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WATER SCARCITY IN EGYPT: CAUSES AND CONSEQUENCES

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ABSTRACT

Water quality is now a major concern for all countries around the world, it depends on the location of the source and the state environmental protection in a given area. Therefore, the quality and the nature of water may be determined by physical and chemical characters. So, water resources are the critical factor affecting production, services, and sustainable development in Egypt. Egypt is facing four major constraints with respect to its water resources: (I) A fixed water supply and rocketing population growth. (II) Difficulties in the country's relationship with the Nile Basin states. (III) Independence of South Sudan declared in July 2011. (IV) Climate change and its hidden future. These four factors pose a number of questions related to the availability of water and the amount of supply that will be allocated for different consumptive and non-consumptive activities and development programs. Egypt also faces the dilemma of pollution of water resources by industrial wastewater, agricultural drainage water and municipal wastewater which may cause many risks to the health of citizens and threaten the safety of the water situation in Egypt.

KEY WORDS
Water resources, Scarcity, Pollution, Climate change

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INTRODUCTION

Since the 1970's, water uses in Egypt have exceeded the available resources. Accordingly, the government has provided additional resources by recycling drainage and wastewater, trapping water losses, and with water use rationalization practices [1]. However, at present, there are significant challenges to water resources management in Egypt. Beginning with a single source of water the Nile, uncertainties in climate, developments upstream, and population growths have characterized efforts to anticipate potential future water constraints. The Minister of Water Resources and Irrigation has stated that the challenges facing the water sector in Egypt are enormous and require the mobilization of all resources and the management of these resources in an integrated manner. This is especially true as the amount of available water resources is fixed, meanwhile water demands continue to grow in the years ahead due to population growth, increased food demand, and expansion and modernization of the industrial base, and improved standards of living [2].

In fact, Egypt's water problem cuts two ways: on the one hand a scarcity of fresh water to drink and irrigate crops, on the other, an overabundance of salt water, already rendering farmlands barren, and threatening to drown the low-lying areas along the Mediterranean coast. Coastal erosion, a consequence of both the Aswan High Dam and global warming-related sea rises, is readily observable in Egypt [3]. All the lakes suffer the additional burden of fertilizer run-off from surrounding farmland, also the fishing communities have disappeared, and it is also threatened by diminished water quality [3]. As the acceleration of the productivity is the main objective of Egyptian economy, however, this is reached sometimes at the expense of sustainability. The challenge the policy-maker faces is how the development can reduce poverty, but to be made compatible with the maintenance of the natural resources [4].

According to United Nations projections, the population of Egypt will grow from 62.3 million in 1995 to 95.6 million by 2026 and will likely reach 114.8 million before it stabilizes in the year 2065. In spite of Egypt using most of its share of the Nile water for irrigation, at present it imports more than half of its food grains. Increasing demand for food in the future will certainly bring further pressure on the scarce water supply [5]. However, it is found that in Egypt, despite considerable planning capacities, many water policy outcomes are influenced by developments beyond the control of the water ministry [6].

Water resources and supply systems in Egypt

Water resources in Egypt are limited to the following resources:

Nile water

Egypt is dependent on Nile River as the major source of its water supply for all economic and service activities. Nile River is considered as one of the most important rivers in the world; it is the life artery of Egypt. Throughout the known Egyptian history, Nile River had dominating influences on the economy, culture, public health, social life and political aspects. Nile River basin covers an area of about 3,000,000 square km, through ten African countries: Burundi, Democratic Republic of Congo, Egypt, Eritrea, Ethiopia, Kenya, Rwanda, Sudan, Tanzania and Uganda. The supply of Nile water is allocated by the Nile Water Agreement, signed with the Sudan in 1959 prior to the construction of Aswan High Dam; Egypt's quota is fixed at 55.5 billion m^3/year. This quota constitutes about 90% of the country's water budget; the remaining 10 % represents minor quantities of renewable and fossil groundwater, and a few showers of rainfall [7].

