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Challenges Facing Sustainable Agricultural Development

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Abstract

Sustainable agricultural development seeks not only to conserve and conserve natural resources, but also to develop them, because future generations will demand more in quantity and quality in terms of agricultural and food products. These goals must ensure balance with the development of the livelihoods of the individuals concerned. Livelihoods should not be limited to an indicator of adequate income levels but should also include public health concerns and education standards.

The vast majority of agricultural water is provided by precipitation that is stored in soil moisture, which is known as green water. This water evaporates or occurs through plants, and plays a crucial role in crop growth, especially for rain-fed agriculture. Water is one of the most important inputs to economic development and sustainable development. The more demand, the more important the water. The future looks miserable if it does not succeed in formulating and implementing a water resource management approach that can match the limited supply of fresh water with increasing demand. This working paper provides an overview of historical development and the status of implementation of land valuation concepts and tools and land-use planning to manage land resources and landscapes, and proposes recommendations for future action. This study also aims to shed light on the future status of water based on the current state of available water resources, water demand, institutional and legislative frameworks for water management, in addition to highlighting strategies and policies to rationalize water use and increase water supply. Recommendations have been made to help overcome anticipated water challenges and to improve opportunities in this valuable study as knowledge of water resource planning is very limited at present and largely undocumented. Hence, challenges and opportunities were discussed to support decision-making related to land and water resource management as a prerequisite for sustainable development. So the aim of this study was to diagnose the challenges facing sustainable agricultural development.

Keywords: Land Resources; Management; Policy Making; Sustainable Agricultural Development; Water Resources

Introduction

Modern agriculture, plant breeding, and agrochemicals such as pesticides, fertilizers, and technological improvements have increased agricultural productivity sharply, but at the same time these technological improvements have caused widespread environmental damage and an increased negative impact on human health associated with organic organic consumption. Likewise, selective breeding and modern animal husbandry practices have increased meat production, but have raised concerns about animal welfare and the health effects of antibiotics, growth hormones and other chemicals commonly used in the production of industrial meat. Agricultural food production and water management are increasingly becoming a global issue promoting discussions on a number of fronts. Significant degradation of land and water resources, including the depletion of aquifers, has been observed in recent decades, and the effects of global warming on agriculture and agriculture on global warming are still not fully understood. New technologies have led to massive growth in the agricultural sector, but they have also led to soil depletion, groundwater pollution, and increased economic instability and other social costs. Besides, intensive agriculture has increased the burden of support on the Egyptian government.

The growing and converging challenges of population growth, demands for limited resources by various actors, land degradation, loss of biodiversity and climate change, require rational use of resources to maintain and enhance productivity and maintain resilient ecosystems. Land use plans and, more broadly, land resource planning (LRP), are tools for achieving sustainable and efficient use of resources, taking into account the biophysical, social and economic dimensions. Water scarcity is problematic in Egypt. Per capita water availability is already one of the lowest in the world. This is suggested for further declines. The main challenge is to bridge the rapidly increasing gap between limited water resources and the growing demand for water from various economic sectors.

Improving agricultural productivity, while preserving and enhancing natural resources, such as water, is a prerequisite for farmers to increase global food supplies on a sustainable basis. The role of small farmers and their families in sustaining sustainable agricultural productivity growth will be crucial. Farmers are at the heart of any change that involves natural resources and should be encouraged and directed, through appropriate incentives and governance practices, to conserve natural ecosystems and their biodiversity, and to minimize the negative impact that agriculture can have on the environment.

The Nile is the main source of fresh water in Egypt with a share in excess of 95%. Lake Nasser storage tank saves 56 billion cubic meters (hereinafter referred to as BCM) annually. The issue of Egypt's share of the Nile water is subject to difficult negotiations. In April 2011, Ethiopia launched construction of the Grand Ethiopian Renaissance Dam, GERD. With a water storage capacity of 63 billion cubic meters and a power generation capacity of 6000 megawatts, GERD is expected to be the largest hydropower plant and one of the largest water reservoirs on the continent. Egyptian experts give indicators of a 20-34% drop in water when the filling period exceeds the dry period. This is estimated at 11-19 billion cubic meters on average during the period of filling the dam.

Water resource management, water quality management and environmental protection are the main concerns of sustainable development. As Martin and Martin (1991) note, "Water is the most valuable resource for humanity." Water is the prerequisite for all forms of food production, "No water, and no food." Unfortunately, most water-poor developing countries depend on insufficient solutions as the use of dirty water and most wastewater is left untreated. Water remains vital to the growth and well-being of the entire Middle East region. Indeed, many scholars and politicians have stated that water and water control are two major factors in the overall stability of the region. About 270 basins are shared between two or more countries, and as demand for water increases, better management of these common rivers will be needed to prevent sparks from occurring.

Land and Water Management

The fate of the rural poor is closely related to the lands and water resources on which they depend for food, water and economic security. While urban and industrial growth supports the fast-growing commercial economy in the region, the rural poor still depend on the benefits that ecosystems provide. Land and water resources are the basis for agricultural production, fisheries and aquaculture that provide nutrition and income. These resources also support the production of livestock and forest products that provide the food, fuel, and fodder and building materials necessary for the livelihood of poor families. At the same time, these ecosystems provide vital services to the rural and urban population on a larger scale, including surface and groundwater restoration, flood regulation and biodiversity conservation, among others.

These land and water resources are under increasing pressure due to patterns of overexploitation, rights conflicts, and the wider environmental change of humankind. As resources and ecosystems deteriorate, the livelihoods of the poor are further eroded. In environmentally fragile areas, such as highland and mountain areas with steep slopes and poor soils, deforestation, overgrazing and intensive cultivation have resulted in soil erosion and loss of fertility, increased sudden floods, and reduced water flow in the dry season. These areas are home to many of the region's poor - especially the politically and socially marginalized ethnic minorities. Their limited asset base has been weakened by the effects of extreme weather events such as severe storms, floods, landslides and mud flows.

