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The Water Crisis with Nile Basin Countries and its Impact on the Water Security of Egypt

Nagwa M. El-Agroudy, Enaam Abd El Fattah mohamed, Soheir Mokhtar and Haitham Bauomy Ali Hasan

Department of Agriculture Economic, National Research Centre, Cairo, Egypt

Abstract: Water security is as important as the national security, as the Egyptian interpretation of the concept of national security is no longer based on the strategic side only, but it is extended to keep pace with water security and be compatible with it. With the great technological development witnessed by the world, especially in the decade of nineties, the rates of development have been increased. Thus, the demand for the resources has been increased, especially the natural resources. Water comes to the fore of the natural resources. It has become a strategic commodity due to the lack of alternatives. Egypt depends on water at a degree not reached to, before, by the dependence of peoples on water sources such as its dependence on the Nile River, and without it Egypt will become a barren desert. There are nine countries participate with Egypt in the River Nile, and these countries are "Sudan – Ethiopia – Uganda – Kenya – Tanzania – Rwanda – Burundi – Congo". The total water Nile resources in the Nile Basin countries reach to about 1708.97 billion cubic meters and Egypt's share of them reaches to about 55.5 billion cubic meters annually. However, the share of the Democratic Congo reaches to about 1282 billion cubic meters annually and Ethiopia's share reaches to about 120 billion cubic meters. In addition, the average per capita of the available water of the Nile Basin countries reaches to about 33366.10 cubic meters, while the average per capita of the available water in Egypt reaches to about 710 cubic meters in 2014 and it is expected to reach to about 350 cubic meters by 2050. The value of the indicator of pressure on water has reached to about 117.15% and the value of the indicator of water dependence has reached to about 96.91%. Agriculture acquires the bulk of water, as it uses about 82.47% of the total water used. The difficulty of the current and future water situation of Egypt seems clearly which makes the decline in revenues, as a result of the projects of storage dams in upstream countries, a cause of various negative results on Egypt. The effect of the repercussions of Entebbe agreement would be dangerous on the water security of Egypt, as they are represented in the decline of Egypt's share in the Nile water by about 11 billion cubic meters annually, if agricultural projects are established in Ethiopia or Sudan, in addition to the fears from the agricultural investments of the different countries in the Nile Basin countries to cultivate the befoul crops. There are several repercussions as a result of the construction of the Renaissance Dam on Egypt and the study has recommended some recommendations to avoid those repercussions.

Keywords: the Egyptian water security, the average per capita of water, the indicator of pressure on water, the indicator of water dependency, the Renaissance Dam.

Introduction

Water security is as important as the national security, as the Egyptian interpretation of the concept of national security is no longer based on the strategic side only, but it is extended to keep pace with water security and be compatible with it. From a long time water was a subject of conflict. At first, it was representing a conflict over sea water because of its importance in the field of trade and distributing the spheres of influence. However, it has recently been emerged, on the world stage, that fresh water is the subject of the existing conflict, after the conflict over salt water (seas and oceans) has been resolved (under agreements held by the countries among each others).

The decade of nineties is considered the decade of conflict over water resources, in the area of the Middle East, where the limited resources of water which concentrate in the main river basins such as the Nile River.

Moreover, with the great technological development witnessed by the world, especially in the decade of nineties, the rates of development have been increased. Thus, the need for the resources has been increased, especially the natural resources. Water comes to the fore of the natural resources. It has become a strategic commodity due to the lack of alternatives in a time when there are other alternatives for energy. And then, the issue of preserving water resources and maximizing the use of it comes to the fore of national security issues and its acute increases in those countries whose headwaters sources are located outside them, and thus they are not able to control them. Those countries include Egypt, as it depends on water at a degree not reached to, before, by the dependence of peoples on water sources such as its dependence on the Nile River, and without it Egypt will become a barren desert. There are nine countries participate with Egypt in the River Nile, and these countries are "Sudan – Ethiopia – Uganda – Kenya – Tanzania – Rwanda – Burundi – Congo".

