EURO-MEDITERRANEAN REGIONAL PROGRAMME
for Local Water Management ME8/AIDCO/2001/0515/59763-P 016

ISIIMM project:

Case studies synthesis

Egypt

MEDA Water

AGROPOLIS INTERNATIONAL

Institutional and Social Innovations in Irrigation Mediterranean Management

ISIIMM

"Promoting an integrated and balanced management of water resources by reconciling respect for the environment with economically viable irrigated agriculture» is the objective of a local dialogue operation between farmers, development professionals, scientists and various stakeholders. This concept has served as a reference for the Institutional and Social Innovations in Irrigation Mediterranean Management project (ISIIMM) led by Agropolis International (France).

ISIIMM is a Euro-Mediterranean regional project funded by the European Commission "EU-MEDA Water" involving six countries: Egypt, France, Italy, Lebanon, Morocco and Spain. The aim of the ISIIMM project was to share experiences, knowledge and build new perspectives for sustainable water management in Mediterranean agriculture, based on a common understanding of six key mechanisms: Social, Institutional, Historical, Agricultural, Territorial, Hydrological/Hydraulic.

A comparative, progressive and participatory approach was adopted between different stakeholders coming from the eleven selected study areas where water is a central topic issue to social and economic life.

The ambitious and challenging activities of the ISIIMM project were built upon a framework of regional network co-operation systems. Many multi-national and multi-sectoral teams worked together with the support and organisational efforts of project partners.

With a primary objective to help local rural communities adapt to the emerging problems resulting from pressures on water resources, two priorities guide the project: a) working with local irrigation organisations; and b) working with the development professionals.

Three main activities were developed with the participation of the target groups.

Diagnostics for action in each of the 11 river basins (national and local case studies) leading to new water-sharing behaviours and institutional innovations. This was focused on a statement of conditions and aims for each river basin and country using a participatory approach and based on existing documentation plus the scientific assessment of the ISIIMM experts.

Social and institutional innovations have been approached thought the ***concrete actions*** on the ground and a wide series of ***training workshops and exchange seminars*** complemented by field visits with farmers, managers of public organisations and canal managers. In total, 19 international workshops and seminars and around 35 local and national meetings and trainings were organised with participation of more than 1500 persons to enable the target groups to gain a wider vision of the problems in Mediterranean irrigation management and more references to solve them in more suitable ways. Concrete actions (SWaMMA (Solid Waste Management in Mostafa Agha) micro-project in Egypt, AIRMF *(Association des Irrigants des Régions Méditerranéennes Françaises)* in France, Irrigators association in Lebanon, wider stakeholder participation in decision making in Morocco, pluri-stakeholders involvement at regional and local level in Italy and Spain) have been initiated with local stakeholders and will be continued thanks to the strong relations developed.

An ***extensive information and data base system called OSIRIS*** has been developed to enable target groups to access information about the ISIIMM case studies and compare this with their own situations (www.isiimm.agropolis.fr).

In addition, a concerted effort was being coordinated to distribute this information through books, films, newsletters, guides and other media. ISIIMM has been contributed to mutual learning and knowledge transfer at local, national and regional scales.

The EU Partners are:

- In France: Chambre Régionale d'Agriculture du Languedoc-Roussillon (CRALR), VERSeau Développment
- In Italy: Autorità di Bacino dei fiumi Isonzo, Tagliamento, Livenza, Piave, Brenta-Bacchiglione (ABAA), Fondazione Eni Enrico Mattei (FEEM)
- In Spain: Universidad Politecnica de Valencia(UPV), Unidad Sindical de Usuarios del Júcar (USUJ)

The MEDA Partners are:

- In Egypt: Center for Rural Development Researches and Studies (CRDRS), Egyptian Association for Sustainable Rural Development (EARSUD)
- In Lebanon: Chambre de Commerce, d'Industrie et d'Agriculture de Zahle et de la Bekaa (CCIAZ)
- In Morocco: University Cadi ayyad (UCAM), Association Al Majal

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ISIIMM project:

Case studies synthesis

E g y p t

Final Report by

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INTRODUCTION

The River Nile is the main source of life in Egypt. It is the source of almost all fresh water in the country because about 95% of the fresh water available for all uses comes across this source. The quota of water resources allocated for Egypt from all the Nile water resources is fixed at 55.5 billion cubic meters annually according to the treaty of 1959 with Sudan. Other water resources, whether conventional or non-conventional, including recycling of agricultural drainage and waste water, "raised the whole water supplies to 72.15 billion m^3 in 2000 and are likely to raise it to about 84.5 billion m^3 in 2020" (Allam, 2001:584).

Cultivated lands in Egypt amount now to about 8.929 million feddans in both old and new reclaimed lands. This area is distributed on around 3.718 millions of holdings (farms) with an average farm size of 2.4 feddans. This aggregate area includes about 2.173 million feddans, constituting about 227 thousand holdings in the new lands with an average farm size of 9.6 feddans (Agricultural Census: New Lands, 99/2000:2). However, the total area of reclaimed lands reached about 3.24 million feddans during the period 1952 to 2003/2004 according to CAPMAS (2005). Until the nineties of the last century they were almost all concentrated in the fringe of the Nile Delta as shown in figure 1. Further, it is planned to add 3.4 million feddans of reclaimed lands to agriculture by 2017 to meet the challenges of population increase and consequent escalating demand on food and other agricultural products (Strategy of Agricultural Development in Egypt until 2017, 2003, p. 31). These expected expansions of cultivated lands impose further pressure on the limited water resources available now in Egypt.

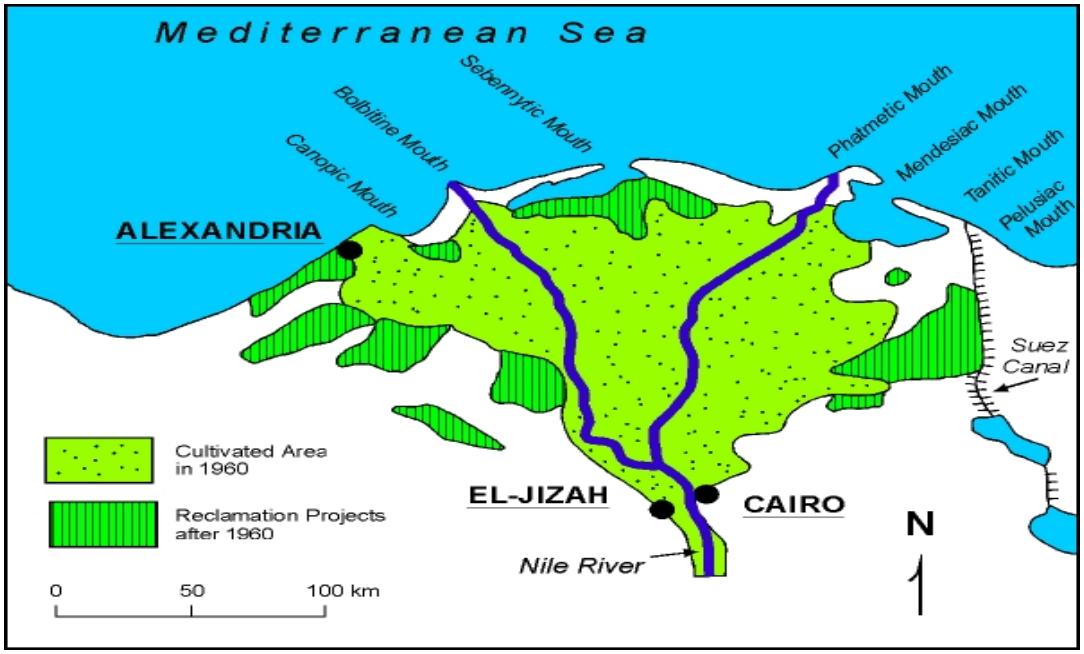


Figure 1. Areas of Horizontal Expansion of reclaimed lands after 1960

Agriculture needs of irrigation water consumed almost 77% of all water supplies in 2000, while it will decline to less than 52.7% of Egypt needs in 2020 (Allam, 2001:584). However, other references mentioned that water consumption in agriculture reached now about 85% of all available water resources. Yet, Allam (2001:584) estimated this quantity to represent almost 96.45% of all foreseen fresh water supplies in 2020!

Water is conveyed to all farms and other users through a very complex network of channels of about 60 000 km long (Shalaby, 2007). There are more than 36 000 Km of irrigation canals in addition to about 22 000 Km of drains at various levels for both.

Horizontal expansion of cultivated lands along with establishment of new communities are being inevitable as an avenue of the two main axes of development strategy, i.e. the vertical and horizontal, to cope with the challenges of high population growth and related economic and social consequences. These new lands are rather far from the River Nile. Conveyance of water from the River Nile to all far new lands goes through a lengthy and a very complex network of water channels of different levels and functions. Thus, the irrigation network itself grows in length and complexity to feed the new farms, and other users connected with the Nile, as their sole major water source. This entails further investments by the state to deliver irrigation water for each single farm to help adding new agricultural productive units to the cultivated area.

Farming is basically a family enterprise. This means that irrigation and related issues do not affect only farmers but also their families and other sectors of rural population. Rural population is estimated at about 41.6 million inhabitants in 2006. They represent about 57.4% of the entire population of Egypt on site at the time of census (72.580 million) excluding 3.901 million who were abroad at the time of the latest census of November 2006 (http://www.msrintranet.capmas.gov.eg/ows-img2/pdf/tab1_e.pdf).

1. THE INTERNATIONAL CONTEXT

1.1. INTERNATIONAL WATERS

The major portion of Egypt water resources is shared with the nine neighboring countries in the Nile Basin (figure 2). This includes surface water from the Nile and groundwater from the Nubian sandstone aquifer system. Yet, control of quantities of surface water allocated for each country, especially at the downstream, is governed by several bilateral as well as multilateral agreements among these countries.

Water from the Nile River satisfies about 95% of Egypt's fresh water demands at present. Egypt's share is controlled by the treaty of 1959 with Sudan which fixed the annual share to 55.5 billion cubic meters as mentioned before when Egypt's population was only 18 millions.

Figure 2. Map of the Nile Basin

The surface area of the Nile basin is about 3.0 million square km; while the length of the river is about 6700 km. There are 10 Riparian States share the river, with about 250 million inhabitants ten years ago. The area of lakes is 81500 square km; while that of swamps is 70000 square km. The total length of the Nile River and its tributaries is about 37500 km.

1.2. THE INSTITUTIONAL AND LEGISLATIVE FRAMEWORK

Flow of the Nile water to Egypt is affected by several international treaties and protocols with other partners on the Nile Basin that have been developed over a long period of time. The following table shows the main agreements in this regard.

Table 1. Treaties with the concerned parties affecting and regulating water rights of Egypt

Date	Countries	Agreement
1891	Great Britain and Italy	Protocol on demarcation spheres of influence in Eastern Africa/Third article stipulates that Italy pledges not to construct on the Atbara River any irrigation work that could significantly affect the Atbara's flow into the Nile (at the time of Italian colonization of Eritrea).
1902	Great Britain and Italy, and ital – Ethiopia	Treaties related to the frontiers between Anglo–Egyptian Sudan, Ethiopia and Eritrea, signed in Addis Ababa on May 15, 1902. In the third article Emperor Menelik II pledged not to construct or allow to be constructed any work across the Blue Nile, Lake Tana, or the Sobat River, that could hinder the flow from their waters into the Nile, except with the agreement of Great Britain and the government of Anglo-Egyptian Sudan
1906	Great Britain and Congo	Signed in London on may 8th and brought a modification to the Brussels Agreements of may 12, 1894. In the third article of the 1906 agreements the Congo undertook not to construct or allow to be constructed any work on or near the Simliki or Isango rivers, which might reduce the volume of waters flowing into Lake Albert, except in agreement with the Government of Anglo–Egyptian Sudan.
1925	Great Britain and Italy	December, in which, inter alia, the Italian Government recognized the previously acquired hydraulic rights of Egypt and Sudan in the waters of the Blue and White Niles, and confirmed not to construct on the headwaters of Blue Nile or White Nile, or their tributaries and effluents, any work which might substantially modify their flow into the main river.
1929	Great Britain and Egypt(the former on behalf of Sudan, Kenya, Tanganyika and Uganda)	Treaty stipulates that no work of any kind may be undertaken on the Nile, its tributaries, or on the lakes which form its course, without Egypt's consent; and in particular these works that are related to irrigation or power generation, or if they affect the volume of water which reach Egypt or any other way be detrimental to Egypt.
1934	Great Britain (on behalf of Tanganyika) and Belgium (on behalf of Rwanda and Burundi)	Concerning the Kagera River flowing at Lake Victoria and stipulating, inter alia, that the contracting parties pledged to return to the River Kagera , before it reaches the common borders between Tanganyika, Rwanda, and Burundi whatever amounts of water might be diverted for power generation.
1953	Great Britain (on behalf of Uganda) and Egypt	Exchange of notes from July 1952 to January 1953 on Egypt participation in the construction of the Owen Falls Dam for the generation of hydropower in Uganda. It was agreed to heighten the dam so as to raise the water level in lake Victoria, allowing Egypt more water for irrigation while the hydro-power generation would allow more electricity for both Kenya and Uganda.
1959	Sudan and Egypt	On November 8, for the maximum utilization of the surplus waters by the two countries and the utilization of the surplus waters resulting from construction of the Aswan High Dam. The average annual flow of 84 BCM was divided between the two; Egypt receiving 55.5 BCM and Sudan 18.5 BCM. Some 10 BCM being assumed lost by evaporation from Lake Nasser.

Source: S. Ahmed in: Howell and Allan, 1994

Other references added the following agreements and treaties;

- Agreement between DRC and Britain: 1894
- Owen's falls Dam Agreement between Egypt and UK on behalf of Uganda:1949
- The Hydrometeological Survey of Equatorial Lakes (HYDROMET 1967-1992).
- Technical Cooperation Committee for Promotion of the Development and Environmental Promotion of the Nile Basin Project (TECCONILE 1992-1998).
- Nile Basin Initiative (NBI) based on the Ministerial meeting resolution: 1997 – now
- Transition period (D3 project, Nile 2002)

The Nile Basin Initiative describes itself as a "transitional arrangement until a permanent legal and institutional framework is in place" (NBI, 2000) and comprises a Council of Ministers of Water Affairs of the Nile Basin (Nile-COM), a Technical Advisory Committee (Nile-TAC) and a Secretariat (Nile-SEC), the latter is located in Entebbe.

The Council of Ministers of the Nile Basin established a Nile Technical Advisory Committee (eighteen members) made up of a single representative for each country and one alternate. The NileTAC is basically charged with coordinating of the NileCOM work, and establishing and overseeing the work of the Nile Basin Secretariat (Nicol, 2003).

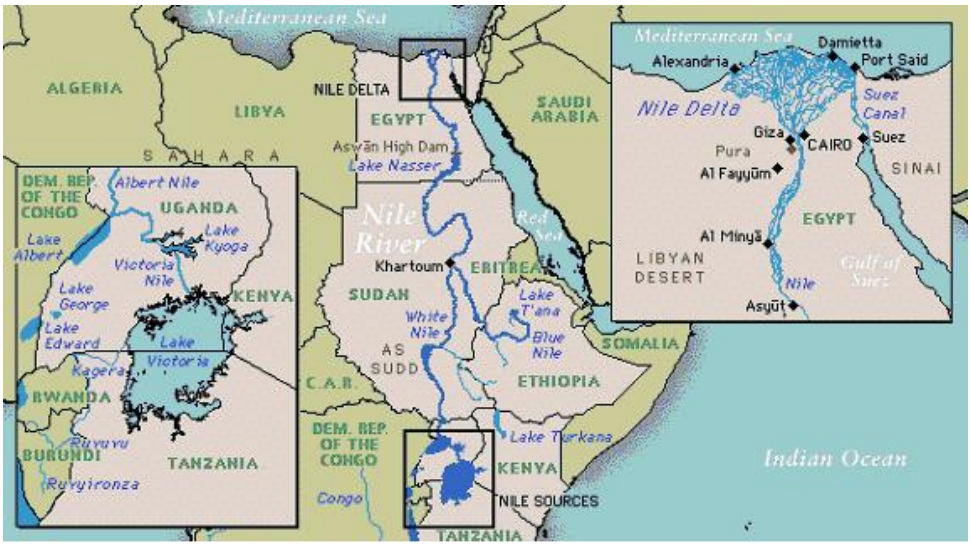


Figure 3. Boundaries of the Nile basin countries

Dynamic negotiations and initiatives for joint development project are in progress among the countries concerned to build trust and raise efficiency of using the water resource available in the basin. Some recent figures estimate the used volume of water at about 5% of all annual water falls in the basin. This raises the potential and aspirations from collective actions and projects of development of the water resources in the region and even makes such cooperation of higher benefits for all partners than the risk of conflict over these resources.

1.3. THE SOCIO-ECONOMIC CONTEXT

The socio-economic conditions in the countries concerned of the Nile basin are relatively low when measured by the human development indicator (see table 2 below). High population growth rate in the region increases the pressure over the water resources available in the countries concerned. This is reflected in the tough attitudes of some countries that need to be streamlined into collective actions in order to achieve more efficient use and development of optimum usage of available resources.

Table 2. Basic indicators of development in the Nile Basin countries

Country	HDI Rank	Category of Human Developme	HDI 2004	GDP per Capita (PPP US$) 2004	Population mid 2004 (Million)	Population Growth rate 1975-2004 (%)	Total Fertility rate 2000-5	Location
Egypt	111	Medium Human Develop.	0.702	4211	72.6	2.1	3.3	N
Congo	140		0.520	978	3.9	3.2	6.3	C
Sudan	141		0.516	1949	35.5	2.5	4.4	N
Uganda	145		0.502	1478	27.8	3.3	7.1	E
Kenya	152	Low Human Development	0.491	1140	33.5	3.1	5.0	E
Rwanda	158		0.450	1263	8.9	2.4	5.7	E
Tanzania	162		0.430	674	37.6	2.9	5.0	E
Dem. Congo	167		0.391	705	55.9	2.9	6.7	C
Burundi	169		0.384	677	7.3	2.4	6.8	E
Ethiopia	170		0.371	756	75.6	2.7	5.9	E
	Total				**358.6**			

Source: UNDP, 2006, Human Development Report

Data in the above mentioned table show how most of the Nile basin countries are in dire need for aggressive collective action for development, which is the aim of the Nile Basin Initiative. Potentials are not less than the risks but deserve careful attention based on the most valuable common resource in the region; i.e. water. The majority of the Nile basin countries experience a relatively very high fertility rate that raise the population growth rate to levels leading to excessive pressure over all natural resources and mainly water. The low GDP per Capita in most of these countries accompanied with misdistribution of wealth raise the percentage of population suffering from poverty to very high ratios. This is reflected in the very low human development indices and ranks at the world level that the majority of these countries possess. This has called for greater degree of attention to be accorded to them in the projects of the NBI.

2. THE NATIONAL CONTEXT OF IRRIGATION IN EGYPT

2.1. HISTORICAL BACKGROUND

Historically, basin irrigation prevailed since the pharaohs until the construction of the series of barrages and the relatively new network of irrigation canals and drains (Amer, 1996:62) during the Mohamed Ali (c. 1769 - August 2, 1849), and his successors' era in the nineteenth century. Thus, perennial irrigation of cultivated lands is relatively a recent phenomenon to farming in Egypt as it was introduced almost a century ago after the construction of the Aswan Dam in 1902. Since then, the distributary's system of irrigation water and related drains have become of greater importance for farming for delivery and drainage of irrigation water. This system has been always under full central control of a competent state agency body, which is represented now by the Ministry of Water Resources and Irrigation (MWRI). Napoleon Bonaparte indeed reported during his campaign on invasion of Egypt this relation stating that "Signs of the good governance of the country are seen in the good running of irrigation system and cleaned canals and benefiting from the flood everywhere. While the signs of government weakness and disturbance could be seen in malfunctioning of canals, destroyed shores, corrupted irrigation system and unfair water distribution" (Zekri, 1995:66). Written history of modern irrigation in Egypt dates back to the Mohamed Ali Pasha era in the nineteenth century. Following is a historical brief about the development of irrigation administration in the last two centuries.

- In 1836, the Public Works Department was established as part of the Schools Headquarter at Mohamed Aly Pasha's era.
- In 1857, The Nizarah (Ministry) of Public Works was established and it comprised many departments like the Railway and Telegraphs Department, the Survey Department, the Building Construction Department, the Agriculture Department, Alexandria port, the antiquities Department , the Opera House, the Zoo, the Aquarium Garden , the Sewage Department in addition to the Irrigation Department.
- In 1914, the name changed from Nizarah to Ministry, so the name became the Ministry of Public Works.
- In 1964, the Republican Decree no. 301 was issued to form a new government and restrict the ministry activities to irrigation and drainage. Hence, it was called the Ministry of Irrigation.
- In 1977, a republican decree was issued to add the responsibilities of land reclamation to the Ministry. Therefore, it was called the Ministry of Irrigation and Land Reclamation. In 1987, the republican decree no. 449 was issued to change the name to the Ministry of Public Works and Water Resources.
- In 1999, the Republican Decree no. 409 was issued to change the name to the Ministry of Water Resources and Irrigation.

At the farm level, distribution of allocated water is traditionally, managed by the communities and/or groups of the farmers concerned who share the property of the tertiary canal (*mesqa*) that irrigate their own farms. Communities had developed their own related social systems that include values, rules and regulations for distribution of irrigation water at the farm level over a long period of time. Thus, under the traditional socio-economic and

technological conditions the collective approach for local management of irrigation water use prevailed in Egypt until the late sixties of the last century. Since the seventies, the trend has shifted towards an individualistic approach. This was due to escalation of purchasing power of farmers when they experienced migration to the Gulf Oil countries and were able to afford buying their own diesel pumps as a result of the economic boom, the remittances from emigrants in the Arab oil countries, and the availability of such machines in the local market.

However, within the context of growing pressure and higher demand on water the system showed several shortcomings such as low efficiency in conveyance of water to all users, inequitable distribution of the water resource and relatively low efficiency of irrigation at the farm level. This situation of irrigation deficiency at local level has even deteriorated further since the expansion of the individualistic approach that has replaced the collective management of this process since the seventies of the last century. Privatization and liberalization of agriculture initiated in the late eighties and early nineties under the SAP have exacerbated the sources of conflict in the irrigation process. This led to an urgent need of intervention of irrigation authorities at the local level to help increasing efficiency and avoid losses attributed to local reasons. **Paradoxically, this was the first time for the irrigation authorities to extend its control to the tertiary canal (*mesqa)* level, which is basically a private property of the group of concerned farmers.**

2.2. HYDRAULIC FRAMEWORK

Flow of the Nile water from the upstream in the Southern countries of the Nile Basin to Egypt is fully affected by the different land contours across the entire length of the river. The slope of lands across the whole Nile is shown in Figure 4. This encourages using surface and flood irrigation by gravity in most if not all the Nile basin countries as the case in Egypt.