The quality and quantity of regional water resources are under pressure due to increased volatility and scarcity, in addition to pressure on ground and surface water resources to meet the intensive agricultural outputs and industrial needs. For example, heavily populated lowland areas with intensive agricultural production depend on intensive inputs and water extraction with long-term effects on groundwater quality and availability and soil fertility. The degradation of wetlands, partly due to land conversion and changing water levels, affects the regulation of flood plains, the regulation of waste from growing urban areas, habitats of fish reproduction and rice production.

In addition, the construction of large water dams to meet the increasing demand for electricity affects seasonal flooding patterns in both upstream and downstream, as well as water flow, fishery habitats and agricultural production. As a result, the livelihoods of large numbers of rural people, dependent on these resources, are at risk. Moreover, decades of investment in flood control, bridges and other control measures have not eliminated large-scale flooding. The sense of safety these investments provide has often been proven false, with the subsequent catastrophic failure of infrastructure, crops and livelihoods that drove families deeper into poverty. In coastal areas, the increase in urbanization, industrial expansion and intensification and competition of fisheries leads to lower productivity and quality of marine environments.

Across the region, economic growth has obscured the widespread failure of resource management efforts to meet these pressures. Management policies often undermine resource tenure and access rights for poor and marginalized groups, who have limited voice in governance and decision-making about the natural resources that they depend on.

The goal of the various challenges, Egypt is currently facing:

Egypt consists of more than 95% of the desert that leaves less than 450 square meters of arable land per capita for more than 100 million people with the idea that the average arable land to support individual consumption in the developed world needs more than 4000 square meters of arable land. Moreover, the population grows annually at an average of 2%, which raises the issue of future food security in Egypt, ***Alnaggar,*** (2003). For Egypt, the real costs related to the economy reflect a lack of natural resources such as land, water and fertile soil. Currently, the Egyptian government has a strategic ambition to reclaim 1.5 million acres in the desert, providing an opportunity for sustainable agriculture towards the Egyptian green economy. For the future of agriculture in Egypt, it will be necessary to absorb the costs of external damage in the cost calculations of each farmer, currently, through high energy subsidies and the absence of public water prices, unsustainable practices and market distortions are supported due to the lack of equitable distribution of the real costs that occur in production Agricultural. In the end, the environment and future generations bear the costs for the Egyptian economy.

Egypt has a total area of about one million square kilometers, or 238 million acres. Most of them are desert and inhabit only 5.5%. The settlements are concentrated in and around the Nile Delta and its valley, which is remarkably narrow in Upper Egypt. The total cultivated land area is about 8.6 million acres - 3% of the total land area - and it consists mostly of old and new reclaimed areas. The climate is dry with rare precipitation in a narrow strip along the northern coast. The Nile River is the main and exclusive source of surface water in Egypt. Agriculture depends on the Nile water and consumes between 80 and 85% of the annual water supply. The agricultural land base consists of old lands in the Nile Valley and Delta, new lands reclaimed from the desert since 1952, rainfed areas, and many oases where groundwater is used for irrigation, Asempa. (2010).

Egypt has reached a country where the amount of available water places restrictions on its national economic development. As an indication of absolute rarity, the threshold value of 1,000 cubic meters per person per year is often used. Egypt actually exceeded this threshold in the 1990s. With the use of the threshold of absolute scarcity 500 m3 / person / year, Egypt will reach this level soon, taking into account population projections for 2025. In desert areas, soil types and their properties are greatly influenced by geomorphological and genetic factors. In general, the soil in new lands lacks fertile nutrients (especially micronutrients), is very low in organic and alkaline substances (high pH) and has lower physical properties and moisture properties. In many areas, other verse features include high calcium carbonate ($CaCO_3$), high salinity content and, in some cases, gypsum. In general, the physical restrictions are solid pans, which are formed at various depths in the form of the soil under the influence of many cement agents. The properties of these resources vary greatly from place to place due to the way they are configured.

The ancient lands represent the largest irrigated area in Egypt and are found in the Nile Valley and Delta. These include lands that have been claimed from the desert for generations and are being heavily cultivated, most of them using the Nile water. These lands, characterized by alluvial soils and spread over 5.36 million acres, are characterized by traditional surface irrigation systems, which, compared to modern and improved irrigation systems, have a very low efficiency in field water application of about 50%. On the one hand, two problems occur in most of this land, on the one hand, the continued encroachment on non-agricultural uses at a rate of 20,000 acres / year and the continued deterioration of soil fertility.

The New lands include relatively newly reclaimed lands, especially since the establishment of the Aswan High Dam - or areas currently being reclaimed. It lies mainly on the east and west sides of the Nile Delta and is spread in different regions of the country. New lands cover 2.5 million acres and cover new old lands as well as new lands. The Nile is the main source of irrigation water, but in some desert areas ground water is also used. Sprinkler and drip irrigation systems are also common.

Soil erosion is one of the most serious environmental problems associated with land use. In many cases, erosion causes an almost irreversible decrease in soil productivity and other soil functions (Baldassarre, & Elshamy, (2011)). And lead to environmental damage. Egypt is located in the very dry region extending from North Africa to West Asia, and wind erosion is considered one of the most important desertification operations in areas exceeding 90% of the state's area in the Western Desert and the Eastern Desert, especially Sinai. These areas are characterized by a fragile ecosystem, scarce vegetation and severe drought. Organic farming aims to be a production system that is more closely aligned with natural cycles and processes. Hence, organic farming should be less conducive to corrosion than conventional cultivation, although this has not yet been proven.

Land Management Systems

Five broad paths of change in agricultural land use in developing countries have evolved in this century, reflecting different land resources and settlement patterns:

- Expanding and intensifying irrigated agriculture
- High quality rainfed lands
- Intensification of marginal lands with a high population density
- Expand agriculture into marginal, sparsely populated lands
- The rise of urban agriculture and of each civilization with rapid urbanization

The agricultural landscapes in the five tracks are usually quite distinct, and they offer completely different risks of resource degradation and opportunities and constraints for intensification, diversification and investment to improve land. More differences in landscape and resource management challenges arise from differences in the history of land settlement and its past history of decline; A mixture of crops, crops and livestock components; And a mix of commercial and subsistence projects. Bell (1998) found empirical evidence that the relationship between population growth and resource quality on hills and mountains was affected by precipitation (mainly by influencing agricultural product selection, soil degradation risks, land use intensity), and topography (by affecting spatial distribution for production systems) and soil properties (through crop selection, crop frequency, and input use). These factors also affected the return to conservation.