These countries vary in terms of their dependence on the Nile River, as Egypt is considered the most dependent country on its water. Thus, it was natural that the concept of water security extends to the main headwaters in the Nile Basin in order to consider any work, done in this basin, aims to affect Egypt's annually determined share of water that is 55.5 billion m3, as a work affects Egypt's national security directly with acknowledging the existence of legal agreements governing Egypt's access to its annually determined share.

The Problem of the Study:

Water is considered the item determining the size of the agricultural production to meet the needs of domestic consumption. But with the limited water resources and the continuous increase in demanding it, as a result of the continuous increase in population and the direction of Egypt's share of Nile River water, which reaches to about 55.5 billion cubic meters per year, to decline as a result of the construction of Renaissance Dam, water has became a national security issue, especially with the decline in the average per capita of water, in the last years, to less than 680 cubic meters / year in 2015 (stock market Thursday 11 February 2016).

The Aim of the Study:

The aim of the study is studying the average of the share of Egypt and Nile Basin countries of Nile water and water uses according to the different sectors, identifying the average per capita of water, in addition to the extent of each country's dependence on the available and used water resources with studying the effect of the Renaissance Dam on the water security of Egypt.

Research Method and Data Resources:

The study has used the descriptive and quantitative analysis method through the use of the tabular presentation method, percentages and some supplier indicators relevant to the field of water security, such as the average per capita, the indicator of pressure on water and the indicator of water dependence. The research has depended on the available published and unpublished data issued by the World Organization for Food and Agriculture and the Ministry of Water Resources and Irrigation as well as using the relevant published studies**.**

The Results of the Study and its Discussion:

The Surface Water Resources of the Nile Basin Countries:

Table No (1) shows that the total of the Nile water resources in the Nile Basin Countries has reached to about 1708.97 billion m^3. Democratic Congo has occupied the first rank of the Nile water share, as it reached to about 1282 billion cubic meters, representing about 75% of the total Nile water resources. Congo is followed by Ethiopia that ranked second by about 120 billion cubic meters, representing about 7% of the total water resources of the Nile Basin countries, and then Tanzania and Uganda by an estimated about 5.4% and 3.52% respectively. Moreover, Egypt has occupied the fifth rank, as its share has reached to about 55.5 billion cubic meters, representing about 3.25% of the total of the available Nile water resources. Egypt is followed by Sudan by about 2.09% of the total of the available Nile water and then Kenya, Rwanda and Burundi at ratios reached to about 1.77%, 0.78% and 0.73%, and finally Eritrea in the tenth rank at a ratio reached to about 0.42% of the total of the available of Nile water resources**.**

Table (1) Nile water resources in the Nile Basin countries in 2013

Country	Millions Population	Available water resources (billion cubic meters)			
		Nile water	%of the total Nile Basin countries	Total country's water resources	%of the total country
Burundi	10.16	12.54	0.73	20.01	37.33
Rwanda	11.80	13.30	0.78	20.30	34.48
Tanzania	49.34	92.27	5.40	122.24	24.54
Kenya	44.40	30.20	1.77	33.7	10.39
Democratic Republic of Congo	67.51	1282	75.46	1324.00	3.17
Uganda	37.58	60.10	3.52	89.10	32.55
Ethiopia	94.10	120.00	7.02	140.0	14.29
Eritrea	6.3	7.26	0.42	7.76	6.44
Sudan	37.96	35.80	2.09	38.80	7.73
Egypt	82.10	55.50	3.25	57.80	3.98
Total	441.16	1708.97	100	1853.74	7.81

Source: collected and calculated data from the Food and Agriculture Organization (FAO), FAO Stat database website.www.fao.org

The Average per Capita of the Water Resources Available in the Nile Basin Countries:

