identification of 10 levels of cooperation which were allocated as appropriate to these three objectives, and thereafter crafted into a time-based typology of institutional and legislative reform for enhanced transboundary cooperation. Various processes with the potential to enhance cooperation at each of the 10 levels were then identified, as were possible objectives of cooperation. These objectives were subjected to stakeholder consideration and possible processes for achieving them were subjected to a multi-criteria analysis, first by the consultant, and later by stakeholders. Encouragingly, the consultant's MCA and that of the stakeholders produced highly similar results, to the extent that the consultant based all subsequent analysis on the stakeholders selection[14].

However, although the typology and its analysis (by both consultant and stakeholders) remains valid in terms of overall water management, it is considered too general in the specific context of irrigation and drainage, especially in terms of their development as anticipated in the short and medium terms. Furthermore, in their comments of the draft report, stakeholders suggested to add "regional trade" as a level of cooperation. A sector specific typology is therefore suggested in Figure 4, where the components of interest are identified by bold text. The text which follows, including Table 23, has been similarly adapted from earlier material.

An institutional process is by definition of a soft nature and it aims to propose institutional and legislative reform and define procedures and mechanisms for enhanced regional cooperation. The last section of this report (Project profiles) describes proposed on the ground activities that are complementary to the institutional process.

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11 Also referred to as the Cooperative Mechanism Analysis

12 It should be noted that in this context, institutions refer both to:
- ***"hard"*** institutions hard institutions which include public sector institutions in the form of relevant official stakeholders at every level of the civil administrative hierarchy, plus where water is managed on a basin basis, at every level of the hydrocracy. They will also include farmer organisations and private sector service providers and investors in service infrastructure.

and
- ***"Soft"*** institutions which are the policies, laws, regulations and incentives that ensure the smooth and equitable running of the sector, attract new players into it and guarantee the sustainability of the natural resource base on which it depends.

13 ENIDS Inception Report, page 29 refers

14 Justification for this is provided in § 4.18 of the ENIDS Component 2, Phase 2 Analysis Report

Figure 4: Typology of Institutional and Legislative Reforms for Enhanced Cooperation

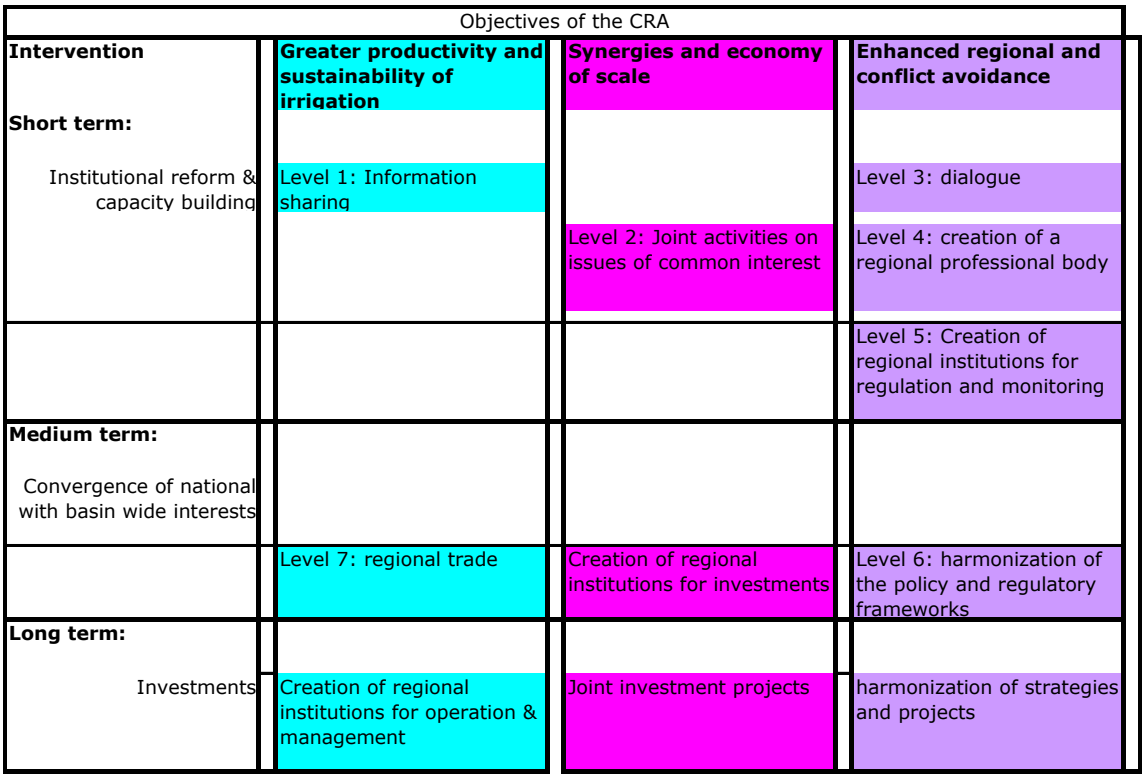

Table 23: Levels and Processes for Short and Medium term Cooperation for Irrigation and Drainage in the Eastern Nile Basin

TIME FRAME	LEVEL		OBJECTIVE	PROCESS
Short Term	1	information sharing	A comprehensive, trustworthy, basin-wide and well organised suite of irrigation and drainage planning and monitoring data accessible by all water planners, managers and regulators in the Eastern Nile Basin	Riparian countries commit to share information .
	2	joint activities on issues of regional interest	Win-win situations resulting from clear and mutually agreeable procedures for international cooperation on a project by project basis	Expansion of ENTRO Joint Multi-Purpose Programme
	3	dialogue	Establishment of the Eastern Nile Dialogue Unit	Establishment of the Eastern Nile Dialogue Unit
	4	Creation of a regional professional body	Technical and policy consensus and epistemic excellent between Eastern Nile Basin water managers	A regional professional body
	5	Creation of regional institutions for regulation and monitoring	Equitable, productive use of water in the Eastern Nile Basin and ecosystem sustainability as a result of well enforced, transparent and harmonised regulations and monitoring procedures	A new regional institution to guide and consolidate national regulatory and monitoring activities

Medium Term	6	Harmonisation of the policy and regulatory framework	Compatible and mutually reinforcing national and regional policy and regulatory frameworks for water resources, agriculture and power development throughout the Eastern Nile Basin	Harmonisation of the policy and regulatory framework throughout the entire Nile Basin
	7	Regional trade	Maximize the utilization of natural resources through increase of regional trade in the Eastern Nile basin.	Design and adoption of a common strategy for enhancing regional trade.

It will be clear that Figure 5 and Table 22 together comprise a specification for an institutional strategy for the irrigation and drainage sector. Based on them therefore, this section is intended to:

- identify where i) institutional reform or restructuring is likely to be necessary; and where ii) new institutions are going to be necessary,
- suggest an action plan for establishing the institutional processes and engendering the intended levels of cooperation, and
- Propose possible funding mechanisms for the implementation of the action plan.

4.3 INSTITUTIONAL REFORMS, RESTRUCTURING AND INNOVATION

This sub-section – which follows the framework suggested by Figure 5 - compares the existing institutional landscape in the three riparian countries with the ideal arrangements suggested by the processes as selected by the stakeholders and thereby identifies as appropriate where reform, restructuring and innovation may be required before suggesting suites of actions necessary to build each level of cooperation.

4.3.1 Short Term: Institutional Reform and Capacity Building

Figure 5 shows that five levels of cooperation will have to be built in the short term.

Level 1: Information Sharing

Level 1 is targeted at the need to improve the productivity and sustainability of irrigation assets in the three riparian countries. Having said that, the consultant notes that information sharing has very much improved. This was confirmed repeatedly during the stakeholder consultations that took place during ENIDS Stage II. However, in order to establish "A comprehensive, trustworthy, basin-wide and well organised suite of water resources planning and monitoring data…." that is "…accessible by all water planners, managers and regulators in the Eastern Nile Basin", stakeholders felt that some sort of institutionalized commitment to this ideal will be necessary.

They did not however, feel that this requires new institutional arrangements given the existence of ENTRO, not least because it was felt that information sharing should be mandatory for all of its members. Although they do not specifically require it to be an information resource, ENTRO/ENSAP objectives would be impossible to achieve in the absence of reliable information. ENTRO furthermore, is therefore clearly committed to the collation and dissemination of reliable information for the benefit of its members and has made concrete steps to that end in the form of the Nile Basin Decision Support System currently being developed and the future Eastern Nile Planning Model.

The issue here concerns the need for the riparian countries proactively to make their information available in a structured and well ordered fashion. And this implies more than just a modification to the terms of membership; it also implies the need for procedures that convert commitment into accessible information.

In summary therefore, the proposed process: "Riparian countries commit to share information" requires no institutional reform or restructuring; but will need a degree of innovation with respect to the collation, management and accessibility/dissemination of the data.

Six activities will be necessary: they are largely self explanatory:

Level 1 – Activity 1: drafting of an appropriate charter for information sharing

This will be an "in-house" activity for ENTRO and requires little in the way of preparation. The results will nonetheless require validation by the members of the ENTRO, hence the next activity.

Level 1 – Activity 2: discussion and agreement of the charter at a relevant meeting of ENTRO

Self-explanatory

Level 1 – Activity 3: establish a working group to develop the information sharing procedures

Self-explanatory

Level 1 – Activity 4: discussion and agreement of the proposed procedures at a relevant meeting of ENTRO

Self-explanatory

Level 1 – Activity 5: preparation of an information sharing procedures manual

In order that the procedures are widely understood and followed, it will be necessary to formalize them in the form of a manual. This activity is likely to be best undertaken by a specialist consultant. If so, considerable advantages would accrue to his/her participation in Activity 4.

Level 1 – Activity 6: promulgate, monitor and facilitate procedures as necessary

This will also be a routine matter for ENTRO as there is no reason why the procedures should not be promulgated and implemented etc, in the same manner as any other operational instrument – but it should be noted that once the procedures are in-place; their utilisation will be continual and ongoing.

Level 2: Joint Activities on Issues of Regional Interest

From the institutional perspective, ***Level 2*** is intended to result in "clear and mutually agreeable procedures for international cooperation on a project by project basis" and hence is directly relevant to the irrigation and drainage sector. Again, stakeholders did not think that new institutional arrangements would be necessary. Instead, it was agreed that the ongoing ENTRO Joint Multipurpose Programme should be expanded such that it hosts and enforces these "mutually agreeable

procedures". Even so, there will be a need for a facilitated capacity building process first to design the procedures, then to have them agreed and thereafter to promulgate them.

Four activities will be necessary:

Level 2 – Activity 1 establish a working group to develop procedures for international cooperation

As with Activity 1 of Level 1, this will be an "in-house" activity for ENTRO and requires little in the way of preparation. In-fact, perusal of the work plan presented in section 4.4 below as Figure 5 suggests that this activity could be a follow-on, thereby suggesting in turn the possibility that the same working group could be used, in which case advantages would accrue in terms of both continuity and conceptual understanding/consistency. Even if this is the case however, the results will once again nonetheless, require validation by the members of ENTRO, hence the next activity.

Level 2 – Activity 2 discussion and agreement of the proposed procedures at a relevant ENTRO meeting

This is self-explanatory

Level 2 – Activity 3 preparation of an Eastern Nile cooperation procedures manual

As for Level 1 – Activity 5

Level 2 – Activity 4 promulgate, monitor and facilitate procedures as necessary

As for Level 1 – Activity 6

Level 3: Dialogue

The Objective of ***Level 3*** is "Transparent, participatory water resources planning and management in the Eastern Nile Basin". Although this clearly has ramifications beyond the irrigation and drainage sector, it is nonetheless of profound relevance to it and hence is recommended for commencement in the ENIDS context. However, although this is clearly an impact oriented objective, rather than being product or process based (like Levels 1 and 2 respectively), it will nonetheless require a degree of institutional restructuring and capacity building. Stakeholders have recommended that ENTRO is established as regional forum to facilitate increased dialogue.

This is almost certain to require the establishment of a dedicated unit within ENTRO that will be responsible for initiating, facilitating and sustaining increased dialogue between the riparian countries. The proposed unit will require both staffing and capacity building. In addition, it will be necessary to suggest a mandate for the Unit in terms of both operational procedures and level of authority.