Although agricultural expansion was at least one of the factors in 96 percent of cases, smallholder farmers' cultivation of food crops, which is often thought to be a major cause, was in fact a relatively small contributor to deforestation. Other forms of agricultural expansion, such as permanent crops or livestock, appear equally or more important in most regions, although agro-environmental factors and policies that influence this cause of forest loss vary greatly across regions - with very different paths being identified For the Amazon, the Congo Basin and Southeast Asia - even within regions across countries. Road construction is closely related to the impact of macroeconomic forces. Often it is paid for by logging companies or through international assistance, new roads open forests, first to extract timber and then to expand agriculture. New immigrants settle down roadsides, use roads to obtain inputs and deliver their products to markets. By linking forest areas to the broader economy, roads reduce costs and increase transfer revenue, which increases the sensitivity of these areas to changes in macroeconomic conditions.

Land users can enhance a variety of environmental services, ranging from regulating hydrological flows to conserving biodiversity and carbon sequestration. However, land uses that provide such services are quickly eliminated by uses that do not. One of the main reasons is that land users usually do not receive any compensation for the environmental services they generate for others. Land degradation and its relationship to rural poverty are still not well understood, although the relationship remains very clear. A downward spiral of land degradation and poverty - a kind of material-technical equivalent of a low-income trap in Lewis - may occur as land degradation causes agricultural productivity to decline and poverty worsens, and poverty causes families to continue to degrade their lands. Recently, soil conservation measures have largely depended on food-for-work programs as an incentive and have been directed towards labor-intensive activities such as terraces, building barriers, and tree planting. There is a growing consensus that the effects of previous soil conservation programs have been somewhat disappointing (Clarke, (1993)), although there is evidence of positive effects from conservation measures in some areas, especially in low rainfall systems.

The general failure of past conservation efforts can be attributed to a combination of factors that make the recommended strategies inappropriate for local conditions. In particular, these tend to focus on stopping soil erosion without looking at the socio-economic reasons behind low soil productivity, thus enhancing unprofitable, risky or inappropriate technologies for farmers' food security needs and financial constraints. Conservation efforts als neglected clear regional disparities within a country, and were often implemented in a top-down fashion, in the absence of community participation.

Knowledge and Restrictions of Land Policy

Low levels of land productivity and the subsequent degradation of land and resources can be attributed to insufficient access to the best or most appropriate knowledge required to overcome local constraints. Providing better information to both technology developers and farmers can stimulate the adoption of both soil conservation techniques and improved land management practices. Usually, farmers realize when the downturn threatens their immediate livelihoods. When a lack of interest arises, it is often because farmers either did not consider the decline a serious long-term threat or because the resource in question only made a marginal contribution to the livelihoods of farm families (Golia, (2008)).

However, in many situations, a lack of awareness among farmers hinders adaptation significantly. The first is when farmers do not immediately notice the effects of decomposition, or its causal agents, without modern measuring devices. Such situations may occur with soil acidification, micronutrient depletion, changes in microflora, or the spread of disease vectors. The second is the situation of new immigrants growing in unfamiliar agricultural environmental conditions or trying to use unfamiliar farming systems. In such cases, external intervention may be needed in diagnosing problems, educating farmers, and demonstrating the positive effects of changing resource management to stimulate the adaptive response. A third situation occurs when the type of resource degradation involved is not only a local concern, but rather a concern for strangers, as may be the case with some types of habitat loss or sedimentation downstream. The adaptive response is unlikely to start without providing appropriate incentives, regulatory and competing interest frameworks, and penal sanctions for non-compliance as appropriate. A fourth situation arises when poor farmers fail to respond due to a short planning horizon or a high discount rate. However, empirical evidence for whether the poor have really high rates of time preference is unclear. Moreover, he argues that poor farmers are often more willing to protect or invest their natural resource assets than their desires because of their relatively greater reliance on those assets for livelihoods.

The property rights held by the poor are the main household assets and societal assets that may provide income opportunities, guarantee access to basic subsistence needs (water, food, fuel, and medicines), and insurance against living risks. Poor groups tend to rely more on customary or informal rights. Consequently, marginal users, such as women and the poor, often lose out as a result of policies and processes that privatize and reduce complex packages of rights in a single unitary right (under many land and water reforms).

In a study of smallholder farmers using participatory methods, (Klawitter, & Qazzaz, (2005).) I identified the following ***five factors*** that farmers in Malawi use as the most important indicators of sustainable agriculture:

- Diversification of crops - cultivation of a group of basic crops
- Getting adequate quantities of good seeds - sufficient seeds for timely planting at the recommended spacing for all crops
- Agricultural land area - enough space to feed the family
- To possess all the necessary agricultural tools and tools
- An ideal mix of crops to manage soil fertility in the field by growing crops and planting a relay (with legumes)

Not surprisingly, farmers' concerns about the sustainability of agricultural systems and crops differ greatly, not only in the spatial and temporal scale but also in the scale, from the detailed priorities of researchers and policy makers.

Critical Issues Affecting The Global Water Outlook

Increasing Request

Most of the net increase in the world's population between 2015 and 2050 will occur in urban areas of low-income countries. Since the bulk of the food consumed worldwide is produced domestically - with only 19 percent of production being traded internationally - improving productivity in developing countries will be crucial to ensuring food security, although poverty and hunger pockets persist in many from the regions. Much of the persistent food insecurity in 2050 will, as today, be found in poor families in low-income countries, and in regions where depleted or degraded natural resources no longer support livelihood activities applicable to smallholders. The main cause of food insecurity will be persistent poverty, which prevents families from buying enough food, especially during periods of scarcity or high prices.