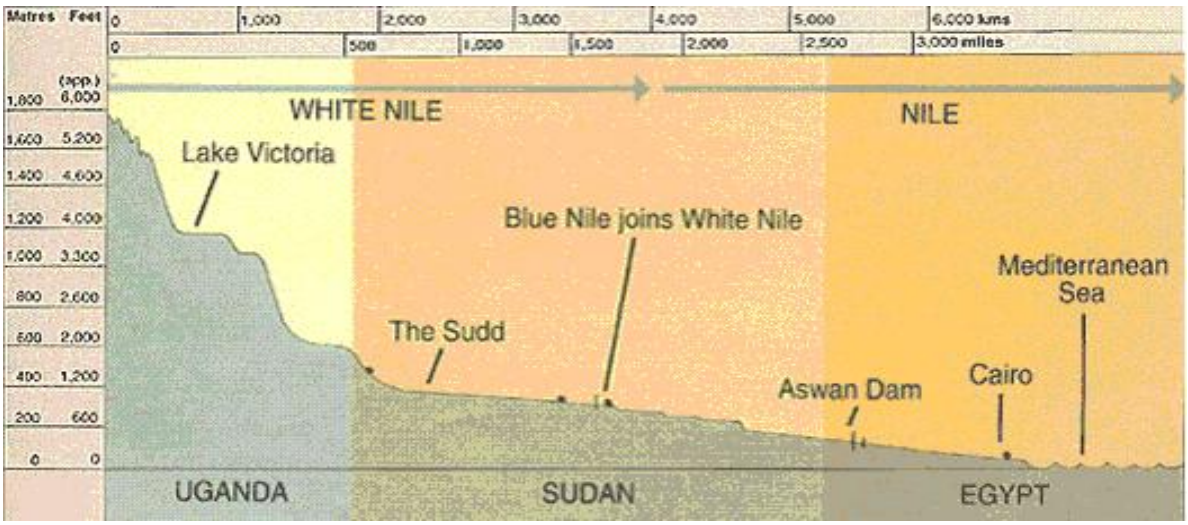


Figure 4. Altitude of the Nile River

However, to regulate water flow to specific areas several major civil works have been constructed across the entire Nile River in Egypt. This includes dams, barrages and regulators that are constructed mainly on the Nile itself and the principle canals and (*Rayahs*) to divert water into the lower level channels as shown in figure 5.

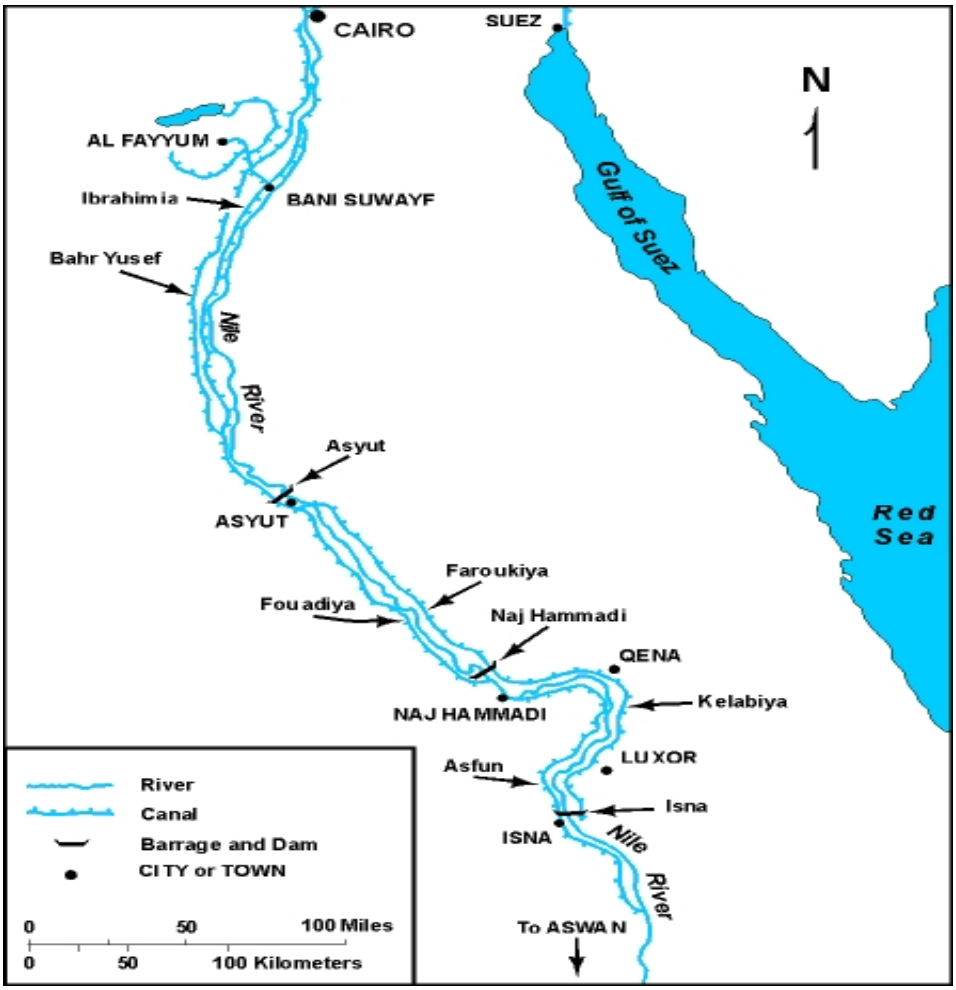


Figure 5. The major civil works on the Nile in the valley of Egypt that control flow of water to the different regions in Egypt

2.2.1. Flooding basin (surface) irrigation

Surface irrigation is still the common irrigation technique used in the old lands in the Delta and valley. This technique goes back to the basin irrigation system used during the flooding season applied in the past before construction of dams and barrages to control perennial irrigation that started during the Mohamed Ali era that raised the cultivated area from about 3.055 million feddans in 1813 to about 3.500 million in 1835 and then to 3.856 million in 1840 (Seoudi, 2001. p. 49).

Under basin irrigation the fields on the flat floodplain were divided by earth banks into a series of large basins of varying size where some as large as 50,000 acres (20,000 hectares) as shown in figure 6. During the annual Nile flood, the basins were flooded and the water was allowed to remain on the fields for up to six weeks. The water was then permitted to drain away as the river level fell, and a thin deposit of rich Nile silt was left on the land each year. Autumn and winter crops were then sown in the waterlogged soil. Under this system only one crop per year could be grown on the land, and the farmer was always at the mercy of annual fluctuations in the volume of the flood.

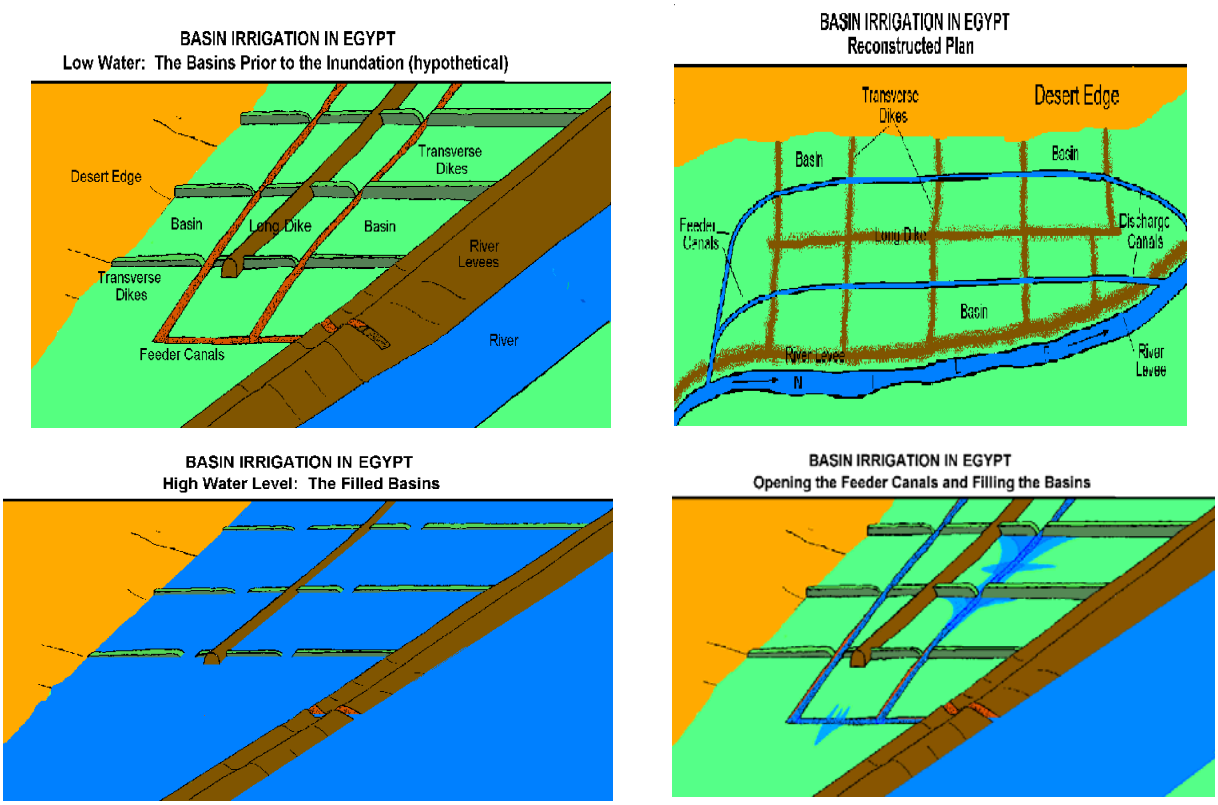


Figure 6. The steps of basin irrigation under uncontrolled flooding in the past

Along the riverbanks and on land above flood level, some perennial irrigation was always possible where water could be lifted directly from the Nile or from irrigation channels by such traditional means as the *shadoof* (a counterbalanced lever device that uses a long pole); the (sakieh), or Persian waterwheel or the Archimedean screw.

Because of the limitations of the flood basin method of irrigation, perennial irrigation—in which the water is controlled so that it can be made to run into lands at regular intervals throughout the year—has largely replaced it. Perennial irrigation was made possible in more lands by the completion of several barrages and waterworks before the end of the 19th century (see barrages and dams in figure 5). By the beginning of the 20th century, the canal

system had been remodeled and the first dam at Aswan had been completed in 1902. Moreover, since the completion of the Aswan High Dam at the late seventies of the 20th century, virtually all formerly basin-irrigated land in Egypt has been brought under perennial irrigation.

In the Nile Delta there is a very complicated network of water channels, for irrigation and drainage, which are comprised of various levels of canals conveying water to all end- users (see figure 7).

Figure 7. Map of the water channels network in the Nile Delta

2.3. CHARACTERISTICS OF THE AGRICULTURE SECTOR

Agriculture in Egypt tends to contribute less to the national economy. Its contribution in the GDP dropped from 18.8% in 1981/1982 to about 13.4% in 2006/2007 while its contribution to the labor force dropped from 39% to 27% during the same period respectively (MED, 2007, pp. 2&8).

In Egypt, nowadays, there are two distinctive agricultural sub-sectors. The first is the traditional one which exists in the old villages located in the delta and valley, called the old

lands. The second one is spread over a wide range of peripheral areas mostly located on the boundaries of old lands in both the valley and delta (see figure 1). They are either reclaimed desert or dried lakes lands. The area of the old lands is diminishing due to the expanding socio-economic and housing activities to meet the high population growth rate. Contrary to that, however, the growth of reclaimed areas encompasses an increasing number of new settlements and population. This dual nature of agricultural and rural areas in Egypt is unique. It is the reason of almost stable percentage of rural population across the last three censuses, i.e. 1986, 1996 and 2006 that accompanied with the stagnation of the urbanization process that dominated almost all the first half of the twentieth century before the inception of the reclamation program in the fifties. However, this did not stop the trend of rural-urban migration, due to the disparity of socio-economic conditions between both areas of what is known as a rural-urban gap. It seems that the higher fertility in rural rather than in urban areas is absorbed in the expansion of new rural settlements and the rural-urban migration wave together. However, the consequence is that there are two different irrigation systems applied. Nowadays surface irrigation is still widely used, specially in the old lands in the Delta and Valley, but with modern mechanical pumps that begun to replace human or animal operated irrigation devices. By law pressurized systems, i.e. dripping and sprinkler, are obligatory in the new lands while the traditional surface system is applied in the old lands. However, there are some violation of this law due to the lack of awareness among the new settlers and some technical problems, mainly low pressure of water, of the irrigation systems in these areas.

Out of the whole agricultural lands of around 8.9 million feddans about 35% are located in the new lands. As aforementioned, parts of this area are used twice or even three times each year to reach 13.764 million feddans of cropping area in 2005 as shown in table 3 (CAPMAS, 2006). In addition, there are around 1220510 feddans of fruits and palm trees that raise the total cropping area to about 14.984 million feddans in 2005.

Table 3. Cropping area by year and agricultural season 2000-2005 (000 feddan)

Season	***Year***					
	2005	**2004**	**2003**	**2002**	**2001**	***2000***
Winter Crops[1]	6606	6482	6571	6479	6286	*6454*
%	48.0	48.3	49.1	48.8	48.4	*49.9*
Summer Crops[2]	6423	6193	6074	6102	6016	*5757*
%	50.4	48,5	47.6	47.8	47.2	*45.1*
Nili Crops[3]	637	637	631	606	590	*623*
%	5.0	5.0	4.9	4.8	4.6	*4.9*
Total[4]	***13764.4***	***13408.9***	***13372.8***	***13372.8***	***12987.6***	***12929***

Source: CAPMAS, 2006, Statistical Year Book
(1) From November to May
(2) From March/April to September & includes Cane and Cotton
(3) From May to October
(4) Excluding Orchards

The main summer crops are Maize (27.9%), Rice (22.7%), vegetables (15.2%) and Cotton (10.2%). Winter crops are Wheat (45.2%), Clover (32%) and vegetables (9.8%). In the Nili season Maize is the main crop (48.2%) followed by vegetables (24.8%). However, due to the high investments in reclaimed lands perennial crops such as orchids represent significant area among the cultivated new lands. The area cultivated by fruits and palm trees in the new lands are about 534413 feddans representing about 43.8% of all fruits and dates lands of 1220510 feddans in both old and new lands in Egypt in year 2003/2004 (GARPAD, unpublished data, 2006).

Yet, so far only less than 8% of rural population lives in the new settlements established in the new lands. However, agriculture is the main activity for more than 85% of the rural labor force in the new lands while it does not exceed 60% in the old lands.

Huge investments are spent on establishment of the infrastructure in the new land settlements. Rational economic usages of these investments necessitate immediate use of the new resources by stable communities. Thus development of the water resources in the new lands became a condition of the rational and sustainable use of all investments allocated for reclamation and development of new the lands.

2.4. WATER BALANCE AND SOURCES OF WATER FOR IRRIGATION

The water balance in Egypt (table 4) shows that in 2006 there are four main sources; the Nile fresh water, the subterranean waters, agricultural drainage water, rainfalls and treated sewage.

Agriculture is the main consumer of water. In 2005/2006 it consumed about 85% of all water resources. Industry consumed only 9.5%. The household potable water amounts to about 5.5% only of all water resources. Navigation and generating of electricity need water resources but they are not considered from among the consumptive sectors of water.

Table 4. Volume of water resources and the consumptive sectors in 2005/2006

Sources	M^3 billion/year	Uses	%
Nile water	55.5	Agriculture	85
Recycled agricultural drainage water	5.0	Potable water	5.5
Rainfall and flash flood water	1.0	Industry	9.5
Subterranean water (Valley and Delta)	6.5	-	-
Deep subterranean water	1.0	-	-
Treated Sewage water	0.7		
Total	69.7	-	63.9

Source: Ministry of Information, 2006, Egypt: Annual Yearbook 2006, p. 15

Table 5 shows that the majority of cultivated area (82.5%) is irrigated by the fresh Nile water, (10.9%) are irrigated by the ground water, (3.9%) by rainfalls and finally agricultural drainage water (2.3%). It should be taken into consideration that in some areas, specially in the

Northern region in the Delta, mixed water of fresh Nile water and drainage water is frequently used through 23 mixing pumping stations, (although three ceased to work lately (Allam, 2001, p. 413) for some technical or health reasons), to compensate shortage of water specially during the peak demand on water in Summer. This practice is under revision nowadays after the negative environmental and health impacts observed in many areas. Use of mixed water will only be applied in the future if drainage water is not polluted by sewage and industrial water and under rigorous conditions.

Table 5. Areas of Cultivated Lands by the Source of Irrigation Water in Egypt in 2000

Item		Source of irrigation water					
		Nile	Ground	Drainage	Rainfall	Other	Calculated Total
Cultivated Lands	**Area**[(1)]	6854805.5	903667.4	193665	326160.7	28909.6	**8307207.9**
	%	82.5	10.9	2.3	3.9	0.3	**100**
Holdings	**Number**	3494641	181777	41383	32166	3736	**3753703**
	%	93.1	4.8	1.1	0.9	0.1	**100.0**

(1) In feddan
(2) Other lands out of the 8.93 millions may be fallow
Sources: GOE, MALR, CAAE, 2005, Results of the Agricultural Census of the Year 1999/2000: Entire Republic, Cairo, Egypt: P. 97

2.5. CHALLENGES FACING IRRIGATION AND DRAINAGE IN EGYPT

MPWI undertook, with USAID funding, a seven-years project "Egypt Water Use and Management Project" (EWUP 1977-1984) conducted by the Water Management Research Institute, and National Water Research Center (NWRC). This project potrayed the main sources of deficiencies of the irrigation system specially on the local level. ***Exclusion of the end- users from the local management process of water resources, especially irrigation water, along with the spread of the individualistic pattern for solving irrigation problems were found as key reasons of the deficiencies at that level and even the higher levels***. Based on the early results of the EWUP the MWRI initiated in 1981 the Irrigation Management Systems (IMS) project which was amended in 1984 to take advantage of the results of the EWUP. The project implemented several structural and non-structural measures to improve irrigation efficiency, to support water saving efforts and to involve water users in water management and in operation and maintenance. The recommendations of that project related to farmer participation included:

- Farmers should be involved in improvements of the water delivery system;
- Farmers must play a role in ensuring more efficient operation and maintenance of hydraulic and irrigation structures; and
- Irrigation Advisory Service (IAS) should be established within MWRI directorates with well-trained professionals to help transferring the responsibilities of the system management to the farmers.

Egypt adopted the planned economy since the sixties of the last century until the late of the eighties. Agriculture was set under heavy control of the state during this era. Cooperatives were used as para-statal organizations by the state agencies to facilitate that control. During this era the state controlled all economic sectors including agriculture using the compulsory pricing system of products and subsidies of inputs. Both were used as tools for the state to control the economic activities. This resulted in distortion of the economy that led to the need of economic reform by the end of the socialist era.

However, by 1993 liberalization of the agricultural sector was complete, which resulted in the removal of the governmental control on farm input and output prices, cropping patterns, and procurement quotas through the following measures:

1. Removal of all governmental control on importing, exporting, and input distribution, delegating that to the private sector.
2. Limitation of government ownership of land and sale of new lands to private sector.
3. Adjustments of the land tenancy system by issuing a new law for the holding of agricultural lands,
4. Reduction of subsidies on agricultural inputs and encouragement of private sector investment in marketing and input supply, except for very few inputs and crops.

The efforts to remove the constraints imposed on the agricultural sector in addition to the ambitious development plans in this sector had led to a growing demand on water resources that imposed more pressures on the limited water resources and their management. For better efficiency of uses of these resources the government sought new ways of recovering costs for investments in the irrigation system based on more involvement of the end users in the management of these resources.

However, the above-mentioned conditions resulted in bringing the irrigation and drainage sector to encounter several basic challenges that could be portrayed in the following:

1. More higher potential conflicts among users;
2. Misuse, and lower efficiency, of water resources;
3. Unsuitable institutional framework for the relationship between parties concerned, and
4. Environmental pollution via water canals

These challenges are met by the MWRI by adopting a new water strategy and policies geared more to approach the end users which are more in favor of service decentralization along with the tendency to adopt the integrated approach.

2.6. INSTITUTIONAL AND MANAGERIAL FRAMEWORK

The River Nile in Egypt delivers its water to several principal canals. Each principal canal with its sub-principal canals feed a number of command areas. Water is distributed within each command area by the main canal and a number of branch (secondary) canals. These canals supply water directly or through some distributary canals to the privately owned

tertiary canals, *mesqas,* (serve between 50 and 500 faddan). These private *mesqas* are owned by the water users concerned who are responsible of their operation and maintenance.

Accordingly, there are five kinds of water delivery canals that could be distinguished in the whole irrigation system (Hvidt, 1998). A parallel level of drain system exists where the collector is equivalent to the *mesqa* in the irrigation system. Following are the various levels of water channels (see Figure 8):

- The principal canals which receive water directly from the Nile. No direct irrigation is allowed from this level.
- The main canals receive water from principle canals for conveyance to the branch canals. Some main canals receive water directly from the Nile. No direct irrigation is permitted from this level too.
- Branch (secondary) canals where direct irrigation is not permitted. There are some exceptions along their lower reaches by special permission.
- In the case of big command areas there are distributary canals that receive water from branch canals for distribution to *Mesqas*. Direct irrigation along distributary's canals banks is permitted through legal farm outlets according to established rotation.
- Tertiary canals or *mesqas,* which distribute water to the *marwas* or directly to the basins and furrow on private farms. There are about 80 000 mesqas across the whole cultivated lands. These mesqas are normally about half a meter below the field level (except in the case of Fayoum). Thus, farmers must lift the water from the canals to their mesqas according to the rotation system. This design is intended to rationalize use of water for irrigation purposes since it is a costly process.