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Aswan High Dam (AHD) is the major regulatory facility on the river. It began operation in 1968, ensuring Egypt's control over its share of water, and guiding its full utilization. Downstream from AHD, the Nile water is diverted from the main stream into an intensive network of canals through several types of control structures, providing water for agricultural and other uses [8, 9 and 10]. Being the most downstream country on the Nile, Egypt is affected by climate change impacts, not only within its borders, but also within the whole basin; which it shares with 9 other countries. Economic developments in upstream countries and measures they might take to adapt to climate change are likely to put more pressure on water resources in Egypt. Therefore, it is of prime importance for Egypt, amongst other Nile countries, to assess the hydrological impacts of climate change on the Nile. From the other hand, several studies showed that Nile River is very sensitive to temperature and precipitation changes mainly because of its low runoff/rainfall ratio (4%) [11 and 12].

There are two branches of Nile River; Rosetta and Damietta. Rosetta is the western branch of about 239 km long and variable widths of 450-1000 m. It is characterized by variable depths with an average range of 12-20 m. The water level in Rosetta Branch is controlled by two barrages; Delta Barrage in the south and Idfina Barrage at about 197 km to the north. On the other hand, the Damietta Branch is about 230 km long with variable widths of 300 and 500 m. This branch is characterized by variable depths with an average of about 8 m. The Nile water quality is characterized by high nutrients concentrations. Nile River from Aswan to El-Kanater Barrage receives wastewater discharge from 124 point sources, of which 67 are agricultural drains and the remainders are industrial sources [13].

Rainfall

Rainfall is limited to the coastal strip running parallel to the Mediterranean Sea and occurs only in winter season. The amount is small ranging between 80 to 280 mm/year and provides an overall volume of 1.3 billion m^3/year. Rain is also erratic with respect to space and time and mainly utilized for agricultural purposes. Rainfall amount cannot be considered a reliable source of water due to high spatial and temporal variability [7 and 12].

Groundwater

Although there is less groundwater than Nile water, the existence of aquifers in the desert, where no Nile water can be conveyed, makes this resource extremely precious. Desert aquifers are mostly deep and non-renewable, meaning that they are mined and the cost of exploitation is high. The average pumping rate from these aquifers at the present time is about 1.5 to 1.85 billion m^3/year although the actual potential is 3.5 billion m^3/year. The second source of groundwater is the Nile aquifer, which lies below cultivated land in the valley and Delta. The reservoir is fed by surplus irrigation water and seepage from the Nile and its branches. Obviously, water in the reservoir is shallow and renewable and the quality is not as good as the deep groundwater in the desert. The third, smaller groundwater reservoir is the coastal aquifer, which is fed by rain falling on the coastal strip, forming lenses of freshwater, which sit above the saline groundwater and run parallel to the shoreline [7].

Non-conventional water sources

Given the continuous need to increase water resources and bridge the gap between supply and demand; Egypt has a long history of water reuse [7]. While conventional (renewable) resources are extremely scarce, non-conventional water sources provide highly valued supplies. This water is generally used for agriculture, landscaping, and industrial uses through specialized processes [12], these sources include:

Treated domestic sewage

Treated domestic sewage is being reused for irrigation with or without blending with fresh water. The increasing demands for domestic water will increase the total amount of sewage available for reuse. It is estimated that the total quantity of reused treated wastewater in Egypt is about 0.3 BCM in 2013 [12].

Agricultural drainage water

The amount of water that returns to drains from irrigated lands is relatively high (about 25 to 30%). The total amount of reused water is estimated to be 13 BCM in 2013. The reuse practices increase the overall efficiency of the system as comparable to the efficiency of modern irrigation systems [7]. Reuse of non-conventional water sources such as agricultural drainage water and treated sewage water cannot be added to Egypt's fresh water resources. In fact, using these sources is a recycling process of the previously used Nile fresh water in such a way that improves the overall efficiency of the water distribution system, however, appropriate strategies are needed for managing soil, water, and crops when these resources are used for irrigation [7 and 12].