Sector Competition

With population growth continuing and rising incomes driving demand for water, increased competition between water, energy, agriculture, fisheries, livestock, forests, mining, transportation, and other sectors may have unpredictable impacts on livelihoods and the environment. Large-scale water infrastructure projects, for example, provide electricity through hydropower and water storage for irrigation, flood management and urban use, but can have significant adverse impacts on the environment, subsequent agro-ecological systems, and on communities and their livelihoods. Global freshwater resources are expected to increase in tension in many regions, with more than 40 percent of the world's population expected to live in river basins with severe water stress by 2050. As pressure on water resources increases, this leads to Tensions between users and industries and excessive pressure on the environment.

Water Scarcity

Water scarcity occurs when the water supply is insufficient to meet the demand for water. This condition arises as a result of the high rate of aggregate demand from all sectors that use water compared to available supplies, in light of the prevailing institutional arrangements and infrastructure conditions. Globally, freshwater resources are sufficient for agriculture to meet demand requirements by 2050, due to appropriate technologies and investments, but a wide variation in water availability is expected between and within countries and significant water scarcity will persist in the Near East, North Africa, South Asia and other regions. Cities and industries compete with agriculture for water use, and an increasing number of countries, or regions within countries, reach alarming levels of stress and water pollution. Excessive water use occurs when withdrawals exceed recharge rates, which ultimately leads to water scarcity. The use of groundwater in agriculture and other sectors has increased dramatically since the mid-twentieth century, and in many areas the annual groundwater withdrawal exceeds the average natural recharge. Water scarcity will worsen in areas where water withdrawals are not sustainable, which may limit agricultural production, threaten ecosystems, and affect income and livelihood opportunities for many people in rural and urban areas. In addition to the depletion of groundwater, groundwater contamination and the salting of aquifers due to seawater intrusion are also increasing concerns.

Climate Change

Climate change places an additional layer of complexity on the difficult scenario described above. Climate change is expected to have a major impact on the water cycle, changing rainfall patterns and affecting the availability and quality of surface and groundwater, agricultural production and associated ecosystems. Increased precipitation variability can affect water flow in surface systems and the feeding and discharging rates of aquifers. The sea level rise caused by the climate will demand the land designated for food production, either by submersion or salty water intrusion into the aquifers, which requires the development of new areas for food production. Rainfed agricultural production, which accounts for 80 percent of global agricultural land and 60 percent of global food production, can be significantly affected by climate change, especially in arid and semi-arid regions.

Get the Water

Access to safe water and sanitation is essential to enable healthy and productive livelihoods and has important links to nutritional outcomes and gender equality. In many developing countries, women are traditionally responsible for collecting water to meet family needs. This attracts women and girls back, as they are at risk and limit their access to education and income-generating activities. Increasing women's access to irrigation can increase productivity and important nutritional improvements by enhancing food availability and diversifying the diet.

Water Quality and Pollution

Agriculture is a cause and a victim of pollution. Agricultural pollution caused by the use of nitrogen, phosphorous, pesticides, herbicides, fungicides and bactericides in many developed countries has bypassed pollution from settlements and industries as the main reason behind eutrophication in inland and coastal waters. This results in the reproduction of toxic algae, loss of habitat and biodiversity, and long-term reduction or loss of fishing. The flow of agricultural chemicals and agricultural treatment in surface water courses and their leakage in the aquifers leads to risks to both human health and the environment. In most developing countries, the contribution of agriculture to water pollution is less important, mainly due to the great importance of pollution from urban and industrial sources.

Contaminated water by other sectors can be useful in agriculture. Using urban wastewater to irrigate fruits and vegetables of nutritional value in peri-urban agriculture can address water scarcity and food insecurity, if appropriately addressed.

The Link Between Water, Food and Energy

In most irrigated areas, water and energy uses are directly related to the use of energy to pump water. Efforts to improve water management through the modernization of irrigation systems often increase farm energy spending. In rainfed areas, higher precipitation usually results in higher yields that may be associated with greater amounts of fertilizer and machine operations. These two inputs require significant amounts of energy, water and energy pairing in crop production. In the past, some countries have supported energy prices to boost crop production and support smallholder families. However, these policies give farmers little incentive to reduce their use of groundwater, and they have contributed to the rapid decline of groundwater levels in some countries.

Water, energy - and land - also interact with crop biofuel production. In areas where land and water are limited, the decision to produce crops for biofuels may reduce food production in the season. The effects of such decisions depend on the market prices for food and energy and the revenue earned in each activity. Water, energy and food also interact in the context of hydropower development in river basins. The establishment of a hydroelectric project can affect food production when farmers are removed from the lands that will be flooded with reservoirs. Hydroelectric projects often provide water storage for electricity generation and for connection to downstream irrigation schemes, but operating a hydroelectric facility to improve electricity generation can impose restrictions on the release of water for irrigation. Nexus reactions are also found in the large amounts of energy required to transport irrigation and drinking water supplies in large-scale canal delivery systems, and the large energy requirements of desalination facilities in arid regions.

Water Resources Management in Egypt: Problems and Challenges

In fact, the water problem in Egypt is interrupted in two ways: on the one hand the scarcity of fresh water for drinking and irrigation of crops, on the other hand, an excess of saline water, which makes agricultural land already barren, and threatens to drown in low-lying areas along the Mediterranean coast. Coastal erosion, as a result of both the Aswan High Dam and the global warming associated with global warming, can be easily seen in Egypt (Cerveny & Cerveny, (2006).). All lakes suffer from the additional burden of fertilizer flow from the surrounding agricultural lands, fishing societies have disappeared, and they are threatened by low water quality.

Water Scarcity Challenge

Egypt already imports more than 50% of the grain it consumes. Assuming that the Egyptian population continues to grow, Egypt cannot meet the demand for food by relying on Nile water for irrigation. In addition to the unstable water situation in Egypt, it appears that evaporation from the surface of Lake Tawila is longer than the previous estimated amount. Egypt is already taking advantage of most of the flow of the Nile and plans to use more. The land reclamation project in Western Sahara has raised internal tensions in Egypt because those residing in other regions fear their water supplies will be affected. The population of Egypt in 2025 is expected to increase to about 120 million, leading to a decrease in per capita water availability annually, assuming that the total water availability remains constant. Moreover, developments in Sudan, Ethiopia or other riparian countries can reduce the availability of water to Egypt.