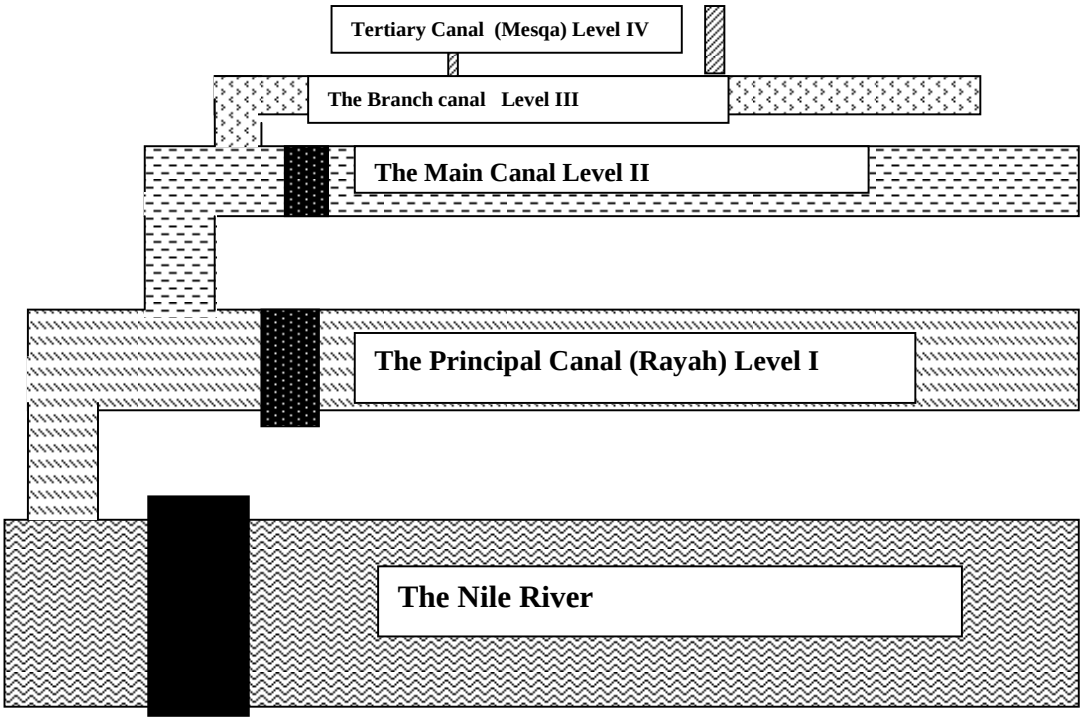


Figure 8. The levels of water channels network until irrigation canals (level IV)

Yet, we should take into consideration the clear distinction of the functions of the tertiary canals, *mesqa*, and the upper level canals. *Mesqas* aim to deliver water to the farms for irrigation purpose only, while other water canals deliver water to a wide range of economic and social activities beside irrigation.

The water network comprised of different levels of water canal and drains reach now more than 36000 km of canals and more than 20000 km of drains. Control of such complicated network linked with only one water source, the Nile, has necessitated the establishment of a very rigorous central managerial system across the whole country since the 19th century.

Two spatial units are in use within Egypt, namely, command areas and directorates. Command areas, of which there are 50, represent a unit, which is served by a particular canal under the irrigation improvement project. The main spatial system is the directorate, which is an administrative unit, responsible for the operation, maintenance, and rehabilitation of the irrigation system within its boundaries. At present there are 30 directorates, which are divided into 60 inspectorates, further divided into 175 districts, i.e. 3 districts per inspectorate in average.

The district engineer is usually responsible for irrigation operations 20000-50000 feddans (divided into 20 to 50 branch canals). The final level of personnel of MWRI exist at the local level are the gate keepers (***Bahaar)*** at the level of branch canals**.** The district engineer

and the gate keepers (***Bahaar***) are the only MRWI offices, the farmers are in direct contact with.

MWRI is the primary Egyptian governmental agency that is by law, (12 of 1984), in charge of the management of all water resources in Egypt. This is valid in respect to both the quantity and quality and regardless of the source whether it is surface or underground water.

Accordingly, the MWRI is the only body authorized and responsible for planning, construction, operation, maintenance and rehabilitation of the entire irrigation and drainage systems and any control structures on them including regulators, weirs and small bridges. The MWRI is organized through four main departments, namely, irrigation, planning, finance, and mechanical and electrical departments in addition to four authorities, namely, the drainage projects, the high dam, the coastal protection, and the survey authorities (Annex 1).

MWRI is charged with ultimate water resource development, water allocation and distribution over the various categories or users, control of water quality and the supervision of all water resources.

The MWRI's responsibilities with respect to the water sector are categorized as follow:

1. Optimization of the use of available fresh water resources

2. Improvement of system and operation: this encompasses reduction of system losses, improvement of irrigation efficiency, effective improvement of distribution equity, and rehabilitation of irrigation system.

3. Improvement of drainage conditions: this includes the application of modern technology and materials in the construction of subsurface drainage systems and O&M of drainage pump stations, O&M of subsurface drains, weed control and channel maintenance of open drains.

4. Environmental management specialized agencies of the MIWR are responsible for monitoring and controlling of water quality, assessment and mitigating of negative impacts of desert reclamation, monitoring and controlling of groundwater exploitation.

5. Reclamation of desert areas for agriculture including planning, and implementation of appropriate irrigation systems, desert development, sustainable groundwater utilization, and installation of drainage networks in newly reclaimed lands.

6. Human resource development of not only the staff of the MIWR but also water users.

From the financial point of view farmers do not pay directly for irrigation services. In the traditional system they pay directly the operating costs of pumps for lifting water to their

fields. They, however, pay or have to pay a part of the irrigation fees through indirect land taxes to the state treasury.

2.6.1. Legislative Framework

Several legislations and regulation were issued during the Mohamed Ali era to organize and manage the use of water resources. These regulations were amalgamated in one law in 1899. This law continued to be valid until 1952. Since then several laws have been enacted to regulate and control water uses. Following is the legislative framework controlling water uses at present.

a) Law no 68 of 1953 concerning Irrigation and Drainage
This law was issued to replace the law enacted in 1899 that continued to be valid until 1952. According to this law only the central authority undertakes the management and supervision of irrigation water and canals at the national level. The Ministry of Public Works and Irrigation was the sole party allowed to formulate and implement policies and regulations related to water resources. This law did not allow any involvement of local authorities in water management. This law was amended by other laws such as the law number 29/1956 and law number 164 /1957 and the law number 116 / 1959 which gave more details about the regulations that deal with the relations between irrigation authorities and their representative agents with the users of irrigation water.

b) Laws of Drainage
Law number 35 of 1949 was the first one issued to regulate establishment of the field drains. Other laws followed it in 1954 and 1956 sought regulating the cost recovery of establishments of the several components of drainage system. These laws were amalgamated in the law number 74 of 1971.

c) Irrigation and Drainage law no 12 of 1984
This law is the milestone of the contemporary legislative framework related to water resources in Egypt. It was enacted to amalgamate the several laws issued to regulate activities related to the management of water, whether fresh or underground, and the operation and maintenance of all irrigation and drainage systems. According to this aw the central authority takes care of the control and management of the water distribution from the Nile River and its branches for the purposes of irrigation, drinking, industry, etc….

d) Law no 213 of 1994 and its bylaws
This law was issued to rectify the gaps appearing during the application of law 12 of 1984 and to furnish a legal base for improvement of the irrigation system. According to this law ***farmers in the specified improved areas could establish their own water users' associations to mange and maintain their private mesqes***. These associations have the authority to estimate irrigation fees which would cover costs of the operation and maintenance of *mesqs*.

This law is the first to provide the legal basis for the farmer's participation and decentralization in water management at the *mesqa* level. Other associations at levels higher than *mesqa*, could be established under the law no 32 of 1964 but according to specific rules to be identified by the MWR&I in coordination with the Ministry of Social Affairs.

e) The Civil Code

Laws pertaining to the civil code first organized water management in the privately owned lands adjacent to the Nile river and its branches, which include private *mesqas* prior to endorsement of law 213 / 1994. No article in the civil code deals with the establishment of organizations among the users of irrigation water.

f) Law no 32 of 1964

Concerning the establishment of associations and private unions this law was the sole legal basis for establishment of non-governmental organizations, including the water users' associations. Yet, this law has its disadvantages from the irrigation point of view. These include:

- Membership in these associations was voluntary, whereas irrigation necessitates that all farmers associated with one canal to became member of the established organization; and.
- The central authority in charge of supervising financial and administrative activities of the organizations established as per this law was the Ministry of Social Affairs which had no experience in the technical aspects of irrigation.

2.6.2. MWRI Irrigation Policy

The main approach of delivery of irrigation water is based on rotation. Management of a water rotation system requires full cooperation and collaboration between farmers and stakeholders in order to ensure equity and fair distribution of water allocation in addition to the efficient use of allocated resources.

However, the system had shortcomings such as inequitable distribution of the resource and relatively low efficiency of water use due to all above-mentioned conditions as will as the higher pressure over the limited amount of water resources. Accordingly and due to the socio-economic development policies and related programs to feed more population, and due to the establishment of new activities the irrigation authorities represented by the Ministry of Public Works and Irrigation (MPWI), called now the Ministry of Water Resources and Irrigation (MWRI), developed a new strategy to improve irrigation management and related physical infrastructure. This was meant to improve the performance of the whole irrigation system through the enhancement of distribution and irrigation efficiencies.

The improvement of the whole system treated all canals until the level of main and secondary canals and the tertiary canal off-takes as public property, and are managed by the MWRI that serve, finally, the private tertiary canals (*mesqa*). It also treated the tertiary and field ditches, *marwas*, as private properties and subject to the farmer's authority. This included the creation of WUAs as part of an Irrigation Improvement Project (IIP) that began in 1988. The creation of WUAs in Egypt was recommended in 1984 in a final report by the EWUMP and made operational at the improved *mesqa* level in 1988 as an essential component of the IIP package. In 1992, an Irrigation Advisory Service (IAS) was initiated within the Ministry of Public Works and Irrigation (MPWI) to work with WUAs. These associations did not have their legal identity until 1994, when irrigation and drainage law 12 of 1984 was amended by law 213 of 1994 to allow for establishing WUAs in the new lands and in the improved irrigation project area in the old lands at the *mesqa* level.

Implementation of the law is restricted to areas of newly reclaimed lands and, in the case of the old lands, only if and when substantial physical improvements are made. This policy of MWRI is seen as a step on the road of decentralization of management of irrigation and drainage systems. Hence, this new law could be considered as the inception of a new era and as the legal base to institutionalize regrouping of irrigation water users to restore the group management of irrigation water at the *mesqa* level, but under new technical and modernized conditions. ***Yet, some others consider it as an indirect and decent way to extend the control of formal irrigation management to that lower level which was a fully private affair before.***

However, the most recent policy of MWRI has adopted the expansion of *formulating* water users organizations at the district level, which is higher than the branch canal level within the context of a newly adopted approach of Integrated Water Management.

At present there are about 6000 WUAs formulated at the mesqa level serving about 300000 feddans and less than 90 organizations at the branch canal level in the same areas. These steps are still in the experimental stage with support of several foreign aid projects. There is also the new proposed draft law of water and irrigation which is waiting for approval in the parliament, may be this year, to give a legal identity to such new organizations.

It could be concluded that there are three periods of development in management towards decentralization in the water management sector;

- Decentralization through transfer of all responsibilities and most mandates at the lowest local level is needed, though irrigation and drainage at that level are traditionally private affairs. This includes improvement of the irrigation system at the tertiary canal (*mesqa*) level through the Irrigation Improvement Project (IIP). It started in the late 1980s. This includes application of a package of physical improvement of the irrigation system at that level in parallel with reorganization of users in formal NGOs (WUAs). So far about 6000 WUAs were formulated at the *mesqa* level serving about 300000 feddans which represent less than 4% of all cultivated lands in Egypt. In case of coverage of all Egypt lands with this project a huge number of new organizations is expected to be added to the fragile social structure of rural areas in Egypt.

- Decentralization through delegation of most responsibilities and some mandates at the second local level of Branch (secondary) canals. This includes establishment of water users associations at that level through the Water Board Project (BCWUA) started in mid 1990s. In 1994 the Netherlands Embassy started experiments in Fayoum to involve farmers in water management to establish participatory organizations at the secondary canal level termed Local Water Board (LWB). The objective was to develop and test new organizational arrangement aiming at complete or partial transfer of responsibilities from the Fayoum irrigation Department to organizations which are partly or completely controlled by farmers. Since 1995 two different models have been tested in selected pilot areas. They agreed upon the model LWB of local water board, including both farmers and officials,

(joint committee) established based on a decree of the Under-Secretary of state for the Fayoum of MWRI. The irrigation and drainage district engineers are included in the local water board themselves. This was followed by a project financed by the World Bank to establish similar organizations at the same level in other governorates. There were less than 90 organizations in 2006 at the branch canal level in the areas identified by the IIP.

- Third project of decentralization expanded this process to the district level. This is to decentralize and integrate water resource management, expanding responsibilities and mandates at the district level for that purpose. This involves integrating functions and building capacity at district level, further strengthening water users' associations, making appropriate changes at the central level of the Ministry of Water resources and Irrigation (MWRI) to further define the responsibilities of the districts and assuring that they have authorities commensurate with these responsibilities, and redefining the role of the Ministry itself in light of the trend towards decentralized management. In particular, the Ministry's role in allocating water supplies, managing data, and maintaining water quality need to clarified, and support will be needed to build capacity in these areas.

- Integrated Irrigation Improvement Management Project (IIIMP) is the last pilot project to be implemented during the period 2004-2012 in about 500 000 feddans. This includes five components; Integrated command area water management plans through institutional development and support, Promotion of WUA at mesqa (tertiary) and branch (secondary) levels for integrated irrigation and drainage management, Rehabilitation and improvement of irrigation and drainage infrastructure, Environmental management, and On-farm demonstration for improved water use. This project is in the preparatory stage and will be implemented in five command areas; Mahmoudia, Meet Yazid, Bahr Tanah, Serry, and Tomas and Afia.

Table 6. Overview of previous water policies in Egypt

Year	Objectives and policy targets	Remarks
1975 policy	▪ Increase water supply through Nile conservation projects. ▪ Increase drainage water re-use in the Delta.	Horizontal agriculture expansion of an area of 1.5 million feddan were projected
1977-1981 Water Master Plan (IBRD/ UNDP)	▪ Development of scenarios to increase Nile supply at Aswan and other local resources. ▪ Development plans to meet the water requirements for agricultural growth from 1980 to 2000. Also, non-agricultural water demands were included.	▪ Collection of different data (hydrological, meteorological, agricultural, municipal, industrial, etc.) and development of information database systems and mathematical models. ▪ 30 technical reports were produced
1980 and 1982 policies	▪ Adoption of Irrigation Improvement resulting in saving 5 BCM on the long run. ▪ Drainage re-use would reach 6.3 BCM in 1985 and 10.0 BCM by the year 1990.	▪ Based on the studies of the Water Master Plan ▪ Projection of the water resources status every five years up to the year 2000 ▪ This policy was based on the assumption that the Jonglei canal will be operational by 1985
1986 policy	▪ Half of the Nile Valley and Delta groundwater utilization projects would be accomplished before 1992/1993. ▪ During the winter closure period 1.5 BCM would be used or saved in the Northern Lakes. ▪ About 2.5 million feddans would be covered by the Irrigation Improvement Project (IIP)	▪ This policy was based on the assumption that the Jonglei canal will be operational before 1992/1993 after the halting of the construction compared to previous policy ▪ More knowledge on effects of the IIP on quantity and quality of re-used drainage water.
1990 policy	▪ Drainage water reuse can be increased from 4.7 to 7.5 BCM by the year 2000. ▪ Deep groundwater extraction can be increased from 0.5 to 2.5 BCM till the year 2000. ▪ Shallow groundwater extraction can be increased from 2.6 to 7.5 BCM by the year 2000. ▪ To decrease fresh water flow to the sea during the low requirements period from 1.8 to 0.3 BCM. ▪ Irrigation Improvement projects (IIP) can save 1.0 BCM by the year 2000. ▪ Horizontal expansion area of 1.6 million feddan can be added to the present area of 7.4 Million feddan (i.e. in 1990). ▪ Increase of efficiency of municipal water use from 50 to 80% therefore domestic water requirements will not increase by the year 2000. ▪ The Jonglei canal would be operational by the year 2000.	<u>Driving forces for this policy were:</u> ▪ The postponing of construction of Jonglei canal. ▪ The impact of drought period from 1979 to 1988. ▪ New agricultural expansion policy.

Source: Fatma Attia, 'Water Board: From Policy to Strategy in the Framework of IWRM', paper presented in Workshop of Water Boards: From Policy To Strategy, Cairo 13-14 January 2007

Evaluation of Previous Policies

A number of studies have been carried out to evaluate the previous policies, including the analysis made by the National Water Resources Plan. A summary of their findings is listed below.

- National water policies were not flexible; Consequently, they could not cope with uncertainties (e.g. lack of addressing future challenges in relation to country's priority issues that may affect the behavior of water users and lack of predicting impacts related to shifting from the central planning economy to the free market economy allowing free cropping patterns based on market needs).
- Water has not yet been considered as a limiting factor for economic development.
- There was a lack of integral national level planning using water as a common resource for different sectors of the economy.
- Environment and water quality were not adequately addressed.
- Political constraints (national and international) were not explicitly represented.
- Socio-economic aspects have not been addressed adequately.

The National Water Resources Plan project (NWRP, 1999) added the following comments:

- In the 1990 water policy, problems related to water quality and environmental qualities are only touched in a superficial way.
- Socio-economic and environmental impact assessment, implementation, cost recovery, priority setting and conflict resolution did not receive sufficient attention.
- Increasing the irrigated area seems to be the main objective.
- Water demands from other sectors are estimated without a detailed analysis.
- Due to the use of gross water demand and supply values in the water balance, there is the risk of double counting, for example by adding water savings due to irrigation improvement, or cropping pattern changes.

More attention has to be given to institutional aspects of water resources management, to water quality management, to the efficient direct measures to control the use of water (e.g. regulation, technology) and to indirect measures that affect water user behavior (e.g. market mechanisms, financial incentives, public awareness programs)

From the comparative analysis of the Egyptian water policies done by Fahmy (1996) conclusions show that there are limiting factors in almost all the previous water policies; i.e. uncertainty, lack of the multidisciplinary approach and the shortage of adopting specific flexible conceptual framework. If these factors are studied this will "provide the decision-maker with a strategy portfolio filled with a set of ranked actions for each scenario along with their environment impacts."

2.6.3. Involvement of stakeholders in irrigation

Stakeholders in Irrigation: Driving forces and developments

- The main approach of delivery of irrigation water is based on rotation. Management of a water rotation system requires full cooperation and collaboration between farmers and stakeholders in order to ensure equity and fair distribution of water allocation in addition to the efficient use of allocated resources.
- However, the system had shortcomings such as inequitable distribution of the resource and relatively low efficiency of water use due to all above-mentioned conditions as will as the higher pressure over the limited amount of water resources. Accordingly and due to the socio-economic development policies and related programs to feed more population, and due to the establishment of new activities the irrigation authorities represented by the Ministry of Public Works and Irrigation (MPWI), called now the Ministry of Water Resources and Irrigation (MWRI), developed a new strategy to improve irrigation management and related physical infrastructure. This was meant to improve the performance of the whole irrigation system through the enhancement of distribution and irrigation efficiencies. .
- The policy of system improvement is based on the fact that all canals until the level of main and secondary canals and the tertiary canal off-takes as public property are managed by the MWRI that serve, finally, the private tertiary canals (*mesqa*). The tertiary and field ditches, *marwas,* are private properties and subject to the farmer's authority.
- The creation of WUAs in Egypt was recommended in 1984 in a final report by the EWUP and made operational at the improved *mesqa* level in 1988 as an essential component of the IIP package.
- In 1992, an Irrigation Advisory Service (IAS) was initiated within the Ministry of Public Works and Irrigation (MPWI) to work with WUAs. These associations did not have a legal status until 1994, when irrigation and drainage law 12 of 1984 was amended by law 213 of 1994 to allow for establishing WUAs in the new lands and in the improved irrigation project area in the old lands at the mesqa level.
- This policy of MWRI is seen as a step on the road of decentralization of management of irrigation and drainage systems. Hence, this new law could be considered as a sign of a new era and as the legal base to institutionalize regrouping of irrigation water users to restore the group management of irrigation water at the *mesqa* level but under new technical and modernized conditions. Yet, some others consider it as an indirect and decent way to extend the control of formal irrigation management to that lower level which was fully private affair before.
- However, the most recent policy of MWRI has adopted the expansion of formulating water users' organizations at the district level which is higher than the branch canal level within the context of a newly adopted approach of Integrated Water Management.
- At present there are about 6000 WUAs formulated at the mesqa level serving about 300000 feddans and less than 90 Water Boards (WBs) at the branch canal level in the same areas. These steps are still in the piloting/evaluation stage with support of several foreign aid projects.

However, the MWRI is not the sole official actor in the management of the water sector. There are several other state agencies involved in the process. Figure 9 shows the state agencies involved in the management of water resources in all sectors.

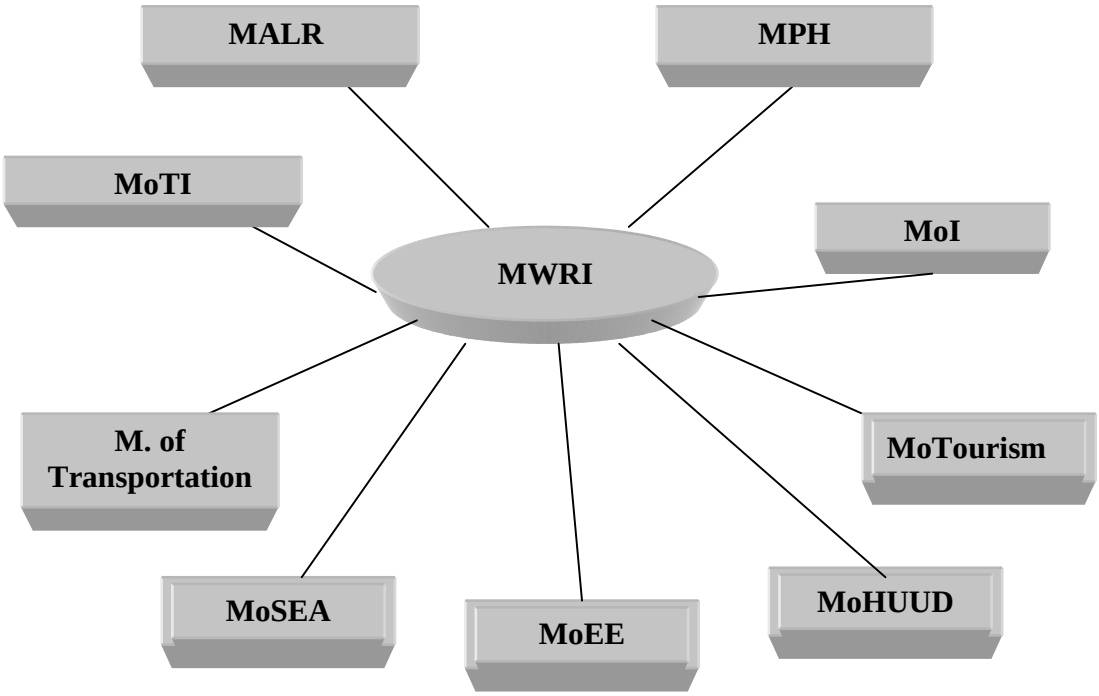


Figure 9. State agencies involved in the management of water resources

MALR is in charge of the on-farm management of irrigation. There is in close interaction between this ministry and MWRI to estimate water demands for agriculture according to the crop structure. Several arrangements are established to coordinate between the activities of the two ministries in this regard. MoTI is in charge of the management of water resources used for the industrial sector. MoHUUD is in charge of the management of water resources and the infrastructure needed for distribution of potable water for the domestic sector an all other sectors in addition to sanitation. The Ministries of Transportation and Tourism are in charge of the navigation in Nile and responsible for securing the level of water necessary for safe navigation for tourist sailing vessels and other kinds of Nile transportation and related regulations. The Ministry of State of the Environment Affairs (MSEA) is responsible for monitoring pollution and imposing the environmental measures in all uses of water resources through the close cooperation with MWRI. This task is shared with the MPH which takes care of the hygienic aspects of potable water and monitor pollution of the water channels with the vectors of water born diseases. MoEE takes care of the generation of electricity and amount of water needed for cooling of electric operators. MoI takes care of application of laws and regulation concerned with the use of water resources.