Four activities will be necessary:

Level 3 – Activity 1 institutional design and capacity building needs assessment for an ENTRO "Dialogue Unit"

This will require a brief consultancy study, which it is recommended should have two deliverables. The first will be an institutional design agreed by ENTRO and the Eastern Nile countries governments; and the second, the capacity building needs assessment.

Level 3 – Activity 2 establish Dialogue Unit's mandate

The mandate itself will have been suggested in the first deliverable above, and hence agreed as part of the overall acceptance process. However, the mandate has to be put in place – hence this activity which will be a simple procedural matter for ENTRO

Level 3 – Activity 3 hire and train staff

This is self-explanatory, except to say that the training may be considered an appropriate task for specialist consultants.

Level 3 – Activity 4 operationalise ENTRO "Dialogue Unit"

This is self explanatory.

Level 4: Creation of a Regional Professional Body

The Objective for ***Level 4*** is "Technical and policy consensus and epistemic excellence between Eastern Nile Basin water managers". This is to be achieved by the establishment of a new, innovative institution in the form of a regional professional body that facilitates and encourages the sharing and peer review of all technical matters relating to the allocation, development and utilisation of Eastern Nile waters. Clearly, as with Level 3, there are ramifications beyond the irrigation and drainage sector. However, it is reasonable to suggest that i) the various components of the irrigation development and capacity building project described in Section 5 below; ii) the challenges that these components represent; and iii) the successful establishment of cooperation levels 1-3 between them call for, and catalyse early progress on this level of cooperation.

Furthermore, even in the specific context of irrigation and drainage, it will be advantageous if membership of the proposed body will be open to representatives of all disciplines involved in the integrated management of the Eastern Nile water resource, including in addition to engineering and hydrology also represented will be environmental and social science, economics etc.

As with other professional bodies elsewhere, the proposed body could also set educational standards for water management professionals in the basin, and in due course could even provide officially recognised professional qualifications such as diplomas or charters for its members.

Six activities will be necessary:

Level 4 – Activity 1: establish a working group

Again this is an "in-house" activity that could increase the remit of the working group set up for Level 1 – Activity 3 and Level 2 – Activity 1.

Level 4 – Activity 2: study tour to visit and observe professional bodies elsewhere

Considerable value would accrue to a study tour to learn how other professional bodies enrol and operate on behalf of their members as well as to assess from other bodies i) the extent to which membership confers any degree of professional status on the members; and ii) the mix of disciplines that characterise the bodies studied . Participants on such a tour would largely comprise the working group; plus key representatives of the Eastern Nile countries.

Level 4 – Activity 3: comprehensive regional consultations

Lessons learned by the working group, not least from the study tour, will have to be shared with the professional community within the sub-basin and the results used as the basis for the next activity.

Level 4 – Activity 4: design the regional professional body

This will be best undertaken on a consultancy basis, ideally involving members of interesting existing examples from elsewhere. It should be remembered however, that the design will not only address institutional arrangements, structure and operations; but also membership enrolment processes (which will have been agreed in principle during the previous activity) and subscription mechanisms.

Level 4 – Activity 5: establish the regional professional body

This is self-explanatory, except to note that this may require the identification and participation of possible donors.

Level 4 – Activity 6: invite, vet and enrol members

This is self-explanatory.

Level 5: Creation of Regional Institutions for Regulation and Monitoring

Level 5 will be the last level of cooperation to be established in the short term and calls for the establishment of a new regional institution "to guide and consolidate national regulatory and monitoring activities." This arrangement acknowledges the advantages in having the regulatory body separate from other service providers – although depending on how ENTRO develops in the future, it may be considered apt to situate the new institution under ENTRO umbrella. Even so, it should be noted that the proposed arrangements imply that the new organisation will have an apex level function that ensures consistency and quality in regulating and monitoring water management and allocation at the national levels. In other words therefore, the new institution will not itself go out and enforce regulatory and monitoring norms in the operational sense: rather, it will establish and promulgate those norms and thereafter monitor their enforcement.

Although this also has ramifications beyond the irrigation and drainage sector, two of the components of the project proposed in section 5 below (components 2 and 3) assume the existence of regulatory and monitoring functions at basin level. Establishment of cooperation Level 5 is therefore relevant in the ENIDS context.

Five activities will be necessary:

Level 5 – Activity 1: consultancy review of existing regulations and monitoring frameworks; recommendations and institutional design

This is self-explanatory.

Level 5 – Activity 2: obtain stakeholder agreement re: definition of transboundary regulations, quantification and institutional design

This will be the responsibility of ENTRO and is necessary to increase stakeholder ownership not only of the institution(s), but also the regulations and their quantification (as for instance in the case of minimum stream flows or quality standards).

Level 5 – Activity 3: promulgate new regional regulations and monitoring requirements

Technically speaking, this will be the responsibility of the three governments, but in execution it is likely to be the responsibility of ENTRO.

Level 5 – Activity 4: establish funding arrangements for establishing the new institution

This is self-explanatory, but will nonetheless involve facilitated discussions between the three Eastern Nile countries with respect to cost sharing. It is likely that a consultant will be required for this.

Level 5 – Activity 5: establish the new institution

This is self-explanatory, but is also likely to require consultancy support.

4.3.2 Medium Term: Convergence of National with Basin Interest and Ongoing Capacity Building

As far as irrigation and drainage is concerned, just one additional level of cooperation will be required in the medium term. It will not require new institutional arrangements.

- **Level 6: Harmonisation of the Policy and Regulatory Framework**

Level 6 is intended to result in "Compatible and mutually reinforcing national and regional policy and regulatory frameworks…" and is to be achieved by "harmonisation of the policy and regulatory framework throughout the Eastern Nile basin", especially with respect to water quality standards and irrigation water use efficiency norms and targets. This clearly does not call for an additional organisational entity, and could be achieved either by ENTRO or the new regional institution for regulation and monitoring created as Level 5.

An implementation schedule for the whole institutional strategy for irrigation and drainage is provided in sub-section 4.4 below. As originally conceived however, work towards this level of cooperation was not scheduled until the fifth year of the institutional strategy. But as stated above, this was in the context of overall integrated water management not the irrigation and drainage sector. Accordingly, it can be brought forward and be thought of as irrigation and drainage oriented pilot exercise ahead of a more general harmonisation of the policy and regulatory framework.

Three activities will be necessary:

Level 6 – Activity 1: harmonisation opportunity and needs assessment by consultancy

It will be neither necessary, nor possible to harmonise the entire, basin-wide policy and regulatory landscape. This activity, which is best carried out on a consultancy basis, is therefore intended to identify which policies, if harmonised, would increase the equitability and productivity of irrigation sector water allocation and utilization in the basin and thereafter to assess how best to approach the actual task of harmonisation itself.

Level 6 – Activity 2: stakeholder consultations

Harmonisation itself should be a fluid and dynamic task performed with maximised stakeholder involvement. Hence this activity should also be carried out as a consultancy under the authority of ENTRO.

Level 6 – Activity 3: validation of the harmonised framework

A workshop process would be ideal for this.

- **Level 7: regional trade**

Level 7 is intended to result in "Maximize natural resources utilization through increase regional trade of agricultural commodities" and is to be achieved by "Design and adoption of a model strategy for enhancing regional trade". Given the Eastern Nile context, it is suggested that the model of strategy first addresses wheat and wheat flour trade. Based on achievements, the model could be then applied to other products such as livestock production. The model will be based on three strategic pillars: (i) optimization of land and water allocation for agriculture in the Eastern Nile basin; (ii) increase agricultural productivity through investments in commercial farming and in research and development; and (iii) reduce exposure to international market volatility by improving marketing chain efficiency. This does not call for an additional organisational entity, and could be achieved through an ENSAP study that would first design the model of strategy and second have it accepted by the three countries for implementation.

Three activities will be necessary:

Level 7 – Activity 1: Design of a strategy for regional trade of agricultural commodities and livestock products

This will require a consultancy which should provide comprehensive information of the constraints and opportunities for regional trade of wheat according to the production constraints in the various agro-ecological zones, efficiency of the regional marketing chains (tariff and non tariff barriers) and policies related to irrigation water allocation for agricultural production.

Level 7 – Activity 2: Assessment of impacts

The strategy would have impacts on food security, consumer prices and producer incomes, demand and supply side of other crops and the environment that need to be assessed. This activity will be best carried out on a consultancy basis.

Level 7 – Activity 3: validation of the strategy

A workshop process would be ideal for this.

4.3.3 Summary

Table 23 summaries the foregoing by simply identifying the nature of any institutional interventions associated with each of the levels of cooperation.

Table 24: Type of Interventions for Each Level of Cooperation

TIME FRAME	LEVEL		PROCESS	TYPE OF INTERVENTION		
				reform	restructuring	Innovation(s)
Short Term	1	**information sharing**	Riparian countries commit to share information	none needed	none needed	procedures • **expanded disclosure commitments**
	2	**joint activities on issues of regional interest**	Expansion of ENTRO Joint Multi-Purpose Programme	none needed	none needed	procedures • **capacity building**
	3	**dialogue**	Establish Eastern Nile Dialogue Support Unit	none needed	ENTRO needs a small, new unit	capacity building
	4	**Creation of a regional professional body**	A regional professional body	none needed	none needed	new institution
	5	**Creation of regional institutions for regulation and monitoring**	A new regional institution to guide and consolidate national regulatory and monitoring activities	none needed	none needed	new institution
Medium Term	6	**Harmonisation of the policy and regulatory framework**	Harmonisation of the policy and regulatory framework throughout the Eastern Nile Basin	none needed	none needed	harmonised policy and regulatory framework
	7	**Regional trade**	Design and adoption of a strategy for enhancing regional trade	commercial agreements	None needed	A strategy for regional trade

4.4 AN ACTION PLAN, BUDGET AND POSSIBLE FINANCING ARRANGEMENTS

Figure 6 suggests a timetable for the activities described in the preceding section, while Table 24 provides an estimate of how much it will all cost and who will be responsible for which aspects of the overall costs. "ENTRO programme funds" signifies a disbursement from funds available to ENTRO that do not comprise regular running costs, but rather are earmarked for project and programme expenses. "New ENTRO funds" signifies the need to increase regular running costs in order to cover new institutional arrangements within ENTRO for a period of five years.

It will be seen that the entire process is expected to take no more than three years. Two years will be required to complete the short term activities and a little less than one for the medium term.

Total non-regular costs are estimated to be around $1.750 million. It is suggested that these costs are shared as follows:

- Development partners $ 1.200 million
- ENTRO programme funds $ 0.050 million
- New ENTRO funds $ 0.500 million

Figure 5: Proposed Work plan for level and process of cooperation

Level		Process	Activities	Year 1				Year 2				Year 3			
				Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1	Information sharing	Membership of NBI commits signatories to share information	Draft clause for NBI charter												
			Establish a working group for procedures												
			Propose, discuss and agree clause at relevant NBI meetings												
			Prepare a manual for information sharing procedures												
			Promulgate, monitor and facilitate information sharing as necessary												
2	Joint activities on issues of regional interest	Expansion of the NBI JMP	Establish a working group for procedures of international cooperation												
			Propose, discuss and agree clause at relevant NBI meetings												
			Prepare a manual for international cooperation procedures												
			Promulgate, monitor and facilitate procedures as necessary												
3	Dialog	NBI is established as a forum to facilitate dialog	Institutional design and capacity building needs assessment												
			Establish dialog unit's mandate												
			Hire and train staff												
			Operationalize the NBI dialog unit												
4	Creation of a regional professional body	a regional professional body	Establish a working group												
			study tour												
			comprehensive regional consultation												
			design the regional professional body												
			establish the regional professional body												
			Invite, vet and enroll members												
5	Creation of a regional institution for regulation and monitoring	A new institution to guide and consolidate regulation and monitoring activities	review of existing legislation and institutional design												
			Obtain stakeholders agreement: definition of transboundary regulation												
			promote new regional regulations and monitoring procedures												
			establish funding arrangements for the new institution												
			establish the new institution												
6	Harmonization of the policy and regulatory framework	Harmonization of the policy and regulatory framework throughout the Eastern Nile basin	Harmonization opportunities and needs assessment by consultancy												
			Stakeholders consultation												
			validation of the harmonized framework												
7	Regional trade	strategy for regional trade	Design of the strategy												
			assesment of impacts												
			Validation of the strategy												

