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Egyptian Needs and the Water Resources Under the Agreements Among the Nile River Basin Countries

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Abstract: Water is Egypt issue today, and its danger is increasing in the future years. Egypt is considered one of the poorest 35 countries in the world,its ownership of freshwater resources, where Egyptian citizen share in 1947year was reached about 2604 m ^{3} / year, it decreased over the years following that reached 860 m ^{3} / year in 2003, possibly the individual share will decrease to 582 m ^{3} / year in 2025, due to the available water resources for agriculture is limited, the future demand increasing for the purposes of horizontal and vertical expansion in cultivated area, the low efficiency of availability use of it, in addition to the obstacles in the traditional sources use, and as a result of the increase in population with demand for water is increased,and the available renewable water resources are constant, which led to increase the water problem in Egypt, Therefore, the study aimed to Identify the current available of Egyptian needs, water resources, individual share average of water, and identify the periods of abundance,scarcity and water poverty through the presentation of the various water agreements among the Nile River Basin countries, The study proved that total water needs reached about 69.29 billion m^3 in year 2010, an increase percentage reached about 10.2% of total water needs in year 1980, while the expected water needs may reach about 80.1 billion m^3 in year 2017, an increase ratio estimated at about 135.35% of total water needs, while expected Egyptian water needs reach about 86.18 billion m^3 in year 2025, an increase average of approximately 145.57% of the total water needs in year 1980, the previous presentation is clear that Egyptian water needs are growing significantly, indicates that Egypt entry in the belt of water scarcity and water poverty. Not only that, but it is expected to be in 2017 about 79.41 billion m^3, equivalent to about 121.61% of the total water resources, in 1980, while the total water resources is expected to be in 2025 about 76.86 billion m^3 is estimated at 117.71% of the Egypt's total water resources in 1980 . The individual average share of water is featured with the annual declining during the period from 1947 to 2010 and during the expectation period by the same average till year 2050, where it was the highest average in year 1947, the water abundance had been achieved, where it reached about 2604 m^3 annually, the lowest average was in year 2050 about 350 m^3 and it is clear the water poverty.

Kew words: Egyptian needs, water resources, agreements, Nile River Basin countries

INTRODUCTION

Water became one of the most important inputs to the process of the economic and social development, we cannot talk about the development of agricultural or industrial without providing the required quantities of water, with the specific quality, given that the food supplies security issues for the nations and peoples which called "food security " (Ahmed Kadri 2002)

The Nile River is the main source of water in Egypt, it is the lifeblood since the cradle of civilizations, noting that Egypt is the estuary state for the Nile River, which runs in 11 African countries with a length of about 3040 km, it is the longest River in the world length and area, the Nile River water consists of several sources: the White Nile, descended from Victoria Lake,that is the main source of the Nile River and blue Nile, descended from Natta Lake in the highlands of Ethiopia and constitutes about 80-85% of the Nile River water, and Atbara river, and Gazal river, so it must be strengthen links among these countries in the water use areas, agriculture, industry, economy and river transport, and asserting the organic relationship among these countries. (Ahmed Kadri 2005)

Water is Egypt issue today, and its danger is increasing in the future years. Egypt is considered one of the poorest 35 countries in the world,its ownership of freshwater resources, where Egyptian citizen share in 1947year was reached about 2604 m ^{3} / year, it decreased over the years following that reached 860 m^3 / year in 2003 year possibly the individual share will decrease to 582 m^3 / year in 2025 year, Due to the available water resources for agriculture is limited, the future demand increasing for the purposes of horizontal and vertical expansion in cultivated area, the low efficiency of availability use of it, in addition to the obstacles in the traditional sources use, and as a result of the increase in population with demand for water is increased,and the available renewable water resources are constant, which led to increase the water problem in Egypt.

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The Study Problem:

How can we achieve the sufficiency of Egyptian water needs under limited water resources, through water agreements among the Nile River basin countries, which determine Egyptian water share of the Nile River?