Thus, it is clear how water resources are real concern for the majority of state agencies in addition to many other NGOs, as well as the scientific and professional organizations and institutions in Egypt. The Egypt Water Partnership and few other civil society associations concerned with environment deal with water issues as of great priority in their activities.

3. THE REGIONAL CONTEXT: CONDITIONS OF IRRIGATION IN THE ISIIMM COMMAND AREAS IN EGYPT

3.1. SELECTION OF THE ISIIMM SITES IN EGYPT: THE CRITERIA OF SELECTION

Selection of the working sites of ISIIMM in Egypt went through several stages to insure representation of the various conditions and contexts of irrigation process in the country. One of the most determinant factors was the topographic variation that led to the selection of areas in the Delta (old lands), the Nile valley (old lands) and the depression of Fayoum. Additional area was necessary to select in the newly desert reclaimed lands where about third of cultivated area in Egypt exist nowadays. Old lands and newly reclaimed lands differ drastically from the socio-economic aspects. Old, traditional and stable rural settlements exist in the villages in the Delta and the Valley, while new rural settlements exist in the new reclaimed lands with a more recent socio-economic structures that lack traditional family structure that dominate in the old lands. They differ also from the technical perspective since traditional surface irrigation is the main system applied in the old lands while the modern pressurized irrigation is the legally accepted system in the new lands though few areas in these lands do not apply it for some technical or socio-economic reason.

Discussions among the members of the scientific committee concluded with the selection of specific criteria to be applied in the selection of the candidate areas and in the light of available data of these areas. These criteria are the following:

- The pilot area should represent one hydraulic unit. This means that all the area has only one intake, is provided by water from one canal, and delivers drainage water to one specific main drain. Explicit boundaries of the area that based on the intakes and outtakes of water resources would help attributing related phenomena that are directly concerned with the management of these resources.
- There should be no Water Board at the secondary canal level in order to have the potential to establish one based on the initiative of local population if our project proved successful.
- Though the area is preferably not to be included in the IIP area, it should not be so far from the areas covered by this project to get benefit of any potential collaboration between the two projects in future. Existence of some sort of water users' organizations either in the same area or somewhere in the nearby areas. This is to compare and exchange experiences with.
- The area should have a relatively satisfactory and easy access to the regional network of roads. This is to facilitate communication and transportation of all staff to the area.
- The area should not have major structural problems that need fundamental and drastic change from the administrative and technical perspectives which could be out of control of our project or potential partners and stakeholders.
- To have some NGO with specific minimum level of capacities that is willing to collaborate and has the potential of evolution through partnership with the project.
- Minimum level of willingness of the farmers in the area to accept the idea of participatory approach.

Secondary data related to these criteria were collected by the facilitators about 11 areas in the four regions of Behera (3), Nubarya (2), Fayoum (3) and Menia(3). Accordingly, application of the criteria on the candidate areas in light of the available data led to selection of the most convenient area in each region by which was approved by the scientific committee.

Field visits had followed to the selected areas where some of them were undertaken in companion with the ISIIMM project manager and his deputy early May 2003. However, these field visits proved that each area selected was characterized by specific features that differ from the other three in a way that would enrich the work and avail good opportunities for comparative analyses.

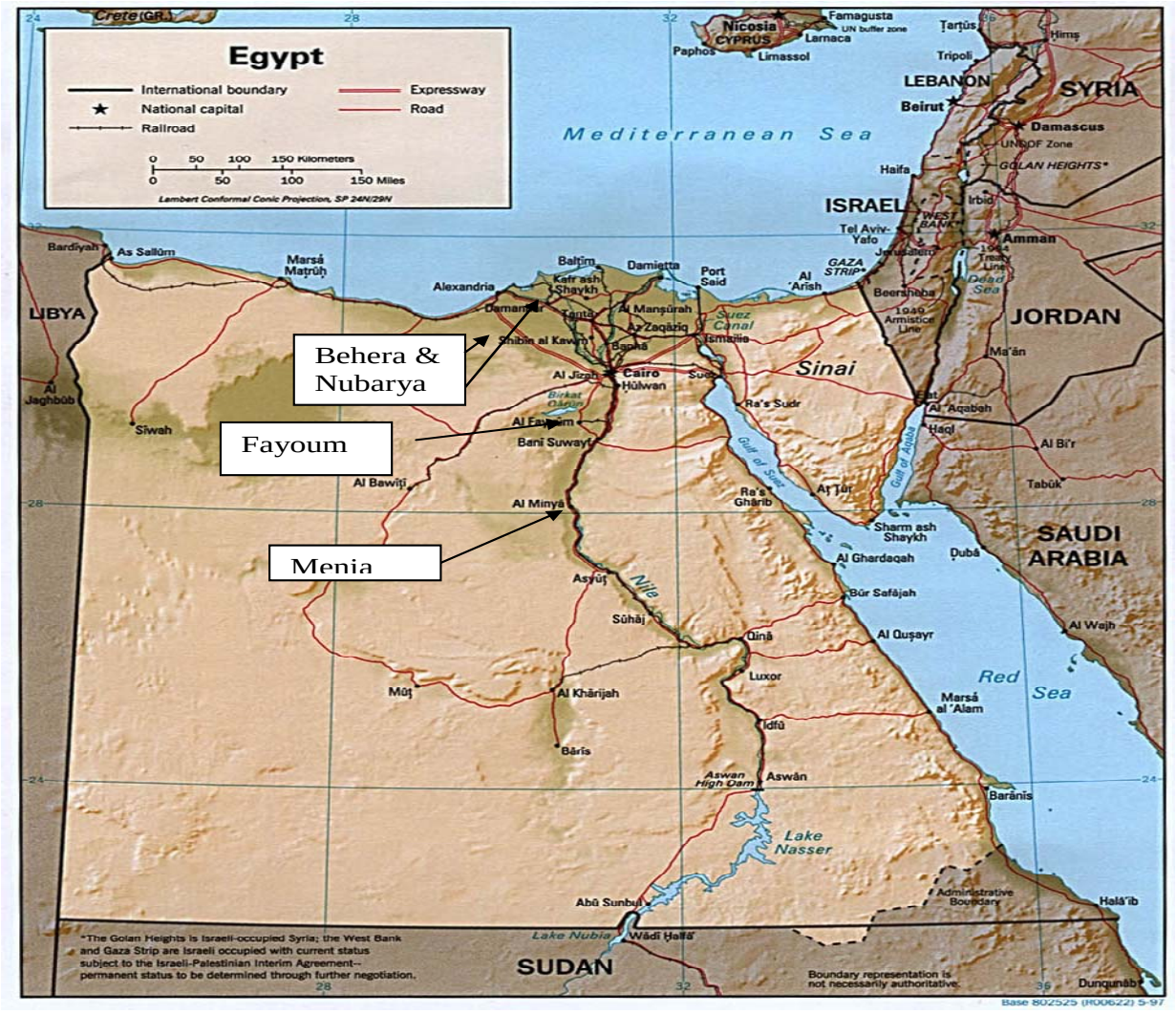


Figure 10. Location of the four sites of ISIIMM in Egypt

The following section explores the main aspects of the different characteristics among the four command areas.

3.2. CHARACTERISTICS OF THE REGIONAL CONTEXT OF TARGETED COMMAND AREAS OF ISIIMM-EGYPT

Selection of the four command areas of the project was based on the above mentioned set of criteria. However, due to the different conditions of operating and management, the irrigation system in the main regions of the four sites specific characteristics were found different among these areas. These differences could be elaborated in the following aspects:

3.2.1. Basic Data about the Regions of the ISIIMM-EGYPT project command areas

The scientific team of ISIIMM in Egypt suggested representing various regions with different characteristics in the sites of this project. This aimed to get benefit from the diversity of knowledge related to the different irrigation structures in comparison of the impact of modes of management of these structures and related innovations on the efficiencies and effectiveness of irrigation process itself. Table 7 shows the main data related to the global overview of concerned regions. The three regions include more than 25% of the cultivated old lands beside a significant proportion of the newly reclaimed lands in Egypt. They encompass about 16% of all population in the country. The three governorates are considered from among the rural regions in the country where not less than 77% of their population are living in rural areas. However, they suffer from low Human Development Indicators (HDI) since they posses the ranks of 16, 19 and 22 among 26 governorates. Percentages of agricultural labor force exceed the national average with the well known low level of income of farming. Average farm sizes are relatively low with many small irrigators which impose more burdens on the management of irrigation process.

Table 7. Basic Data about the Governorates of the ISIIMM-EGYPt project command areas

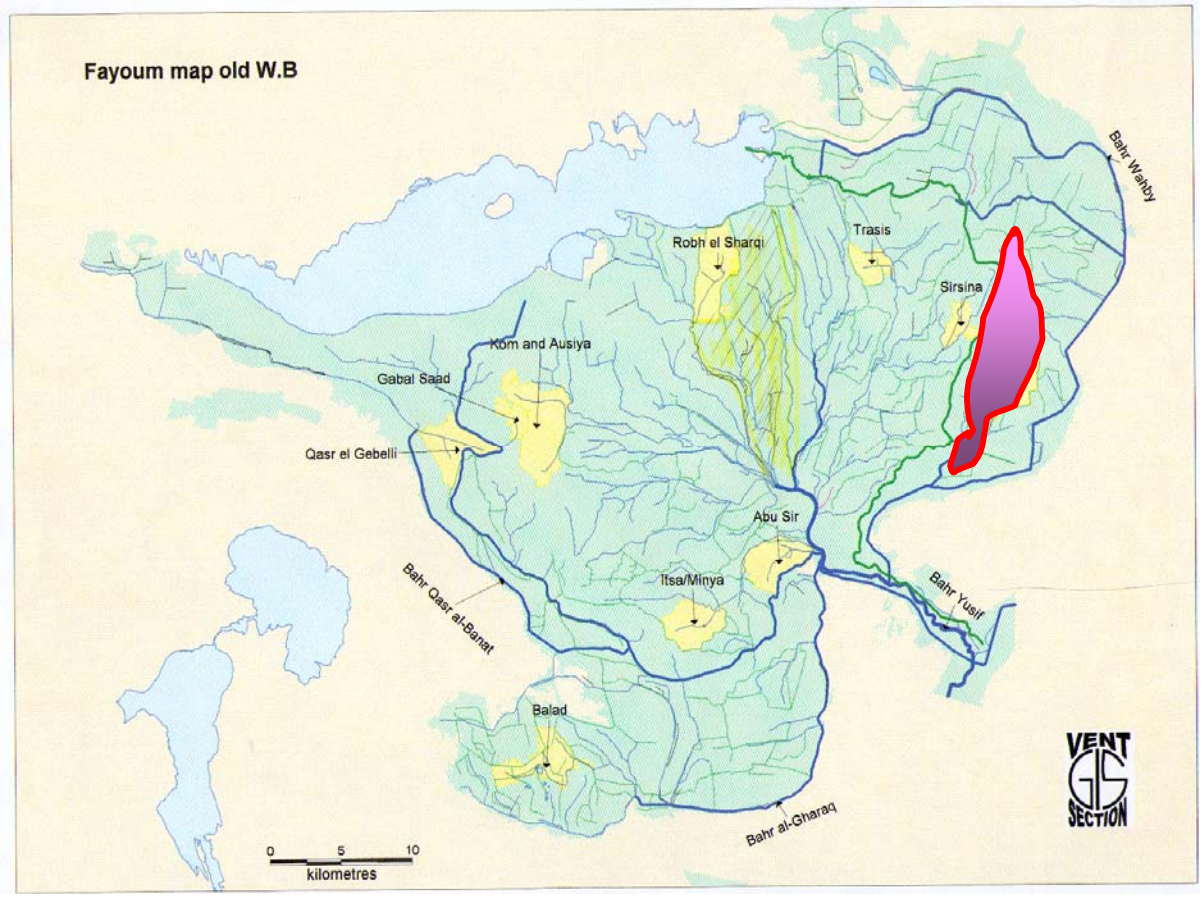
Governorate	Behera	Fayoum	Menia
Location	**Nile Delta and western desert**	**Depression (Middle Egypt)**	**Nile Valley (Middle Egypt)**
Population (x1000)[1]	4515	2321	3875
Rank in population[2]	5	15	8
Labor Force (x1000) [1]	1515	605	1171
% Labor Forces in Agriculture & Fishing[1]	37.9	42.5	55.7
% Rural population [2]	77.2	77.5	80.6
Villages and satellites[3]	490 (5737)	162 (1428)	346 (1429)
Cultivated Area (feddan) [4]	922445	330945	406416
Number of Farms [4]	301177	118702	296837
Average farm size[4]	3.6	2.8	1.4
HDI 2004 (govs. rank) [5]	0.658 (16)	0.609 (22)	0.625 (19)

[1]Central Agency Of Public Mobilization And Statistics (CAPMAS), 2003, Statistical Year Book, Cairo: estimates in 1/1/2003
[2] CAPMAS, 2003, Statistical Year Book, Cairo, Census of 1996
[3]Ministry of Local Development in April 2003
[4]CAPMAS, 2003, Statistical Year Book, Cairo, data of the agricultural census of 2000
[5]UNDP and INP, 2005, Human Development Report –Egypt 2005, Cairo

3.2.2. The Irrigation Systems in the Project sites of ISIIMM in Egypt

a) The Irrigation system in Fayoum

Fayoum is a natural depression area linked to Nile Valley through a narrow cultivated area around the main canal, Bahr Yousef, (figure 11) that provides it with the Nile water. It has 395513 feddans and 176 613 land holdings (Agric. Census, 2000, p. 1). All this area, in addition to some newly reclaimed areas, are irrigated by gravity through a complex network with 1400 km irrigation canals, 1100 km drains and 6500 irrigation structures like weirs, off-takes, etc. The system is attached with more several drainage re-use pumping stations for mixing the Nile water with drainage water. This leads to an increase of about 25% of mixed water added to irrigation water.



Source: WFMP

Figure 11. Fayoum Irrigation Network

The gravity flow irrigation system in Fayoum is unique in Egypt. It is the only gravity flow irrigation system in Egypt. The water enters into Fayoum, at 20 meters above sea level, and ends up 50 meters below sea level to drain finally in the 70 meters below sea Lake Karoun and now AlRayan Lake without any other outlet (Hopkins, 1999). Hence it is considered a closed irrigation system. Farmers are not required to lift water, but there is a strict limitation on the quality of water allowed to enter the Fayoum in order to prevent excessive water from causing the lake to overflow.

Each farmer has a time- share in the flow according to a traditional system called *Motarfa*. The ministry of irrigation fixes the amount of water that enters the channel according to the size of the command area based on the peak summer irrigation needs per feddan. The management of irrigation in Fayoum is an example of exchange of water rights. Each field has a weekly turn. Vents are used as gates for the tertiary canals where each vent (figure 12) is designed to feed the concerned canal with specific amount of water to irrigate the related cultivated area. Farmers have a long tradition of managing their own tertiary units and distribute water on a rotational basis. The 10 080 minutes each week are divided by the

number of feddans to determine the period of time allocated to each one feddan. Hence each farmer is entitled to specific time of irrigation, in minutes each week depending on the size of his holding. The irrigation cycle begins at 12:00 clock on Friday; the rotation among the users of the channel is supervised by a chief usually an elderly and rich farmer, who informs each user of his time-share and his turn. Hopkins explained that this system produces disputes among farmers. As the common point for the water is distant from most fields, there is an opportunity here to cheat by diverting one's water early, or by drawing water from a flowing channel while the irrigator is busy in his field (Hopkins, 1999).

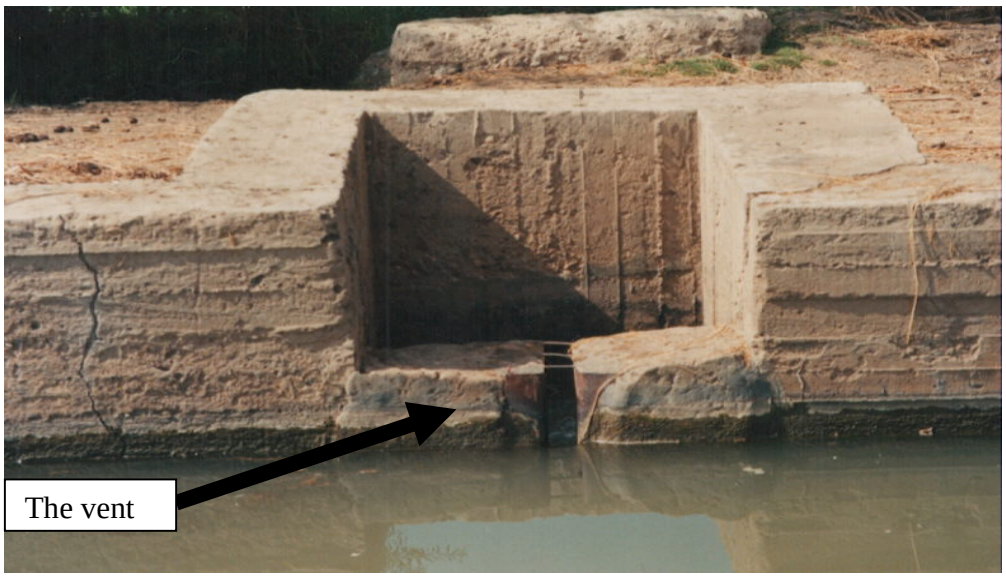


Figure 12. Design of the vent in Fayoum

The area selected was located on a branch canal called Seila connected directly to the Wahby main canal (see figures 11 and 13). The Seila branch canal feeds eight distributorary canals that feed in turn all vents.

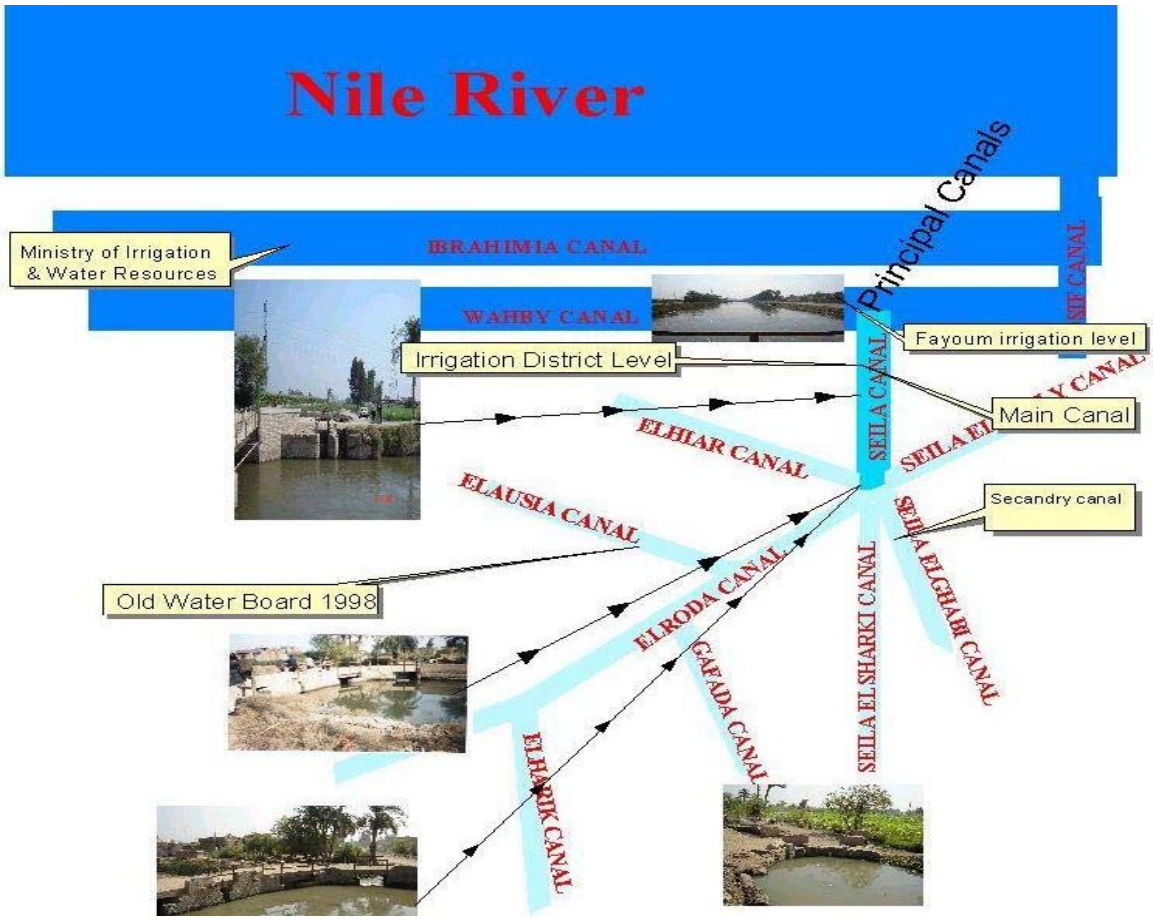


Figure 13. Irrigation system in Seila canal area in Fayoum Governorate

Figure 14. Gates of the Seila canal to the distributary canals

b) Fayoum Water Management Project (FWMP)

In 1993 the Netherlands Embassy started experiments with farmers' involvement in water management to establish participatory organizations at the secondary canal level termed Local Water Board LWB.

The objective of the project was to develop and test new organizational arrangement aiming at complete or partial transfer of responsibilities from the Fayoum irrigation Department to such organizations, which are partly or completely controlled by farmers. Since 1995 two different models are tested in selected pilot areas. They agreed upon the model of local water board, including both farmers and officials (joint committee) established by decree of the Under-Secretary of state for the Fayoum of MWRI. The irrigation and drainage district engineers are included in the local water board themselves.

The experiments have started in 1995 in six pilot areas divided over the whole of Fayoum. At present there are LWB in ten secondary canals. On the mesqa, tertiary, level water distribution is quite fair, but not at the second canal level which is the government domain.

The specific goals of the project are: creating an effective interface between farmers and FID; increasing equity in water distribution; minimizing cost of structural works; increasing the efficiency of weed control; cost recovery; and conflict management

In 1997, The minister of irrigation and water resources issued Decree no 236, the decree has given the authority to establish LWBs. Based on the decree, a new local water board have been established and guidelines have been developed and are being implemented.