Table 25: Proposed Allocation of Implementation and Funding Responsibilities

Level		Process	Activities	Responsible party	Cost component	Estimated cost (USD)	Potential funding sources
1	Information sharing	Membership of NBI commits signatories to share information	Draft clause for NBI charter	ENTRO	none	not applicable	ENTRO regular budget
			Propose, discuss and agree clause at relevant NBI meetings	ENTRO	none	not applicable	ENTRO regular budget
				Riparian governments	none	not applicable	National budgets
				Consultant participates	consultant fees	25 000	Development partners
			Prepare a manual for information sharing procedures	Consultant			
			Promulgate, monitor and facilitate information sharing as necessary	ENTRO	none	not applicable	ENTRO regular budget
2	Joint activities on issues of regional interest	Expansion of the NBI JMP	Establish a working group for procedures of international cooperation	ENTRO	none	not applicable	ENTRO regular budget
			Propose, discuss and agree clause at relevant NBI meetings	ENTRO, RGs, consultant	none	not applicable	ENTRO regular budget
				Riparian governments	none	not applicable	National budgets
				Consultant participates	consultant fees	25 000	Development partners
			Prepare a manual for international cooperation procedures	Consultant			
			Promulgate, monitor and facilitate procedures as necessary	ENTRO	none	not applicable	ENTRO regular budget
3	Dialog	NBI is established as a forum to facilitate dialog	Institutional design and capacity building needs assessment	Consultant	institutional design	175 000	Development partners
				ENTRO	approval & acceptance	not applicable	ENTRO regular budget
				Riparian governments	approval & acceptance	not applicable	National budgets
				Consultant	needs assessment	75 000	Development partners
				ENTRO	approval & acceptance	not applicable	ENTRO regular budget
			Establish dialog unit's mandate	ENTRO	none	not applicable	ENTRO regular budget
			Hire and train staff	ENTRO	training	50 000	ENTRO program funds
			Operationalize the NBI dialog unit	ENTRO	payroll & establishment	500 000	New ENTRO funds
4	Creation of a regional professional body	a regional professional body	Establish a working group	ENTRO	none	not applicable	ENTRO regular budget
			study tour	ENTRO	travel & subsistence	150 000	Development partners
				Consultant participates	included in next	not applicable	
				Representatives of professional bodies	miscellaneous	30 000	Development partners
			comprehensive regional consultation	Consultant	included in next	not applicable	
			design the regional professional body	Consultant	consultant fees	150 000	Development partners
			establish the regional professional body	ENTRO	none	not applicable	ENTRO regular budget
				Consultant	consultant fees	50 000	Development partners
				professional community	none	not applicable	
			Invite, vet and enroll members	professional body	first years running cost	250 000	Development partners

Table 25: Proposed Allocation of Implementation and Funding Responsibilities (continued)

Level		Process	Activities	Responsible party	Cost component	Estimated cost (USD)	Potential funding sources
5	Creation of a regional institution for regulation and monitoring	A new institution to guide and consolidate regulation and monitoring activities	review of existing legislation and institutional design	Consultant	consultant fees	50 000	Development partners
			Obtain stakeholders agreement: definition of transboundary regulation, etc	ENTRO	none	not applicable	ENTRO regular budget
			promote new regional regulations and monitoring procedures	Riparian governments	none	not applicable	National budgets
				ENTRO	none	not applicable	ENTRO regular budget
			establish funding arrangements for the new institution	ENTRO	none	not applicable	ENTRO regular budget
				Riparian governments	none	not applicable	National budgets
				Consultant	consultant fees	25 000	Development partners
			establish the new institution	ENTRO	none	not applicable	ENTRO regular budget
				Riparian governments	none	not applicable	National budgets
				Consultant	consultant fees	75 000	Development partners
6	Harmonization of the policy and regulatory framework	Harmonization of the policy and regulatory framework throughout the Eastern Nile basin	Harmonization opportunities and needs assessment by consultancy	Consultant	consultant fees	included below	Development partners
			Stakeholders consultation	Consultant	consultant fees	included below	Development partners
			Validation of the harmonized framework	ENTRO	none	not applicable	ENTRO regular budget
				Riparian governments		not applicable	National budgets
				Consultant	consultant fees	50 000	Development partners
7	Regional trade	strategy for regional trade	Design of the strategy	Consultant	Consultant fees	50 000	
			assesment of impacts	Consultant	consultant fees	20 000	
			Validation of the strategy	Riparian governments	none	not applicable	National budgets

Total costs (USD)	**1 750 000**	
Made up as follow		
	1 200 000	Development partners
	50 000	ENTRO program funds
	500 000	New ENTRO funds

4.5 POSSIBLE IMPLEMENTATION ARRANGEMENTS

This section is concerned with how the institutional strategy might usefully be implemented and who could/should participate in the costs.

It will be clear that four kinds of players will be involved:

- The governments of the three riparian countries, their water sector institutions and the population that they serve.
- ENTRO
- Consultants.
- Development Partners.

Each will have different, but complementary roles.

Governments' primary role will be to "own" the resulting institutional arrangements and regulatory frameworks. But for this role to be optimised will require that the Governments also participate to the greatest extent possible in the building of the 6 levels of cooperation. As such, they will need to i) supply information when required; ii) cooperate fully in the various consultations and review processes and iii) be represented in the Steering Committee (see below).

ENTRO will have a more hands-on role. It will be responsible for:

- Coordinating all the activities specified in Figure 6. Inter-alia this will involve making sure that Governments are kept aware of progress and of any substantive points reached.
- Facilitating the work as it progresses, this will include ensuring that consultancy missions to the three countries are adequately anticipated by the host governments and that everything will be in-place to maximise the productivity of such missions.
- Commissioning the consultants, including preparation of terms of reference and all aspects of the bidding cycle and payments: also, depending on the financial arrangements, this will also include paying the consultants against deliverables.
- Establishing and operating a Steering Committee that will be in place throughout the entire institutional strategy. As anticipated, the proposed Steering Committee will have permanent seats for the riparian governments and the NBI itself; but there should also be provision for temporary seats for specific development partners when their funding is in play. There should also be temporary seats to allow subject matter specialists to be co-opted from time to time as required on a consultancy basis if necessary.
- Legitimising the results of each activity. In other words, this concerns final acceptance of consultancy outputs and formal acknowledgement of the new institutional arrangements as they are achieved.

Consultants will be responsible for executing the studies indicated below in Tables 26, where it will be seen that a total of 11 consultancy studies are anticipated, and an additional three activities in which consultants will participate. However, there will be considerable advantage in consolidating these consultancies in order to achieve economies of scale, reduce transaction costs and flatten the learning curve. A possible clustering of the consultancies is therefore suggested for consideration as shown in Table 26 below.

Finally, there are the ***development partners*** whose responsibility will be to help cover costs of the various consultancies and activities that cannot be funded from regular budgets of the NBI or riparian governments. In addition, as indicated above, the development partners will be expected to participate in the Steering Committee during the periods when their funds are in play. With this in mind the possibility is noted that development partners may also wish to make and implement their own, parallel monitoring processes whenever relevant.

Table 26: Suggested Clustering of the Consultancies

POSSIBLE TITLE	LEVEL OF COOPERATION	PROCESS	ACTIVITIES INVOLVED
Options and Agreements for Increased Cooperation for Information Sharing, Dialogue and Joint Activities in the Eastern Nile Water Sector.	**Level 1** information sharing	Riparian countries commit signatories to share information	Activity 4 discussion and agreement of the proposed procedures at a relevant meeting of ENTRO
			Activity 5 preparation of an information sharing procedures manual
	Level 2 joint activities on issues of regional interest	Expansion of ENTRO Joint Multi-Purpose Programme	Activity 2 discussion and agreement of the proposed procedures at a relevant ENTRO meeting
			Activity 3 preparation of an international cooperation procedures manual
	Level 3 dialogue	ENTRO is established as a regional forum to facilitate increased dialogue	Activity 1 institutional design and capacity building needs assessment
			Activity 3 hire and train staff
Assistance to the Establishment of a Regional Professional Body for Water Sector and Related Professionals in the Eastern Nile Basin	**Level 4** Creation of a regional professional body	A regional professional body	**Activity 2** study tour
			Activity 3 comprehensive regional consultations
			Activity 4 design the regional professional body
			Activity 5 establish the professional body

POSSIBLE TITLE	LEVEL OF COOPERATION	PROCESS	ACTIVITIES INVOLVED
Institutional Support for Regulation and Monitoring in the Eastern Nile Basin	**Level 5** Creation of regional institutions for regulation and monitoring	A new regional institution to guide and consolidate national regulatory and monitoring activities	**Activity 1** consultancy review of existing regulations etc and institutional design
			Activity 4 establish funding arrangements for establishing the new institution
			Activity 5 establish the new institution
Harmonisation of the policy and regulatory frameworks for allocation and management in the Eastern Nile Basin	**Level 6** Harmonisation of the policy and regulatory framework	Harmonisation of the policy and regulatory framework throughout the Eastern Nile Basin	**Activity 1** harmonisation opportunity and needs assessment by consultancy
			Activity 2 stakeholder consultations
			Activity 3 validation of the harmonised framework
Regional trade	Level 7 Design of a regional strategy for regional trade	Design and adoption of a strategy for increasing agricultural production and enhancing regional trade	**Activity 1** Design of the strategy
			Activity 2 Assessment of impacts
			Activity 3 Validation

5. Section 5: Project profiles

INTRODUCTION

The proposed project profiles are intended first to respond to the challenges and opportunities for irrigation development that were identified during the ENIDS CRA Analysis phase. These challenges and opportunities are summarized in section 1 of this report. Secondly, the project profiles seek to enhance regional cooperation through suggesting a series of "on the ground activities" corresponding to the level and process of cooperation described in section 4.

Project profile 1: *"Development of an Eastern Nile data base"* aims to a comprehensive, truth worthy and well organized basin wide information on irrigation development that will provide a solid basis for information sharing amongst countries. It also seeks to define procedures for continuous updating and improving information.

Project profile 2 "Formulation of a Regional Strategy for agricultural water development" is potentially revolutionary since it aims at shifting from unilateral to regional planning of irrigation development and to bridge the institutional and technical divide between irrigation and rain-fed agriculture. In the three Eastern Nile countries, policies on water resources management for agriculture are focused on irrigation, hydropower and drinking water supply while the frameworks for integrated water resources management concentrate on allocation and management of blue water in rivers, groundwater, and lakes. The proposed Regional Strategy would be a first step to focus more on investment options for water management across the continuum from rain-fed to large scale irrigation and to place agricultural water resources management and planning more centrally in the policy domain of agriculture development at large.

Project profiles 3, 4 and 5 respectively "Feasibility study of new irrigation development"; "Increasing the performance of existing irrigation" and "Upgrading rain-fed agriculture" provide indication for implementing agricultural development project. All these projects should be identified agreed and committed by the Regional strategy and not unilaterally planned. This would enhance cooperative activities amongst countries during project implementation, increase the chance of success and avoid potential conflict over water.

Finally project profile 6 proposes regional capacity building activities related to irrigation management at large and assessment, improvement and monitoring of irrigation performance.

5.1 PROJECT 1: DEVELOPMENT OF AN EASTERN NILE IRRIGATION DATA BASE AND IRRIGATION PERFORMANCE MONITORING SYSTEM

5.1.1 Objective

The objective of this project is to provide a comprehensive picture of the current situation of the irrigation sector with a view of having a better knowledge of existing irrigation water use for planning further irrigation expansion and/or improving the performance of the existing irrigation schemes in the Eastern Nile basin. It will also establish baseline data and a procedure for monitoring and evaluation as well as information exchange among EN countries.

5.1.2 Rationale

Continued unilateral irrigation development is a major risk of conflict over water in the basin where more than 80% of available water is used for irrigation. Mitigating this risk requires regional cooperation across the Eastern Nile countries for planning interventions aiming at increasing the productivity and profitability of existing schemes or developing new viable irrigation projects. An essential element for such cooperation is the development of a shared knowledge base on irrigation development to support decision making among multiple stakeholders. Currently, the knowledge base on irrigation development is fragmented, sharing of information is minimal, and there is no effective mechanism to envision various irrigation development scenarios and analyze their implications on equity and productivity of water use, socio-economic benefits and their impacts on environment and other water users at the basin level.

One major objective of ENTRO is that countries in the Eastern Nile adopt regional decision support tools to identify water-related investments and evaluate them in a regional context. The Eastern Nile planning Model (ENPM) is the main initiative to develop knowledge base, analytical tools and stakeholders participation for evaluating water related investments in a regional context and to strengthen regional institutions for analysis of water investment projects.