The Study Objective:

Identify the current available of Egyptian needs, water resources, and individual share average of water, and identify the periods of abundance,scarcity and water poverty through the presentation of the various water agreements among the Nile River Basin countries, not only that, but to reach some of the recommendations that achieve greater cooperation and the Nile River water use efficient increase.

The Statistical Methods and Data Sources:

familiar Statistical methods were used such as appropriate, average and depended on Egyptian Water Resources Ministry data, and various sources interested in this matter.

The Study Results:

The results of the study were cleared total water needs, water resources, and individual share average of Egyptian water, and the water agreements for the Nile Basin countries, and some proposals to increase the cooperation and use efficient of Nile water.

First: Egyptian Water Needs:

The water needs include use water for agriculture, drinking water, industry, and navigation, as shown in Table (1) where the total Egyptian water needs reached about 59.2 billion m^3 in 1980year, and those needs were took to grow up amounted to about 64.5 billion $m^3$of water in 2000 year, while it reached about 69.29 billion m^3 in 2010 year, an increase percentage reached about 10.2% of total water needs in 1980 year, while the expected water needs may reach about 80.1 billion m^3 in 2017year, an increase ratio estimated at about 135.35% of total water needs, while expected Egyptian water needs reach about 86.18 billion m^3 in 2025 year, an increase average of approximately 145.57% of the total water needs in 1980year, and the previous presentation is clear that Egyptian water needs are growing significantly, indicates that Egypt entry in the belt of water scarcity and water poverty.

Future Water Needs Until Year 2017:

Egypt policy in the new century is the reclamation and cultivation 3.4 million feddans until 2017 in order to meet the nutritional needs for people where it is scheduled growers 1.2 million feddans in the valley and delta. 540 000 feddans in Western desert, 620 000 feddans north and west of the Suez Canal, 540 thousand feddans in Toshka 0.250 feddans in North Coast 0.250 feddans in Sinai. And thus, Egypt needs to additional water resources to meet the irrigation water for these lands. This is in addition to other uses like water for drinking, industry, agricultural and river navigation, and these areas need to about 20.4 billion m^3 of irrigation water to meet the necessary. Thus Egypt's water needs in 2017 reach about 80.1 billion m^3, and agriculture occupies first place in terms of the needs reach about 77.9% of it, and industry by 11.6%. Then drinking water and household use by 7.7%. therefore the need is urgent and necessary to work according to specific programs and objectives for water conservation.

Table 1: Egyptian water needs during the period 1980 – 2025. (milliard.m^3.).

Title	1980	1985	1990	1995	2000	2003	2004	2005	2006	2007	2008	2009	2010	2017	2025
Water uses for agricultures	49.7	49.7	49.7	49.7	49.7	57.8	58.1	58.5	59.0	59.3	59.3	59.3	59.3	61.8	67.13
Water uses for drinking	3.3	3.7	4.8	5.9	6.8	5.4	5.6	5.8	6.1	6.5	6.5	6.5	6.5	9.5	6.6
Water uses for industry	2.2	2.9	3.1	3.6	4	1.1	1.1	1.15	1.15	1.13	1.15	1.15	1.15	6.5	10
Water uses for balances	4	4	4	4	4	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.15
Total water needs	59.2	60.3	61.6	63.2	64.5	66.6	67.1	67.75	68.55	96.25	69.25	69.25	69.25	80.1	86.18

Source: 1. Al-Ahram newspaper – Statement of irrigation minister – March 19th 1981.

2. Ministry of works and water resources the monitory and future policies for Egypt in year 1988.

3. Ministry of water resources and irrigation water distribution sector, un published data in year 2009-2010.

Second: Egyptian Water Resources:

Egyptian water resources include six sources, as shown in Table (2) the Nile River water is about 55.5 billion m^3, representing 79% of the total water resources, in Egypt 2010, followed by groundwater in the Valley and Delta, 6.2 billion m^3 estimated by 9 % of those resources, and recycling agricultural drainage water is ranked third reached about 5.9 billion m^3 is estimated at about 8%, and recycling of wastewater is ranked fourth

by 1.4 billion m^3, equivalent to about 2%, and rain and floods rain and floods is ranked fifth by 1.3 billion m^3 estimated at about 1% of water resources, and Egyptian water resources reached about 65.3 billion m^3, representing about 101.23% in 1990, while those resources reached about 67.83 billion m^3 in year 2000 is estimated at about 103.87% of the total water resources in Egypt in year 1980, and in 2010 reached about 70.26 billion m^3, equivalent about 107.75% of the total water resources, in year 1980 . Not only that, but it is expected to be in 2017 about 79.41 billion m^3, equivalent to about 121.61% of the total water resources, in 1980, while the total water resources is expected to be in 2025 about 76.86 billion m^3 is estimated at 117.71% of the Egypt's total water resources in 1980 . Figure No. (1)was cleared Comparison between Egyptian Water Resources in 2010 and 2025.

Table 2: Egyptian water resources and water balance 1980-2025.

Title	1980	1985	1990	1995	2000	2003	2004	2005	2006	2007	2008	2009	2010	2017	2025
% Egypt of the Nile river	55.5	55.5	55.5	55.5	55.5	55.5	55.5	55.5	55.5	55.5	55.5	55.5	55.5	57.5	57.5
Underground water in the valley of Delta	4.6	4.9	5.3	5.3	6.7	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.2	8.4	8.8
Agricultural drainage water recycling	2.5	2.3	2.9	2.9	3.2	4.4	4.8	5.1	5.4	5.7	5.7	5.9	5.9	9.7	7
Sanitation water recycling	1.2	1	0.9	1.2	1.1	0.9	1	1.1	1.2	1.3	1.3	1.3	1.4	2.4	2.1
Rain and flood	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.4
Desalination of sea – water .	0.2	0.2	0.2	0.2	0.03	0.06	0.00	0.06	0.00	0.06	0.06	0.06	0.06	0.11	0.06
Total water resources	65.3	65.2	66.1	66.4	67.83	68.2	68.78	69.2	69.56	69.96	69.96	70.16	70.36	79.4	76.86
Water balance	2.2	2.2	2	1.9	1.8	1.66	1.66	1.41	1	0.71	0.71	0.91	1.11	0.51	3.24

Source:

1. Al Ahram newspaper statement the statement of Irrigation Minister in March 19th 1981.
2. Ministry of Works and water resources. The water and future policy for Egypt in year 1988.
3. Ministry of water resources and Irrigation-water distribution sector un published data in year 2009-2010.

Third, Egyptian Individual Average Share of Water:

The individual average share of water is featured with the annual declining during the period from 1947 to 2010 and during the expectation period by the same average till year 2050, the table No. (3) shows, the period of water abundance (1947-1960), after that comes the period of water sufficiency from (1970-1986), followed by the period of water scarcity (2003-2010), then the water poverty during (2017-2050), where the individual average share is less than 1000 m^3 annually.

The figure No. (2) shows the Egyptian individual average share of water (annually m^3) during the studied period. The individual average share of water ranged during the period of study (1947-2050), where it was the highest average in year 1947, and the water abundance had been achieved, where it reached about 2604 m^3 annually, the lowest average was in year 2050 where about 350 m^3 and it is clear the water poverty.

Table 3: Egyptian individual average share of water during the period (1947-2050).

Year	Egyptian individual average share (m^3 annually)	Indicator
1947	2604	Water abundance
1960	1893	Water abundance
1970	1713	Water sufficiency
1986	1138	Water sufficiency
1996	936	Water scarcity
2003	860	Water scarcity
2007	800	Water scarcity
2010	726	Water scarcity
2017	629	Water scarcity
2025	582	Water poverty
2050	350	Water poverty

Source:

1. Al Ahram newspaper statement – statement of Irrigation Minister in March 19th 1981.
2. Ministry of Work and water resources the water and future policy for Egypt in year 1988.
3. Ministry of Water resources and Irrigation-water distribution sector.