The project has positive effects on the water distribution within the branch canals, change in cropping patterns and there is a marked decrease in the fallow areas especially during summer seasons. Other major effect is in the field of improved relations between engineers and farmers and diminishing between farmers in the areas.

Research has shown that women are on a wide scale involved in agriculture and irrigation. Therefore the project explored a strong need for participation of them in the project. It was in the beginning of 1995 that gender became a topic in the program of the Fayoum Water Management (FWMP). The purpose is to determine to what extent women play a role in water management in Fayoum. In 1995 and 1996 rapid appraisals were carried out in the first five pilot areas. Halfway 1996 a short mission Gender activities have include setting up a system with the female water users to keep the canals from garbage, the other areas women have been actively involved in planning of construction and rehabilitation works in the LWBs areas.

d) Irrigation System in Menia

The main canals in Menia Governorate are Ibrahimia, Serry Bash, and Bahr Yousef. The main drains are Al-Moheat and Kabkab. Mantout canal is fed b Serry Basha canal.

After establishing Asuit Barrage in 1902 to raise the level of the Nile water in Ibrahimia canal about 5 meters, the system of irrigation has changed from basin irrigation to perennial irrigation the whole year in some areas in Mantout. As early as 1930s the farmers had devised a way to farm year-round, certain large farmers installed stationary diesel pumps to draw water from wells during the dry time of year. After constructing the first phase of Aswan Dam and the second phase in 1933 the whole area was transferred to perennial irrigation. After the High Dam was completed, the state built a network of distributary's canals, which in effect linked these existing pumps. The state provides water to large stationary pumps in these canals every other week, and the owners and operators of the pumps lift the water to the level of the fields. Here the water flows through a private network of field ditches until it reaches the field of individual farmer (Hopkins, 1995; Abou Elatta, 1977).

Projects in Mantout area

In the realm of the national strategy of upgrading and advancing the irrigation methods in Egypt, the advancement of the irrigation scheme was introduced in Menia governorate early in 1989. One year later in 1990, the authority for water control was initiated. The advanced irrigation method comprises three main types namely: covered irrigation canal, covered pipelines, and irrigation baseline with a direct opening for irrigation water.

That year marked also the beginning of an American funded program with a budget of 25 million LE. The duration of the project lasted for five years. On the whole an area of 20,000 feddan was upgraded, each irrigation canal covers an area of 70 to 90 feddans and each basin covers 10 feddan.

A second concern of this program comprised the provision of a number of collective irrigation water pumps. To hand over the responsibility of that machine to the farmers, a group had to be formed. In 1990 the first water association or water group was formed. The areas with the irrigation basin did not receive a collective irrigation pump, as there was no need for it. The idea behind the delivery of collective irrigation pumps was to provide the rest of farmers with a demonstration model. Handing over the machine did not automatically mean the ownership of that group to the machine. The groups were encouraged to buy the pumps, which several groups did in fact do. The rest of the pumps were delivered back to the irrigation directorate to be given out further to other areas (USAID, 1998).

The command area in Menia is characterized by its inclusion in the second group of pilot areas of the national experimental project of Irrigation Improvement Project (IIP) initiated early nineties, 1994, of the last century. Because of the strong resistance of local population to any change in the local irrigation system especially at the inception of the project the IIP local staff in Menia tried, that time, to alleviate and avoid this strong opposition. This happened through relaxation of application of the organizational component of the project and promise of staff not to impose any organizational change in the management of local irrigation system. Farmers were more aware with the direct and good impacts of the physical improvement of the system. This facilitated smooth implementation of the physical infrastructure component of the project with the least opposition. But, meanwhile, this situation has led to a mismatch between the physical and organizational components of the local irrigation system. This is manifested in the pattern of management in the majority of Mesqas where framers are still using their own private pumps in the one lifting point of the improved mesqas for irrigation with minimum group effort to manage just to avoid conflict over scheduling of each one turn of irrigation. Elapse of long time since completion of the

mesqas physical improvement regardless of the reorganization component has led to the adaptation of new practices that are still based on individual rather than group management of the local irrigation system. This situation is contradictory with what is originally aimed by the IIP.

This situation has led to the emergence of several problems originated from the contradiction of water needs among neighbor farmers. Framers are reluctant to share costs of lining canals or purchasing and managing one group pump for all irrigators on the Mesqa.

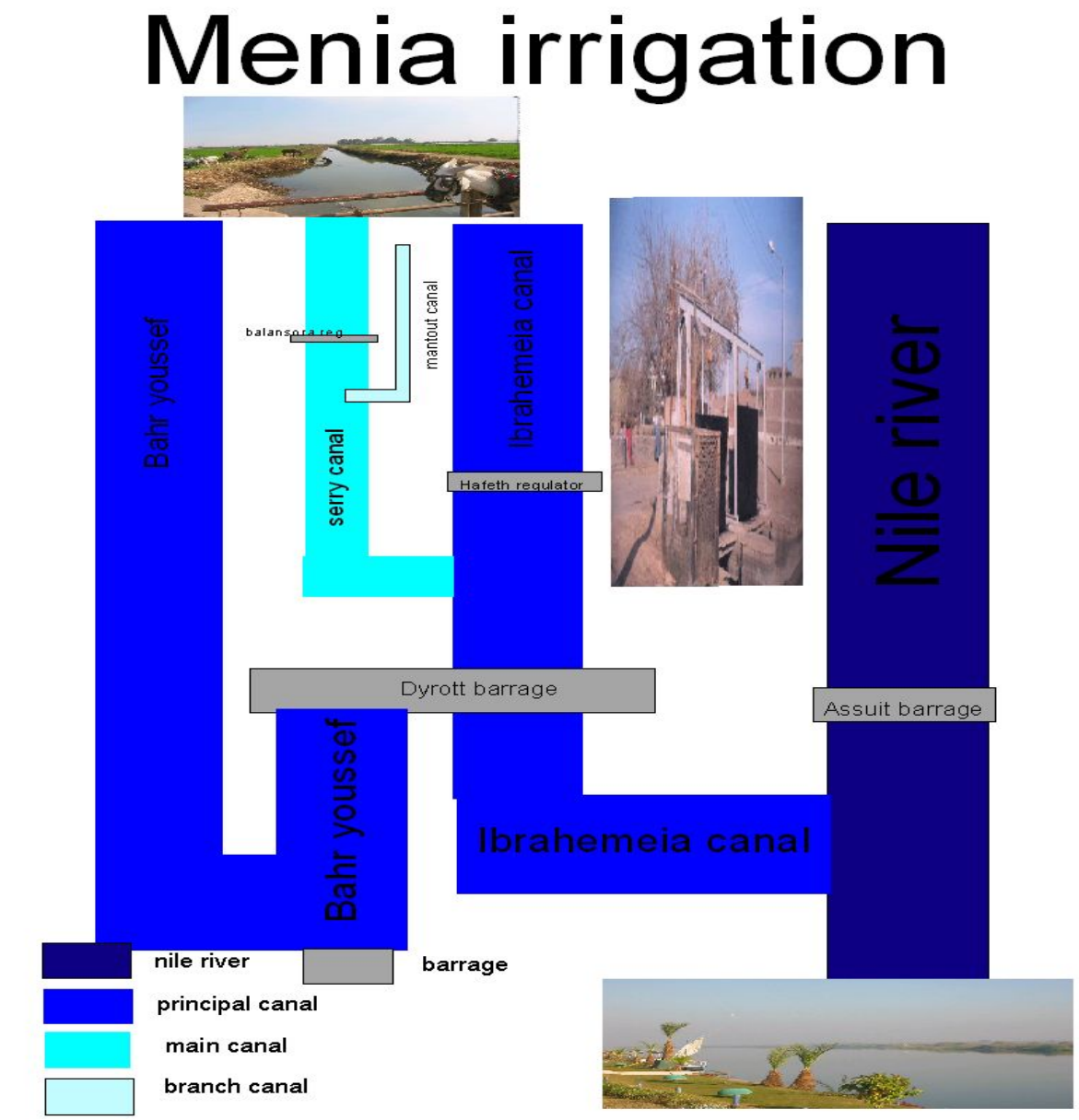


Figure 15. The irrigation system in Mantout canal area in Menia Governorate

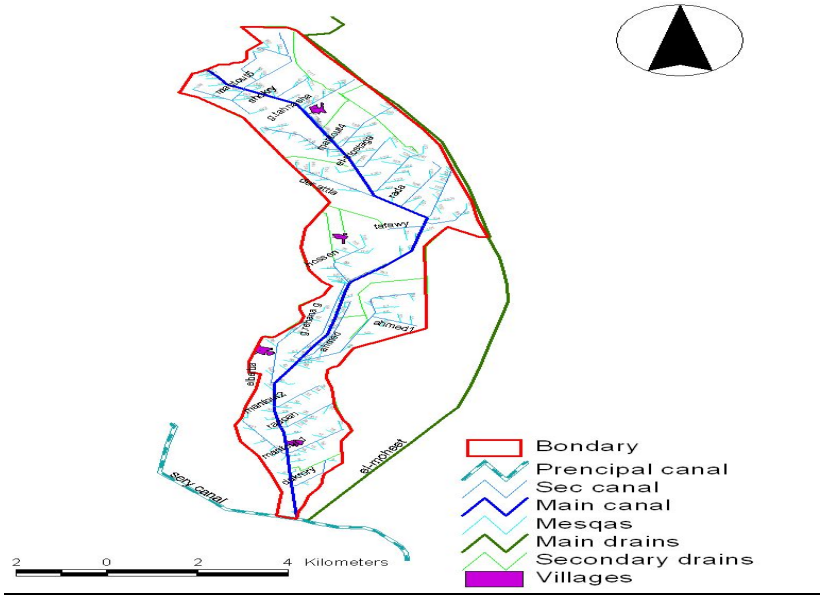


Figure 16. Map of Mantout canal and the related mesqas

e) Irrigation system of El-Rezqa Canal in Behera governorate

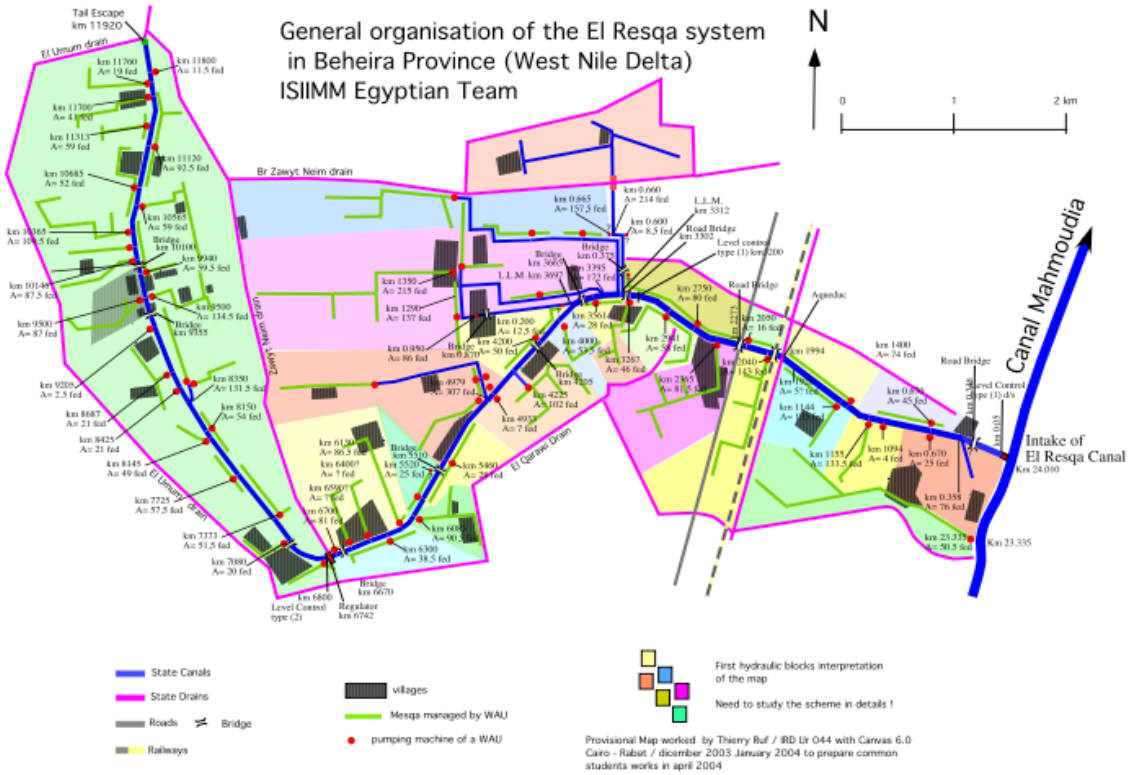
The history of establishing El-Rezqa canal goes back to 1920 where the area was irrigated from El-Karawy Canal (in parallel with El Rezqa canal now), which supplied the area through a small tube crossing the railway line.
At that time there were about 7 to 8 large and famous families plus a charity agency (EL-awkaf, endowment, agency) own the whole agricultural land in the area. The command area for each family ranged between 2000 and 3500 feddans, in addition to small families owned 2-7 feddans.

The irrigation water was not sufficient to irrigate the whole area. In 1930 the families submitted a petition to the ministry of irrigation asking for digging a private canal for this area in order to reclaim the surrounding lands of the area. In 1940 the canal was established and named El-Rezqa, which means more welfare to people. The large families reclaimed many fallow lands along the canal.

During the forties and fifties, after digging the canal, the state fixed a water rotation of four days on and four days off. The irrigated water was sufficient due to the small number of users based on families rather than individuals.

The area of El-Rezqa was and still under the activities of some on-going national and regional projects that cover part of the Behera governorate. They are the following:

1- The Irrigation Improvement Project (IIP) sponsored by the World Bank and the German Bank for Reconstruction KFW, the project extends for 7 years and end in December 2004. The main objective of the project was to improve irrigation in 500 000 fed command area, for 1400 WUAs in Abu-Hommos District, in addition to on-farm irrigation activity in 6 extension farms. The project is supervised by coordination between the department of Irrigation Advisory Services (IAS) and the Ministry of Agriculture.
2- The Egyptian German project for rational use of irrigation water in Agriculture. It extends for 9 years. Two main Canals were selected "Besentway" and Hammamy to work in the project. It aimed to strengthen WUAs and improve the on-farm efficiency of the improved areas.
3- "The Water Board project" at the branch canal level sponsored by the Egyptian and Royal Netherlands Embassy. The project has begun 4 years ago ended December 2006. In the first stage it has established 2 water boards at Besentway and Hammamy areas, the second stage aims at establishing water Board at the level of irrigation engineering at Abou-Hommos District.
4- The Integrated Irrigation Improvement & Management Project (IIIMP) which aims to improve the management of irrigation and drainage for all farmers in two command areas in the Nile Delta. The seven-year project which started in 2005 will cover 196,000 feddans on El-Mahmoudia canal in Behera with its services in addition to the rest of 550,000 feddans in other areas. The project is expected to have positive impacts on water distribution, quantity, quality, equity, and timing opportunity. This is to be effected through: (i) reduced and more rational use of irrigation water, at both off-farm and on-farm levels; (ii) greater and more effective participation by users and stakeholders in water management; and (iii) development and application of an integrated approach to planning, implementation and management of irrigation and drainage improvements.



Source: Thierry Ruf, 2004, OSIRIS

Figure 17. The irrigation system in El-Rezqa canal area in Behera Governorate

f) Irrigation System in the New lands at Nubarya

New Nubarya is a resettlement area between Alexandria and Cairo in the Western Desert. During the period from 1959 to 1967, all of the reclaimed desert lands in the Nubarya region had been managed as state-run farms. However, in a later stage the GOE allocated a part of the reclaimed area to migrant farmers from the Suez Canal due to the 1967 war. In 1986 a shift in reclamation policies was directed towards the allocation of reclaimed land to new graduates which was seen as a solution to graduates' unemployment (FAO, 1990; Fawzy, 1999).

An important physical feature of the area that has great implications on the way agriculture is practiced is its climate. The location of the reclaimed areas in desert implies an arid climate. The water needed for irrigation is supplied by main canals, secondary and tertiary canals. El Nubarya Canal is the main canal which receives its water directly from the Nile by gravity. It feeds El-Nasr and El-Bustan canals. El-Nasr canal provides water for the area west of the canal. Water is pumped through five pumping stations along El Nasr canal into tertiary canals and then flows by gravity until the farmers' fields. El-Nasr canal and its open secondary canals and tertiary canals have continuous flow while the booster pumping station serving the pipe networks operate from 6 a.m. until 10 p.m. daily (FAO, 1990). In the case of settlements of graduates the command area of each of these pump stations is 320 feddans

divided into units of 20 feddans for each four farms. Farmers have to make their own irrigation rotation schedule in order to distribute water according to their needs. Unfortunately, in most cases there is no such rotation schedule. This situation led to conflicts among different irrigators. Situation might become more complicated especially with other categories of farm size such as the small and large investors in the area. In 1990 the MWRI transferred its responsibility for operation and maintenance of the irrigation network up to the field to the users. Consequently, this led to an unreliable water supply and delivery (FAO, 1990). However, this encouraged governmental led development projects to contribute to the organization of graduates as water users through establishment of Water Users Unions. These organizations include only graduates and not other users such as the small and large investors in concerned areas. This necessitates extension of the organization processes of users to include theses other categories of users in the Water Boards that are established before on the branch canal levels, called now BCWUA. Farmers in the area use different irrigation techniques, depending on different soils. Most graduates in Nubarya (sandy soils) use sprinkler irrigation for field crops and drip irrigation for vegetable and fruit trees. Highly modern sophisticated techniques are further applied in the modern big investors' farms.

Figure 18. The main boosters in Regwa canal area in Nubarya (Reclaimed Lands)

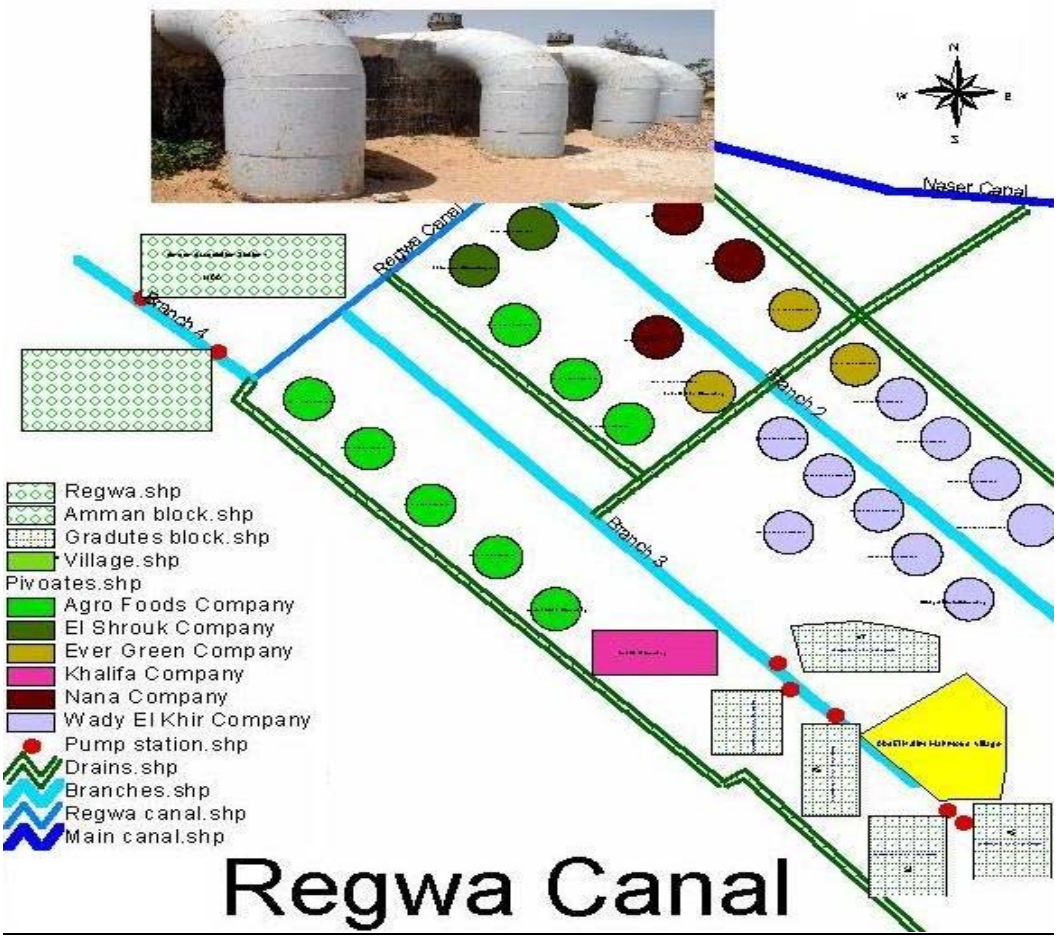


Figure 19. The irrigation system in Regwa canal area in Nubarya (Reclaimed Lands)

New lands Agricultural Services Project

In 1992 The GOE and The International Fund for Agricultural Development (IFAD) signed a project loan agreement to assist farmers in the New Nubarya under the name of New Lands Agricultural Services Project (NLASP). The project started its activities in 1994. The overall objective is to establish sustainable, profitable and modernized farming system and to optimize the on-farm use of water.

Goals were defined that covered efficient on-farm water use, adaptive research for appropriate technology package, the establishment of demand–driven extension service incorporating a comprehensive male/female settlers training program. These goals were achieved through five components covering, Water management, Extension Communication, Adaptive Research, Credit and project Management.

The project aimed at increasing the crop yield by 300 % by the optimization of irrigation water and the reduction of fallow lands.

The water management component had three major objectives:

- Maintaining efficiency of operation of the available pressurized irrigation system to avoid farmers switching to flood irrigation.
- Amendment of the relevant civil work.
- Establishment of WUAs to bring about effective participation of the associated farms in tertiary and on-farm water system management and to secure sustainability (Fawzy, 1999).

3.3. SUMMARY OF THE MAIN PROBLEMS OF THE WATER USERS AND THEIR ORGANIZATIONS IN THE AREAS OF PROJECT

3.3.1. Introduction

The four domains of ISIIMM-Egypt had different positions concerning organizing water users in formal organizations at the inception stage of ISIIMM. WUAs were established, with very wide degrees of accuracy and functionality, in three areas; Menia, and Behera within the context of the IIP and through the IFAD rural development project in Nubarya. There were no WUas in the Fayoum project site at the inception stage of ISIIMM project. Members of the WUAs were mainly farmers, except in Nubarya where they were new graduates.