Desalination

Desalination of seawater in Egypt has been given low priority as a water resource because the cost of treatment is high compared with other sources. Desalination is actually practiced in the Red Sea coastal area to supply tourism villages and resorts with adequate domestic water supply where the economic

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value of the water is high enough to cover the treatment costs. It may be crucial to use such resource in the future if the growth of the demand for water exceeds all other available water resources. However, its use will depend on technological development in this field [12].

Pollution

Pollution is considered as one of the most serious problems that faces human societies in the whole world especially in the developing countries. Though produced by man himself and his activities, it has deleterious effects on human's environments and resources, so pollution and its effects are considered as one of man's greatest crimes against himself. It is well known that all water resources in Egypt depending on surface water which could be exposed to many pollutants and contaminants; natural contamination arising from leaching, and normal geological weathering processes in the surrounding watersheds, Domestic and industrial wastewater may be disposed directly into surface water and percolate into ground water and agricultural activities are also a contributor to water pollution. Within limits, materials like organics and microorganisms can be degraded by the water's natural-purification process, or by flowing through wetlands such as the Delta. In contrast, inorganic pollutants are not affected by natural purification processes; their concentrations may only be reduced by dilution. Toxic compounds arising from industrial discharges (heavy metals, herbicides and pesticides, plus inert suspended or dissolved solids) destroy the natural biological activity in the water. Oxygen balance is also affected due to organic or inorganic substances, oils and detergents that hinder oxygen transfer across the air-water interface [14].
Aquatic habitats, especially the freshwater ecosystems, are more subjected to pollution than other environments, because of water use in industrial processes as well as discharge of effluents from industry and urban developments. Most aquatic ecosystems can cope with a certain degree of pollution, but severe pollution is reflected in a change in the fauna and flora of the community, which suffer such pollution. The sources of contaminants can be grouped into three categories: industrial activities, municipal wastewater, and agricultural drainage water [15].

Industrial activities

Although industrialization is considered the cornerstone of the development strategies due to its significant contribution to the economic growth and hence human welfare, however, in most developing countries it led to serious environmental degradation. Chemicals, food, metal products, and textiles are the most prominent branches in Egypt. The worst industrial waste liquids are those heavily laden with organic or heavy metals or with corrosive, toxic or microbial loaded substances; such waters endanger public health through the direct use as well as through feeding with fish that live in the polluted streams. Some groups of chemicals, such as carcinogenics, mutagenics and neurotoxins, are even unaffected by the usual methods of water treatment. The threats imposed by chemical discharges comprise contamination of drinking water supplies, phyto- and aquatic toxicity, destruction of agriculture as well as fisheries, bioaccumulation, and biotransformation. As it might be expected, the mid-stream conditions of the Nile are still, on an average, at a fairly clean level owing to dilution and degradation of the pollutants discharged. The riverbanks, however, are much more polluted. Inefficient production in some industries (e.g., oil and soap) generates waste that contains raw material as well as products, a costly burden to the national economy and the consumer [16 and 17]. Evidently, efficient production causes lesser pollution. Cleaner production is defined by UNEP's Industry and Environment Program Activity Center as "the continuous application of an integrated preventive environmental strategy to processes and products to reduce risks to humans and the environment". Obviously, cleaner production is the unique answer for the industrial pollution in Egypt [16].

Municipal wastewater

Egypt had 372 municipal wastewater treatment plants in 2012, treating an average of 10.1 million cubic meters per day [18]. In the rural areas accommodating about half of the population, 95% of the people have no access to sewer systems or wastewater treatment facilities. The "septic tank" is the most common disposal facility where excreta and a limited amount of sludge water can be collected for biological digestion. The digested excreta leach into the soil surrounding the tank and hence subject shallow groundwater to pollution [16]. Furthermore, secondary treatment cannot be satisfactory in emphasizing the quality of wastewater for reuse or in preventing further pollution with pathogenic bacteria and other microorganisms [19]. Admittedly, the unused drainage water led into waterways transfers its pollution burden to the surface water which might be contaminated with pollutants from domestic sources. Typhoid, paratyphoid, infectious hepatitis, and infant diarrhea are some endemic diseases indicating deterioration of water quality in Egypt. Despite the assiduous endeavours for public awareness through the media, the prevalence of Bilharzia substantiates the lack of rural sanitation against the traditional contamination of surface waters with human wastes, i.e., urine and faeces [16].