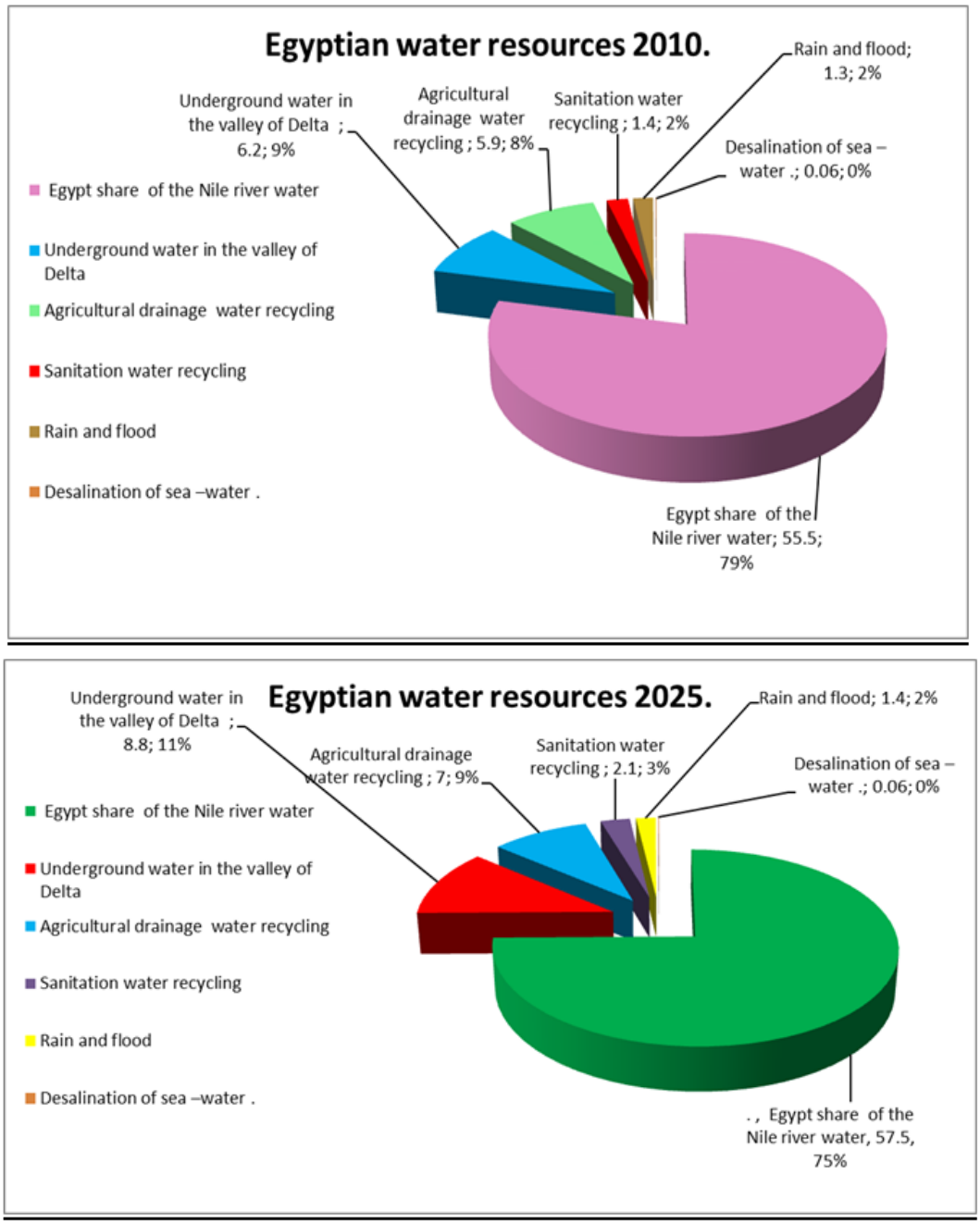

Fig. 1: Comparison between Egyptian Water Resources in 2010 and 2025.
The source:
1- According to Table (2)
2- Ministry of water resources and Irrigation-water distribution sector un published data

Fourth:International Agreements Among the Nile Basin countries:

1 - Agreement in year 1891: between Britain (occupied Egypt and Sudan) and Italy occupied Eritrea, where Italy pledged to not establish or create any work on the Atbara River, In order not to affect the Nile water to Egypt and Sudan.