Water Supplies

The Aswan High Dam HAD [1960-1971]: It was built to assist and accelerate food production in order to accommodate the rapid population growth in Egypt. Surface water resources are limited to Egypt's share of the Nile, along with small amounts of rain and floods. The Aswan High Dam provides storage to ensure organized water supplies (Al-Rai, (2009)). The authority intends to protect Egypt from fluctuations and changes in the flow of the Nile and ensure water supplies for municipal, industrial and agricultural uses. Expanding and expanding the cultivated area beyond the borders of the Nile Valley.

Rainwater: In the western part of the city of Alexandria to Salloum, the northern coast receives a modest amount of winter rain to the east in the Al-Arish area and then rises again to the east of Al-Arish in Rafah, northeast of Sinai. Available water is only sufficient for pastoral purposes, to some extent for seasonal cultivation especially in excessively rainy years, to grow some olives and figs in the west and peaches in the eastern regions. The coastal sand dunes and valley sediments receiving rain shall absorb the shallow wells of drinking water. In Sinai, some reservoirs were built to collect torrential rains in the valleys.

Groundwater: Groundwater is found mainly in the Nile Valley, Delta, Western Desert and Sinai. The largest aquifer is the Nubian sandstone aquifer beneath the eastern part of the African desert, and it is shared between Egypt and four other countries. Groundwater in the Nile Basin cannot be considered as a separate source of water. The groundwater layer is renewed only by leakage from the Nile, irrigation canals and drains and the nomination losses from irrigated lands.

Water Demand

Demand for water in Egypt is growing rapidly in response to the growing population as well as the high standard of living that has led to increased crop density and horizontal expansion. The logical sequence in the management of water resources is the study of the current demand for water for all purposes, and determining how demand in various sectors has been affected by growth and then anticipating what the demand for water will be in the short and long term. Various demands on fresh water exert excessive pressure on available water supplies as follows:

Agriculture: The agricultural sector is the highest consumer of fresh water, because crop patterns are a critical factor in managing water resources, especially in light of free market policy. Predicting future water needs depends on the best estimate of crop patterns. The combined effect of rapid population growth and increased living standards has increased the demand for food. However, irrigation farming mainly consumes the bulk of the available water supply. Despite losses in agricultural land due to urbanization, crop area statistics indicate a very modest increase over the past decade due to increased crop intensity, and compliance with the National Plan for Food Security and Distribution of Crop Areas has not changed significantly over the past decade (Hvidt, (2000).) Demand for municipal and industrial water: The estimate of municipal water use depends on population growth rates, consumption of liter / person / day, and losses of the distribution system that are expressed as an estimate of the efficiency of transportation in the municipality using water.

Renaissance Dam Challenge

The most important challenge is that Ethiopia is proceeding with the implementation of the Nahda Dam, which represents the greatest threat to water security in Egypt, in light of the information available on the Renaissance Dam, which is located on the Blue Nile in western Ethiopia. . In fact, Egypt's share of water has not changed since the 1950s, despite the increasing population and high rates of population development in Egypt, and therefore the dam could be a disaster disrupting the development map in Egypt. In fact, the Nile has been a source of political tension between three of its major riparian states. Egypt, Sudan and Ethiopia. Egypt and Sudan play a central role in the conflict over the Nile, as they realize that they can no longer ignore the thirst for water. However, the main challenge to accessing the Nile water in Egypt comes from Ethiopia, which has an increasing demand for developing water resources to increase the agricultural production of the country, as Ethiopia suffers from a recurring and radical lack of food production that leads to an increase in food imports continuously. Consequently, Ethiopia is serious about achieving self-sufficiency in food production at all costs (Swain, 2008). Energy is another major issue. It is estimated that Ethiopia needs about 20% of energy annually and less than 0.2% of hydropower utilized. Addis Ababa has an ambitious plan to use the Blue Nile to turn the country into a hydroelectric giant. Consequently, Ethiopia is serious about preserving more Nile water for its own use. However, any irrigation project in the Ethiopian highlands will definitely have a negative impact on the Nile water supply downstream. In short, Ethiopia presents a larger and more complex water security problem in Egypt than Sudan Selaamawet (2013).

***Renaissance* Dam** with such specifications has catastrophic effects on Egypt and the dam in Egypt will maintain a large deficit in the water share, causing the end of agricultural expansion, a possible decrease in the area currently cultivated, and an increase in salinity in the northern part of the delta in a way that prevents the cultivation of those lands and lands Fallow water, damage to drinking water stations, the collapse of canals and drains, and destabilization of the environment in the northern part of Egypt (Alexandria and the northern coast). Moreover, this dam can prevent water from reaching the coast, affect navigation in the river and cause a 20% decrease in electricity production from the Aswan High Dam. Moreover, if the Renaissance Dam collapses, an area of 16-20 square kilometers stretching from the site of the dam to Khartoum will be submerged and destroyed. Moreover, a massive flow of water will flow into Lake Nasser. This could lead to the collapse of the High Dam in southern Egypt, if the lake is already full, due to the lack of a mechanism to drain excess water from the lake. In this case, this would destroy all the cities near the dam and extend to Cairo, and would flood the delta. Despite all the challenges, the Egyptian way of dealing with developments was not commensurate with the seriousness of the pending risks John & Müller (2003).

Water Pricing Challenge as a New Concept of Water Use

Water is a completely human right, but at the same time, how it is managed, is very important all over the world, where there is a constant innovation of new and better and more efficient concepts of water use. Technology alone cannot bridge the growing gap between water demand and water supply. In fact, water should be considered more valuable than oil today. However, due to its lack of pricing, it is still politically prohibited in many countries to talk about water pricing, but there is a lot of waste in how water is managed. The truth is that pricing water below its true cost will lead to the inability to meet tomorrow's demand. Consequently, it is important for countries to cooperate with each other on the sound management of river basins. Just as private companies invest in energy, some also invest in water and sanitation.