In this context, this project aims to increase the knowledge on existing irrigation development and improve the planning of irrigation development projects at the regional level through the development of an irrigation data base and procedures for monitoring and evaluating the performance of existing irrigation systems. It is expected that the data base will be then used for running simulation of water-related investments scenarios using the analytical tools developed by the Eastern Nile Planning Model and/or the NBI Decision support System Project. Monitoring and evaluation of the performance of existing irrigation schemes will provide information to plan strategic intervention for increasing the performance of the poor performing schemes. The project will also contribute to enhancing dialogue amongst irrigation professionals by providing them trustworthy and comprehensive information on irrigation and drainage development.

5.1.3 Project description

Component 1: Development of a regional irrigation data base

The development of the data base will build on analysis of existing information from reports of previous studies such as for instance the Efficient Water Use for Agricultural (EWUAP) study, ongoing efforts in countries (establishment of the Abay basin organization and its subsidiary office in Tana and Beles sub basins, irrigation data base system in Egypt and the five joint decentralized technical offices of the Dams and Planning directorates in Sudan), other ENTRO projects such as

the Eastern Nile planning Model. The data base will be supported with computer-based technologies, a GIS platform and an associated website making information available to the wider public.

- **Activity 1.1: Review/baseline survey of the irrigation sector** based on available data, including information based on remote sensing technologies. For the main categories of irrigation systems, the review will address:

  - History of development and size of areas developed/cropped;
  - Current socio-economic situation on existing schemes, including land tenure and land holding size
  - Farming practices, cropping patterns, cropping intensity and yields;
  - Source and volume of water abstracted and water use efficiency;
  - Present condition of the irrigation and drainage facilities;
  - Types of irrigation technology used;
  - Responsibility for operation, maintenance and management
  - Levels of cost recovery
  - Identification of data gaps to be collected during activity 1.2.

- **Activity 1.2: Collect missing data** from field investigations and consultations with stakeholders.

- **Activity 1.3: Elaboration of the data base and test functionalities for its utilization at scheme, country and regional levels:** design of the data base structure and enter data; the project will coordinate with other regional projects such as the Eastern Nile Planning Model and The Nile Decision Support system for compatibility of the data base with other developed analytical tools.

- **Activity 1.4: Training on utilization of the data base of ENTRO personnel and irrigation staff in the riparian countries.**

Component 2: Development of procedures and guidelines for monitoring and evaluation of irrigation performance and information sharing.

- **Activity 2.1: Enhance regional cooperation for continuous information sharing**

  - Establish common guidelines for information collection and sharing and improve data quality at scheme, national and regional levels
  - Drafting, discussion and adoption of a charter for information sharing
  - Involve relevant stakeholders for data provision and data analysis; potential stakeholders are the central and district Irrigation Directorates in Egypt, the Irrigation Operation Directorate in Sudan and the regional bureaus of water resources and agriculture in Ethiopia.
  - Design and implement mechanisms and incentives for data provision and information sharing

- **Activity 2.2. Develop guidelines and procedures for monitoring and evaluation of irrigation performance**

  - Develop or adapt as set of irrigation performance indicators acceptable by all stakeholders

- Develop guidelines for monitoring and evaluation of irrigation performance through field data collection and the use of remote sensing technologies
- Design an internet-based regional irrigation benchmarking system using performance indicators
- Develop and implement training programs on utilization of the system and on use of remote sensing technologies
- Organize regional seminars to enhance regional cooperation for improving irrigation performance
- Make recommendation for long term financial and technical sustainability
- Undertake simulation of irrigation expansion scenarios using the irrigation data base and the existing decision support tools and criteria developed by the Nile decision system and/or the Eastern Nile planning model.

5.1.4 Beneficiaries

Irrigation managers and planners will be both the main stakeholders and beneficiaries of the project. They will contribute to data provision, will beneficiate of the training programs and will participate to the regional seminars.

Policy makers of the irrigation sector will have increase access to useful field data to formulate irrigation development strategies.

Irrigating farmers and their organizations will have the opportunity to improve their performance through access to new practical information and technology from regional experience.

Indicators of success and hypothesis

Components	Indicator of success	Hypothesis
Component 1: Development of a regional irrigation data base	Appropriate knowledge base adopted for monitoring and evaluation of irrigation development in the eastern Nile basin.	The project is accepted by regional stakeholders
Component 2: Development of procedures and guidelines for monitoring and evaluation of irrigation performance and information sharing	Data and information are continuously collected and capitalized at the regional level	Regional stakeholders accept to provide information in a transparent manner
	Regional stakeholders participate to training programs and regional seminars. A data base of quantitative irrigation performance indicators is established, case studies on irrigation performance are carried out. Exchange of information and cooperative activities among regional institutions are developed Simulation of irrigation scenarios using the analytical tools developed by ENTRO and NBI.	Regional stakeholders find an interest in regional cooperative activities. Appropriate analytical tools for simulating water-related investments at the basin level are developed under other NBI / ENTRO projects.

5.1.5 Implementation and budget

The project is a continuous program by nature. The four above activities would be phased so that stakeholders provide data and information and participate to the continuous improvement and updating of the irrigation data base and compute performance indicators. The project would be implemented by ENTRO in cooperation with irrigation institutions of the EN countries. The project would be supported technically by a competitively-recruited international consultant mainly for activity 1 and during project year 1.

- Table 26 provides an estimate of how much the project will cost and who will be responsible for which aspects of the overall costs. Total cost is estimated at 1,125,000 USD, it does not comprise regular running costs.

Figure 7 suggests a time table for implementation of the project activities.

Deliverables

- Functional data base with users manual and recommendation for future improvement;
- Guidelines for information sharing;
- Guidelines and procedures for monitoring and evaluation of irrigation performance at scheme, country and regional levels;
- Functional website for information sharing (data base) and comparison of irrigation performance (benchmarking).
- Training curricula and minutes of training workshops
- Minutes of regional seminar
- Results of simulations of irrigation investments scenarios

Table 27: Proposed Allocation of Implementation and Funding Responsibilities of project 1

N°	Activity	Tasks	Responsibility	Cost component	Cost (USD)
1.1	**Review/baseline survey of the irrigation sector**		Int. Consultant	Consultant fee	70 000
1.2	**Collect missing data**		Nat. Consultant	Consultant fee	150 000
1.3	**Elaboration of the data base and test functionalities**		Int. Consultant	Consultant fee	30 000
1.4	**Training on utilization of the data base**		Int. Consultan & Nat trainers	Consultant & trainers fee for 3 training sessions	250 000
2.1	**Enhance regional cooperation for continuous information sharing**				
		Establish common guidelines for information collection and sharing and improve data quality at scheme, national and regional levels	Int. Consultant	Consultant fee	15 000
		Drafting, discussion and adoption of a charter for information sharing	ENTRO	none	-
		Involve relevant stakeholders for data provision and data analysis	Riparian countries	none	-
		Design and implement mechanisms and incentives for data provision and information sharing	ENTRO	Fist year running costs	250 000
2.2	**Develop guidelines and procedures for monitoring and evaluation of irrigation performance**				
		Develop or adapt as set of irrigation performance indicators acceptable by all stakeholders	ENTRO & riparian countries	none	-
		Develop guidelines for monitoring and evaluation of irrigation performance	ENTRO & riparian countries	None	-
		Design an internet-based regional irrigation benchmarking system using performance indicators	ENTRO	Website designer fee	10 000
		Develop and implement training programs on utilization of the system and on use of remote sensing technologies	ENTRO	Trainers fee, travel andsubsistence for 3 training sessions	200 000
		Organize regional seminars to enhance regional cooperation for improving irrigation performance	ENTRO	Travel and subsistence for 3 seminars	150 000
		Undertake simulation of irrigation expansion scenarios	ENTRO	none	-
				TOTAL COST	**1 125 000**

Figure 6: Proposed Work plan of project 1

N°	Activity	Tasks	Year 1				Following years
1.1	**Review/baseline survey of the irrigation sector**						
1.2	**Collect missing data**						
1.3	**Elaboration of the data base and test functionalities**						
1.4	**Training on utilization of the data base**						
2.1	**Enhance regional cooperation for continuous information sharing**						
		Establish common guidelines for information collection and sharing and improve data quality at scheme, national and regional levels					
		Drafting, discussion and adoption of a charter for information sharing					
		Involve relevant stakeholders for data provision and data analysis					
		Design and implement mechanisms and incentives for data provision and information sharing					
2.2	**Develop guidelines and procedures for monitoring and evaluation of irrigation performance**						
		Develop or adapt as set of irrigation performance indicators acceptable by all stakeholders					
		Develop guidelines for monitoring and evaluation of irrigation performance					
		Design an internet-based regional irrigation benchmarking system using performance indicators					
		Develop and implement training programs on utilization of the system and on use of remote sensing technologies					
		Organize regional seminars to enhance regional cooperation for improving irrigation performance					
		Undertake simulation of irrigation expansion scenarios					

5.2 PROJECT PROFILE 2: FORMULATION OF A REGIONAL PROGRAM FOR NEW IRRIGATION DEVELOPMENT

5.2.1 Rationale and objective

The rationale for this project is to shift from unilateral to regional planning of irrigation expansion and thus avoid conflict over water. The objective of this project is, in addition to the already agreed and ongoing fast track projects, to jointly plan and identify the next set of new expansions (up to 100, 000 ha in each country) for feasibility studies and having done so, to reach consensus among riparian countries to undertake feasibility studies.

Main Outputs are:

A regional program for new irrigation expansion articulated according to:

- The priorities and objectives based on challenges and opportunities identified by ENIDS CRA study and further information derived from component 1 of this project and other relevant studies.
- The countries' national plans and strategies
- The identification and selection of new and safe irrigation expansion projects (up to 100,000 ha in each country).
- The feasibility studies of the selected projects.

5.2.2 Description

Component 1: Identification and preliminary assessment of irrigation expansion projects

- **Activity 1.1: Round-table meeting**

A round-table meeting of senior representatives of the ministries responsible for water resources and irrigation development and ENTRO will initiate the project (and will also serve as inception meeting). Regular subsequent meetings/ contact with the project team and decision makers should encourage exchange of ideas and contribute to the quality and validity of the final strategy report.

- **Activity 1.2: Review of irrigation development and performance**

From a desk study of available documentation and consultation the following will be reviewed:

- The location, extent and nature of irrigation and drainage systems by national boundaries and sub-basins.
- Past and present performance in terms of developed and harvested areas, water use efficiency, cropping patterns and cropping intensities, yields (if lower than expected reasons for this);

- Typical O&M costs
- Assessment of water supply arrangements and O&M
- Social impacts of existing development: farmers income, job creation, conflicts over land and water, other;
- Environmental impact: erosion and sedimentation, salinization, pollution of surface and ground water, others;
- Measures taken to mitigate negative social and environmental impacts and their degree of success.
- Environmental and social constraints: degradation of the natural resources base, conflict between pastoralists and farmers, others.

Activity 1.2: Assessment of land and water resources and scope for further irrigation expansion and options for joint investment projects

This activity will consist in making an estimate of potential and competing water demand in the basin and providing an indication of water for irrigation expansion. This will be compared with estimates of suitable land resources and, using generalized estimates of annual gross water requirements for typical cropping patterns applicable to each sub-basin/agro-ecological zones; the scope for further irrigation expansion.

With respect to land availability, the Blue Nile and Main Nile sub-basins in Sudan have a huge potential of suitable land and offer opportunities for joint investment irrigation projects. The Tekeze and Atbara sub-basin also offers opportunities for joint irrigation projects. At this stage, the highest attention must be paid to potential downstream impact and the limitations imposed by the 1959 Nile Water Agreement. Running simulation models developed by NBI and ENTRO and regular contacts with senior representatives of the riparian countries should help reaching appropriate agreements and avoiding subsequent delays or even failure of the program formulation and implementation.

Activity 1.5: Identification of comparative advantages

From the available data on irrigation costs and benefits, a rapid financial analysis of crop production will be prepared for each sub-basin, main crops, categories of irrigation systems[15] and rain-fed production systems[16] to demonstrate the typical return to land, water and labour and determine comparative advantages within the entire basin. A similar analysis will be done in economic terms, i.e. with all taxes and subsidies removed and if necessary shadow prices of currencies. More precisely the objective of this work would be to indicate for comparative purposes:

- The profitability to irrigating farmers of the different types of on-farm investments

[15] Large public irrigation schemes, small scale irrigation, private and state -owned commercial irrigated farming.
[16] Small scale rain-fed farming, mechanized rain-fed farming in the various agro-ecological zones of the basin with and without improved water management.