2 - Agreement in year 1902: between Britain (behalf of Egypt and Sudan) with Ethiopia to not establish any works or enterprises on the Blue Nile or Tana Lake or the Sobat affect the Nile River water.

3 - Agreement in year 1906: between Britain and Congo to not establish any enterprises or works on the Alsmlika and Tango rivers will reduce the water in the Alberta Lake therefore does not affect the Nile River water.

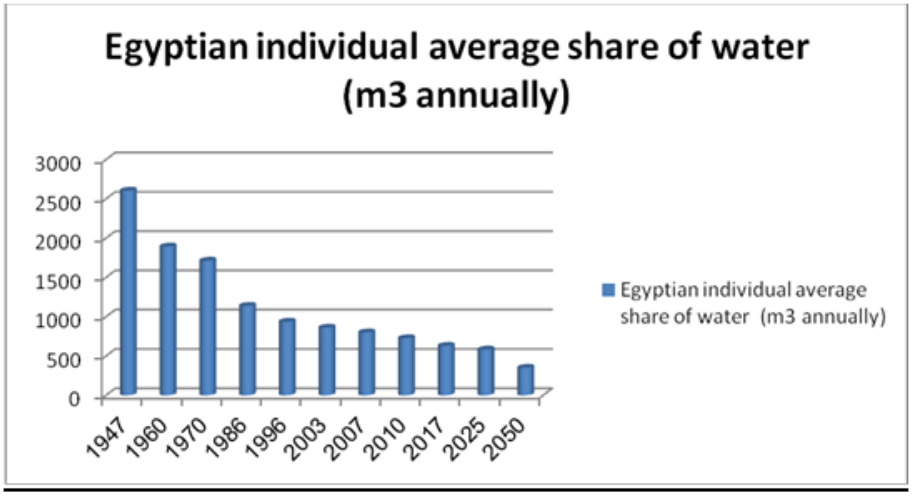

Fig. 2: Egyptian individual average share of water during the period from 1947 to 205.
The source : Accounting to Table(2)

4 - Agreement in year1925: signed between Britain and Italy against Egypt and Sudan in the Blue Nile and White Nile waters,and not creation any facilities on the rivers or their tributaries, including its subsidiaries, or does not affect the river.
5 - Agreement in year 1929: signed between Egypt and Britain (behalf of the Sudan), Kenya, Tanzania and Uganda the following:
A - The natural and historical right for Egypt in the Nile water and maintain it.
B - Recognition of not to establish dams or bridges or facilities affect Egypt's share of Nile water, but in agreement with the Government of Egypt.
C - Egypt has the right to monitoring and following up the river from upstream to downstream.
D - determine Egypt's share by 48 billion m^3 annually which is the right for Egypt.
E – Egypt had agreed with Britain, (behalf of Uganda) to create a dam on Owen Falls to generate energy and raising the water level in Lake Victoria until Egypt can benefit from the water with Uganda to compensate for damage to the high water level of Victoria Lake from Egypt.
6 - Agreement in year 1959: Following the separation and independence of the Sudan from Egypt and is a complement to agreement in year1929 which include:
- Recognition of acquired rights of two states on basis of 48 billion m 3 of Egypt, as well as add any new projects increase also for Sudan about 4 milliard m 3.
- Egypt holds the establishment of the High Dam at Aswan as the first step of the water storage projects, and Sudan to establish Roseires reservoir on the Blue Nile for Sudan's benefit of its quota of water, that is 4 milliard m 3.
- Distribution of revenue is obtained after the construction of the dam as follows: - 14.5 billion m 3 of Egypt 7.5 billion m 3 for the Sudan, and if more than 22 billion m^3 overdistributed equally between the two countries.
- Egypt pay to Sudan 15 million pounds in compensation for the damages to Sudan, which affect the Sudan because of the establishment of the High Dam.
- Decided to agreement of cooperation between Egypt and Sudan in the exploitation of water projects on the basis of water lost to benefit equally and the cost of maintaining them equally well.
7 - Agreement Alexandria in July 28, 2009Where the Irrigation Ministers meeting was failed to the ten Nile Basin countries and time limit for 6 months had ended in 28-1-2010, which claim 7 countries and two countries which downstream (Egypt and Sudan) to cancel agreement 1929 and another distribution to the water shares.
To face of the demand increasing for water there are a number of solutions for the water resource development.
1 – Additional of water resources management
2 - Raise the use efficiency, or the rationalization of water use
3 - Re-use groundwater of all kinds
4 - Expansion in the groundwater use
5 - Desalination of sea water
6 - Maximizing the use rainwater.