Affected price controls can be linked to performance standards in other ways. The challenge is that water is traditionally seen as a free good in Egypt, resulting in very high local consumption because consumers do not use water rationally especially in areas where water systems work well.

Water privatization allows the voluntary transfer of rights between buyers and sellers under adequate protection to other affected parties in order to ensure the effective use and conservation of available water resources. In other words, the privatization of water authorities tends to provide economic incentives for both water suppliers and customers to achieve effective water resource management by creating a multi-supplier competitive framework to demonstrate the efficiency of water allocation and distribution. Therefore, they tend to create water transportation systems run by organized private companies that sell their services to water supply companies and customers. Meanwhile, water transmission systems are subject to quality control and pipeline channel network specifications and price restrictions (Kliot, (1994)).

The Challenge of Fragmentation of Agricultural Land Holdings

Indeed, fragmentation of holdings is one of the main issues threatening agriculture in Egypt, especially in the ancient lands of the Nile Valley and Nile Delta. This is due to its direct impact on agricultural production efficiency, marketing, water efficiency, and even the income of farmers who have become among the lowest income groups nationwide. The average holding size in the 1920s and 1930s was over 2.4 hectares. After the Agrarian Reform Act, the average tenure fell to about 1.5 hectares. The current average holding size at the national level is about 0.8 ha. Without livestock and poultry that provide additional income, farmers will not be able to make ends meet. More fragmentation will increase the difficulties of irrigation management and thousands of farmers may leave their cultivated land in search of better income in urban centers. Farmer migration will have serious social, economic and security consequences (Luzi, (2010).).

Water Quality and Climate Change Challenges

With the steady increase in population and the continuous expansion of urban areas, pollution issues have also increased. One of the biggest challenges facing Egypt in the field of water is pollution of surface and ground water resources from agricultural, local and industrial sources. The cost of environmental degradation due to degraded water quality is relatively high, with health consequences and a dangerous quality of life. Pollution arises from persistent and widespread sources. Insufficient industrial and domestic wastewater treatment plants and the rapid increase in population and industrial activities have created major pollution problems with serious health impacts.

Challenge Of Insufficient Legal And Institutional Framework

Like Swain, (2008). He noted that there is no legal framework anywhere where an international agreement has been signed but not fully ratified in many countries. In fact, there is no single comprehensive law for water resources in Egypt. The main laws related to water resource management include laws on irrigation and drainage on the one hand, and environmental protection laws on the other. Among the irrigation and drainage laws are Law No. 12 of 1984 for Irrigation and Drainage, and Law No. 213 of 1994 regarding Farmer Participation and Cost Sharing. However, the current laws in force governing government control of water resources and related facilities are unable to meet the government's needs in a manner consistent with the reform of its policy and economic plan. Therefore, it became necessary to draft new rules and amend existing laws.

Challenges Of Lack Of Public Awareness And Unreliable Information

The lack of information is also another challenge in managing water resources as Egypt lacks the necessary data in various sectors, especially water. The only measured resource is the Egyptian Nile Water Quota (HAD). There is no exact measurement and available measurements are limited to a few items. This is also usually done at long intervals, so it is not possible to know the exact uses of agricultural water in different regions. In addition, there is no accurate information available on municipal and industrial water uses or on distribution network losses. Moreover, insufficient dissemination of information and communication between different institutions and stakeholders increases the difficulties of the water distribution process, and restricts efforts to develop comprehensive water policies and plans. With regard to a lack of public awareness, technology alone cannot bridge the growing gap between water demand and water supply.

Water Resources Management In Egypt: Future Water Scenarios

In fact, most current water policies are sensitive to overcoming the challenges of sustainable water resource management in Egypt. However, these water policies, unfortunately, still contain many questionable issues that not only affect the outcomes of these policies, but also their effectiveness. Consequently, three scenarios of the water situation in Egypt can be expected in the future. The first scenario assumes the continuity of the current water practices without major changes, the second scenario assumes a relative development of water policies, and the third scenario is ambitious and reflects a fundamental development in water management practices in Egypt. The results of the three scenarios show that unless urgent steps are taken to control the challenges of resource management in Egypt, it will be difficult to maintain sustainable development in Egypt. The latter scenario may be difficult to achieve due to the massive financial investment required. Hence, a worrying crisis urgently requires effective resource management in Egypt. Getting water is your right, but providing water is your responsibility. In this context, the following recommendations should be actively adopted (Water, (2013).):

- Intensifying government efforts to reduce the rate of population growth.
- Create an appropriate legal framework where enabling existing water use laws and water pollution appears to be critical.
- Enhancing cooperation relations through better cultural, social, economic and political relations with the Nile Basin countries, as well as supporting the Upper Nile projects, which increases the share of the Nile waters, which increases governmental and private investments in the Nile Basin countries.
- Increasing government and private sector interventions needed to increase public awareness of water scarcity problems, rationalizing water use in the domestic and industrial sectors, as well as protecting water sources from pollution.
- Supporting the role of scientific research to develop new technologies for affordable desalination and the introduction of new agricultural seeds with high productivity, high disease resistance and low water consumption.
- Pushing decentralization of water management forward at the district level, but it must be accompanied by serious capacity building programs.
- Establish a well-coordinated information system to support decision makers for effective management of water resources on an environmentally sound basis.

Improved Water Management

Rain is the primary freshwater source above the river basin. On average, 110,000 km3 of rain falls on continents annually. Plants consume two-thirds of the precipitation or return to the atmosphere by evaporation and transpiration (green water). About a third reaches the aquifers, rivers and lakes (blue water), of which only about 12,000 km3 are readily available for human use. The current water withdrawal rate for municipal, industrial and agricultural uses is about 10% of blue water resources. Green water is a very important resource for global food production. About 60 percent of the world's main food production depends on rainfed irrigation, and therefore green water. Livestock grazing and browse systems depend on green water, as well as wood production from natural forests and farms.