It is shown from table No (2) that the average per capita of the available water resources of the Nile Basin Countries has reached to about 33366.1 cubic meters. Countries are divided into two groups according to this indicator. The first group represents the countries which lie outside the scope of water poverty, as the average per capita increases to more than 1000 cubic meters annually. This group includes the Democratic states of the Congo, by about 19611.91 cubic meters, followed by Tanzania then Uganda, Burundi, Rwanda then Ethiopia, followed by Eritrea and then Sudan by about 2482.64, 2370.94, 1969.49, 1720.34, 1487.78, 1231.75 and 1022.13 cubic meters respectively. However, the second group is the countries which lie on the edge of water poverty belt, as the per capita, in it, ranges from 500 – less than 1000 cubic meters annually. This group includes Kenya by about 759.01 and Egypt by about 710.11 cubic meters**.**

The Indicator of the per Capita of the Water Resources Used in the Nile Basin Countries:

It is shown from table No (2) that the average per capita of the water resources used in the basin countries has reached to about 1934.71. Egypt comes in the first rank by about 831.91 cubic meters, followed by Sudan then Tanzania, Eritrea and then Ethiopia by about 831.91, 709.43, 105.18, 92.06, 64.51 cubic meters. Kenya comes in the sixth rank by about 61.71 cubic meters followed by Burundi then Uganda and then Rwanda by about 26.56, 17.03, 15.25 cubic meters. However, the Democratic Congo occupies the tenth and last rank by about 10.07 cubic meters**.**

The Indicator of Pressure on Water in the Nile Basin Countries:

It is shown from the same previous table No (2) that the indicator of pressure on water in the Nile Basin countries was estimated at 5.8%. Nile Basin Countries are divided into three groups. The first group is the one that uses a ratio of less than 10% of its water resources. It includes Burundi, Kenya, Eritrea, Ethiopia, Tanzania, Rwanda and then Uganda that occupies the seventh place followed by the Democratic Congo in the eighth place. The second group is the one that uses a ration of more than 10% till 100% of its available water resources. This group includes Sudan only, as the indicator of pressure on water has reached to about 69.41%. However, the third group includes the countries that use a ratio of more than 100% of its available water resources. It includes Egypt only as the value of its indicator has reached to about 117.15%**.**

The Indicator of Water Dependency in the Nile Basin Countries:

It is shown from the data of table No (2) the disparity among the Nile Basin Countries in terms of their dependency on the water that comes from outside the country and these countries are divided into two groups. The first group includes the countries whose indicator is between zero percent - 50%. It includes Uganda, Kenya, the Democratic Congo, Rwanda, Burundi, Tanzania and Ethiopia, as the value of the indicator has reached to about 35.11%, 32.57%, 29.85%, 28.57%, 19.75%, and 12.8% respectively. The second group includes the countries whose indicator ranges between 50% - 100%. It includes Egypt, Sudan and Eritrea, as the indicator of their water dependency has reached to about 96.91%, 96.13%, and 61.72% respectively**.**

Table (2) the most important indicators of water resources in the Nile Basin countries in 2013

Country	Average per capita water resources (in cubic meters)		Pressure indicator on water %	* dependence indicator on water%
	Available	Used		
Burundi	1969.49	26.56	1.40	19.75
Rwanda	1720.34	15.25	0.89	28.57
Tanzania	2482.64	105.18	4.24	12.80
Kenya	759.01	16.71	8.13	32.57
Democratic Republic of Congo	19611.91	10.07	0.05	29.85
Uganda	2370.94	17.03	0.72	35.11
Ethiopia	1487.78	64.51	4.34	00
Eritrea	1231.75	92.06	7.47	61.72
Sudan	1022.13	709.43	69.41	96.13
Egypt	710.11	831.91	117.15	96.91
Total	33366.10	1934.71	5.80	

*** This index is estimated by the Food and Agriculture Organization (FAO).**

Source: collected and calculated data from the Food and Agriculture Organization (FAO), FAO Stat database website. www.fao.org

