



The role of water in sustainable agricultural development in Iraq (Review)

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Abstract

This article aims to find out the impact of water in the process of sustainable agricultural development in Iraq, by presenting the reality of water resources in Iraq and water sources with reference to water sources globally and at the level of the Arab world, the low efficiency of the use of water resources in Iraq, which was considered one of the biggest challenges that led to the depletion of this important and vital resource, as it did not exceed in the best cases 40%, which is a small percentage if compared to neighboring countries and the Arab homeland. Moreover, the study did not indicate any trend to use virtual water as a more rational alternative to importing water between the high costs of water and its transportation, and it was also shown through the study that there are many challenges that affected water management in Iraq, including water share and water security, as well as shared water with neighboring and upstream countries. The study recommended supporting and encouraging the use of modern irrigation systems (sprinklers) to raise the efficiency of water use and link water security with food security because of their major role in raising the process of sustainable agricultural development in Iraq As well as activating the rule aquatic Agricultural extension because of its role in guiding and guiding farmers in rationalizing the use of water resources and urging them to adopt modern irrigation technologies.

Key words: Virtual Water , Water Security, Water Costs, water management.

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Introduction

Water plays a major and important role in the agricultural development process, as it is not possible to imagine agricultural development without water, which means that achieving sustainable agricultural development is based on the use of water resources, which are the main source of agriculture and achieving food

security[1]. Iraq is one of the arid and semi-arid countries and today suffers from a severe water crisis, as there is a clear water deficit, if we take into account the scarcity obstacle identified by the United Nations Development Program by 1000 m³ per year per capita, while in Iraq it does not exceed 300 m³ per year. Therefore, water represents a key pillar of

agricultural development in Iraq, especially in light of the relative scarcity of this resource, as well as the policies of neighboring countries and the great waste of water resources, which has been thrown. These calls for appropriate attention to be paid to the study of issues that would contribute to the development and maintenance of this important resource, and achieve the maximum possible levels of rationalization and efficiency in its use. [2]

Distribution of water resources in the world

The total amount of water has not changed for millions of years despite the changes that have occurred on the earth [3], 97.5% of the total water of the earth is salt water, and the remaining 2.5% is the proportion of fresh water, which is mostly found in the South and North Poles in the form of ice, while freshwater resources that are easily accessible (rivers, groundwater, etc.) constitute only 0.7% of the total global freshwater reserve, and the amount available annually does not exceed 0.02%, meaning that the total amount of freshwater constitutes more than 40,000 km³, or 6,500 m³ per capita per year, which is an amount that is supposed to be sufficient to cover the needs of the individual and protect the climate system [4], but this percentage is likely to decline, especially with the climate change the world is witnessing that negatively affects these natural resources, as well as the rapid demographic growth, which rose from 6 billion people in 2000 to 8 billion in 2022.

Table 1. World Water Distribution

Site	Volume (m ³)	% of the total
Freshwater lakes	125	0.009
Salty lakes and inland lakes	104	0.008
Rivers	125	0.009
Soil moisture	67	0.005
Groundwater (4000 m ³)	8350	0.61
Ice	29200	2.14
Steam Passing	13	0.001
Oceans	1320000	97.2
Total	1360000	100

Source: The Arab Encyclopedia of Knowledge for Sustainable Development, Arab Science House, Volume 2, 1st Edition, Lebanon, p. 398

Water Distribution in the Arab World

The agricultural sector in many Arab countries is one of the most important sources of employment and sources of income for a large segment of the population, in addition to its contribution to achieving food security and providing raw materials for many manufacturing industries. Water sources in the Arab world fall into two main categories: traditional and non-traditional sources. The following is a summary of these sources:

1. Traditional water sources.

Rain, surface and groundwater, the distribution of rainfall in the Arab world is as follows:

Table 2. Distribution of precipitation in the Arab world/ billion cubic meters

Territory	Rainfall pilgrimage m ³	Rate %
Arabian Peninsula Region	211	9.2
Arab Mashreq Region	178	7.8
Maghreb Region	588	25.8
Central Region Region	1305	57.2
Total	2282	100

Source: Arab Monetary Fund. (2011). Arab Economic Report, p. 51.