- A cost-benefit analysis and indication of comparative advantages for the main crops and category of irrigation projects; e.g. joint investment projects in Sudan, transboundary irrigation development in the Tekeze & Atbara sub-basin at the basin level.

Such an analysis will help to identify any crops for which there is a comparative advantage under the various options, i.e. irrigation development in the various sub-basins and joint investment projects.

Activity 1.6 Assessment of possible harmonization of government policies

A rapid review of policies and plans of each riparian government will establish what they see as the main national benefits of irrigation: food security, export earnings, poverty alleviation, employment creation, others. The connection with land and water availability, comparative advantages and potential for regional trade will be assessed to determine how national policies can be harmonized to increase the equitability and productivity of water allocation in the irrigation sector and thereafter to assess how best to approach the actual task of harmonization itself.

Activity 1.7 Assessment of possible harmonization of legal and institutional framework

The extent to which the national institutional frameworks can be harmonized will be assessed. Cooperative activities aiming at reducing institutional capacity gaps will be identified. Issues to be addressed include but are not limited to the following:

- Legal and administrative problems of land re-distribution
- Provisions for legal establishment of WUAs and implications for O&M
- Security of water and land rights and implication of public or private investment in agricultural water;
- Regulations for private sector investments in agriculture and enforcement
- Regulations and control on environmental impact and the existing capacity for enforcement
- Dam safety regulation and means for enforcement
- The existing institutional frameworks and their capacity for managing irrigation development projects
- The adequacy of coordination between the various institutions involved in irrigation development and the need for rationalization both at country and basin wide level;
- The availability of trained manpower for irrigation planning and implementation of projects and potential for regional cooperative capacity building activities;
- The capacity of existing institutions for integrated water management;
- The success / drawbacks of existing management and O&M of large public schemes and constraints to the transfer to or greater responsibility of WUAs.
- Issues related to cost recovery.

Activity 1.8 : Defining strategic options and accompanying measures

On the basis of the above activities, the regional program will determine the most appropriate and type and scale of support for agricultural water development and will consider the options for achieving this. These may consist in implementing the already agreed fast track irrigation projects, and defining the next set of irrigation expansion through for instance maximizing basin level comparative advantages of joint irrigation projects.

Accompanying measures could include regional cooperative activities for:

- Harmonization of agricultural, water resources and irrigation policies within and across countries,
- Harmonization of legal framework in particular with respect to environment protection
- Decentralization of integrated water management activities towards regional and local public bodies which would help to recover costs through user charges and collection instruments, and thus help sustain the investments by water users,
- Regional guidelines / procedures for utilization of the analytical tools developed by ENTRO and the NBI;
- Increase regional trade for maximizing comparative advantages and planning of cropping patterns at basin level;
- Encourage private sector investments and/or joint investments in the irrigation and agricultural sectors;
- Strengthening agencies responsible of environmental legislation enforcement
- Establishing guidelines and indicators for monitoring agricultural water use and use efficiency and impacts of agricultural water-related investments on water availability at basin and sub-basins level;
- Capacity building for project planning, design and implementation,
- Capacity building for irrigation management transfer and cost recovery.

Activity 1.9 : Identification of priority projects and actions

The formulation of the strategy will result in identification, preliminary assessment and approximate costing of investments in agricultural water development and cooperative regional institutional development programs that can be further explored by subsequent projects as suggested in project profiles 3, 4 and 5.

Activity 1.10: Reaching consensus on the program

The output of the work carried out so far will consist of an outline of a draft program supported by a series of brief working papers and previous consultation with / and recommendation of regional stakeholders. These will have to be presented and discussed at a final workshop bringing together all major stakeholders including policy decision makers and potential international development partners. Presumably, the result of this consultation should be a convergence of views and interests on the most appropriate regional program to which all riparian countries should be consequently committed.

Component 2: Feasibility studies

The document "Generic guidelines for identification and assessment of irrigation projects" provides with a detail description of the activities to be carried out during feasibility study of new irrigation projects. Only the main elements are indicated in the following.

Activity 2.1: Engineering studies

The object of the engineering studies is to provide the necessary technical information to permit the preparation of preliminary designs upon which estimates of quantities, accurate to plus or minus 15 percent, and project cost estimates, can be based. Engineering studies should include some or all of the following:

- Interpretation of satellite imagery and aerial photography.
- Site topography survey at appropriate intervals and preparation of topographic maps at appropriate scale and as required by the government Irrigation planning and Coordination Team.
- Surface water resources studies including a correlation of rainfall with run-off. Where practicable, water availability should be simulated to provide an indication of likely availability to meet demand over the period of analysis of the project (generally 30 years). This should permit the prediction of the likely year-by-year cropping intensity, rather than assuming one based on the area that it would be possible to irrigate if the 80 percent probability (say) flows occurred each year. For small un-gauged catchments a synthesis of rainfall, catchment area and assumed run-off coefficients may be acceptable.
- Groundwater studies to investigate water table depth, the nature of recharge and sustainable yield of aquifers.
- Water quality analyses and limitation for irrigation.
- Studies of present utilisation and future demand for surface and underground water and the prospects for other developments within the same catchment that could affect water availability:
  - Assessment of the emergence of competing demands for water for urban and industrial uses that could influence availability for irrigation. Conversely, consideration may be given to the use of agricultural drainage water and municipal waste water for irrigation.
  - Estimates of water demand for the existing and proposed cropping patterns, based on the use of the FAO CROPWAT software and its computer database CLIMWAT or an alternative locally developed method of estimating crop water requirements if this is appropriate. These studies may include a consideration of the possibility of designing for conjunctive use of surface and groundwater for irrigation, buffer reservoirs and on-farm ponds to increase predictability and security of water supply in dry years and dry periods. Consideration should also be given to the possible crop rotation that farmers might adopt, and cropping patterns that avoid unreasonable peaks in water demand.
  - Estimates of surface and subsurface drainage requirements based on a design storm of selected return period and locally obtained data on subsoil drainage and water table depth.
  - Geological and/or geotechnical investigations for foundation design, seepage predictions (which are of particular importance in decisions on whether or not to line canals), slope stability analysis and creep ratios.

Outputs of the engineering studies should be:

- Preliminary engineering designs for the scheme layout, main structures and water supply/drainage system including the technology for water control and monitoring by users.
- Preliminary engineering designs for roads and other infrastructure.
- Detailed cost estimates for the civil works and their operation and maintenance.

Activity 2.2: Soil and land capability studies

This activity would consist in mapping soils and land or to upgrade the available mapping to an acceptable scale and standard making a specific attention to drainage requirements to limit the risk of water logging and soil salinization. This time consuming activity should be carried out by the government soil survey agency or private contractors, depending on which is likely to deliver the quickest result.

Outputs: The soils and land suitability should be assessed on the methodology outlined in the FAO soils bulletin N° 55: "Land evaluation framework". Alternatively other methods recommended by the government can be applied.

Activity 2.3: Agro-socio-economic studies

Depending on the nature and complexity of the proposed project and the availability of detailed information regarding the without-project situation, it may be necessary to organise an agro-socio-economic survey. This is usually carried out by local consultants. Specialised briefing and support for field work may be given by the staff of the international consultant involved in the projects.

Outputs of the agro-socio-economic studies should be:

- A description of the current situation of the agricultural sector: cropping patterns and corresponding profitability for farmers or for rehabilitation projects, a diagnosis of irrigated agricultural production
- An evidences backed estimation of the likely evolution of the agricultural sector "without the project" in terms of productivity decline, stability or increase supported by sound arguments
- The selection of cropping patterns and crop rotations under irrigation based on: agro-ecological conditions, farmers' preferred crops, priorities of the government and market size and prices (for high value crops).
- Corresponding crops water requirements;
- Corresponding labour and inputs requirements;
- Estimations of land productivity (gross margin/Ha); labour productivity (Gross margin/farm worker) and of beneficiary household income from irrigated farming
- Estimation of farmers' capacity to pay for O&M based on the above
- Proposed O&M charging modalities (see box 2) and level estimate of cost recovery of O&M.
- Level estimate of beneficiaries' participation to project implementation in cash and labour.

Activity 2.4: Environmental and social impact assessment

If, at the identification stage, a full and separate Environmental and Social Impact Assessment (ESIA) was found necessary, the ESIA should at least consider the following issues:

- Potential erosion and sedimentation hazards;
- Water logging and salinization,
- Depletion of groundwater supplies,
- Pollution of surface and groundwater by agro-chemicals
- Risks related to ecosystem functions and natural resources
- Displacement of human settlements and the impacts on ousted people (loss of land and assets)
- Risks of conflicts between farmers and pastoralists and between upstream and downstream water users
- Health aspects.

The ESIA may be carried out by government agency staff or a consulting company.

Outputs
It should be an environmental action plan (EAP) and if necessary a land acquisition plan (LAP) which will include measures such as compensation for ousted people, proposed legal provisions and regulatory mechanisms for minimising adverse impacts, and provision for systematic monitoring and evaluation. All identifiable costs should be itemised for inclusion in the total cost stream of the proposed projects.

Activity 2.5: Land Tenure and Water Rights Investigations

The existing formal or customary arrangements for land tenure and, for rehabilitation projects, water rights should be examined in detail. This should establish whether there might be any obstacles to successful implementation, such as a lack of secure tenure or water rights, which could inhibit farmers' participation and contribution to the project.

Outputs
Depending on the circumstances of the project and its location, it may be necessary to arrange for a cadastral survey to establish the existing land tenure pattern and its implications for project planning. This should provide data on the size and distribution of properties and farms, degrees of fragmentation, the proportion of owner and tenant-operated farms, and type of tenure. Data should be interpreted in terms of recommendations for land rights redistribution or consolidation and compensation for lost of land and assets that would result from the project. Land tenure issues should be approached with caution, and the views of the present users taken fully into account.

Activity 2.6: Assessment of institutional capacity for management and O&M.

A key condition for sustainable irrigation development is that the implementation requirements of the projects should be matched to a local institutional set up or a coordinated set of accompanying measures to ensure long terms sustainability and productivity of irrigation projects when under operation. The assessment of the institutional set-up is likely to benefit from an independent external review. It should address all or some of the following:

- Institutional roles and responsibilities of public or private irrigation agency in charge of management operation and maintenance of major hydraulic infrastructures such as dams, pumping stations, main canals and drains of large schemes.

- Institutional roles and responsibilities of Water Users Organizations for management and O&M of the secondary or tertiary irrigation and drainage work in large schemes or for the whole system of small scale irrigation schemes;

- Institutional roles and responsibilities of large scale commercial farmers in management, operation and maintenance of irrigation projects;

- Government technical and financial support to irrigation agencies and WUAs;

- Government supervisory role and control over management, operation and maintenance of irrigation;

- Support for marketing, storage and processing of irrigated farming products.

- Research and extension service to ensure high productivity of irrigated farming.

- Investment credit: Irrigation development leads to increased needs of investment credit for farming machinery, planting of fruit trees, storage and transportation of the production flow.

- Input access and seasonal credit: High productivity of irrigated farming will also come from increased use of agricultural inputs which will generate an increase of seasonal credit needs.

Activity 2.7: Economic analysis

The return due to irrigation will normally consist of the value of the incremental output of the project. To establish this value it is necessary to compare what would happen without the project with what would occur with the project. The agro-socio-economic study should provide information for comparing the situation with and without the project.

The Economic Internal Rate of Return (EIER) is most usual indicator to assess the merit of an investment. All costs should be estimated at market price and the return including products for home consumption should be expressed at farm gate market prices. Taxes and subsidizes should be eliminated from the calculation and if found necessary shadow prices of currencies can be used.

Activity 8: Risk and Sensitivity Analysis

An assessment should be made of the extent to which the proposed investment implies risks for the project. Risks should be explicitly identified and their possible impact on the economic viability of the investment and on its sustainability examined.

Activity 9: Planning for implementation

To encourage smooth and rapid progression from appraisal to project start-up and loan disbursements, it is essential to prepare a detailed implementation plan for the period leading to start-up and extending through at least Project Year 1 (PY1). This should contain step-by-step guidance on all activities to be undertaken. It should also clearly identify who is responsible for and who supervises each activity.