Agricultural drainage Water

The increased nutritional needs due to the high population growth in Egypt imposed major challenges to the agricultural policy over decades. the rate of growth in agricultural production increased since the construction of Aswan High Dam, many programs of land reclamation were implemented; transformation of basin irrigation to permanent irrigation make agriculture consumes more than 85% of Egypt's share of

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Nile water annually. Although the country lost part of its fertile land to urbanization, this has been balanced by expansion of agricultural areas [12]. The intensive use of chemical fertilizers and insecticides was essential for the exploitation of the available land. A part of the used fertilizers is usually drained into the surface and groundwater systems along the Nile. The use of these sources for drinking water supply is at risk due to the presence of nitrogen and phosphorus salts [20]. The heavy implementation of pesticides, as in the case of cotton crop, poses serious environmental risk. Some pesticide residues were found in canals and drains, however, their concentration was far below the guidelines set by WHO [21]. In the downstream direction the water quality gradually deteriorates due to the poorly treated wastewater discharges from both domestic and industrial activities and uncontrolled mixing with water from polluted drains. Therefore, they contain high levels of various pollutants, such as faecal bacteria, heavy metals, pesticides and insecticides. Some drains should be considered as open sewage system that smell is very bad due to the production of hydrosulfide [16].

Water scarcity

Average per capita fresh water availability in Egypt is on a steady decline from about 1,893 cubic meters per year in 1959 to about 900 cubic meters in 2000, to 700 cubic meters in 2012. According to government, population in Egypt will likely reach 98.7 million in 2025. According to the Ministry of Water Resources and Irrigation, Egypt will need 20 percent more water by 2020, Egypt already uses 127% of its water resources; meaning that Egypt imports 27% of its water used through imported food and other products; and by 2020 Egypt could be using 147%. United Nations now says Egypt could be water scarce by 2025. Assuming that Egyptians' population carries on growing, The land reclamation projects in deserts and the fact that Egypt is already importing more than 50% of the cereals it consumes, Egypt cannot meet its food demand by relying on Nile water for irrigation [22]. Adding to Egypt's precarious water situation, the evaporation from the surface of the long Lake Nasser apparently exceeds the earlier estimated amount. Egypt is already utilizing most of the flow of the Nile and it plans to use even more. Additionally, Egypt has built several irrigation projects such as the Isna Barrage, Nag Hammadi Barrage, and Asyut Barrage, which will certainly be affected by decreased flow from Aswan [5]. It is forecasted that in 2025 the population of Egypt will increase to about 95 million, leading to a decrease in per capita water availability per year assuming that total water availability remains constant. Moreover, developments in Sudan, Ethiopia or other riparian countries could reduce water availability to Egypt [23]. Potential risks around water availability include the huge population density and deteriorated water pipe network which causes a huge water loss that reach the values of 34-35% which is equal to around 791 million m3/year; which if saved can provide fresh potable water to additional 11 million inhabitants. This combination of water scarcity and pollution of the available water resources could be one of the worst resource crises Egypt faces. Industrial facilities are source of industrial waste water, which is considered one of the major causes of water pollution in Egypt and therefore, these facilities must be inspected and subjected to Egyptian laws; which preserve a certain balance between economic gain and preservation of water resources from pollution.