Members are in charge of the operation and maintenance of the improved mesqas and their related irrigation pumping stations that deliver water, mostly, to their WUAs. This happened very recently, in 2004, with the water users associations (WUAs) in the Behera site and ten years ago in the Menia site. In Nubarya the Water Users Unions (WUUs) were established on the secondary canal levels. The case in Fayoum is different since the Local Water Boards, which include all water users in addition to farmers, were planned to be established on the canal level but according to a protocol of agreement ISIIMM took over this responsibility from the CD-IAS in Fayoum during the site selection stage.

During the exploratory phase the main problems of the irrigation management were explored by the baseline survey. An inventory of the main constraints facing the irrigation management and related organization in the selected sites are shown below;

3.3.2. Institutional Constraints

1. Central management of the irrigation process is quite well known and even accepted by the farmers along the whole history of farming in Egypt due to several historical reasons. However, this approach proved inadequate for efficient and effective irrigation system under the global changing conditions of farming and liberalization process.
2. Legal status of the WUAs established in the old lands is controlled and supported by the internal regulations of MWRI but do not have independent legal status supported by the law. This is different from the WUOs established in the Nubarya which is called Water Users Union (WUU) which is controlled by different items in the law that gives them independent legal status. This gap was intended to be recovered by the new irrigation law under legislation process in the parliament for several years.

3. In general, establishment of the WUOs was based on quite different levels of application of the real democratic approach. WUOs established at the early stages of the improvement projects took more time and efforts to convince farmers with the idea. Organizations established later were allocated less time and efforts to convince farmers so they had more problems.
4. Mostly there were more regular and effective meetings held with farmers before establishment of the WUOs in the early stages of implementation of the irrigation improvement projects (IIP). Disperse, few, irregular and less effective meetings were held in the later period of the IIP project. This was due to the wider expansion of the project, lack of the number of experienced personnel than needed and the time pressure exposed by donors on the number of association to be established within the life span of the project.
5. Members of the WUOs are less motivated to attend the meetings due to the lack of self motivation and some other different social reasons. Farmers, especially in Egypt as a developing country, neither accustomed nor prepared for formal pattern of organization in their daily social life. Most of their activities are organized informally except that relted to their relationship with state authorities. Formal organization of WUAs imposed on the farmers by IIP needs intensive capacity building and awareness campaigns that irrigation authorities con not separately afford for financial, time limit, type of adopted approach and technical constrains.
6. Members of the boards of the WUOs and specially the secretaries of the associations have little experience with preparing the agenda of meeting, documentation of meetings and the communication skills needed to deal with the members.
7. Few WUOs maintain good documentation of the meetings, if there is any, while there is no monitoring of the actions related to the decisions taken.
8. Most treasurers do not record inputs and expenditure. They lack experience even in simple bookkeeping.

3.3.3. Social Constraints

1. In general there is a historical lack of trust between the state irrigation personnel and the farmers due to the authoritative approach applied in the central pattern of management of irrigation systems. Supremacy of the technical view in the management process dominated all the time except in the last two decades. In the far past irrigation personnel were considered form the elites and top officials in rural areas who should not be argued and got all respect in rural areas until several decades ago.
2. Members of WUOs had negative attitudes towards sharing the costs of operation and maintenance especially of the irrigation branch canals. This is due to their past experience with management of irrigation under full supervision of the state irrigation agencies that dealt with such canals as fully state ownership.
3. In the case of WUAs in Menia there were no real associations established due to complicated historical organizational and administrative conditions preceded establishment of these WUAs.
4. Low rate of participation of members in the few meetings of WUOs due to the reasons mentioned before.
5. Lack of monitoring and evaluation of the activities of WUOs.

3.3.4. Technical Constraints

In many cases WUAs have several technical problems with the operating of pumping stations and the civil work at the delivery stage of improved mesqas to the users in addition to other problems such as the following:

1. Design of some *meqas* seem improper from the farmers point of view. This reflected relaxed application of the seven well designed stages and related institutional dimensions hypothetically adopted by the IIP authorities for establishment of WUAs.
2. In case of long improved *mesqas* that cover more than 100 feddans more problems and disputes among farmers occurred. This is due to some technical problems that occur and affect management of the irrigation process at that level. Clear relationships were found between the number of farmers and/or the length of *mesqas* and frequency of occurrence of disputes.
3. Implementation of the IIP was relatively very slow due to some economic crises encountered by the contractors in general and the internal small and mostly low qualified contractors who were responsible about the direct construction of the civil works.

4. THE LOCAL CONTEXT OF COMMAND AREAS OF ISIIMM SITES IN EGYPT

4.1. HISTORICAL BACKGROUND OF IRRIGATION SYSTEMS IN THE ISIIMM DOMAIN AREAS IN EGYPT

4.1.1. Historical Background of Irrigation System of *Seila* Canal in Fayoum

As mentioned in the previous chapter, irrigation in Fayoum, before construction of the Aswan Dam, was based, as in the rest of Egypt's lands, on basin irrigation depending on annual flood of the Nile River. Since operating of the Aswan Dam in 1902 the majority of irrigation system has changed to permit perennial irrigation all over the year whenever water is available.

Fayoum gets its irrigation water from Bahr Yusuf canal through Al-Ibrahimia principal canal which is fed directly from the Nile River by "AL- Lahoon" regulator (about 284 Km from Dairout). Fayoum is allocated 2.5 BM^3 / year of water from the Nile River.

Qaruon Lake area is 55000 feddans and Rayan Lake is 35000 feddans. Both lakes are considered as the main outlet gates for the agricultural drainage water from cultivated lands in Fayoum.

Water feed the entire irrigation network from Bahr Yusuf canal to all lands in Fayoum through Hassan Wasef and Wahba main canals. Due to the nature of Fayoum land as a depression where the slope from South to North is 67 meters along a distance of 35 Km to Qaruon Lake, most of Fayoum lands are irrigated by gravity which is controlled by regulators or weirs (Hadarat) across Wahba canal for East Fayoum and Hassan Wasef for the West. Wahba canal is under the management of irrigation inspector of East, which is under the supervision of Fayoum irrigation general director. Continuous flow of water in the branch canals, controlled by weirs, is allocated to each basin on a weekly basis through specific designed vents to permit irrigation all the day around.

Water distribution among farmers during the week depends on (*AL-Motarfa*) system. This system was invented informally but is approved officially by the irrigation authorities. It is in operation for several decades since shifting to the perennial irrigation. Land share of water (*tarf)* is considered a water right which is protected across generations. When land is inherited or sold it is accompanied by its own *tarf*.

The volume of water for each area is estimated according to the following formula:
Weekly time period for irrigation per feddan (per hour/or minute) =168 (the total hours of the week) divided by the served area (by feddan). Each farmer is allocated the irrigation water time for his land, in minutes, across the week accordingly.

Seila primary canal is fed directly by Wahba canal. Both are controlled by irrigation administration of Fayoum governorate. Seila canal is under direct management of the district engineer of Seila, who, in turn, is under the supervision of the irrigation inspector of the East branch. Secondary canals are under the management of the district engineer.

Water is distributed to the farms through vents (see figure 12), which control the amount of water to be allocated to the area served by its fixed design.

In order to fix and control the amount of irrigation water, allocated for a specific served area, two main measures, for the design of vents, are used; the width of the off take (vent) and the height of the water level in the canal.

The responsibility of the irrigation authority is to insure the level of water in the canal, which automatically would permit the specified quantity of water to flow to the served area. Distribution of the allocated water at the vent level is fully the responsibility of water users (farmers) according to the *Motarfa* system.

However, areas served by vents are varied. A relatively large number of vents (40 vents) are serving relatively small areas (up to 50 feddan), compared with relatively small number of vents (4 vents) are serving relatively large areas (more than 300 feddan). These variations do not affect distribution of the water according to the *Motarafa* system by adopting different diameters for the vents to allow the allocated water to flow within the allocated time, given there is no other barrier of the water flow or violations among farmers which are relatively low except in summer. Areas cultivated by rice mostly violate assigned area by authorities which lead to more opportunities for conflict among farmers in summer. This situation necessitates compromise and the mediation role of the new water users association in the area.

New system of drainage such as the tillage (sub-surface) was established in Fayoum. This has affected the levels of irrigation water needed and the cropping patterns adopted.

4.1.2. Historical Background of Irrigation System of *Mantout* Canal in Menia

Basin irrigation was the technique applied by farmers in Mantout area as the case in the whole region since the pharaohs' era. This technique changed to perennial irrigation partially after the establishment of the Ibrahimia canal in 1873. The canal flows in the high beach in parallel with the Nile heading north till Dirout city where the Dirout barrage was built 60 km from the start of Ibrahimia canal. As shown in figure 15 Serry Principal canal which provides Mantout canal with water gets its water before the Hafez regulator on Ibrahimia canal. The whole irrigation system in this region was getting better in 1902 after construction of the Assuit barrage to raise water level before the gate of Ibrahimia canal with more than five meters. Thus the canal helped securing enough water to the region especially during the years of medium or low floods.

With the first rising of Aswan dam in1912 and the second 1933 the whole Mantout area was transformed from basin irrigation to perennial irrigation. This included expansion of the irrigation system to all farms in the area. Private canals were established to irrigate the whole area in Mantout. Water was transferred to these canals by lifting water from the public canals to the private canals by more than dozen wheels, *Sakkyas,* in the whole area. Most of the area was cultivated by sugar cane besides expanding the cotton cultivated areas.

In this period between 1969 and 1985 the private canals in the area were transformed into irrigation branches and became under the supervision of the Ministry of Irrigation. The

ministry modified these canals to become as main canals so the irrigation system in the area became more stable. The number of wheels, *Sakkyas,* was declining gradually until they almost disappeared. The triple shift system started at this period which were 5 working days on and 10 days off.

After construction of the High Dam the in the late sixties summer crops varied and most of the region, about 80% of the area, was cultivated by sugar cane in addition to Potatoes as vegetable, cotton, corn, wheat and bersim (clover) in the rest of the area.

Since 1994 the whole Mantout area was added to the IIP area as previously mentioned in chapter three. Individual rather than group management of irrigation system in Mantout area still dominates until now regardless of all sporadic efforts to shift to the group type of management. Such shift needs a comprehensive and long term plan to persuade all farmers supported by the state authority involvement.

Nowadays, the area cultivated by sugar cane, cotton, potatoes and similar traditional crops are declining. Sugar cane is occupying only 15% of the whole area and so is cotton. This period witnessed the cultivation of other non-conventional types of crops such as Soya bean, some aromatic and medical plants, onion and garlic and more vegetables even under tunnels in winter. Perennial irrigation has led to rise of the groundwater and deterioration in the land fertility which led to the introduction of the tillage drainage system that became inevitable for improving the soil fertility.

4.1.3. Historical Background of Irrigation System of *AlRezqa* Canal in Behera

In 1920 all the area east of the railway and the agricultural road from Cairo to Alexandria in the current domain of *AlRezqa* canal was irrigated by a canal Called *Karawi* Canal. Since the twenties of the last century the owners, who belonged to about seven big families, reclaimed new lands west of the railway and the road. The added area was provided by water through a sub-tube extended under the railway and road. In the 1930s the owners of the newly reclaimed lands applied to the Ministry of Public Works (MPW) to expand the canal to irrigate their reclaimed lands west of the road. In 1940 the new canal was established and called *AlRezqa* branch canal to replace the old one with its intake from *Mahmoudia* canal across a bigger sub tube. The cultivated area expanded west were divided among few big farms of hundreds and thousands of feddans owned by the big families along with small farmers owned between 2 to 7 feddans each. However, expansion of reclaimed lands out of the domain of *AlRezqa* has led to establishment of other new branch canals in parallel to *AlRezqa*.

AlRezqa under railways **AlRezqa under the road** **AlRezqa crossed the road**

Figure 20. AlRezqa canal crossing the railway and agricultural road at Mostapha Agha Village now

Since the 1920s water was delivered to the branch canals by rotation of equal periods (4 days ON and 4 days OFF). Irrigation water was sufficient for the low number of owners and small area at that time regardless of the variation of the size of farms. Irrigation applied was by gravity. After establishment of *AlRezqa, the Sakkya*s (small water wheels) powered by animals were the main irrigation tool to lift water from the canal to the *Mesqa* (tertially canal) which convey water to each farm. One feddan needed one full day to irrigate by *Sakya*. Each *Sakkya* was allocated an area between 10-15 Feds and was operated by farmers' animals while maintained collectively. Some small farmers used *Tanbour* (the screw) which would irrigate 5-10 Qirats daily (see Figure 21).

Figure 21. Animal powered Sakkya still operating in AlRezqa area until the millennium in areas uncovered by the IIP and the Tanbour used in the past

Old farmers in the area of each *Sakkya* agreed, informally, upon dividing the period of the 4 days ON of the rotation by the area allocated. Each feddan was allocated about 4 to 6 hours each rotation. Each farmer had to respect the schedule and their allocated time whether day or night. *Sakkya* rings were established as informal social organizations to take care of the management of local irrigation process. They had unwritten but effective informal regulations to control irrigators' behavior and manage disputes and conflicts over irrigation scheduling and other related issues. Night irrigation was a practice applied during that period

to get full benefit from the allocated time and due to the privilege of irrigation evening and night to avoid high evaporation of water especially in summer.

By the mid fifties all big farms more than 200 feddans were divided among more small farmers by application of the agrarian reform law enacted by the 1952 revolutionary regime. Many landless farmers were allocated five feddans each and thus were added as new water users. Early in the sixties no individual farm exceeded 100 feddans. Irrigation by *Sakkya* continued afterwards while few big farmers started using tractors instead of animals in operating bigger *Sakkyas*.

a) Irrigation system in the sixties and seventies
Due to the inheritance norms and laws the number of land owners increased drastically and the main irrigation tool was the *Sakkya* but with many new big ones operated by tractors. However, because of the growing number of fragmented smaller farms and their owner farmers new institutional problems occurred concerning the irrigation scheduling and allocated time per farmer and feddan.

By the mid-seventies many farmers started replacing the *Sakkya* by pumping machines to save time and efforts. However, the investment costs of machines were very expensive. So some farmers bought machines and rented them to other farmers. Meanwhile, the scheduling arrangement of irrigation maintained to some extent valid.

b) Irrigation system in the eighties and nineties
Across time the fragmentation of lands intensified. Increasing number of farms along with the spread of private pumping machines had resulted in adopting the individual approach of solving irrigation problems. Farmers' respect of the scheduling arrangement relaxed seriously while the farmers in head tail of *Mesqas* operate their pumping machine longer time and cultivate high consumption water crops such as Rice leaving farmers at the end tail suffering from shortage of water if got any. As a result more conflicts and disputes occurred among farmers; the big against the smaller, the rich against the poorer and at the head tail against the end tail.

c) Irrigation system from 1999- till now
IIP started to improve all *Mesqas* across the canal according to the stages mentioned in chapter three. All framers share one *Mesqa* were obliged, by law, to participate in one pumping station of one to three pumping machines according to the capacities needed to irrigate the whole area during the rotation On days. The IIP replaced old *Mesqas* mostly by buried tubes or J section raised surface channel as mentioned previously in the MWRI irrigation policy. All civil works had to finish by 2004 and the irrigation rotation had to shift to a continuous flow. Neither of these two objectives was fully achieved in spite of the strong intervention of ISIIMM through its networking with the MWRI agencies at various levels until the end of ISIIMM due to several internal and external economic and institutional complicated reasons.

d) The Water Rotations in the Canal
There are two rotations in *AlRezqa*, triple and double. The triple rotation is used in summer season (6 days on 4 days off) while the double rotation is used in winter season (5 days on 10 days off). Water needs of cultivated crops are less in winter than in summer. That is why the

water is made available for irrigation in 33% of the time of longer period of the rotation (15 days) in winter while it is made available in 60% of the time of shorter period of the rotation (10 days) in summer.

4.1.4. Historical Background of Irrigation System of *Regwa* Canal in Nubarya

The history of Regwa canal goes back to the eighties where the area was included in the expansion of land reclamation into this desert area. After establishment of all physical infrastructures in the area the public owned company in charge started allocating and selling the reclaimed lands to three main categories of beneficiaries; the new graduates (12.5%), the land reclamation cooperatives as small investors (12.5%) and the rest of the area for the medium and large investors. This was in consistent with the state policy since the late eighties to liberalize the agricultural sector by encouraging all levels of investors while not forgetting the socio-economic and political dimensions by providing more job opportunities to the new graduates in the newly reclaimed lands.

Settlements and accommodation infrastructure were constructed only in the areas allocated to the new graduates. Other areas have no settlements except sporadic constructions for machinery, administration and employees in the farm.

Irrigation in Nubarya follows the state regulations to restrict irrigation techniques applied in the reclaimed desert lands to the modern techniques; dripping, sprinkler and sub soil.

Figure 22. Modern pressurized irrigation techniques applied in newly reclaimed desert lands

4.2. BASIC CHARACTERISTICS OF DOMAIN AREAS OF ISIIMM-EGYPT AND THEIR IRRIGATION SYSTEMS

4.2.1. Rural communities covered by ISIIMM activities in Egypt

ISIIMM project covered four areas in four regions: Menia, Fayoum, Behera and Nubarya. As shown in table 8 the project areas include 96 villages most of them exist in Fayoum (58), Menia (31), Behera area include only 6 villages while Nubarya representing the new land is represented in the project by only one village. The total rural population in the covered area is about 178 thousand; 74,000 in Fayoum, 64,000 in Menia, 40,000 in Behera and 1,250 in Nubarya.

Densities of population in the rural areas covered by ISIIMM, at the inception of the project, were different among the four regions. It was the highest in Behera governorate with an average of about 6450 inhabitants per village, against about 2072, 1272 and 1250 in Menia, Fayoum and Nubarya respectively. This reflected almost the same trend of densities of population in the concerned regions except Fayoum had more density than Menia. Corresponding densities per km^2 at the governorates level in 2003 were 468.6, 390.9 and 122.7 inhabitants in Behera, Fayoum and Menia respectively (Human Development Report of Egypt, 2005, p. 229).

Table 8. Distribution of villages by population number in the project areas

Number	Area of the Project									
	Fayoum		Menia		Behera		Nubarya		Total	
	Num	%	Num	%	Num	%	Num	%	Num	%
Less than 5000	56	96.5	26	83.9	3	50	1	100	86	89.6
5000-	0	0	4	12.9	1	16.6	0	0	5	5.2
10000-	2	3.5	1	3.2	2	33.4	0	0	5	5.2
20000-	0	0	0	0	0	0	0	0	0	0
Total Villages	**58**	**100**	**31**	**100**	**6**	**100**	**1**	**100**	**96**	**100**
Av. No. of population	1272		2072		6450		1250		1857	
Total population (000)	74		64		39		1.25		178.3	

Source: Calculated from the ISIIMM database

4.2.2. Characteristics of the tertiary canals served areas

In this section the characteristics and conditions of the served areas and farmers on the tertiary canals, *mesqas*, which provide their farms directly with the needed irrigation water, will be explored from the following aspects; the cultivated area served by *mesqas*, the average farm size in the domain of each *mesqa*, the length of *mesqas*, the membership of each WUA or number of farmers served by each *mesqa*, and the type of improvement of the tertiary canals, *mesqas*, in the areas covered by the IIP project mainly in Behera, including Nubarya and Menia.

a) The cultivated area served by mesqas

With respect to the areas served by *mesqa*; table 9 presents distribution of *mesqas* in the project areas accordingly. Areas served by *mesqas* in Menia are generally smaller than those in Behera; about 69% of *mesqas* in Menia cover areas that are less than 40 feddans compared to only 27% in Fayoum and 19% in Behera. Nubarya region is distinguished in that all *mesqas* are covering large areas that exceed 140 feddans each while only 33% of the *mesqas* in Fayoum and 21% the *mesqas* in Behera serve areas exceed 100 feddan each.

Table 9. Distribution of mesqas by served area in the project areas

Mesqa served area (Feddan)	Area of the Project									
	Fayoum		Menia		Behera		Nubarya		Total	
	Num.	%	Num.	%	Num.	%	Num.	%	Num.	%
Less than 20	15	14.7	34	16.3	2	3.8	0	0	51	13.9
20-	13	12.7	109	52.4	8	15.4	0	0	130	35.5
40-	17	16.7	51	24.5	14	26.9	0	0	82	22.3
60-	14	13.7	11	5.3	6	11.5	0	0	31	8.4
80-	9	8.8	3	1.5	11	21.2	0	0	23	6.3
100-	9	8.8	0	0	5	9.6	0	0	14	3.8
120-	6	5.9	0	0	1	1.9	0	0	7	1.9
140+	19	18.7	0	0	5	9.7	5	100	29	7.9
Total	**102**	**100**	**208**	**100**	**52**	**100**	**5**	**100**	**367**	**100**

Source: Calculated from the ISIIMM database

This situation entails specific conditions on the management of the large *mesqas* which are likely to experience more sources of disputes and conflicts if this area is distributed among big number of small holders.

b) The membership of WUA or served number of farmers

As mentioned above the number of farmers sharing one source of irrigation water has direct relationship with the potential of conflicts. Table 10 shows the distribution of *mesqas* in the four regions according to that criterion.

Table 10. Distribution of mesqas by membership (served farmers) in the project areas

Size of Membership	Number of WUAs or Mesqas							
	Behera		Nubarya		Menia		Fayoum	
	No.	%	No.	%	No.	%	No.	%
Less than 15	28	53.9	0	0	32	15.4	44	43.1
15-	12	23.1	0	0	79	38.0	23	22.6
30-	10	19.2	0	0	66	31.7	19	18.6
45-	2	3.8	4	80	21	10.1	7	6.9
60-	0	0	1	20	6	2.9	3	2.9
75+	0	0	0	0	4	1.9	6	5.9
Total	**52**	**100**	**5**	**100**	**208**	**100**	**102**	**100**

Source: Calculated from the ISIIMM database

Distribution of *mesqas* in the four areas shows that the majority of *mesqas* serve members less than 30 where this category represented about 77% of the *mesqas* (WUAs) in Behera, 65.7% in Fayoum and 53.4% in Menia. No WUA in the new lands in Nubarya had less than 45 members. Yet, there were 15.7% of the mesqas in Fayoum and 14.9% of the WUAs in Menia and only 3.8% in Behera had more than 45 members. The linkage between the served area and number of members could be better illustrated when using the distribution of *mesqas* according to the average farm size as follows.

c) The membership of female farm holders in the WUAs/mesqas

Table 11 shows the data concerning the female members in the areas of ISIIMM in Egypt. It is clear that the areas that have more female farm holders as members in the WUAs or female farm holders on the *mesqas* are in Nubarya (80%) then Behera and Menia (53.8% and 53.4% respectively) and at last in the Fayoum area (44.1%). This situation does not reflect any significant differences among the three areas of the old lands but clearly significant differences between the areas in old and new reclaimed land. The policy adopted by the state in allocation of new reclaimed lands to new graduates took into consideration relatively more equal statuses for both sexes when applying for getting new reclaimed lands if there is an interest of female graduates to benefit from such lands. However, the interest of female new graduates is generally less than that of the males due to social and cultural reasons. The situation improves in the case of married females.