Activity 10: Writing of the feasibility Study Report

The feasibility report should usually contain a description of the project rationale and planning considerations, which is likely to repeat the arguments developed first in the project identification document, but modified and deepened to reflect the findings of later investigations. In particular, in view of the emphasis that would be placed by the Regional Strategy on the requirements for win-win projects, the document should clearly demonstrate that the costs and benefits of the project are equitably shared amongst the Eastern Nile countries.

The feasibility study report should describe:

- The irrigation and drainage works and other hardware which are proposed for financing
- The expected phasing of this development.
- Institutional responsibilities and staffing requirements for project implementation;
- The implementation plan;
- Mechanisms adopted for users' participation in implementation;
- Details of expected supervision of implementation by the financing or cooperating institution.
- The organisational structure decided upon for O&M, which may include allocating or transferring responsibility to the users, or to a financially autonomous irrigation authority dependent on the users for financing, and/or participatory joint management.
- The suggested legislative and regulatory framework for WUAs and other management organisations proposed;
- The proposals for water charges and cost recovery mechanisms, reflecting the country irrigation sector strategy;
- Technical assistance and training requirements;
- The estimated changes in cropping patterns and yields expected as a result of the development, and the rate at which these are expected to occur.
- Marketing possibilities and forecast of prices.
- The financial returns to farmers and distribution of costs and benefits amongst the eastern Nile countries, taking account of all social and environmental costs, with sensitivity and risk analysis.

The feasibility study report should normally incorporate or be supported by the working papers that have been generated at various stages of the planning process. These should either be presented separately or attached to the project document as annexes, depending on the form that best facilitates subsequent appraisal.

Component 3: Project implementation

Main activities include:

- Preparation of terms of reference for technical assistance services for detailed engineering design work, promotion of beneficiaries participation, design of

extension programs and training of farmers, design of irrigation staff training programs, etc;

- Invitations to bid and bidding, bid evaluation, contract negotiation, award of contracts and mobilization of staff;
- Preparation of procurement packages for project vehicles, construction plant and equipment, and possibly temporary site accommodation. Invitations to bid and bidding, bid evaluation and award o contracts;
- Negotiation of agreements with communities on their labour and other contributions to construction and subsequent O&M;
- Participatory planning with farmers for irrigation water delivery/distribution systems and in-field works;
- Preparation of bidding for additional topography surveys, invitations to bid, bid evaluation and award of contract;
- Cadastral surveys;
- Additional site investigations and topographic surveys;
- Detailed engineering designs and cost estimates for subsequent years construction work;
- Initiation of farmer training and extension programmes;
- Initiation of irrigation staff training programme;
- Preparation of procurement packages for construction work, invitation to bid and bidding, bid evaluation and award of contract;
- Preparation of procurement packages for supervision of construction work, invitation to bid and bidding, bid evaluation and award of contract;
- Construction;

Six-monthly interdepartmental review/planning workshops

5.2.3 Implementation and budget

Duration of the project, required staffing and budget can vary a lot according to the size of the project and number of sites for individual irrigation schemes and pre-existing information (i.e. previous feasibility studies, soil mapping, topography survey, etc). Table XX provides a tentative cost estimates for component 1 and for component 2 for the feasibility study of 20,000 ha not including the costs of topography and soils surveys that can vary a lot according to pre-existing available information.

Table 28 Cost estimate for component 1 & 2 of project 2

N°	Activity	Cost component	Cost (USD)
Component 1			
1.1	Round-table meeting	Organization, travel cost, DSA	30 000
1.2	Review of irrigation development and performance	International consultants 12 man-months; national consultants 14 man-months; includind travels osts and DSA.	400 000
1.3	Assessment of land and water resources and scope for further irrigation expansion and options for joint investment projects		
1.4	Identification of comparative advantages		
1.5	Assessment of possible harmonization of government policies		
1.6	Assessment of possible harmonization of legal and institutional framework		
1.7	Defining strategic options and accompanying measures		
1.8	Identification of priority projects and actions		
1.9	Reaching consensus on the program during workshop	Organization, travel cost, DSA	30 000
		TOTAL COMPONENT 1	**460 000**
Component 2 (Feasibility for 20,000 ha)			
2.1	Engineering studies	Int. Consultants 8 man-months, Nat consultant 20 man-months	320 000
2.2	Soil and land capability studies	Int. Consultants 2 man-months, Nat consultant 6 man-months	88 000
2.3	Agro-socio-economic studies	Nat consultant 6 man-months	48 000
2.4	Environmental and social impact assessment	Int. Consultant 2 man-month, nat. Consultant 6 man-months	88 000
2.5	Land Tenure and Water Rights Investigations	Int. Consultant 2 man-months	40 000
2.6	Assessment of institutional capacity for management and O&M	Int. Consultant 1 man-month, Nat. Consultant 3 man-months	64 000
2.7	Economic analysis	Int. Consultant 2 man-months	40 000
2.8	Risk and Sensitivity Analysis	Included in the above	
2.9	Planning for implementation	Int. Consultant 1 man-month	20 000
2.10	Writing of the feasibility Study Report	included in all the above	
		TOTAL COMPONENT 2	**708 000**
		GRAND TOTAL COMPONENT 1 AND 2	**1 168 000**

(Consultant fees include travel costs, DSA and secretariat support.)

5.3 PROJECT PROFILE 3: PREPARATION OF ACTION PLAN FOR REHABILITATION/MODERNIZATION OF EXISTING IRRIGATION SCHEMES.

5.3.1 Objectives

The objective of the proposed project is, based on the previous studies (ENIDS CRA, EWUAP Diagnosis and others) and the information provided by the irrigation data base and monitoring system (project profile 1) , national priorities and strategies; to identify poor performing irrigation schemes in the basin and undertake feasibility studies to improve their productivity and water use efficiency through infrastructure modernization and management reforms.

5.3.2 Rationale

Rehabilitation and modernization of existing poor performing or ageing irrigation schemes can boost the productivity of irrigated agriculture and hence strongly contributes to food security and increase farmers income. All Eastern Nile countries promote decentralization and privatization of irrigation management as well as cost recovery of at least, O&M costs. Difficulties of irrigation management transfer and cost recovery policy stem from difficulties with both infrastructure and management required to establish steady and predictable flows in distribution systems. Modernization of infrastructure thus corresponds to the need to increase control over flows by users. This is a prerequisite to improve water productivity and to the formation of strong and financially autonomous farmers controlled irrigation management entities. Hence, this project mainly focus on infrastructure modernization on one hand and formation and capacity building of Water Users Association on the other hand.

5.3.3 Description

Component 1: Preliminary study and comparison of development options for rehabilitation and/or modernization

This component will be a preliminary examination of options for the rehabilitation / modernization of the selected schemes and a follow-up of the EWUAP study. The objective is to assist concerned stakeholders and farmers in selecting the preferred option, to plan the work for feasibility study of the preferred option and to promote rapid progression to the implementation stage. This is a crucial and sensitive stage because it leads to the critical decisions on project choice, concept and content on which all subsequent work is based, and which are difficult to change at a later stage.

- **Activity 1.1: Consultation with farmers**

The preliminary study will start with a visit of the project team to the selected irrigation schemes with a view to:

- Introduce the study to the farming community
- Define the procedures of farmers' participation at the various stage of the whole study
- Conduct Focus Group discussions with farmers in the different part of the schemes to collect their perception of the constraints of irrigated farming and possible solutions for improving water management and the overall performance of irrigation, and assess farmers' willingness to pay for operation and maintenance after rehabilitation.

- Visit of the schemes with farmers to gain first hand information on the condition of the irrigation and drainage facilities (sedimentation and weeds in canals and drains, types and status of water division structures, destruction made by farmers or livestock) and what brought the need for rehabilitation other than "old age". The visit should also allow observing the irrigated crops (signs of water stress, pests and diseases), on-farm irrigation methods, conjunctive use of water (from shallow wells or reuse of drainage water) and estimating the size of fallow lands and area with water logging or salinization problem within the scheme.

Activity 1.2: Assessment of the current situation in the selected schemes

Previous studies and reports could have already proposed development options and the level of information available / required for the preliminary study will vary according to the schemes. Thus, the assessment of the current situation will be based on available information and complementary field investigations. However the project team shall exercise sound professional judgement to decide on the needs for complementary field investigations to avoid unnecessary detail, delay or extra survey.

The output of this activity should the identification of the main constraints and opportunities for improving the performance of the selected schemes. It will address the following:

- **The history of the scheme:** Highlights of the important historical events which may explain the management problems that evolved since construction. These important events may relate to expansions of irrigated area, previous rehabilitation, and change of cropping patterns and markets, policy and institutional reforms for irrigation management and so on.

- **The status of the irrigation facilities and their needs for rehabilitation / modernization:** Assessment of the present condition of the infrastructure, constraints, sources of inefficiency and the scope for efficiency gains. A particular attention will be given to the most appropriate irrigation technology that will allow improving water management and water use efficiency.

- **Topography, soils and drainage requirements:** Threats posed to the schemes by water logging, poor drainage, and salinization problems and possible mitigating measures and to seepage estimates which are of particularly importance on decision of whether or not lining canals.

- **Size of landholding, land tenure and water rights:** Identification of obstacles to successful implementation of scheme modernization such as a lack of secure land tenure or water rights, which could inhibit farmer's participation and contribution to the project.

- **Irrigated farming systems and outputs:** Identification and assessment of the irrigated farming systems of the different categories of farmers within the scheme: size of farmers groups by categories, land use, cropping patterns, agricultural practices, crop yields, farmers' income and market. Farmers' capacity to pay for O&M should be assessed at this stage.

- **Irrigation water requirements for existing and proposed cropping patterns:** estimates of the crops water requirements for existing and alternative cropping patterns.

- **Water availability:** the volume of water made available on an annual or seasonal basis will be assessed and compared to water demand. The project team will also consider the need and opportunities for on-scheme / on-farm storage of water to cope with possible unreliability of water supply.

- **Institutional capacity for management and O&M:** Institutions that will be assessed are governmental agencies responsible for O&M of the main hydraulic infrastructures, agricultural support services and WUAs. The assessment should identify the needs for strengthening WUAs and establishing workable contract agreements between IWUAs and water users (by-laws) and between IWUAs and the government agencies in charge of the main hydraulic infrastructure. Other institutions such as private traders or cooperatives involved in agricultural inputs and marketing and private contractors for the development and O&M of the irrigation infrastructure will also be assessed.

- **Environmental and social issues:** the project team will identify the major negative environmental or social impacts of the irrigation schemes such as: high occurrence of water borne diseases, water pollution by agro-chemicals, conflicts between farmers within and outside the schemes or upstream / downstream water users, conflicts between farmers within the scheme due for instance to tail-end effects or poor management. The consultant will propose mitigation measures.

Activity 1.3: Formulation of development options

Based on the assessment of the current situation, the project team will prepare three development options for each irrigation scheme. These development options will involve:

- Pre-feasibility level designs of rehabilitation and modernization work of the irrigation and drainage infrastructures and preliminary estimates of quantities and investment and O&M costs.

- Strategy options for increasing the productivity of irrigated farming: cropping patterns, crop rotations and cropping intensity; for improved agricultural extension service; and for improved sourcing of inputs and market access;

- Proposed institutional and organizational arrangements for irrigation management transfer to WUAs including proposals for water charges and cost recovery mechanisms; the option will be designed to enhance the autonomy of the WUAs.

- Proposed mitigation measures for adverse social and environmental impacts;

- Proposed respective roles and responsibilities of government agencies and WUAs during construction work

- The prospects for involvement and interest of the private sector for agricultural development (inputs, marketing), development of irrigation infrastructure, O&M.

- Economic analysis: costs and benefits analysis of the proposed options; farm budget.

- Outstanding issues and needs for further investigations and surveys to be addressed during the feasibility study phase.

Activity 1.4 Achieving consensus on the preferred development option for each selected scheme

The development options will be presented to the leaders of the farming community of each scheme in an easily understanding format and language supported by visual aids. Discussions with farmers for selecting the preferred option will use a multi-criteria analysis developed the Consultant. The multi-criteria analysis will address:

- The impact of each option on productivity of irrigated farming;

- The sustainability of each option;

- The equitability of each option;
- The level of farmers' contribution in cash and labour for implementation of each option;
- The participation of WUAs in monitoring the implementation process
- The level of O&M costs to be paid by farmers for each option after implementation;
- Others.