1 – Additional of Water Resources Management:

Egypt had planned for many projects in the Nile Upper in order to have control of the Nile water resources and management of additional water, these projects such as: - A- "Jonglei" channel project in Sudan Southern, The water that can be provided at the end of the project in the first stage up to about 4 billion m^3, and the second stage up to about 3 billion m^3,divided equally between Egypt and Sudan, but the problem of Sudan Southern have prevented the completion of the project.

b- Muchar swamps project in Sudan southern :The water that can be provided from the project up to about 4 billion m^3 divided equally between Egypt and Sudan.

C - Projects of Bahr el Ghazal: provides about 7 billion m^3 is divided equally between Egypt and Sudan. (Mahmoud Abu Zeid2004)

D - Water storage in tropical lakes, where the project aims to finance the Nile sources of tropical Lakes (Victoria, Kyoga, Albert).

E - Albert Dam Project: The project aims to establish a tank on the northern exit of Albert Lake to turn the lake into tank for water during drought years, to provide water about 3.2 billion m^3 is divided equally between Egypt and Sudan.

F - Storage in Egyptian North Lakes aim to store the waters of the Nile River in the northern lakes of Egypt (Manzalah - Burullus - EDCO - Mariot) The stored water reach about 5 billion m^3, in addition to 3.5 billion m^3 can be stored in a low-Wadi al-Natrun .

2 - Raise the Water Use Efficiency (the Rationalization of Water use) Through:

A - Raise the water use efficiency in irrigation.

B – Reduce the water. losses

3 - Re-use of Wastewater Types:

Egypt started in the fifties before the High Dam establishment to reuse some of drainage water for irrigation and used 2.7 billion m 3 annually of waste water in the Delta after mixing it with equal volume of Nile water, and Increased to 5.7 billion m 3 in 2009/2010, it is estimated that up to 9 billion m^3 in 2017, this is maximum estimated for wastewater use which reach about 12 billion m^3 annually, and wastewater re-use for irrigation after treatment, the total amount of wastewater which can be used for irrigation is estimated in 2005 at about 7 billion m^3 annually, an increase of 2.2 billion m^3 annually, and can use 1.3 billion m^3 annually after treatment.

4- Expansion in the use of Groundwater:

Groundwater is a vital source of water in Egypt, no less important than agricultural drainage water, but it was characterized by quality, use of it currently 6.1billion m^3 in the Valley and Delta, this amount equivalent to about 50% of the amount which the aquifers nutrition, in addition to 0.57 billion m^3 of desert land tanks, and we can increase this amount in the future to be7.5 billion m^3 without exposing the groundwater stock risk.

5-Desalination of Sea Water:

Because of fresh water resources lack must be expanded the use of sea water and desalination using modern technology with the establishment of desalination plants powered by nuclear, and focuses the use of this technique to feed the coastal cities with drinking water, and the required access in 2017 to produce 0.14 billion m 3 annually using this style. Also necessary to desalination wells water that salinity increase to 1000 ppm by mini-desalination units. And Egypt's water resources from desalination of sea water reach about 0.06 billion m 3 / year until year 2009/2010.

6- Maximizing of the Rain Water Use:

Annual averages of the regular winter rain that falls in the northern parts of Egypt to about a depth of 30 km.The total amount of water that is obtained from the rain and floods 1.3 billion m^3 / year until the year 2009/2010

The concept of rational use of irrigation water is a means and artistic styles, technological and economic potential for economic use of irrigation water and the preservation of the environment.