Table 11. Distribution of mesqas by female membership (served female farm holders) in the project areas

No. of female members	Number of WUAs or Mesqas									
	Behera		Nubarya		Menia		Fayoum		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
Zero	24	46.2	1	20	97	46.6	57	55.9	179	48.8
1-	23	44.2	4	80	79	38.0	34	33.3	140	38.2
5-	5	9.6	0	0	27	13.0	9	8.8	41	11.1
10-	0	0	0	0	5	2.4	1	1.0	6	1.6
20-	0	0	0	0	0	0	1	1.0	1	0.3
Total	**52**	**100**	**5**	**100**	**208**	**100**	**102**	**100**	**367**	**100**

Source: Calculated from the ISIIMM database

d) The average farm size of the area served by mesqas

Table 12 shows that about 95% of the total number of the *mesqas* in Menia serve landholdings that are less than 3 feddans, compared with 50% in Fayoum and 43% in Behera. The Nubarya region has a unique situation since all landholdings were between 5 and 10 feddans and all of them were, and still, graduates.

These data goes along with the fact that poor segment of population, which is represented here by access to land holdings, is more in Upper Egypt than other areas.

Table .12. Distribution of WUA/Mesqas in the project areas according to average farm size

Average Farm Size (Feddan)	Area of the project									
	Fayoum		Menia		Behera		Nubarya		Total	
	Num.	%	Num.	%	Num.	%	Num.	%	Num.	%
Less than 1	7	6.9	84	40.4	1	1.9	0	0	92	25.1
1-	44	43.1	114	54.8	21	40.5	0	0	179	48.8
3-	24	23.5	7	3.4	11	21.1	0	0	42	11.4
5-	16	15.7	3	1.4	7	13.5	5	100	31	8.4
10-	5	4.9	0	0	1	1.9	0	0	6	1.6
15+	6	5.9	0	0	11	21.1	0	0	17	4.7
Total	**102**	**100**	**208**	**100**	**52**	**100**	**5**	**100**	**367**	**100**

Source: Calculated from the ISIIMM database

e) The length of mesqas

Table 13. Distribution of mesqas by their length in the project areas

Length of Mesqa (meter)	Area of the project									
	Fayoum		Menia		Behera		Nubarya		Total	
	Num.	%	Num.	%	Num.	%	Num.	%	Num.	%
Less than 250	0	0	8	3.9	6	11.5	0	0	14	3.8
250-	5	4.9	71	34.1	12	23.2	0	0	88	24
500-	11	10.8	112	53.8	22	42.3	0	0	145	39.5
1000-	14	13.7	13	6.3	2	3.8	0	0	29	7.9
1250-	8	7.8	3	1.4	3	5.8	0	0	14	3.8
1500-	12	11.8	1	0.5	2	3.8	0	0	15	4.1
2000+	52	51	0	0	1	1.9	5	100	58	15.8
n.a	0	0	0	0	4	7.7	0	0	4	1.1
Total	**102**	**100**	**208**	**100**	**52**	**100**	**5**	**100**	**367**	**100**

Source: Calculated from the ISIIMM database

The length of *mesqas* reflect some physical feature of the water channels that is likely to impose some burden of the efficiency of the whole irrigation system as well as on the management and costs of operation of that system.

Data in table 13 reveals that the majority of *mesqas* in Menia, 91.8% are less than l km in length while the corresponding percentage was 77% in Behera against only 15.7% in Fayoum. Thus the situation was on the contrary where all *mesqas* were even more than 2 km in Nubarya and more than 84.3% of the *mesqas* were longer than 1 km in Fayoum against 33% in Behera and only 8.2% in Menia. This is a well known phenomenon where in Upper Egypt the small width of the Nil Valley affects the length of water channels to become, generally, shorter.

f) The type of improvement in the regions covered by the IIP

Table 14 shows the total number of improved *mesqas* in the project areas which reached 265 *mesqas*. These *mesqas* are located in three regions; Menia (208), Behera (52) and El Nubarya (5), while there was no improved *mesqas* in Fayoum where *mesqas* are still traditional.

Table 14. Distribution of improved mesqas in the project areas according to type of improvement

Type of Mesqa	Area of the project						Total	
	Menia		Behera		Nubarya			
	Num	%	Num.	%	Num,	%	Num.	%
J-Section	119	57.2	1	2	0	0	120	45.3
Pipe line	89	42.8	51	98	3	60	143	54
Mix b)	0	0	0	0	2	40	2	0.7
Total	208	100	52	100	5	100	265	100

Source: Calculated from the ISIIMM database

a) Fayoum is not included because it has no improved mesqas.

b) Part of this mesqa is pipe line while the remaining is J-section.

The buried pipeline *mesqas* have proved better in terms of maintenance and irrigation efficiency than J-section raised *mesqas*. Table 13 shows that in Menia the majority of mesqas (57%) are J-section and the rest (43%) are pipeline *mesqas*. In Behera almost all *mesqas* except one are pipeline**s.**

g) Cropping pattern in the area

Cropping pattern is an important issue regarding the water management as a whole. Types of crops determine to great extent the pattern of consumption of irrigation water and meanwhile the expected output per unit of water. On the other hand variations in cropping pattern at the mesqa level contribute to the complexity of irrigation water management especially for the WUAs. However, the cropped cultivated land ratio-representing the intensification rate- was almost the same in the three governorates where they were 1.8, 1.8 and 1.7 in Behera, Fayoum and Menia in 2003 respectively (Human Development Report of Egypt, 2005, p. 229). This rate is less in Nubarya where they have more perennial crops and mainly fruits.

Table 15 presents the cropping pattern which is dominant in three of the project areas, Menia, Behera and Nubarya. Detailed date was not available in Fayoum. Total cropped areas in Menia, Behera and Nubarya amount to 13.9, 7.6 and 1.7 thousand feddans respectively. Wheat and berseem (Egyptian clover) was and still the main crop in winter season in both Menia and Behera.

Recently there are trends to substitute the traditional crops in improved areas with more cash crops that have more potential for marketing, export or industrial value. On the contrary to this trend Cotton cultivated areas in Behera and Fayoum and Sugar cane areas in Menia are shrinking for economic and political reasons. Rice areas are increasing in Behera and Fayoum in violation to all state regulations and in spite of the increasing rates of fines for such violation. This pushed the state authorities lately to ban export of Rice to restrict the irrational trend to increase Rice cultivated areas.

Table 15. Cropping pattern in the project areas according to the cropping area in 2004

Crop	Nubarya		Behera		Menia		Fayoum
	(Fed)	%	(Fed)	%	(Fed)	%	
Winter							
Wheat	360	21.1	1366	18.1	2907	20.9	n.a
Clover	110	6.5	1849	24.5	2545	18.3	n.a
F. Beans	-		544	7.2	-		n.a
S.beet	300	17.6	-		-		n.a
Others	-		-		1421		n.a
Total Winter	**770**	**45.2**	**3759**	**49.8**	**6873**	**49.4**	
Summer							
Cotton	-		1798	23.8	436	3.1	n.a
Rice	-		1396	**18.5***	-		n.a
Tomato	130	7.6	548	7.3	-		n.a
Maize	-		-		4714	33.8	n.a
Groundnuts	410	24.0	-		-		n.a
Others	150	8.8	-		1479	10.6	n.a
Total Summer	**690**	**40.4**	**3742**	**49.5**	**6629**	**47.6**	
Nili maize	-		56	0.7	-		n.a
Trees	245	14.4	-		-		n.a
S. Cane	-		-		427	3.0	n.a
Total Cropped A.	**1705**	**100**	**7557**	**100**	**13929**	**100**	**n.a**
Land area	**875**		**3806**		**7178**		

Source: Calculated from the ISIIMM database

*Area cultivated by Rice in Behera exceeds 50% of the cultivated area in summer by the end of ISIIMM project in 2007.

5. MANAGEMENT AND ACHIEVEMENTS OF ISIIMM IN EGYPT

5.1. GLOBAL OVERVIEW OF ACTIVITIES ACHIEVED BY ISIIMM-EGYPT

The kick off of activities of ISIIMM in Egypt was launched by the visit of the head of the project and his Deputy coordinator to Egypt early May 2003. This included the first field visits to two of the areas suggested as field work sites and meeting with the recommended scientific committee, nominated regional facilitators and development and governmental partners of the project in Egypt. Since that moment the national team has been undertaking the following activities under the three phases of the project.

5.1.1. Phase 1: Collection and Organization of Knowledge

This phase included inception of the project activities in Egypt and implementation of all tasks needed for collection and organization of the knowledge related to local management of irrigation in the selected sites of work in the project. This included the following activities:

- Formulation of the national scientific advisory committee (NSAC) of the project.
- Setting up the organizational structure of the national team
- Setting up the job description and related tasks for each post in the organizational structure of the national team,
- Staffing (selection of and contracting with the 3 regional facilitators and their 10 assistants)
- Orientation of the national team with the project objectives and recommended methodology
- Setting the criteria of selection of the work sites according to the project objectives by NSAC,
- Collection of basic data about alternative sites according to the set criteria,
- Making final decision and selecting four work sites instead of three by NSAC This ensured selection of strictly four different schemes of irrigation that represent the majority of irrigation conditions in Egypt; the Nile valley in Menia, the Nile delta in Behera old lands, the depression areas in Fayoum and the newly reclaimed desert lands in Nubarya. At the time of inception of the project irrigation technique used was and still flooding in all areas except in Nubarya which applies pressurized irrigation. In the Fayoum selected site flood irrigation by gravity follows a historically special informal system called *"Motarfa"*. In Behera selected site irrigation system was under reconstruction applying a new design taking into consideration both physical and organizational perspectives within the context of a pilot project for improvement of irrigation. But irrigation in Menia selected site applied physical improvement since 1996 but without much attention to the organizational perspectives.
- Surveying the potential stakeholders at regional and local levels in the selected areas,
- Establishing networking with regional stakeholders (MWRI representatives),
- Approaching the local communities (identification of main local leaders and early networking at local level),

- Logistical arrangements at the local level (contracts with local NGOs and establishing local station-Offices for the project in all the four work sites),
- Design of survey data collection tools and their field pre-testing
- Field data and information collection using semi-structured schedules and participatory approach around the main axes of the project in each working site. This survey addressed the existing local irrigation systems and their related hydraulical framework, the agricultural setup, the socio-economic setup and the administrative affiliations and the irrigation related problems and their priorities from local and historical perspectives. Data collection was achieved at three levels; the regional (governorate), the local community (village) and the irrigation channel (tertiary level) known as *Mesqa* level.
- Electronic processing of the field data collected from primary sources.
- Construction of Baseline Data based on both primary and secondary resources data.
- Setting an internal managerial system for the Egyptian team to enhance coherence among activities and decisions taken at both national and regional levels. This includes the following periodical meetings and reporting;
    - Monthly meeting for all regional facilitators and the national coordinator in the headquarter and on rotation basis among the four site offices to coordinate activities, making decisions concerning part or all the group and disseminate latest information and news,
    - Annual plan of action based on application of the participatory approach with the local actors specially farmers,
    - Monthly regional achievement and planning brief reports,
    - Periodical, mostly quarterly, field visits to the sites by the national coordinator and interested members of the scientific committee. This arrangement accompanied with similar visits the members of the monitoring committee.
- Thorough studies of the local conditions through expert field studies covering all related areas through; Survey of the Projects and Previous Studies In Local Irrigation Management In Egypt, The Social and Gender Constrains of Integrated Local Water Resource Management, the Economic Factors Affecting Integrated Local Water Management: The Case of Water User Associations in the Domain Areas of ISIIMM-Egypt and The Socio- Cultural Aspects of Integrated Local Water Management: The Case of WUAs in the three areas of ISIIMM – Egypt
- Disseminating early results of the survey to local communities in the work sites (through local group meetings).
- Understanding main contradictions, their causes, potential impacts and possible intervention actions through the stakeholders meetings in the regional seminars.

5.1.2. Phase 2: Mutual Learning activities (from diagnosis to action)

The activities of ISIIMM-Egypt during this phase has fully benefited from all the knowledge and information gathered during the first phase. Effective use of these resources helped in achieving several goals related directly or indirectly to the main objectives of ISIIMM. This included several forms of mutual exchange of experience through local, regional, interregional and international meeting and seminars to reach common understanding

among partners, alleviation or elimination, if possible, of the sources of contradiction or conflict among stakeholders and supporting sustainable setup of irrigators' organizations and related networks to take care of tackling irrigation problems after termination of ISIIMM project. This phase included intensive activities that included the following:

- Strengthening networking with main stakeholders in irrigation management at the national level through establishment and regular meetings of the supreme national coordination committee with key MWRI representatives,
- Advocating participatory planning of local actions through intensive local stakeholders meetings and annual seminars at regional and national levels,
- Technical support by the ISIIMM-Egypt staff for establishment of new local community based organizations (WBs and CDA)
- Active exchange of knowledge between the Egyptian and French ISIIMM partners through the North-South (Durance-Rezqa) back-to-back exchange seminar in March 2005,
- Capacity building of WUAs and local communities (through interregional training activities and regional seminars and meetings that included 2 training sessions about the management skills for 42 of the WUAs leaders in the four areas and 2 training sessions about operation and maintenance of the irrigation pump stations of 20 operators in Behera and Menia in 2006)
- Preparation of audio-visual materials for documentation of all activities of the project.
- Mutual exchange of experience among the irrigators and their organizations through the annual seminars at the international and interregional levels,
- Disseminating knowledge acquired and learned experiences through; a) two annual regional seminars in each site in 2005 and 2006 attended by all regional stakeholders with representatives from the other three sites to encourage interregional exchange of experience, and b) participation in irrigation management related meetings and seminars at national and international levels.
- Supporting training activities of interested young scholars and students at the local, national and international levels through training of Masters degree students in IRD in spring 2004, and Summer training of specialized undergraduate students from Cairo University in 2006 and supporting 2 graduate students one French who completed her M.Sc. degree while the second is Egyptian who pursue her Ph.D. in rationalization of irrigation behavior at local level.
- In-depth case studies at the local level of work sites through 5 case studies addressing; In-depth Case Studies of Local Conditions Affecting Irrigation Water Management in ISIIMM Egypt's Sites-Fayoum, In-depth Case Studies of Local Conditions Affecting Irrigation Water Management in ISIIMM Egypt's Sites- Menia and Behera, Economic Efficiency of WUAs and Applied Irrigation Systems in ISIIMM Egypt's Sites, Evaluation Of On-Farm Irrigation Systems' Efficiencies iIn ISIIMM Egypt's Sites, and Evaluation of Demand Management for Water Conservation in ISIIMM Egypt's Sites.
- Preparation of three pr-feasibility studies for solid waste management at the community level in three sites; AlBerba in Menia, Seila in Fayoum and Mustapha

Agha in Behera. This helped in assessment of the most feasible area for implementation of the micro project that was undertaken later on in Mustapha Agha village.

- Building capacities of the ISIIMM-Egypt staff through specific training program addressing; the presentation skills, the GIS application and the reporting skills.
- Active intervention based on the utilization of the gathered information and knowledge in enhancement of the organizational and even the physical setups of irrigation management in all the field work sites of ISIIMM-Egypt. This was achieved through:
    - Supporting establishment of *new* 7 WUAs and their federation on Seila branch canal by the regional team of ISIIMM-Egypt in Fayoum,
    - Revival of the organizational setup of 22 WUAs on the tertiary canals level by the regional team of ISIIMM-Egypt in Mantout branch canal in Menia,
    - Revival of the organizational setup and completion of the physical infrastructure of the new irrigation system of 12 model WUAs on the tertiary canals level (*mesqas*) in AlRezqa branch canal by the regional team of ISIIMM-Egypt in Behera,
    - Supporting election of the representatives of 52 WUAs on the tertiary canals level (*mesqas*) on AlRezqa branch canal in Behera by the regional team of ISIIMM-Egypt in Behera in preparation for creating their branch canal WUA in future,
    - Supporting establishment of a new water board at Regwa canal level by the regional team of ISIIMM-Egypt in Nubarya,
- Launching all activities needed for preparation of implementation of the micro project of solid waste management "SWaMMA" in Mustapha Agha including:
    - Finalization of the detailed feasibility study,
    - Organizational setup at the national, regional and local levels including networking at all levels,
    - Preparation of technical specifications of equipment needed for the project for tendering,
    - Completing the lengthy process of testing, selection and procurement of equipment,
    - Training of operators on the purchased equipment,
    - Supporting local executive committee in selecting, getting approval of allocation and establishing the field site of the project
    - Launching the awareness campaign at village level,
    - Undertaking the technical training program for farmers on recycling of agricultural and household solid waste,
    - Supporting the local initiatives to establish the first community based local association for development (CDA),
    - Supporting SWaMMA local executive committee in the project management and monitoring.

Table 16a. Regional and National Seminars Held in the context of the ISIIMM-Egypt Project (second phase)

Governorate	1st regional & national seminars					
	Date	Attendees				
		Team	WUA Members	MWRI	Others*	Total
Behera (Rezqa)	20/4/04	7	12	5	2	26
Behera (Regwa)	21/4/04	5	5	4	1	15
Fayoum (Seila)	27/4/04	6	11	6	9	32
Menia (Mantout)	26/4/04	6	21	3	5	35
National	3/5/04	12	4	13	6	35
Total		**36**	**53**	**31**	**23**	**143**
Governorate	**2nd regional & national seminars**					
	Date	**Attendees**				
		Team	**WUA Members**	**MWRI**	**Others***	**Total**
Behera (Rezqa)	23/4/05	5	20	7	8	40
Behera (Regwa)	9/5/05	5	4	5	12	26
Fayoum (Seila)	11/5/05	6	18	6	2	32
Menia (Mantout)	14/5/05	5	16	4	3	28
National	31/8/05	15	10	14	15	54
Total		**36**	**68**	**36**	**40**	**180**

* Partners, assistants, and other stakeholders
** Students
*** International participants

Table 16b. Regional and National Seminars Held in the context of the ISIIMM-Egypt Project (third phase)

Governorate	Date	3rd regional & national seminars					
		Attendees					
		Team	WUA Members	MWRI& MALR	Other Partners*	(Intern.) RMSU & AGROPOLIS	Total
Behera (Rezqa)	17/7/06	7	21	4	7 +9**	0	48
Behera (Regwa)	19/7/06	4	13	4	3	0	24
Fayoum (Seila)	7/6/06	5	18	6	2	0	31
Menia (Mantout)	22/6/06	4	20	4	5	0	33
National	27-28/6/07	5	18	19	26	6***	**74**
Total		**25**	**90**	**37**	**52**	**6**	**210**

* Partners, assistants, and other stakeholders
** Students
*** International participants

*Table 17. Summary table of activities in the 2nd phase of ISIIMM-Egypt**

#	Activity	2nd year		3rd year		7th half year		Total	
		Frequency	Participants	Frequency	Participants	Frequency	Participants	Frequency	Participants
1	**Meeting of the ISIIMM staff in the HQ (CRDRS) and local sites**	**44**	**-**	**37**	**-**	**28**	**-**	**109**	**-**
2	**Meeting of the supreme national coordination committee**	**1**	**5**	**4**	**20**	**1**	**5**	**6**	**30**
3	**Meeting of the scientific committee**	**2**	**10**	**2**	**9**	**2**	**9**	**6**	**28**
4	**Meetings with the regional committees**	**76**	**-**	**91**	**-**	**57**	**-**	**224**	
5	**Joint meeting between the officials and stakeholders**	**89**	**389**	**104**	**559**	**52**	**176**	**245**	**1124**
6	**Meeting with members of the water users organizations**	**285**	**3189**	**260**	**2722**	**120**	**751**	**665**	**6662**
7	**Training activities (local and interregional)**	**0**	**0**	**47**	**386**	**12**	**48****	**59**	**434****
8	**R.F. Office works (days)**	**118**	**-**	**85**	**-**	**51**	**-**	**254**	**-**
9	**R.F. Field work (days)**	**99**	**-**	**155**	-	**94**	**-**	**348**	**-**

* Extended to the first half year of the third phase
R.F. Regional facilitators
** Some of the trainees attended 2 or more training sessions

5.1.3. Phase 3: Dissemination of knowledge and exchange of experience

The activities during this phase emphasized on completion of the activities initiated in the second phase in addition to the documentation and dissemination of the learned experiences at both national and international levels:

- Formal and official inauguration of SWaMMA in May 2006,
- Establishment of ISIIMM supported CDA of Mustapha Agha for sustainable management of SWaMMA in September 2006,
- Dissemination of learned lessons for possible impacts at national level (national coordinator of IIIMP tendency to adopt lessons learned from applied approach of ISIIMM-Egypt),
- Active exchange of learned experience between the Egyptian and Moroccan ISIIMM partners through the South-South Marrakech exchange seminar in September 2006,
- New perspectives of mutual collaboration at national and international levels (post doctoral in IAMB and preparation of educational materials for teaching and media).

5.2. SUSTAINABILITY OF ACHIEVEMENTS

Careful efforts were undertaken to insure sustainability of the activities achieved by ISIIMM in Egypt by strengthening networking and collaborative action after termination of ISIIMM and through:

- The active plan of training of actors in the WUAs on their main roles in the three sites Behera, Fayoum and Menia) during the last year, regardless of the fact that there was no budget allocated in the ISIIMM project for this purpose. The counterpart contribution of CRDRS was intensively used for this type of activities though local partners asked for more long and intensive training activities.
- joint planning of annual civil works in Seila canal by the Central Administration of MWRI in Fayoum and local WUAs is effective tool now since the support of regional team of ISIIMM-Egypt in Fayoum of this mechanism,
- a trilateral protocol among ISIIMM-Egypt, the FWMP and IAS in Fayoum for completing and building the capacities of newly established WUAs,
- a letter of support intention of MWRI-CD in Menia,
- the positive response of MALR-IFAD rural development project in replacing irrigation pump stations in graduates' area in Nubarya based on the initiated feasibility study of the regional team of ISIIMM-Egypt), and
- Transfer of the responsibility of management of SWaMMA to a special committee under the umbrella of a more endured organizational structure supported for establishment by ISIIMM (the Mustapha Agha CDA which still needs some capacity building efforts).