Irrigation (blue water) lending in sub-Saharan Africa has decreased significantly over the past two decades. It is believed that there are various causes for this decline, but the common factor is the disappointing performance of development so far in terms of sustainability and return on investment. Moreover, the decrease in irrigation lending was offset by the decrease in the prices of the agricultural crops portal, which led to a further decrease in returns on investment in agricultural water control facilities. The persistence of declining investment for more than 20 years indicates that the sector has been slow to respond and adapt to change. Rain-fed agriculture contributes to most of the world's food production: 95 percent in sub-Saharan Africa, where only 15-30 percent of rain is used; the rest is lost, mostly like devastating runoff.

Green water management contributes to blue water. Soil treats many times more water than it retains, while soil erosion, by surface runoff and massive erosion during peak flows, contributes to almost all sediment loads from streams, leading to sedimentation of reservoirs and waterways. More effective green water management can reduce competition and potential conflict between agricultural water users on the one hand and the needs of industry, urban residents and the environment on the other.

Green water is essential for food and timber production, water supply (streams and flows in springs and streams), water quality (including salinity and freshwater mitigation function in wetlands), aquatic ecosystems, and waste treatment. Sustainable land management can positively affect green water, thus greatly enhancing the efficiency of "crop per drop" irrigation. Such innovation would also require adaptive botanical research studies of the relationships between crops, water, soil chemistry, structure and accessibility to many potential service areas.

Recommendations To Policy Makers

Given the increasing demand for water in the competing sectors, the idea that agriculture "should produce more food with less water" has taken root. While this concept is convincing, it can lead to misconceptions because it does not distinguish between the transferred water applied to farm fields, and the water that is made in the crop yield production process. Much of the water used for irrigation flows from the ends of farm fields or seeps into shallow groundwater, where it is available for additional use in irrigation or other purposes. Only a portion of the water the crop consumes during transpiration, and the water that evaporates from the plant and soil surfaces, is "lost" from the system at this point in the hydrological cycle. Opportunities to save water through investments in technology will be limited by the extent of water loss in each environment.

Recommendations in the Field of Agriculture

Strengthening irrigation infrastructure and management and increasing irrigation efficiency and access:

Irrigation infrastructure is costly in construction, operation and maintenance. Irrigation and daily management systems of the same service often need to adapt to changing conditions over their useful life. Financial resources and technical support from public or international donors for maintenance and management are less than those available for initial investment. This can lead to poor maintenance and servicing.National governments have built and run many irrigation projects worldwide, with often mixed results in terms of system performance and financial viability. In some cases, community infrastructure maintenance is mandated, while infrastructure property remains state-owned. Ambiguity over ownership and responsibilities often neglects infrastructure.

In some contexts, public-private partnerships (PPPs) can facilitate the mobilization of resources for infrastructure investment and accelerate the development and implementation of new technologies. The expertise and technology provided by public-private partnerships can increase agricultural production and benefit farmers and the general economy. However, public-private partnerships in the water and agriculture sector are more appropriate in countries where certain preconditions exist - such as clear land ownership and water rights / allocations, and the ability of the public sector to promote private investment goals and align them with national priorities. The Public-Private Partnership (PPCP), which is a special type of public-private partnership, has been used in some water projects that bring in the community as a partner, creating a local pillar for investment (Koch-Weser, (1994)).

The shift from surface irrigation on the farm to compressed irrigation on the farm and from channel transport to pipelines has improved conservation of water resources. However, such improvements have the disadvantage of increasing energy demand at the farm and system levels (see section on the relationship between water, food and energy), which must be taken into account when an intervention is planned. However, the adoption of compact irrigation often represents a step forward towards improving control, flexibility and accountability in the delivery of irrigation water, thus allowing a shift from low-yield agriculture to high-yield agriculture. Thus these transformations can be justified not only in terms of water supply but in terms of increased irrigation productivity.

Increased access to irrigation is associated with increased productivity and important nutritional outcomes through improvements in food availability and diet diversification. Investments in irrigation designed to provide equal access for women and men are important to ensure that women, children and disadvantaged groups benefit from increased access to food and diversification of diets.

Improving Water Supply Management:

Globally, rainfed agriculture is the main source of food production. In many areas, gaps remain between actual and potential yields and opportunities to improve yield and water productivity without irrigation. Rainwater harvesting, as well as supplementary irrigation, can greatly improve rainfed agriculture. Conserving water on the farm, especially the adoption of agricultural practices that reduce runoff and increase soil infiltration and water storage in rainfed agriculture, is the most relevant domestic supply enhancement option that farmers need to increase production. On a slightly larger scale, small and decentralized water collection and storage systems contribute to increased water availability and agricultural production at the household and community levels. These small measures enhance local economic development and make communities more resilient to climate change.

Harvesting rainwater slows or stops increased surface runoff from increasing rainfall intensity, allowing more infiltration, increasing soil water storage and improving groundwater recharge. Much can be done in dry environments where rainwater is lost through runoff of water in salt pans and rapid evaporation from bare soil surfaces. In these cases, water harvesting can reduce by storing water in surface areas, in the form of soil, or by facilitating the recharge of aquifers from exposure to drought, reducing yield losses, and allowing farmers to invest in other inputs, such as fertilizers and high varieties yield. Water stored in surface basins or aquifers is often used as a supplementary source of irrigation that can improve rainfed yields and help stabilize farmers' production and income. Supplemental irrigation also increases farmers' resilience and ability to adapt to climate change.

Improving productivity, including water production, with a focus on the natural resource base:

Increasing yields (production per unit of land) is the single most important source of increased crop water productivity. Over the past thirty years, yield increases have accounted for 75 percent of agricultural production growth. Now low productivity and slower yield growth in some developing countries and on small family farms raises particular concerns. The gap between farmers' yields and the potential technical yield reflects near-optimal use of inputs and insufficient adoption of more productive technology. Intensified sustainable production provides the required transformation from past practices that focus on productivity gains as the primary concern and reduce environmental impacts as a secondary issue, thus transferring sustainability to the core of agricultural development.