Water demands

Rapidly growing demand for water in Egypt in response to an increasing population led to higher crop intensities and horizontal expansion. The logical sequence in water resource management is to examine the present demand of water for all purposes, to determine how the demand in various sectors will be affected by growth then to project what the water demand will be in the short and in the long term future [24]. Various demands for freshwater are exerting excessive pressure on the available water supply as follows:

Agriculture: The agricultural sector is the highest freshwater consumer as cropping patterns are a crucial factor in water resources management, especially under the free-market policy. The prediction of future water requirements depends upon the best estimation of cropping patterns. The Ministry of Water Resources and Irrigation (MWRI) in Collaboration with the Ministry of Agriculture & Land Reclamation have planned an ambitious program for reclamation [24]. However, irrigation mainly consumes the bulk of the available water supplies. Despite losses of agricultural land to urbanization, the cropped area statistics indicate a very modest increase during the last years due to the increase in cropping intensity, complying with the national plan to achieve food security and the distribution of crop areas then has not change significantly during the last decade [2 and 24].

Municipal water demands: Estimation of the municipal water use depends on population growth rates, the consumption in liter/capita/day, and distribution system losses.

Industrial water demands: industrial facilities demands of water should be regulated in a certain way preserving a balance between economic gain and resources preservation.

Navigation and Hydropower Water Use: From February to September, water released from the High Aswan Dam (HAD) for irrigation, municipal, and industrial purposes is sufficient to maintain the required navigational draft in the Nile.

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Outflows to Sea: Water enters the system at the High Aswan Dam and flows to the sea as freshwater through the Rosetta and Damietta branches, and as drainage water through the main drains [24].

Challenges of water quality and climate change

Due to the progressive increase of population and the continuous expansion of urbanized areas, pollution dilemma has increased too. One of the greatest water related challenges facing Egypt is the pollution of its surface and ground water resources from agricultural, domestic and industrial sources. Although monitoring water quality of the Nile system started as early as the 1980s, the complexity of water quality management still required the development of other mechanisms including policies, institutional and governance arrangements, infrastructure for monitoring and analytic laboratories, awareness and skilled human resources. The cost of environmental degradation due to water quality deterioration is relatively high with serious health and quality of life consequences; it was also found that the level of bacteria is higher than what is permitted for both municipal and irrigation purposes. The closed water system of the country makes it more vulnerable to quality deterioration in a northward direction [25]. Control of the groundwater withdrawals, especially in the Northern oases and Siwa oasis, is necessary in order to prevent the deterioration of groundwater quality [26]. Contamination arises from both point and diffuse sources. Inadequate treatment of industrial and domestic wastewater and the progressive increase of the population and industrial activities have created significant pollution dilemma with serious health effects [24]. The severity of water quality problems in Egypt varies among different water bodies depending on the flow use pattern, the population density, the extent of industrialization, the availability of sanitation systems as well as the social and economic conditions [2].

The poor quality of drinking water is of great importance since the sources of raw water for many areas have become increasingly polluted. Therefore, it requires more sophisticated treatment to produce drinking water of adequately quality. In addition, water treatments units are not always functioning properly as a result of lacking maintenance and proper operation. Even when water treatment is satisfactory, drinking water is sometimes contaminated in leaking distribution network, which are infiltrated for example by sewage [2]. In addition, despite of the flourishing fish production in Egypt, only 17 species remain as of 1995 out of 47 species which used to be available in 1948 [2]. In fact, MWRI cannot solve the pollution problem alone, but requires a combination of all the efforts of all people and community groups and also needs to collaborate with different stakeholders including the polluting sectors such as industries, agriculture, and municipal water users. However, water quality control is not generally a top priority in the respective ministries, and their departments dealing with issue of water quality may lack full internal support [6]. At present, industrial facilities managers, engineers and workers in Egypt do not have the sufficient knowledge and know-how enough to deal with the industrial pollution. Neither their academic, nor their on-the-job training have provided them with knowledge and experience necessary for identifying and dealing with environmental problems [25].