The project team will then assist farmers' leadership to discuss the options with the general membership. It will also be worth that the project team consults with representatives of the private sector.

The farmers' preferred option will be the one selected for feasibility study after economic, financial and technical evaluation by the government and adjustments made following discussion with concerned stakeholders during a workshop.

Component 2: Feasibility Study of the preferred Options for the selected irrigation schemes

The outcome of component 2 should be a feasibility study report that should demonstrate that the project is:

- Consistent with the needs of the intended users;
- Technically sound and the best of the available alternatives under existing technical and economic constraints;
- Institutionally workable;
- Technically, environmentally and fiscally sustainable;
- Economically and financially viable; and
- Ready for implementation.

Activity 2.1 Engineering studies

The objective of the engineering studies will to define the type of improvements intended to the physical irrigation and drainage infrastructures for improving water management upon which estimates of quantities and project cost estimates, will be based. Depending on the scheme, the engineering studies may include consideration of the possibility of designing for conjunctive use of surface and groundwater for irrigation, buffer reservoirs and on-farm ponds to increase predictability and security of water supply in dry years and dry periods. **In Sudan**, consideration should also be given to the costs and benefits of lowering the water level in the reservoir of the Jebel Awlia dam to save evaporation losses. Main activities will include:

- Carry out an inventory of all existing infrastructures on the basis of satellite imagery based on GPS surveying and field inspections;
- Carry out a topography survey (cadastre) of the schemes and prepare corresponding maps at the appropriate scale and contour lines intervals.

- Carry out a topography survey of the sites earmarked for rehabilitation and construction of irrigation and drainage infrastructures and prepare maps at the appropriate scale and contour lines intervals.
- Carry out an estimate of the costs (increasing pumping head of upstream schemes) and the benefits (water saving) of lowering the reservoir of the Jebel Awlia dam.
- Prepare engineering designs at feasibility study level of drawings, layouts, profiles, longitudinal drawings;
- Prepare engineering designs at feasibility study level typical sections of irrigation and drainage facilities
- Shape files and survey data for all layouts, longitudinal and cross sections drawings
- Prepare detailed cost estimates for the civil work and their operation and maintenance

Activity 2.2. Agriculture and agro-economy studies

The objective of the agriculture and ago-economy studies will be to define and justify the proposed irrigated farming systems after implementation of the project and assess the incremental gains of irrigated farming productivity. Main activities include:

- An evidences backed estimation of the likely evolution in the selected schemes "without the project" in terms of productivity decline, stability or increase supported by sound arguments;
- The detailed description of the selected cropping patterns and crop rotations;
- Corresponding crops water requirements and irrigation water requirements;
- Corresponding labour and inputs requirements;
- Estimations of land productivity (gross margin/Ha); labour productivity (Gross margin/farm worker) and of beneficiary household income from irrigated farming;
- Estimation of farmers' capacity to pay for O&M based on the above;
- Level estimate of beneficiaries' participation to project implementation in cash and labour.

Activity 2.3 Environmental and social studies

The objective of the environmental and social studies is to prepare a mitigation plan for reversible adverse environmental impacts which includes a monitoring and evaluation system and compensation measures for negatively affected groups. For doing so, the Consultant will examine the following issues:

- Pollution of surface and groundwater by agro-chemicals
- Potential erosion and sedimentation hazards;
- Water logging and flooding of the command areas and surrounding areas;
- Depletion of groundwater supplies,

- Risks related to ecosystem functions and natural resources
- Land rights and water rights;
- Risks of conflicts between farmers and cattle growers and between upstream and downstream water users
- Health-related aspects.

Activity 2.4: Marketing studies

If the viability of the project relies on the inclusion of high value crops for the domestic or export market, it will be necessary to carry out marketing studies. Eastern Nile countries are not self sufficient in cereals and other non-perishable staple food, therefore there would be no need to dwell on market issues for such crops except than assessing the availability and adequacy of transport and storage back-up services and roads.

Activity 2.5 Land tenure, land rights and water rights studies

The existing formal or customary arrangements for land tenure and water rights in the selected schemes will be examined through on site investigations. This will establish whether there might be any obstacles to successful implementation, such as a lack of secure tenure or water rights, which could inhibit farmers' participation and contribution to the project.

Activity 2.6 Studies of roles and responsibilities of WUAs, public and private institutions for management, operation and maintenance.

The objective of these studies is to propose the institutional set-up and a coordinated set of accompanying measures and capacity building activities to ensure long term sustainability and productivity of the selected schemes after rehabilitation and modernization. Through consultations with stakeholders and farmers, these studies will address the following:

- The management, operation and maintenance of the major hydraulic infrastructures: pumping stations or river diversion, main canals and large drains;
- Local systems of village administration, customary or otherwise, that could form the basis of WUAs.
- Institutional roles and responsibilities of WUAs for management and O&M of the secondary or tertiary irrigation and drainage work;
- Financial sustainability of irrigation development: mode of assessment and collect of the O&M fee and control of its utilization by water users.
- Defining the status, objectives, internal structures, by-laws and operational rules of WUAs and assess ongoing training activities and further capacity building needs.
- Defining the contract agreements between WUAs and the governmental agency in charge of O&M of the main infrastructure (Irrigation management transfer agreements and water supply agreements);
- Defining possible Public Private Partnerships for operation and maintenance;
- Public or private supporting services to WUAs;

- Defining the procedures for the government supervisory role and control over management, operation and maintenance of the irrigation schemes in particular regarding maintenance standards, utilization of O&M fee and prevention of corruption or abuses, and prevention of negative environmental impacts water;

- The roles of research and extension service to ensure high productivity of irrigated farming.

- Investment credit: Irrigation development leads to increased needs of investment credit for farming machinery, planting of fruit trees, storage and transportation of the production flow.

- Input access and seasonal credit: High productivity of irrigated farming will also come from increased use of agricultural inputs which will generate an increase of seasonal credit needs.

- Defining the involvement of cooperatives or private sector institutions for marketing, storage and processing of irrigated farming products.

Activity 2.7 Economic and financial evaluation

The project team will assess the viability of the selected projects by measuring the Economic Internal Rate of Return (EIRR):

$$(1+r)^m K = \sum_{j=1}(R - C) / (1 + r)^j$$

Where K = cost/ha of project, R = return/ha due to irrigation, C = O&M costs/ha, n = lifetime of project often assumed to be 30 years and m = gestation period of investment. A rate of 10% to 12% is the threshold value widely adopted among international donor agencies when evaluating the outcome of an investment project, below which the investment is generally considered not worth implementing.

The capital costs (K) of the projects include:

- The hardware cost: the cost of physical irrigation infrastructure development such as dams, diversion weirs, canals, drains, water division structures, etc and land acquisition, resettlement and compensation costs; plus

- The software costs which includes engineering costs during implementation for monitoring and supervision of the project, training of agriculture extension services, institution building, training of irrigation agency staff and beneficiaries, formation and capacity building of WUAs, additional and so on.

The return due to irrigation will be the value of the incremental output of the projects. To establish this value the Consultant will compare the situation "with" and "without" the projects.

All costs will be estimated at market price and the return including products for home consumption should be expressed at farm gate market prices. Possible taxes and subsidizes will be eliminated from the calculation.

The project team will also make an estimation of increase in the farm budgets and the rate it will occur and assess farmers' capacity to pay for O&M.

Activity 2.8: Risk and sensitivity analysis

Possible sources of risk are the effects of extreme climatic events (droughts or floods), change in the economic environment (rises in inputs prices or falls in commodity prices), cost overruns and

unnecessary delay in implementation due perhaps to poor management or inadequate staffing. There are also risks that do not lend themselves to quantitative analysis such as possible change in the government's macro-economic policy.

The analysis of the risk factors will therefore not be limited to quantitative analysis, but expand to cover the other major areas of concern, drawing attention to the possible need to take corrective measures before or during project implementation.

Activity 2.9: Writing the feasibility study report

The purpose of the feasibility report is to facilitate appraisal. The content and layout should be discussed with concerned stakeholders before drafting commences.

Activity 2.10: Achieving consensus on the project

The feasibility report will be presented in draft form to the concerned stakeholders for discussion at a consultation workshop. The objective of the workshop will be to reach a consensus on all aspects of the project proposal. On completion of the workshop, an "aide mémoire" will be prepared by the project team which will summarise the proceedings and note any matters that still need to be clarified or corrected in the feasibility report. The aide mémoire should be agreed with the senior representatives of the government in attendance at the workshop. The final version of the feasibility report will then be prepared on the basis of the consensus or conclusions reached.

Component 3: Implementation

The implementation should be carried out according to the feasibility study report. Presumably main activity would be:

- Preparation of terms of reference for technical assistance services for detailed engineering design work,
- design of extension programs and training of farmers,
- design of irrigation staff training programs, etc;
- Invitations to bid and bidding, bid evaluation, contract negotiation, award of contracts and mobilization of staff;
- Preparation of procurement packages for project vehicles, construction plant and equipment, and possibly temporary site accommodation.
- Invitations to bid and bidding, bid evaluation and award o contracts;
- Negotiation of agreements with communities on their labour and other contributions to construction and subsequent O&M;
- Participatory planning with farmers for irrigation water delivery/distribution systems and in-field works;
- Implementation of institutional reforms as per the feasibility study report
- Preparation of bidding for additional topography surveys, invitations to bid,
- bid evaluation and award of contract;
- Cadastral surveys;

- Additional site investigations and topographic surveys;
- Detailed engineering designs and cost estimates for subsequent years construction work;
- Initiation of farmer training and extension programmes;

5.3.4 Implementation and budget

The project will be implemented by ENTRO with technical support of an internationally recruited consulted. The project team will be composed of an Irrigation/civil engineer (Team Leader), economist, agronomist, institutional specialist and land tenure specialist with national teams of similar composition.

Since it is not possible to presume of the size of the schemes earmarked for rehabilitation, table 28 and figure 9 following give an indication of the costs and implementation schedule for components 1 & 2 only for the modernization of 100,000 ha in Egypt or Sudan. Average costs of successful modernization projects in Sub-Sahara Africa amount to approx 3,500 US dollars/ha and approx 3,200 US dollars/ha in North Africa and the Middle East[17].

[17] Source: « Cost and performance of irrigation projects, a comparison between Sub-Saharan Africa and other developing regions » IWMI, Research Report 109.

Table 29: Cost estimates for components 1 and 2 of project 3 (US dollars)

Components	Cost component	Estimated cost
Component 1: Preliminary study and comparison of development options		
	International irrigation /civil engineer (3 man-month)	72 000
	International economist (2 man month)	42 000
	International agronomist (1 man-month)	21 000
	International institutional specialist (2 man-month	42 000
	International land tenure expert (1 man-month)	21 000
	National civil/irrigation engineers (4 man-month)	20 000
	National agronomist (4 man-month)	18 000
	National sociologist (3 man-month)	13 500
	National autocad specialist (1 man-month)	4 500
	National GIS expert (1 man-month)	4 500
	National environmental specialist (3 man-month)	13 500
	Office rental and secretariat	40 000
	International travel cost and DSA	15 000
	Consultation workshops	100 000
	Local travel cost and DSA	6 000
Component 2: Feasibility study of the preferred option	International irrigation /civil engineer (10 man-month)	240 000
	International economist (2 man month)	42 000
	International agronomist (1 man-month)	21 000
	International institutional specialist (4 man-month	84 000
	International land tenure expert (1 man-month)	21 000
	National civil/irrigation engineers (24 man-month)	72 000
	National agronomist (6 man-month)	27 000
	National sociologist (2 man-month)	9 000
	National autocad specialist (3 man-month)	13 500
	National GIS expert (3 man-month)	13 500
	National environmental specialist (1 man-month)	4 500
	Office rental and secretariat	150 000
	International travel cost and DSA	40 000
	Local travel cost and DSA	30 000
	Consultation workshops	100 000
	TOTAL	**1 300 500**

Figure 7: Implementation schedule for components 1 and 2 of project 3

	Months	1	2	3	4	5	6	7	8	9	10	11	12
N°	**Name**												
	Component 1												
1.1	First consultation with farmers												
1.2	Assessment of the current situation in the selected schemes												
1.3	Formulation of development options												
1.4	Achieving consensus on the preferred development option for each selected scheme												
	Component 2												
2.1	Engineering studies												
2.2	Agriculture and agro-economy studies												
2.3	Environmental and social studies												
2.4	Marketing studies												
2.5	Land tenure, land rights and water rights studies												
2.6	Studies of roles and responsibilities of IWUAs, public and private institutions for management, operation and maintenance												
2.7	Economic and financial evaluation												
2.8	Risk and sensitivity analysis												
2.9	Writing the feasibility study report												
2.10	Achieving consensus on the project											⊗	
	Final feasibility report												

5.4 PROJECT PROFILE 4: UPGRADING RAIN-FED AGRICULTURE IN ETHIOPIA AND SUDAN.

5.4.1 Rationale and objective

Rain-fed agriculture in Ethiopia and Sudan will continue to be the main contributor of agricultural production. In Ethiopia almost all the agricultural area is rain-fed and approx 90% in Sudan. However the current productivity of crop per unit area is very low thus providing opportunities to produce more food through investments in the almost untapped potential of upgrading rain-fed agriculture. Upgrading rain-fed agriculture is also a key to poverty reduction as most of the people living in rural areas of Ethiopia and Sudan rely on rain-fed agriculture as the main source of livelihood.