As for surface water and rivers in the Arab world, they include:

- The Nile River originates from Lake Victoria in central Africa.
- The Tigris and Euphrates Rivers originate from Turkey and then enter Iraq.
- The Litani River (Lebanon) originates in the vicinity of the city of Baalbek, north of Bekaa.
- The Jordan River consists of three small rivers: Baniyas and Dan which are in Syria and Hasbani in Lebanon.
- The Senegal River forms the border between Mauritania and Senegal.

Groundwater is one of the main water resources available in the countries of the Arabian Gulf, the Arabian Peninsula and the Western Desert in Egypt.

2. Non-traditional water resources in the Arab world:

Many Arab countries are looking for strategies to provide alternative water sources, which are of three types.

- I) Desalination of seawater and groundwater with high salinity.
- II) Wastewater treatment.
- III) Agricultural drainage water treatment.

Water resources in Iraq:

A large part of the territory of Iraq is located within the arid and semi-arid belt, There for is necessary for Iraqi agriculture to adopt several resources of water , and the water sources in Iraq are three, the first is the Tigris and Euphrates Rivers, the second is rainwater, which depends on it in demi-based agriculture (farming in rainy areas), which is characterized by fluctuating precipitation rates from region to region in Iraq, and the third source is groundwater, which is a strategic source of water resources in Iraq. [5]

- 1) **Tigris and Euphrates Rivers:** The tributaries of the Tigris River are limited to (Khabur, Great Zab, Little Zab, Azim and Diyala), while the Euphrates River has no tributaries within the Iraqi territory, and the total revenue of the Tigris River with its tributaries is estimated at 40 billion m³, while the annual revenues of the Euphrates River have been estimated at 18 billion m³. If we look at the percentage of imports of the two rivers upstream, we see that 56% of the Tigris River imports are from Turkey, 12% from Iran and 32% from inside Iraq. As for the water revenues of the Euphrates River, 88% of it comes from Turkey, 9% from Syria and 3% from Iraq . [6]
- 2) **Groundwater:** When estimated, it was classified into three categories:
 - I) Revolving storage is estimated at 3.46 billion m³.
 - II) Investable fixed storage is estimated at 2.96 billion m³.
 - III) Investment storage, which is the sum of renewable storage and fixed storage, estimated at 6.42 billion m³ . [7]
- 3) **Rainwater:** It is the source that occupies the highest percentage of fluctuation and uncertainty in terms of amount and quantity, the northern regions are

characterized by good rainfall rates that reach in the northeastern regions of 500-1000 mm annually, while in the central and southern regions, it reaches 200 mm annually and may reach less than 50 mm per year . [8]

Although Iraq has multiple sources of water, these sources have been exposed to several challenges, as many factors have exacerbated the pressures on freshwater resources, including population growth, irrational consumption patterns (waste), regional conflicts and climate change. These pressures, in turn, have increased risks and uncertainties associated with water quantity and quality.

The most prominent challenges affecting water management in Iraq:

1. **Water share:** Total water imports in Iraq have declined over the past two decades by up to 70% at the aggregate level and the per capita level.
2. **Shared water:** It is one of the most important challenges facing water management and the reason is that the main sources of rivers are shared with neighboring countries, and are outside the borders and thus hinder agricultural development.
3. **Water security:** As it is known, agriculture consumes the largest share of the available resources, which is a major reason for the pressures on these resources, and constitutes 70% of the total water demand, and despite these high rates of water use, we find that the agricultural sector in Iraq is unable to produce enough food to meet the needs of the population . [9]
4. **Water pollution:** The most prominent thing that accompanies the development and sustainable agricultural development and population growth is the environmental problems resulting from the misuse and management of natural resources, and water is the most affected element of the environment from pollution in all its forms, and perhaps one of the most prominent contaminates river water is the waste of the industrial sector, sewage and others, and what makes it worse is the weak flow,

shallowness of the water level and the decline in annual revenue from the Tigris and Euphrates rivers, which led to the exacerbation of pollution problems. [10]

Virtual water and its importance for sustainable agricultural development

Virtual water is the water included in the product, commodity or service, not in the real sense but in the hypothetical sense, it refers to the water necessary to produce the product or commodity, as it is sometimes called (external water), which refers to the virtual water imported to a country, and to reach a more accurate quantitative definition of virtual water two different approaches are applied: [11]