Good agricultural practices based on soil and water management, fertility and pest control, along with improved market access, can lead to significant improvements in agricultural productivity and adaptation to climate change with minimal impact on water resources. For example, conservation agriculture (CA), based on minimal soil disruption, permanent soil cover and crop rotation, has enormous potential for all farm sizes and agricultural ecosystems. Under CA, the soil has a higher waterproofing ability, which reduces surface runoff and hence greatly eroding the soil. This improves the quality of surface water that reduces pollution from soil erosion, and enhances groundwater resources.Insurance services are the main determinant with regard to adopting a sustainable production intensification approach, especially in the context of climate change. Insurance builds flexibility and opens up opportunities that facilitate investment in new agricultural technologies or inputs. Innovative instruments, such as index insurance, differ from conventional compensatory insurance, where payments are explicitly based on the measured loss. Alternatively, farmers in indices insurance can purchase coverage based on an index related to those losses, such as wind speed, the amount of rain during a specific time period (weather-based indicators) or average yield losses in a larger area (area return indicators).

The achievements in Earth observation science have indicated that it is now possible to define the main data for sustainable agricultural production on the basis of spatial space measurements. Remote sensing, information and communication techniques can be used, along with on-site data, to assess soil balance in soil soils and related biomass production to monitor farmland and water productivity. In this way, farmers can be assisted to obtain more reliable crops, and irrigation authorities will have access to information to improve water delivery services (UNDP (2011)).

Reducing food waste and waste to help reduce pressure on the ground and water:

Large quantities of land, water, energy, and plant nutrients are used to produce food that is lost or wasted along the supply chain from farms to homes. In some circumstances, efforts to reduce these losses can improve resource use and enhance food security. Globally, about a third of the volume of food produced for human consumption is lost or wasted every year. Rough estimates put the cost of producing wasted food at US $ 750 billion every year. This amounts to 1.3 billion tons, which is enough to feed 2 billion people.

Aside from reducing the quantity and quality of food available along the entire food chain, food loss and waste also have negative environmental impacts. Each year, the amount of water that corresponds to food loss and waste is estimated at 250 cubic kilometers, or three times the size of Lake Geneva. In addition, the production, processing and marketing of food that is lost or wasted ultimately contributes to greenhouse gas emissions. The economic and environmental impacts of food loss and waste must be addressed simultaneously due to their direct and major impact on food security, nutrition, natural resources and climate change.

Using agricultural trade as an option to address water scarcity:

Many countries are already experiencing small but progressive changes in seasonal rainfall patterns and temperatures due to climate change. These fluctuations are expected to become more evident, along with increasingly frequent, extreme and unpredictable extreme weather events. High temperatures, changing rainfall patterns, and more frequent droughts and floods will affect the availability and quality of water and hence its production and production. With climate change affected by some countries and the benefit of others, its impacts on water for food security will be uneven across regions, and the overall net effects on yields are expected to be negative. The risks to water and food security are generally greater in areas with low latitudes, where the negative impacts of climate change will be felt sooner, as countries face multiple pressures and low resilience are expected to be most affected.

Water Recommendations

As demand grows, there is a growing competition for resources between water, energy, agriculture, fisheries, livestock, forests, mining, transportation and other sectors with unpredictable impacts on livelihoods and the environment. Large-scale water infrastructure projects can, for example, simultaneously create multiple benefits (hydropower, jobs, water storage for irrigation and urban uses, adaptation to climate change) and negative impacts (on downstream agro-ecosystems, social impacts such as resettlement).

Addressing the challenge of water management and water allocation between and within economic sectors requires major efforts, especially in the context of restrictions on water availability and climate change. There are significant benefits in coordinating water policies with development, agriculture, industry and energy policies. Various forms of coordination, including relationship approaches, can build on synergies between different government departments but also across local and regional actors, including consulting with private actors, civil society, and water users (World Bank (2007)).

Improving Knowledge and Understanding of the Water Cycle:

Governance mechanisms should also recognize the high level of uncertainty associated with future situations, with an emphasis on flexible planning that allows plans and activities to be updated regularly. This level of response is only possible if the information and knowledge is updated, and if monitoring and information management systems provide decision makers with reliable information. There is always a risk that adaptation strategies will come out through external factors (such as climate change, global financial and economic shocks, and the transformation of international cooperation agreements), but in order to be effective, these must be based on a clear understanding of the hydrological cycle and sound water accounting.

Scarcity of Communication:

Scarcity conditions in the agricultural sector can be reported in a variety of ways, including farmers' awareness campaigns, regulations, prices, incentives and allocations. Water pricing is an option to communicate scarcity - charging higher water rates to reflect conditions of scarcity can encourage farmers to manage their water connections more carefully. A number of countries use water pricing to express water scarcity. For example, in Australia, price signals and effective water markets are seen as an essential part of improving the economic efficiency of water use and encouraging water users to adapt to changing climate conditions.

In areas where water pricing is not yet politically feasible, governments may consider implementing water allocations by allocating a proportional share of this volume to each user. When farmers know that their water supply is limited, they have an incentive to improve the values they get with the amount of water they receive. Such a binding restriction of water at the farm level can be as effective as pricing water in generating regional water use efficiency, if farmers are allowed to trade or sell parts of their water allocations.

Promoting and leading global coordination on water and agriculture:

Adequate access to food and water is essential to life and socio-economic development, and as such, global forums address it in its efforts to end hunger and poverty around the world. Water is at the heart of the 2030 Agenda, with many links devoted to health, food security, climate change, resilience to disasters and ecosystems, among others. Reaching its ambitious goals requires that we tackle access to water and sanitation alongside water quality and supply issues, along with improving water management to protect ecosystems and build resilience.

The global framework will support the development and implementation of policies and programmers for the sustainable use of water in the agricultural sectors (including crop and livestock production, fisheries, aquaculture and forestry), and along the value chain, using context-specific approaches and processes. Countries will be supported to integrate climate change into agricultural policies by identifying priority actions and increasing successful responses to threats to agricultural production due to increased water scarcity.

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