The key challenge in Ethiopia and Sudan is to reduce water-related risks posed by high rainfall variability rather than coping with an absolute lack of water. There is generally enough rainfall to significantly increase production but it is available at the wrong time, causing dry spells and water losses. Apart from water, upgrading rain-fed agriculture requires investments in soil, crop, and farm management. However, to achieve these, rainfall-related risks need to be reduced, which means that investments in rain water management are the entry point to unlock the potential in rain-fed agriculture. Several technical options for improving water efficiency in rain-fed agriculture are currently implemented or planned in Ethiopia and Sudan. They include water harvesting, watershed management, supplemental irrigation and conservation agriculture.

Evidence is emerging that climate change is increasing rainfall variability and the frequency of extreme events such as droughts and floods. This re-enforce the need for investment in water management in rain-fed agriculture to build more resilient farming communities.

Reducing water-related risks is a strong incentive for on-farm investments by farmers.

The knowledge already exists to at least double yields in rain-fed agriculture, even where water poses a particular challenge. The key is adaptation and adoption strategies. Needed for success are human capacity building and stronger institutions. Due to the general perception that rain water takes care of itself in rain-fed systems, farmers in Ethiopia and Sudan practice rain-fed farming with no explicit water management strategies.

The goal of this project is therefore to build a strategy for upgrading rain-fed agriculture in Sudan and Ethiopia primarily based on investments in water management. The focus will be on supplemental irrigation and conservation agriculture.

Supplemental irrigation systems are external rainwater harvesting systems that collect run-off from watershed areas external to the cultivated land and add it to the rainfall in cropped areas. Since rainfall is the principal source of water, supplemental irrigation is applied to provide additional soil moisture for increasing and stabilizing production. Run-off can be collected using small dams, stream diversion and run-off harvesting ponds. Where applicable, local springs and shallow groundwater can also provide the amounts of water needed for supplemental irrigation.

Conservation agriculture is one of the most important strategies for enhancing soil moisture conservation. It consists in replacing conventional ploughing with ripping and no-tillage systems using direct planting techniques combined with mulch management and improving soil structure. Conservation agriculture can be practiced on all agricultural land since it has no limitation related to the need for watershed areas, storage capacity or availability of groundwater compared to supplemental irrigation. Another advantage is that conservation agriculture significantly reduces the need for animal traction or tractor. Some drawbacks of the technique are the costs of specialized planting equipment, the need for new management skills and weeds control during the

first years particularly for poor farming households for which herbicides is not an option. These constraints should be addressed during the planning and implementation stages of the project.

The main objectives of the project are:

- Upgrading rain-fed agriculture in selected areas covering up to 500,000 ha in Ethiopia and Sudan
- Creating a new set of extension services to support rain-fed farmers in improving water management
- Building the capacity of research institutions to adapt technologies to local conditions
- Contribute to defining long term strategies and plan for expanding the project to other areas.

5.4.2 Description

Activity 1: Selection of project areas

Areas for the pilot project will be selected by the Ministries in charge of agriculture and their corresponding bureaus or departments in the regional states. It is proposed to implement the pilot project on Amhara, Oromya and Tigray in Ethiopia; Gezira, Sennar, Blue Nile, Gedaref states in Sudan. The total area covered by the project would be up to 1 million ha of which 250,000 ha and 400,000 ha in Ethiopia respectively for supplemental irrigation and conservation agriculture and 150,000 and 200,000 ha in Sudan respectively for supplemental irrigation and conservation agriculture (both techniques can be combined in one site). The reason for larger project area in Ethiopia is that the upper part of the basin is normally more suitable to apply the techniques and the lower part is more suitable for irrigation development. Selection will be based on agro-ecological zones (climate, types of soil, elevation) and socio-economic characteristics (population density, farming systems, rural infrastructure, and so on).

Activity 2: Training of specialists

The knowledge in supplemental irrigation and conservation agriculture techniques exist but the major impediment is inadequate knowledge sharing and scaling-up of best practices. Training will be conducted through conventional classroom training, field visits, organization of study tours to East or southern Africa countries which are technically more advanced. Classroom sessions will alternate with activities during pilot project implementation to capitalize experience and provide guidance for next steps.
Participants to the training would be staff of agriculture extension services, water resources and irrigation institutions and agencies in charge of environmental protection to bridge the divide in governance of water resources, agriculture, and the environment.

Activity 3: Planning of project activities

For each selected area, a detailed work plan, including a logical framework with specific objectives, expected outputs and indicators of success and impacts as well as implementation schedules and human, technical and financial resources to be mobilized. The main activities will consist in applying in selected areas the techniques of conservation agriculture and supplemental irrigation from small dams, stream diversion, ponds, and shallow wells combined with production factors: crop varieties, fertilizers and land management techniques and continuous training of farmers and field extension agents. Farmers and extension agents in each selected area should actively participate to the planning of activities.

- **Activity 4: Implementation**

In each selected area, resources will be mobilized and project activities implemented according to the planning to reach the objective. Continuous monitoring of activities will seek to better adapt the technologies to local physical condition and socio-economic context and determine the best bet options based on cost-benefit analysis and identify research needs. In this aspect research institutions should have a great role in assessing the results and providing recommendations to make the necessary adjustments of project activities.

- **Activity 5: Evaluation**

The evaluation will provide the governments with useful and reliable information to define a strategy and plan similar future projects. It is recommended to have a mid-term evaluation to re-orientate the project and correct drawbacks and a final evaluation to draw the lessons learnt for future similar projects.

5.4.3 Implementation and budget

The project can be implemented by ENTRO and by country project teams established by the ministries in charge of agriculture in Ethiopia and Sudan. Support of an internationally recruited consultant is desirable at critical stages of the project and for its evaluation. Tentatively, the implementation period would be 10 years (average progress rate of 100,000 ha upgraded every year. From experience of similar projects in East Africa, unit investment costs (engineering and construction) in infrastructure for supplemental irrigation are approximately 1,500 US dollars per ha, and 250 US dollars for conservation agriculture. On this basis approximate project cost is 825 millions US dollars including 10% contingency but excluding technologies for water lifting and equipment for on-farm irrigation. For comparison purpose unit cost of new irrigation project range between 7,000 and 10,000 US dollars per ha.

5.5 PROJECT PROFILE 5: CAPACITY BUILDING

5.5.1 OBJECTIVES

The objective of component 1 is to increase and share the knowledge base on irrigation management. It endeavours to : (1) synthesise and share existing experiences in irrigation water management practices, decentralization and privatization of irrigation management and cost recovery policies in the Eastern Nile, (2) promote a common multidisciplinary framework for assessing the impact of improved irrigation technologies and water use efficiency policies in order to facilitate comparisons between countries and irrigation schemes, (3) provide policy recommendations for improving the acceptability of new technologies and the inculcation of effective irrigation management decentralization, privatization and O&M cost recovery, (4) favour the emergence of a regional technical group who can be called upon by policy makers and irrigation managers for the analysis and evaluation of water use efficiency policies and technologies, (5) disseminate to a larger public the acquired knowledge on irrigation management in the Eastern Nile basin.

5.5.2 Rationale

The rationale of this project is to enhance regional cooperation amongst irrigation professionals, address the challenges and opportunities for irrigation development and management, build the technical capacity within the riparian countries to plan, implement and monitor irrigation projects. Organization of capacity building activities involving irrigation professionals at all levels may lead to the establishment of a regional professional association that would help establishing regional irrigation standards and would facilitate exchanger of experience, expertise and transfer of best practices.

5.5.3 Description

For the duration of the project two committees will be established by ENTRO:

- An organizing committee in charge of the organization of the training sessions and study tours workshop and seminar organization and dissemination of knowledge.
- A technical committee which will evaluate the proposed training curricula and technical papers to be presented during the seminars and identify target groups.

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Component 1: training and exchange of experience

- **Activity 1.1: Design of training sessions and preparation of training materials**

Design of training curricula for each training session will be proposed by international and local consultants on, tentatively, the following themes:

- Identification and planning of new irrigation projects
- Implementation of irrigation projects
- Management, operation and maintenance of irrigation systems
- Formation and capacity building of Water Users Associations

- Planning and implementation of rehabilitation/modernization projects
- Use of remote sensing technologies for monitoring agricultural water use.
- Improving water management in rain-fed agriculture

For each theme policy briefs, manuals, leaflet in local languages for stakeholders at various levels (decision makers, irrigation professionals, farmers) will be prepared.

- **Activity 1.2. Identification of target groups**: For each training sessions or study tour, target groups will be identified by the Technical committee in liaison with stakeholders in the riparian countries.
- **Activity 1.2 Organization of training seminars**: Seven training seminars (8 to 12 days) will be organised by the organizing committee. During training sessions, due value should be given to knowledge and experience of participants by building in time for participants to share ideas and experience or to appeal to their respective expertise. Classroom training sessions will alternate with relevant field visits or short study tours.
- **Activity 1.4: Organization of study tours:** Three study tours outside the basin will be organized to provide information on best practice, cutting edge technology and approach. Tentatively study tours would deal with (i) Water management for rain-fed agriculture (India), water users associations and cost recovery policies (Turkey), modernization of irrigation and agricultural technologies (France).
- **Activity 1.4 Dissemination of knowledge:** The deliverables will be disseminated by the organization committee through publications on NBI website, reference books and CR ROM, leaflets in local language, news letters and policy briefs published by ENTRO.

Component 2: Improving technical capacity for irrigation water management
It is proposed to establish new or rehabilitate tentatively six class A meteorological stations in strategic locations within the basin to:

- Permit a better assessment and monitoring of crop water requirements and irrigation water use;
- Program irrigation scheduling
- Build capacity for volumetric water management

5.5.4 Implementation and budget

The project will be implemented by the technical and organization committees under ENTRO over a period of three years Training materials and other publications will be prepared by national consultants, senior irrigation professionals or researchers from the Eastern Nile countries. Intervention of internationally recruited consultants may be necessary to develop parts of the training curricula by bringing in lessons from countries outside the basin. Table 30 and figure 9 give and indication of implementation schedule and project costs.

Table 30: Cost estimates of project 5 (US dollars)

N°	Activities	Cost component	Cost (USD)
Component 1			
1.1	Design of training sessions and preparation of training materials	Consultants fees (7 seminars)	10 000
1.2	Identification of target groups	None	-
1.3	Organization of training seminars:	Travel cost, DSA, local travels,trainers fee (7seminars)	350 000
1.4	Organization of study tours	Travel cost, DSA, local travels (3 study tours)	240 000
1.5	Dissemination of knowledge	Editing, publication, translation in local languages	10 000
		TOTAL COMPONENT 1	**610 000**
Component 2			
	Establishment or rehabilitation of six Class A meteorological stations	Purchase, installation of equipments	90 000
		TOTAL COST	**700 000**

Figure 8: Implementation schedule of project 5

N°	Activities	Year 1				Year 2				Year 3			
Component 1													
1.1	Design of training sessions and preparation of training materials	·····	·····	·····	·····	·····	·····	·····	·····	·····	·····		
1.2	Identification of target groups	·····	·····	·····	·····	·····	·····	·····	·····	·····	·····		
1.3	Organization of training seminars		⊗		⊗	⊗		⊗		⊗	⊗	⊗	
1.4	Organization of study tours			⊗			⊗					⊗	
1.5	Dissemination of knowledge			·····	·····	·····	·····	·····	·····	·····	·····	·····	·····
Component 2													
	Establishment or rehabilitation of six class A meteorological stations												

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