- The first approach: in which virtual water is defined by the volume of water used to produce the product or commodity, and this of course will depend on the production conditions, i.e., the place and time of production or water use efficiency.
- The second approach: the end user of the goods is considered and not from the perspective of the source of the goods. [12]

The latest definition of virtual water appeared in the mid-nineties, which is that virtual water is the amount of water required to produce a commodity, and therefore the export or import of any commodity is the export or import of the quantities of water necessary for its production. Virtual water contains four types: glaucoma, green water, grey water and black water. [13]

If we look at the concept of virtual water and its relationship to sustainability more broadly, we note that the use of virtual water as a tool to achieve efficiency in use and reduce water loss, it may be more reasonable to import water through the import of food instead of using the rare and high-cost water element in the production of all food, as well as the use of virtual water in achieving food security for the country, which is largely related to water security through virtual water trade, and therefore this concept prompted many countries Suffering from water scarcity to reconsider their export policy, especially important agricultural commodities, especially

when they realize that they export their water at low prices.

Therefore, the responsible authorities in the country must use the concept of virtual water in formulating the crop composition and reducing the areas planted with water-consuming crops significantly and in a way that suits the conditions of Iraq . [14]

Water Resources Efficiency in Irrigation in Iraq

The inefficiency of water use in Iraq is one of the biggest challenges that lead to the depletion of this vital resource, as a result of the low efficiency of water transfer and distribution from rivers and water sources to the field due to poor irrigation methods, the efficiency of water use ranges from 25% to 40% at the level of Iraq and from 40% to 50% at the level of the Arab countries, as 15% of irrigation water is lost in distribution networks, 25% in irrigation networks and 15% in the field, so the average loss It is estimated at more than 100 billion cubic meters, and studies conducted in several Arab countries, including Iraq, have shown that the use of modern irrigation methods helps to save about 60% of water and increases production by 33%. At the level of the Arab countries, Egypt is at the forefront of the Arab countries in the percentage of areas planted with modern irrigation systems at 35.3%, followed by Algeria at 17.5% and Saudi Arabia at 15.8%, while Iraq came in fifth place by 7.6%. Therefore, the rate of water use compared to the available is one of the indicators of judging the status of available water resources with the high water demand, so it is related to the policy of pricing water by imposing full or partial fees on it, and from an economic point of view it is an effective way to raise the efficiency of water use and reduce waste in its use, and therefore water is an essential element in the costs of producing crops, but while overcoming all obstacles that limit the rationalization of water consumption, including low prices Irrigation water, the high costs of modern irrigation technologies, the scarcity of water research centres in Iraq, the weakness of the water extension aspect, especially farms that rely heavily on water, and

the weakness of legislation that limits water waste. [15]

Conclusion

Although Iraq has many water resources, this resource has begun to decline, especially in recent years, due to several reasons, including the pressure of population growth, changing consumption patterns, upstream policies and climate change. Agriculture requires 70% of Iraq's water demand, which puts great pressure on the water supply, although agriculture is unable to meet the country's needs for the country's main crops to meet the needs of the population. The clear decline in the efficiency of water use in Iraq, led to the depletion of much of it and its distribution from rivers to agricultural fields and orchards, as the efficiency of water distribution did not reach at best 40%. Water plays a major role in sustainable Agriculture development and there can be no sustainable Agriculture development without preserving this important resource. So we can recommend, Supporting and encouraging the use of modern irrigation technologies to encourage intensive use of them and thus raise the efficiency of water use and conservation. Making the most of rainwater through the expansion of the construction of dams and reservoirs. And Supporting scientific research in the field Water by linking it to the field side by using water in a studied scientific manner and the latest ways.. Achieving sustainable agricultural development by linking water security with food security because of their essential role in formulating development policies for future generations..