In an initiative to contain water pollution without confronting the business interests of the industries, the Egyptian Environmental Affairs Agency EEAA supports efforts to improve the capacity of industrial plants for wastewater treatment. However, the Ministry of State for the Environment itself is also considered a still relatively weak actor in the water sector by many observers. In summary, decisions regarding water quality control are very much subject to bargaining over stakeholder interests, both within the government and between the government and water users [6]. The anticipated environmental deterioration that may take place in the northern lakes should be closely monitored and evaluated [26]. As for the challenge of the climate change, in recent years, a large part of the scientific community has made efforts analyzing the impact of projected climate change on water resources and proposing adaptation strategies. In this context, a number of studies analyzed the effects of climate change on the hydrology of the River Nile Basin (RNB), the world's longest river. In fact, the RNB could be vulnerable to water stress under climate change because of the limited water availability and the increasing demand for water from different sectors [23]. Furthermore, climate change is likely to affect water availability to Egypt, although the direction of change is uncertain. Some studies foresee a decline of up to 70 percent in Nile water availability, while other studies project an increase in Nile water levels by 25 percent [27].

Population and Its distribution in Egypt

Egypt's resident population surpassed 83 million in 2003, according to the Central Agency for Public Mobilization and Statistics [28], making it the most populous country in the Arab World and the third largest in Africa. A recent report published by the Information and Decision Support Center (IDSC) [40]; places population growth rates at close to 2% per year. Egypt's population growth rate remains high compared to growth rates of less than 1% in Europe [29]. Egypt's surface area is almost entirely desert. Since the climate is hyper-arid, the presence of Nile water concentrates the population within the confines of the valley and delta. A commonly quoted number is 96% of the population living on 4 % of the land [30]. Rural population densities as high as 1,600 people per km2 exert profound pressure on natural resources of land and water. The rapid urbanization and urban encroachment around the metropolitan areas of Cairo and Alexandria, as well as around the cities in the delta, is reducing available agricultural land [31]. According to the United Nation's Food and Agriculture Organization (FAO), since 1997, Egypt's rural population as a percentage of the country's total population has been relatively stable, declining by only 1.7%, and now makes up almost 56% of the population [32]. It is worth noting that, despite the relatively

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stable percentage of rural population, the percentage of the labor force in agriculture has declined to only 24% of the total national labor force [32].

Water resources and water security in Egypt

Without significant rainfall, Egypt is classified as a hyper-arid country, and its agricultural production is almost wholly dependent on irrigation [30]. Freshwater resources are limited to the Nile River and groundwater stored in shallow and deep aquifers. National dependence on freshwater withdrawal from the Nile is estimated at between 95% and 98% [16 and 33]. Desert groundwater withdrawals, accounting to a few billion m3 yearly, are mainly drawn from the deep Nubian Sandstone aquifer supplying the Western Desert, which is depleting at an increasing rate. Egypt's set share of the annual Nile flow is 55.5 billion m3 [1 and 34]. The primary function of the Aswan High Dam is to provide Egypt with water security, protecting it from the unpredictability of the annual flow. About 85% of Nile water is devoted to the agricultural sector, and releases and quantities are timed according to the national agricultural cycle. The country fell below the World Bank's water scarcity threshold of 1,000 m^3 of renewable water available per capita per year in 1997 [30]. By 2007, this figure sunk below the 700 m^3 international water poverty limit [35]. Economic growth in Egypt also threatens the quantity and quality of water resources, inflating the existing issue of contaminated shallow groundwater from industrial chemicals, and excessive fertilizer and pesticides use [36]. Egyptian farmers still overwhelmingly practice flood irrigation, which results in evaporative loss and over-irrigation, causing soil damage and rises in groundwater tables [37]. In 2005, only 6% of Egypt's cultivated area was equipped with modern pressurized irrigation systems [1]. Inadequate agricultural drainage coupled with the Nile Delta's particularly flat slope contributes to salinization of soil and water resources. Local demand for water is also increasing, both through horizontal growth from desert land reclamation projects and vertical growth in terms of production intensification. Policy changes that give more freedom to farmers in cropping pattern choices, while stimulating yield increases have led to an overall increase in water demand [37]. El-Agha et al., (2011) [35] and Radwan (1998) [38] reported a mismatch between irrigation demand and supply at the level of main canals in the Nile Delta, and Radwan (1997) [39] blamed bureaucratic, overly centralized government administration and management for inefficiencies in irrigation water supply and distribution [35 and 39].