Water Use in Egypt

The water resources available in Egypt: Egypt depends on five sources of water resources which are the Nile River, groundwater, the reused agricultural drainage water, rain water and the treated sewage water. Moreover, table No (3) shows that the Nile River is the main source providing Egypt's needs of water whether for agriculture or the other economic activities. Egypt's share of the Nile River reaches annually, according to the agreement of 1959 between Egypt and Sudan, to about 55.5 billion cubic meters. Nile water represents more than 75.9% of the total of the available water resources as an average to the period (2010 – 2014). The reused agricultural drainage water comes in the second rank in terms of its relative importance at an average reached to about 8.33 cubic meters. Reused agriculture drainage water means the water that is disposed in the agricultural drains due to its increase over plants' need, and it represents about 11.4% of the total available for the same period. Ground water follows the reused drainage water, as it comes in the third rank, in terms of its relative importance by about 9.22% for the same period. This water is characterized by its high quality, especially South

Delta. However, treated sewage water occupies the fourth rank in terms of its relative importance. The available of this water is estimated at about 1.3 billion cubic meters annually, representing about 1.78% of the total of the available water for the same period**.**

Table (3) the development of water resources and their uses and water balance in billion cubic meters In the Arab Republic of Egypt during the period (2010-2014)

The source	2010	2011	2012	2013	2014	Average period	Relative importance%
Nile water share	55.5	55.5	55.5	55.5	55.5	55.5	75.9
groundwater Valley and Delta	6.50	6.30	7.50	6.70	6.70	6.74	9.22
Agricultural Wastewater Reused	8.50	5.80	5.40	11.07	11.1	8.33	11.40
Sewage processor	1.3	1.3	1.3	1.3	1.3	1.3	1.78
Rain and floods	1.3	1.3	0.97	0.93	1.3	1.16	1.59
Seawater desalination	0.06	0.10	0.10	0.06	0.10	0.08	0.11
The total water resources	73.16	70.30	70.57	75.56	76.00	73.11	100
Water use for agriculture	60.50	60.90	62.10	62.00	62.35	61.57	82.74
Evaporative losses from the Nile and canals	2.10	2.10	2.50	2.40	2.50	2.63	3.10
Drinking and household uses	8.50	9.55	9.70	9.90	9.95	9.32	12.75
Industry	1.35	1.20	1.20	1.20	1.20	1.23	1.65
River navigation	0.10	-	-	-	-	0.02	0.03
The total water use	72.55	73.80	75.50	72.50	76.00	74.66	100
Water balance	0.61	-3.45	4.93	0.06	0		

Source: Ministry of Water Resources and Irrigation, Water Conservation sector, unpublished data, 2013/2014

Furthermore, rain water comes in the fifth rank, as it is estimated by about 1.16 billion cubic meters whose relative importance represents about 1.59%. Finally, the data of table No (3) refer to the increase in the total of the available amounts of water from about 72.55 billion cubic meters in 2010 to about 76 billion cubic meters in 2014. This increase is due to the increase in reusing the agricultural drainage water by about 2.6 billion cubic meters and the increase in groundwater in the Valley and Delta to about 6.7 billion m^3**.**

The Uses of the Water Resources Available in Egypt:

Water needs increase in Egypt strangely as a result of the increasing population growth, along with the State's policy to increase the agricultural area through reclaiming new lands, as the uses of water of the agricultural sector were increased from about 60.5 billion cubic meters in 2010 to about 62.35 billion cubic meters in 2014, representing about 82.47% of the total water resources as an average to the studied period. However, the human use of drinking water and domestic purposes has occupied the second rank in terms of the relative importance by about 12.75% of the total water used**.**

Water Balance in Egypt:

The water balance of water resources in Egypt shows the relationship between the available resources and their different uses, as it is shown from the same table that the water balance achieved a surplus estimated at 0.61 and 0.06 billion cubic meters during 2010 and 2013 respectively. However, it made a deficit estimated at

3.45 and 4.93 billion cubic meters in 2011 and 2012 respectively because of the increase in the uses of the agricultural sector and the losses by evaporation from the Nile and canals, and the increase in the domestic purposes, but the balance was achieved in 2014.