References

- [1] Morel, J. (2007) Water resources on Earth: origin, use and prospects in the context of climate change—a review of the literature.
- [2] Nour El Hoda, B.(2015) The Role of Water Resources Efficiency in Achieving Sustainable Agricultural Development and Food Security – The Case of Algeria, Master's Thesis, Faculty of

- Economic Sciences, Commerce, Ferhat Abbas University.
- [3] Al-Emadi, J. O. (2022) An Economic Study of the Water Footprint and Virtual Water for the Most Important Agricultural Imports in Iraq for the Period 2000-2020, Master's Thesis, College of Agricultural Engineering Sciences, University of Baghdad.
- [4] David Blanchon, Del'eau. (2009) World Atlas of Nutrient Edition, Paris, France .
- [5] Thalaj, A. A.(2009) an economic study, the reality of water resources in Iraq and their prospects, Journal of Mesopotamian Agriculture, 37 (3).
- [6] Al-Amir, F. Q.(2010) The Water Budget in Iraq and the Water Crisis in the World, Dar Al-Ghad, Baghdad.
- [7] Ministry of Planning, Central Bureau of Statistics, Directorate of Agricultural Statistics,(2012) Water Resources Report .
- [8] Abdul Razzaq, M. H.(2008) Arab and International Water Resources, Ministry of Water Resources, Ataa Al-Rafidain Magazine, Issue (29) .
- [9] Shukr, A. S. (2020) Economic Analysis of the Most Important Factors Affecting Sustainable Agricultural Development in Iraq, PhD Thesis, University of Baghdad, College of Agricultural Engineering Sciences.
- [10] Al-Jawahiri, I. A. and Al-Shammari, R. A.(2013) Water Problems in Iraq, Reality and Proposed Solutions, Al-Qadisiyah Journal of Law and Political Science, 1(2) .
- [11] Salam, O. M. (2017) Egyptian Water Footprint, Water and Food Security Index, Cairo.
- [12] Bedaiwi, I. M. and Hammam, N. M.(2016) . Production and trade of some crops in light of the concept of virtual water, Journal of Agricultural Economics and Social Sciences, Mansoura University, 7(4).
- [13] Mohamed, W. H.(2016) Virtual Water and its Impact on the Foreign Trade of Egyptian Agricultural Commodities in Light of Limited Water Resources, Master's Thesis, Cairo University, Faculty of Administration and Political Science.
- [14] Minshawi, (2014) I. Virtual Water Addressing the Threat of Water Scarcity in the Middle East, Arab Center for Research and Studies website.
- [15] Farhat, S. and Abbas D(2013) . Efficiency of Water Resources Use in the Agricultural Sector: A Case Study of Arab Countries, Institute of Economic and Commercial Sciences, Mila University Center, Algeria .



دور المياه في التنمية الزراعية المستدامة في العراق (مقالة)

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المستخلص

تهدف هذه المقالة الى معرفة أثر المياه في عملية التنمية الزراعية المستدامة في العراق، عن طريق دراسة استعراض واقع الموارد المائية في العراق ومصادر المياه مع اشارة الى مصادر المياه عالمياً وعلى مستوى الوطن العربي، وقد تبين من نتائج واحصائيات بعض الدراسات بأن هناك انخفاض في كفاءة استخدام الموارد المائية في العراق والتي عدت من اكبر التحديات التي أدت الى استنزاف هذا المورد المهم والحيوي حيث لم يتجاوز في افضل الحالات 40 %، وهي نسبة قليلة اذا ما قورنت بدول الجوار والوطن العربي، فضلاً عن ذلك لم تؤشر الدراسة اي توجه الى استخدام المياه الافتراضية كبديل اكثر عقلانية من استيراد المياه بين ارتفاع تكاليف المياه ونقلها، كما تبين من وجود الكثير من التحديات التي أثرت على ادارة المياه في العراق، منها حصة المياه والامن المائي فضلاً عن المياه المشتركة مع دول الجوار والمنبع. بناء على ما تم عرضه في هذه المقالة بدعم وتشجيع استخدام منظومات الري الحديثة (المرشحات) لرفع كفاءة استخدام المياه وربط الامن المائي بالأمن الغذائي لما لهما من دور كبير في رفع عملية التنمية الزراعية المستدامة في العراق وكذلك تفعيل دور الارشاد الزراعي المائي لما له من دور في ارشاد وتوجيه المزارعين في ترشيد استخدام مصادر المياه وحثهم على تبني تقانات الري الحديثة.

الكلمات المفتاحية: مياه افتراضية، الامن المائي، تكاليف المياه، ادارة المياه.