Industrial pollution in Egypt

Assessing the industrial landscape of Egypt, wastewater from various industrial processes could regularly contain pollutants such as asbestos, lead, mercury, cadmium, arsenic, sulfur, oils and petrochemicals. All of these are very hard or even impossible to separate from the water causing permanent damage once dumped in it. Furthermore, radioactive materials can also be found in wastewater from ore processing such as uranium, thorium, iodine, cesium and radon and cause pollution to both surface and underground water. To date however, industrial polluters have continued to pollute unabated, despite laws which expressly state they cannot pollute above certain levels. What we now see is uncontrolled polluted wastewater from leather tanning and dyeing processes, sugar distillation factories, chemical producing factories, building materials industry - including cement, the food canning industry, paper and wood pulp processing factories and the electrical industry (amongst many others). Despite the argument that a level of deregulation is required to bring in investors to rebuild the economy in Egypt, it should not come at the cost of the lives of those supposedly benefitting from the economic improvement. Egyptians suffering from long-term illnesses and in need of medical care owing to kidney failure, cancer or the Hepatitis C Virus (10-20% of the population). Worryingly high and increasing rates of renal diseases and renal failure: roughly 30% of which are caused by Schistosomiasis. The highest rates of Schistosomiasis contributing to renal failure are in Lower and Upper Egypt: the areas with least access to safe drinking water and sufficient sewage treatment infrastructure. Public Health researchers based in El Minia identified Drinking unsafe water and exposure to pesticides as the cause of renal diseases for an estimated 72% of patients. The dilemma manifests in case of rural villages along the Nile which are not connected to mains water and without sufficient means to buy bottled water, drinking the untreated and polluted river water. Industrial pollution is causing many risks for Egyptian fishermen who losing their livelihoods because the fish can no longer survive in the water, on the other hand making sources of food to be polluted: fish, fruit and vegetables grown using polluted water and soil. The added cost to farmers whose land remains permanently polluted and unusable whilst the groundwater and water sources are also polluted, finally, loss of tourism due to lack of safe access to clean water and unsightly surroundings. In 2008, the EEAA recorded that roughly 102 industrial plants are discharging their waste water either directly into the Nile or through the municipal system. The waste produced from these industries contains some of the most hazardous detergents, heavy metals, and pesticides of all. Such industrial contaminants dumped in the Nile have reached levels of almost 4.5 tons per year. And the percentage of industrial organic pollutants thrown in the water is roughly 270 tons per day. The only published inventories of industrial facilities violating the regulations are 5 years or more old, therefore there is no longer an up to date dataset of the facilities in question sufficient to operate good monitoring and enforcement activities as required.

CONCLUSION

Egypt, as a developing country is facing a crisis in water resources sustainability and management. The water shortage dilemma is not related only to increasing demands, but rather also to poor infrastructure

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and management practices. It has limited access to funding, and infrastructure requires urgent upgrading. The water sector in Egypt is facing many challenges including water scarcity and deterioration of water quality due to population increase and lack of financial resources. The fragmentation of water management and lack of awareness about water challenges are also clear challenging problems. Water scarcity is the most serious dilemma facing Egypt at the present time in addition to the problems caused by pollution of water resources by various forms of contaminants loaded with sewage, agricultural drainage water and industrial wastewater which in fact posing continuous challenges facing the government and the institutions responsible for the preservation of water resources in Egypt and make it very necessary and imperative to maintain water resources by all means including rationalize the consumption, reduce the waste and strict laws governing the process of industrial wastewater pumping on water resources , as well as improve the quality of sewage treatment to reduce pollution in addition to the search for alternative sources of water , such as desalination of sea water.

CONFLICT OF INTEREST

There is no conflict of interest.

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