6. GENERAL CONCLUSIONS

6.1. IMPACTS OF ISIIMM-EGYPT

- Active networking among the main actors in the irrigation sector, the farmers and their organizations, based on mutual understanding of working conditions and constraints of each partner, in Seila area in Fayoum and Regwa area in Nubarya.
    - Joint planning of the annual civil works in Seila canal by the Central Administration of MWRI in Fayoum and local WUAs has become an effective tool now since the support of regional team of ISIIMM-Egypt in Fayoum of this mechanism,
    - A trilateral protocol among ISIIMM-Egypt, the FWMP and IAS in Fayoum for completing and building the capacities of newly established WUAs by the new Dutch project after termination of ISIIMM,
    - The networks created by ISIIMM attracted other partners in some of the working sites to join these networks. The case of trilateral protocol in Fayoum signed among ISIIMM, the GD-IAS in Fayoum and the Dutch FWMP was a good example. This included a joint arrangement of the exchange of experience with the ISIIMM Moroccan team and the ISIIMM-Fayoum and FWMP teams together.
    - A letter of intention of support from MWRI-CD in Menia for the WUAs mobilized by ISIIMM in Mantout area after termination of ISIIMM,

- The positive response of MALR-IFAD rural development project in replacing irrigation pump stations in graduates' area in Nubarya based on the initiated feasibility study of the regional team of ISIIMM-Egypt in Behera,

- Careful efforts have been undertaken to insure sustainability of the activities achieved by ISIIMM in Egypt by strengthening networking and collaborative action after termination of ISIIMM and through:
    - The active plan of training of actors in the WUAs on their main roles in the three sites Behera, Fayoum and Menia during the third phase of ISIIMM,
    - Transfer of the responsibility of management of SWaMMA to a special committee under the umbrella of a more endured organizational structure supported by the local administration and a CDA established by the support of ISIIMM in Mustapha Agha though there still a need of some capacity building efforts to improve efficiency and effectiveness. CRDRS is playing the role of taking care of this aspect through regular monitoring of SWaMMA activities and supporting the local executive committee

- Attracting attention among a wide range of new specialists to the issues related to social and institutional dimensions of local management of irrigation. (Training of 2 groups of students; one international in spring 2004, and one national in summer 2006).

- Encouraging graduate students from Egypt and France to pursue their career in areas related to the issues addressed by ISIIMM. Four scholars with wide interest and different levels of training that include one M.Sc. in France, 2 Ph.D.s in Egypt and one an Egyptian postdoctoral in Italy):
    - A DEA thesis conducted by the French student Cécile Ophèle about "Etude du fonctionnement d'un système hydraulique en cours de transformation : le canal d'irrigation El Resqa, delta du Nil" in Université Pierre et Marie Curie, Université Paris-Sud, École des Mines de Paris & École Nationale du Génie Rural des Eaux et des Forêts under the supervision of Dr. Thierry Ruf, IRD.
    - A Ph.D. dissertation conducted by Ms. Salwa Ismaeel an Egyptian research assistant at the faculty of Agriculture, Cairo University about comparison of the rationalization of irrigation behavior under improved and unimproved irrigation systems in Behera to be defended in December 2007.
    - A post doctoral thesis about "The screening Phase of RG2 Local Groups and Institutions: Water Users Associations in Egypt- from the case of Fayoum WUAs established in Seila area under ISIIMM project" submitted by Dr. Gehan Elmenofi, Associate Researcher in the Agricultural Research Center, Ministry of Agriculture in a one year Diploma of Sustainable Agriculture at the Mediterranean Agronomic Institute of Bari (MAI-Bari), Italy in the academic year 2006-2007
    - A Ph.D. dissertation under preparation by Mr. Medhat Ezzat an Egyptian research assistant at the faculty of Agriculture, Cairo University about the adoption process of innovations and related variables in Behera with emphasis of the case of SWaMMA to be defended in 2008

- Taking ISIIMM learned lessons into consideration in the future irrigation policy (emphasis on higher administrative level WUAs and end users orgs as clearly declared in a policy workshop of the running IIIMP project).

6.2. CONSTRAINTS ENCOUNTERED IN IMPLEMENTATION OF ISIIMM IN EGYPT

Several negative impacts of the late economic reforms (included in SAP) have occurred on the performance of contracting sector. These consequences were not considered in the contracts between the MWRI and some main contractors in charge of implementation of the civil woks and infrastructure of the newly improved system of irrigation. Hence, several irregularities of relationships have occurred between the two parties. These irregularities have affected negatively the relationship between the MWRI and the irrigators in connection with the efficiency of implementation of the civil works of the infrastructure of improved mesqas or the management of the WUAs. Intervention of high ranked officials did not help much overcoming related difficulties. This situation was one of the main sources of difficulties the ISIIMM staff in Egypt encountered when trying to help WUAs build their own capacities.

However, recent improvements of the irrigation system that directly affect the irrigation behavior of farmers did not consider the long traditional history of indigenous irrigation knowledge of farmers. This trend was based on the believe in supremacy of technical

knowledge among MWRI personnel. This situation has disturbed the long balanced and esteemed historical relationship between the farmers and irrigation authorities. In the context of improvement of irrigation system most young engineers neglected the social related issues of irrigation. In case of such neglect discrepancies in the relationship between both parties occurred. Nevertheless, this did not hamper the emergence of hybrid technologies that merged between the traditional technologies and the new ones imposed by improvement authorities. Some of these changes made by users could be considered real technical innovations to overcome some though are not accepted by authorities. (See attached photos).

Figure 23. Hybrid solution for irrigation techniques as a new innovation in progress in Behera

Informal social organization of irrigation, normally, develops over a long period of time. This situation insures consistency and harmony with the existing context of local social structures. Smooth introduction of any new informal organization might help improving the functionality of local communities without creating new sources of conflict. However, development that needs establishment of new organizations should carefully consider the capacity of existing social structure to absorb the new organizations from one side and the social value added to the community and related sector at all levels.

Creating new formal organizations for irrigation and others for drainage has been adopted by many projects in the late eighties and the nineties. The potential number of such organizations at the community level, mesqa, could exceed tens of units in each village where the fragile social structure in rural communities could not absorb easily. In fact we can not imagine creating more than eighty thousand such organizations, one for each tertiary canal "*mesqa"*, just for irrigation sector in rural areas while all Egypt has less than twenty thousand NGOs!

Though approaching farmers and their local rural communities in the projects of irrigation improvement is given first place in the stages of irrigation improvement projects it is frequently badly implemented. This was partially due to the short period allocated for execution of this phase especially under the pressure of donors contracts and meanwhile the lack of personnel experienced with social techniques of attitudes change and capable to deal with the social and institutional settings for such technical changes. This necessitated establishment of specialized agency, called irrigation advisory service (IAS), within the context of institutional reform of MWRI to be in charge of this responsibility. This is a recent change that took place just within the last decade. Further empowerment of this authority is needed to deal carefully with the social dimension of irrigator behavior.

Lack of transparency concerning the costs recovery system of civil works and the physical infrastructure in the irrigation improvement projects has led to increase of tension among farmers and irrigation personnel. This was clearly a source of reluctance of farmers to response positively to the ISIIMM staff especially in the case of Mantout site in Menia and some neighbor areas to the Rezqa site in Behera which reached farmers in the area. This obliged the ISIIMM staff to include related aspects in their activities.

Complexity of the water channels of all levels that exceed 36 thousand km in length in addition to more than 21 thousand drain canals have imposed heavy load on MWRI authorities on operating and maintenance of that network. This in addition to the lack of coordination between local administration and irrigation authorities related to the management of solid waste has led to heavy pollution of canals that imposed more pressures on the irrigation authorities to maintain the flow and quality of water in canals.

The tendency of adopting the authoritative approach by some irrigation personnel based on their technical background and the irrigation laws, especially those who do not believe in social approach, surpass application of the development approach needed for improvement of irrigation system. This needs intensive training and capacity building for the technical personnel emphasizing on the change of attitudes and social and negotiation and communication skills.

6.3. LEARNED LESSONS

ISIIMM staff in Egypt has acquired intensive experience based on deep understanding of the social and institutional settings of irrigation behavior before action. Analysis of many aspects of the attitudes and responses based on that understanding fostered adoption of the participatory and social mediation approachs and not ready made recipe of change. This has resulted in real changes in the networks of relationships among irrigation partners and stakeholders in many of the areas of work sites. Drastic changes have fully taken place in Fayoum (joint planning between MWRI and irrigators' WUAs and group action) and Nubarya (investors-graduates new pattern of collaborative relationship institutionalized through the new Regwa Water Board established by the initiatives of ISIIMM regional team in Behea and supported later on by the MALR Tiba Directorate and its development sector and related project in Nubarya).

The social mediation role of ISIIMM proved that a third interested, capable and neutral party is crucial for development projects in the irrigation sector. Long history of fully technical based centralized decisions by irrigation authorities has created suspicious and even some times antagonistic attitudes among irrigators that segregate decision makers from the end users. Changing such attitudes needed time, efforts and neutral party with relevant experience in attitude change. This is rather needed in the cases where irrigators acquired uncomfortable experience in the past. This was the case in Menia where early activities of ISIIMM encountered real resistance and needed several and long term trials before reaching any progress.

Theoretical approaches are needed to understand some of the ambiguous patterns of irrigation behavior. The manifest and latent function analysis was fully useful in many situations especially in some in-depth case studies in Fayoum and Behera.

Networking with the real partners and stakeholders at all levels of action proved to be a very influential approach in action in irrigation management. This approach was incorporated in the management of the ISIIMM activities across its all three phases. Thus ISIIMM –Egypt got involved in several networks in many of its activities with; MWRI, MALR, Local Administration, EWP,

Full application of the participatory approach proved very effective at all levels of action in ISIIMM-Egypt. This was not always an easy task but in case of ignoring this rule-of-thumb the impacts were rather more costly.

Transparency was very important in interaction with all parties in the networks. This created a win-win situation where all parties found reasonable ground for joint collaboration and cooperation. This case was applied in the relationships with IFAD RD project in Nubarya, with FWMP and GD-IAS in Fayoum, MALR and EWP in SWaMMA.

Cautious action was necessary to avoid creating a dependency relationship between ISIIMM as a change development agent and irrigators during the capacity building and empowerment activities. This helped establishing balanced and sustainable relationships with all partners and stakeholders.

Development agents and projects have to avoid confrontation and conflict of interest with other partners and stakeholders. This was necessary to concentrate efforts towards achievement of the project main and detailed objectives.

Decentralization of management accompanied with dynamic monitoring system proved very efficient in most cases,

Importance of dynamic capacity building for all partners and stakeholders, and not only for some of them, is essential for efficient and effective work at all levels,

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ACRONYMS

APRP	Agriculture Policy Reform Program
ASEAN	Association of Southeast Asian Nations
BCWUA	Branch Canal Water Users Association
CAAE	Central Administration of Agricultural Economics
CAPMAS	Central Agency for Public Mobilization and Statistics
CDA	Community Development Organization
CD-IAS	Central Administration of Irrigation Advisory Services
COMESA	Common Market of Eastern and Southern Africa
EU	European Union
FID	Fayoum Irrigation department
GARPAD	General Authority of Reconstruction Projects and Agricultural Development
GDP	Gross Domestic Production
GOE	Government of Egypt
HDI	Human Development Indicators
IFAD	International Fund for Agricultural Development
IIIMP	Integrated Irrigation Improvement Management Project
IIP	Irrigation Improvement Project
ISIIMM	Institutional and Social Innovations in Irrigated Mediterranean Management
LWB	Local Water Board
MALR	Ministry of Agriculture and Land Reclamation
MoEE	Ministry of Electricity and Energy
MoHUUD	Ministry of Housing, Utilities and Urban Development
MoI	Ministry of Interior
MoTI	Ministry of Trade and Industry
MoTo	Ministry of Tourism
MoTr	Ministry of Transportation
MPH	Ministry of Population and Health
MSEA	Ministry of State for the Environment Affairs
MSLD	Ministry of State for Local Development
MWRI	Ministry of Water Resources and Irrigation
NAFTA	North American Free Trade Agreement
NBI	Nile Basin Initiative
NLASP	New Lands Agricultural Services Project
NPI	National Planning Institute
NWRPP	National Water Resources Plan Project
PRA	Participatory Rapid Appraisal
SAP	Structural Adjustment Program
UNDP	United Nations Development Programme
WTO	World Trade Organization
WUA	Water Users Association

Measures

1feddan = 4200 m^2 =1.038 acres or 0.42 hectares
1feddan = 24 qirat
1 qirat = 175 square meters
1 EgP (£E) = about $ 0.18

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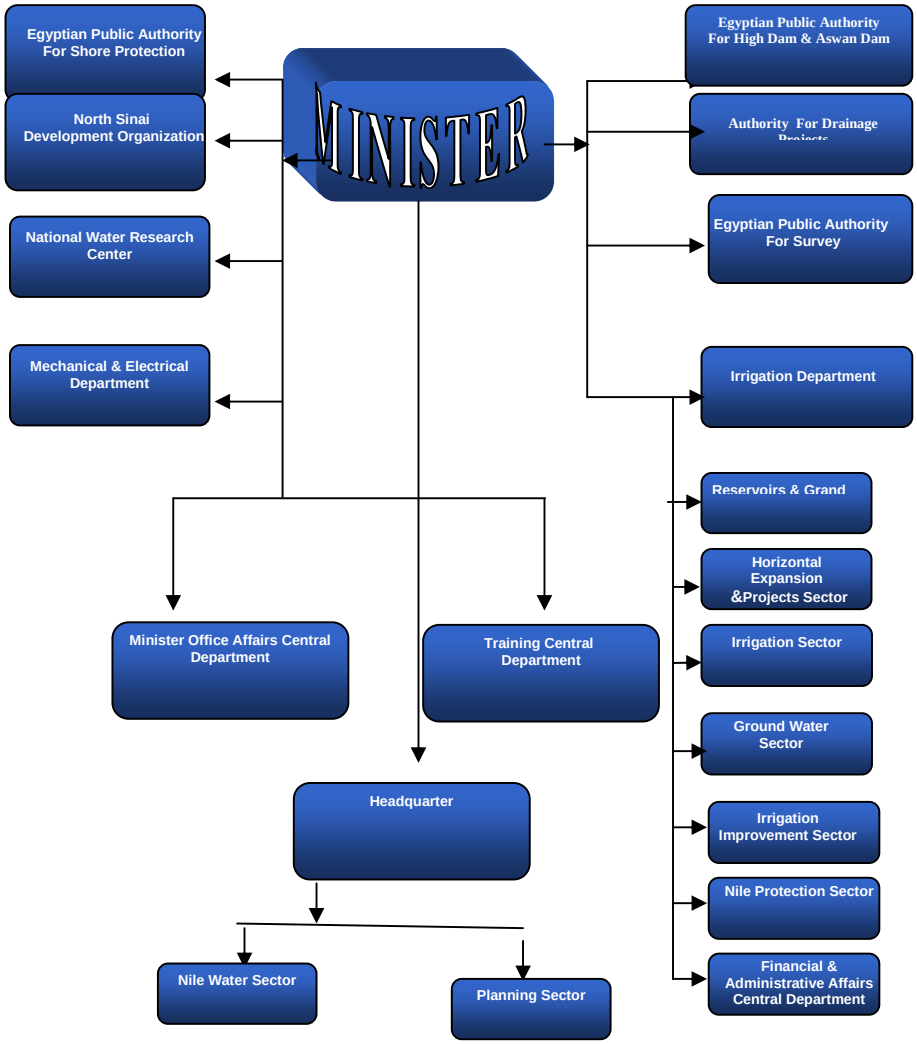
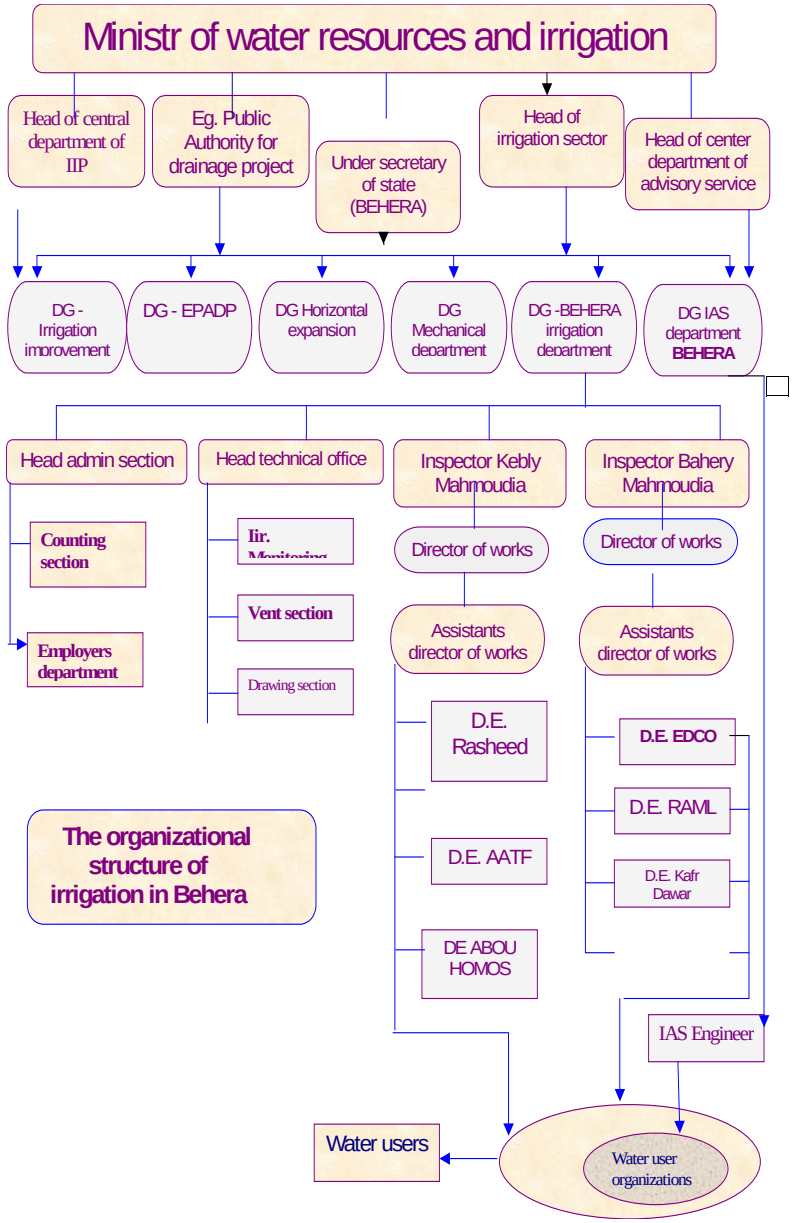
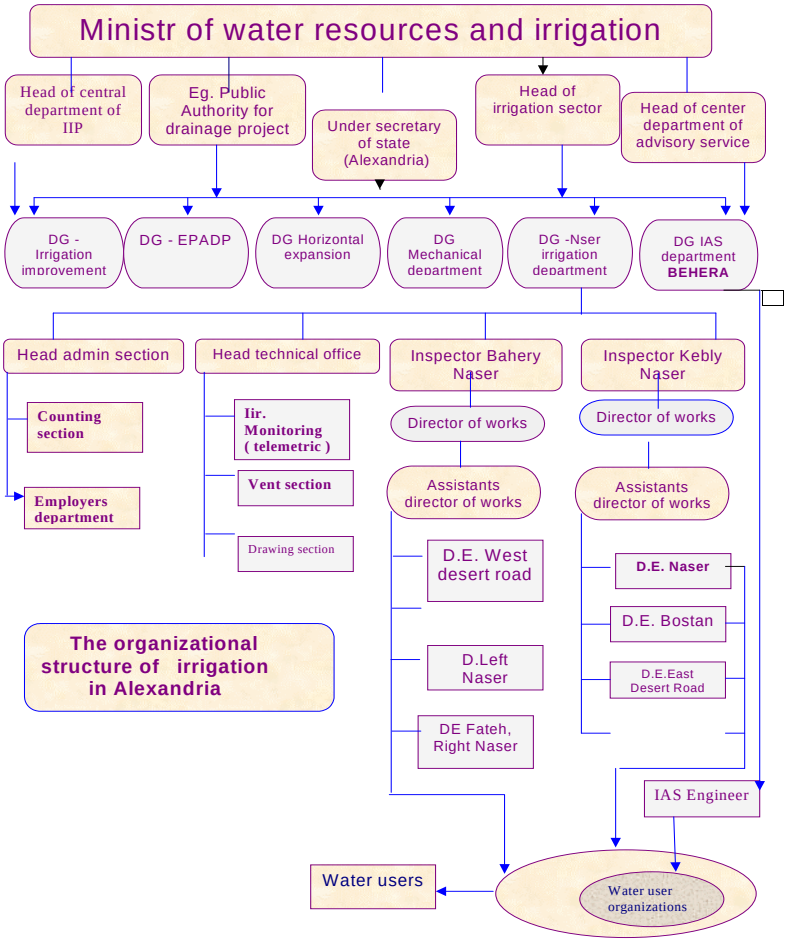
ANNEX: ORGANIZATIONAL CHART OF MWRI



Organizational Chart of the MWRI


Ministr of water resources and irrigation
Head of central department of IIP
Eg. Public Authority for drainage project
Under secretary of state (BEHERA)
Head of irrigation sector
Head of center department of advisory service
DG - Irrigation improvement
DG - EPADP
DG Horizontal expansion
DG Mechanical department
DG -BEHERA irrigation department
DG IAS department BEHERA
Head admin section
Head technical office
Inspector Kebly Mahmoudia
Inspector Bahery Mahmoudia
Counting section
Employers department
Vent section
Drawing section
Director of works
Director of works
Assistants director of works
Assistants director of works
D.E. Rasheed
D.E. AATF
DE ABOU HOMOS
D.E. EDCO
D.E. RAML
D.E. Kafr Dawar
IAS Engineer
Water users
Water user organizations
The organizational structure of irrigation in Behera


Ministr of water resources and irrigation
Head of central department of IIP
Eg. Public Authority for drainage project
Under secretary of state (Alexandria)
Head of irrigation sector
Head of center department of advisory service
DG - Irrigation improvement
DG - EPADP
DG Horizontal expansion
DG Mechanical department
DG -Nser irrigation department
DG IAS department BEHERA
Head admin section
Head technical office
Inspector Bahery Naser
Inspector Kebly Naser
Counting section
Employers department
Iir. Monitoring (telemetric)
Vent section
Drawing section
Director of works
Director of works
Assistants director of works
Assistants director of works
D.E. West desert road
D.E. Naser
D.E. Bostan
D.E.East Desert Road
D.Left Naser
DE Fateh, Right Naser
IAS Engineer
Water users
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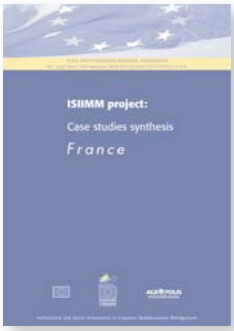
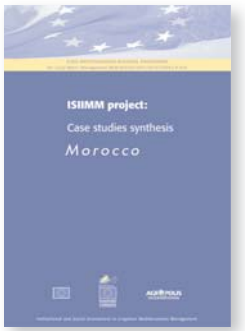


Case studies synthesis *France* (English, French)

Case studies synthesis *Italy* (English, Italian)

Case studies synthesis *Lebanon* (English)



Case studies synthesis *Morocco* (English, French)

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General synthesis (English, French)

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