Moreover, under the conditions of the climatic change, it is expected that the water needs necessary to irrigate the different crops would be increased as a direct result of high temperature and this would be accompanied by a rise in the efficiency of water use for some crops as a reaction to the increase in carbon dioxide concentration. In addition, the total of water uses will reach to about 80.10 billion cubic meters during 2025. The average per capita of water in Egypt has reached to about 625 cubic meters per capita per year, and it is expected that it will be declined to about 350 cubic meters by 2050. However, the global line of water poverty has reached to about 1000 cubic meters per capita. The difficulty of the current and future water situation of Egypt seems clearly which makes the decline in revenues, as a result of the projects of storage dams in upstream countries, a cause of various negative results on Egypt. The effect of the repercussions of Entebbe agreement would be dangerous on the water security of Egypt, as they are represented in the decline of Egypt's share in the Nile water by about 11 billion cubic meters annually, if agricultural projects are established in Ethiopia or Sudan. In addition to the fears from China's agricultural investments in the Nile Basin countries to cultivate the biofuel crops, and also the Arab Countries hired about 6 million acres for agriculture in the basin countries. In addition, the major countries' direction to hire vast tracts of agricultural lands in the basin countries means an increase in the demand for water, which may be a deduction from the determined shares of the downstream countries**.**

The Repercussions of Constructing the Renaissance Dam on Egypt:

In the light of what was clarified by the study about the importance of the Nile water for Egypt in all walks of life, it is expected that these repercussions are dangerous and may be disastrous, especially during the period of filling the dam, as it is expected that that will lead to

1. A decline in Egypt's share of water by about 11 billion cubic meters (about 20% of the current share) and it can reach to about 19 billion cubic meters (about 34% of the current share) during all the period, of filling the tank, which may be extended from 5-6 years. But if Ethiopia wants to fill the tank in one year, that necessarily means the non-arrival of any water resources to Egypt and Sudan.
2. This will be accompanied by a decline in the hydroelectric power from the High Dam by about 40%.
3. It is expected that the agricultural production would be declined by about 12% as a result of the decrease in irrigation water, as the cultivated area will be declined by about 2.62 million acres.
4. An increase in the food gap in the amount of the decline in the agricultural production, i.e. about 12%.
5. The displacement of about 2 million rural families and the increase in the agricultural unemployment rate.
6. An increase in water pollution and salinity and a deficit in the sockets of waterworks as a result of the decline in water levels in the Nile River.
7. A sever decrease in the Nile tourism.
8. An increase in the interference of sea water with ground water in Delta region.
9. By the completion of the Dam, Ethiopia will become the country controlling the amount of water of the two downstream countries, Egypt and Sudan.
10. In addition, in the case of dam's collapse, due to the lack of the hydraulic and technical studies about the Renaissance Dam and the nature of the land on which it is established and because the studies conducted by the American office of land reclamation in 1964 were for constructing a dam with a storage capacity reaches to 14.5 billion cubic meters not 74 cubic meters in the same place of the Renaissance Dam, the collapse of the dam is probable which would lead to disastrous results for Egypt and Sudan. These disastrous results include collapsing dams, sinking a lot of the major cities and villages and exposing millions of lives to the risks of death and displacement.

Recommendations:

1. The necessity of the economic, political, security, cultural and technological cooperation between Egypt and the Nile Basin countries and the equitable sharing in the Nile water in the framework of the agreements previously agreed upon, especially the agreement of 1959 and the Nile Basin Initiative in 1999.

2. Working speed on the implementation of the joint projects that achieve an increase in water resources through reducing losses, especially in the regions of the tropical plateau, Great Lakes or the Ethiopian plateau.
3. The revival of the Congo River project, which can provide about 95 billion cubic meters of water that are enough to cultivate about 19 million acres in Egypt, Sudan, South Sudan and Congo, which contributes to the agricultural and economic development in those countries.
4. Resorting to the international arbitration and raising the issue in the international forums such as Security Council.
5. Working by the principle of energy for water, as Egypt is the main crossing for exporting the tremendous energy generated by the Renaissance Dam to the major consumption areas in Europe, and that will be a condition to ensure the Egyptian water security with Ethiopia and the rest of the basin countries.

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