Economic Objectives of Rationalizing the Irrigation Water Use:

(1) The reduction of the water irrigation loss: The state establish irrigation systems, but the operating system of these networks, bad maintenance and management affect of the irrigation efficiency, it could cause a decline to below 30% for the start the water in the distribution channels without dragging it to irrigate the fields which would lead to loss of large amounts of it by evaporation or with wastewater.

(2)Increasing crop output: This is achieved through:

1- The introduction of high-quality varieties of crops and with less water needs. _ Modified crop structure to suit with the policy Water, production and export for the State, and reduce the amount of irrigation water to the crop area for the crop installation proposed, we find that the ministry's plan aims to provide about 1.5 billion m 3 / year of water by bringing agriculture beet replace sugar cane and reducing rice cultivated area of 1.3 million feddans to 950 thousand feddans.
2- Raise the cropping intensity by increasing cultivated crop area, which reduces the water used to irrigate this area.
(C) Maximize the net return of the water unit: Through the crops cultivation with less water needs, so that the available quantities of water for other purposes and for years to come.
(D)Increase the return of foreign exchange and reduce the deficit in the payments balance .
(E)Improve the quality of crops and reduce their prices:
Methods of rational irrigation water use:

- First : The Economic Methods:
1 - Modify the prevailing cropping: Choose the optimal crop composition, planting drought-resistant crops to the agricultural cycle is linked to water use efficient
2 - Estimate the value of irrigation water:
Due to the availability of irrigation water without a price or value, and cost management, maintenance and distribution led to the farmer to the misuse of irrigation water use in the field.
3 - Raise the efficiency of water use for irrigation: agriculture consumes about 85.6% of our water resources, if it covers more than 95% of the total suitable land for cultivation in Egypt .(Mohammed Nasr El-Din Allam2000)

4 - Reduce Water Loss:
A - loss during transportation of the High Dam, where water is cut off in this journey 38,530 km and the length of a network of irrigation 37 000 km and exposed to risk of loss by evaporation and pollution, leakage and Ministry of Water Resources and Irrigation was estimated lost water by about 35% of the total water discharges from the High Dam, about 19.4 billion m 3.
B- Reduction of the lost water in the network, household and industrial uses: The total amount of water consumed in the household use and industrial about 7.65 billion m^3 in 2009/2010 of which about 6.5 billion used for drinking purposes and health and as a result of increase in the number of population and industry growth, the amounts used for these symptoms increase at rapid rates, where increased the available quantity of the drinking water of about 21.9 million m^3 / day in 2009 to about 22.5 million m^3 / day in 2010, then about 27.8 million m^3 / day in 2011, an increase of 5.9 million m^3 / day increase of 27% for year 2009, and increase water availability of 301 liters / day in 2009 to 303 liters / day in 2010, then to 310 liters / day in 2011. It is expected to increase pure water consumed in 2025 between 06.09 to 09.14 billion m^3. The rate of the lost water between 10 - 36.5% in 2025 due to poor public awareness of the dimensions of the water crisis, if drinking water were separated from other uses it can provide large amount of money and water.

Secondly - The Technical Methods:
1- Expansion of irrigation projects:
2-Improving agricultural service operations:
3-Expand the use of modern irrigation methods:
4 -Improve the water resources management and maintenance :
The loss in the irrigation canals around 2.3 billion m 3 annually

5 - Use of Supplemental Irrigation: (Nader Nour El-Din2010):
Supplementary irrigation means complete lack of water consumption for a crop from rain water and determine the growth stage that require adding supplementary irrigations to get a high efficiency of water use, and this type of irrigation is used in areas which depend on rainfall.

Recommendations:
1 - The efficiency of water use for irrigation and reduce losses .
2 - Maximizing the use of rain water .
3 - Re-use of wastewater types.
4 - Establishment the Federation for Nile Basin countries in order to integrate in all areas such as policy, cultural and agricultural,

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