WATER RESOURCES AND AGRICULTE IN LEBANON PROBLEMS AND SOLUTIONS

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ABSTRACT

Water resources are abundant in Lebanon known to be the Water Tower of the Middle East. Indeed, it receives annually between 8 and 9 billion m3 of precipitation, a quantity estimated largely sufficient to irrigate all its useful agricultural area and much more if well used. This should immediately ensure high agricultural yields and, consequently, low production costs, giving it an edge over its competitors in the region.

However, despite the local abundance of water resources that rival neighboring countries envy Lebanon for, the useful agricultural area, which is 112,954.7 ha, is only irrigated at a rate of 48.9% (Ministry of Agriculture, 2010) [3]. The yield is therefore relatively low in more than half of the non-irrigated land, which partly justifies the high agricultural production costs in Lebanon and causes water wastage, both an environmental and agricultural problem in the country.

This paper will highlight Lebanon's main natural resources that create significant opportunities and represent a comparative advantage to the country's agricultural sector. It will also identify the State's infrastructure policies and present in the final part the policies intended to develop the sector.

KEY WORDS

Agriculture ; environmental problem ; water resources; Lebanon

1. INTRODUCTION

Any agricultural policy seeks to develop irrigation projects with the aim of improving agricultural productivity and yield and avoiding wastage, thus seeking to increase the income of farmers while preserving this natural resource. . Lebanon has rich water resources, abundant rainfall and a geographical landscape that allows its mountains to store large quantities of water. Likewise, Lebanon has 2000 springs and 40 rivers that provide citizens with an annual supply of 1,073 m3 of water per capita, a much higher figure than that of Jordan and Israel, which respectively supply their population with 158 and 240 m3 per inhabitant. Yet, only 10% of water resources are used in Lebanon, and this inefficiency poses a significant environmental problem. Despite the country's abundant water resources, the agricultural sector is experiencing a water shortage that prevents it from increasing its production. This is due to a mismanagement by the State in terms of ensuring an adequate infrastructure and water storage facilities.

2. METHODOLOGY

The data collection essential for this study was carried out thanks to:

Thorough Literature research based on books, articles and documents pertaining to

agriculture, agrarian policies and the environment.

Documentary research concerning basic statistical data relating to agriculture, water resources and the environment in Lebanon.

3. OUTCOMES AND DISCUSSION

1. Water Resources

1.1.Availability and Importance of water in Lebanon

Several reports and studies estimate that the average annual precipitation amounts to 8.6 billion m3 (MOEW, 2010) [4]. Other studies have estimated them at 9.7 billion m3 (CDR-NLUMP, 2004) [1], of which one billion m3 is due to snow. Most of these reports refer to sources over 20 years old.

Table 1: Annual resources available in Lebanon (in millions of cubic meters)

Source	**Mm3**
Precipitation	8.600
Evaporation et evapotranspiration (-)	4.500
Losses (-)	1.400
Rivers running towards neighboring countries	700
Groundwater	700
Total of renewable and exploitable resources	2.700
Surface water	2.200
Groundwater	500

Source: MOEW, (2010).

Although data on water resources in Lebanon exist, they are not entirely reliable as they go back almost four decades, hence the need to measure the water parameters of the country through a hydrometric network that is functional and modern, capable of continuously providing essential data on all natural phenomena concerning water (precipitation, stream flows, groundwater, evaporation, evapotranspiration). It is important to underline that there are four water companies in Lebanon whose work is insufficient to date, since the country's water resources remain underused (the Beirut and Mount Lebanon water company, the North Lebanon Company, South Lebanon Water Company, and Beqaa Water Company)

Likewise, the importance of water in agriculture is underscored by the large difference in average yield between non-irrigated and irrigated land. Cultivation in irrigated land produces an average of 28.635 kg / hectare while in non-irrigated land it produces on average 3.5 times less: 8071 kg / hect.

Solving the irrigation problem will therefore directly increase the quantity produced and probably the resulting profits.

Table 2: Average yield irrigation status (irrigated or non-irrigated) (kg /hect)

Irrigation status (irrigated or non irrigated)	**Average yield per type of agriculture In kg/hect**
Non irrigated land	8071
Irrigated Land	28635

Source: this table is based on data from a 2018 survey we carried out

1.1.2. Rivers in Lebanon

As we announced previously, hydraulic resources remain very abundant in Lebanon where there are 16 permanent rivers and 23 seasonal rivers. These rivers flow about 3,900 million m3 per year, of which some 700 million m3 are throw in neighboring countries. It is in the first five months of the year that most water flows occur. They are led to decrease gradually at the beginning of summer (16%) to become minimal (9%) during the eighth and ninth months of the year (Comair, 2010) [2]. Lebanon is a country that has experienced wars and conflicts which have hampered its development and had consequences on its hydrometric systems. In particular, it is difficult to have precise current data on the flows of the country's rivers, the measurement of which, carried out by the Litani River National Authority (ANFL), falls under the competence of the Ministry of Energy.

The table below shows the data provided by the ANFL about the flows of the 16 permanent Lebanese rivers covering two periods: from 1971 to 1975 and from 2005 to 2009. It should be noted that at a country level, the rivers El Assi, Litani and Nahr Ibrahim have the most important flows and that the two rivers which do not discharge into the Mediterranean are El Assi and Hasbani

Table 3: Flows of the 16 permanent rivers of Lebanon

River	Length (km)	Average annual volume		Average flow	
		(71-75) Mm^3	(05-09) Mm^3	(71-75) m^3/s	(05-09) m^3/s
El Litani	**170**	**-**	**167.83**	**-**	**5.38**
El Kabir	58	259.20	283.86	9.07	9.13
El Awali	48	393.70	252.88	12.54	8.05
El Assi	**46**	**326.40**	**275.54**	**11.03**	**8.70**
Abou Ali	45	148.60	206.57	4.62	6.58
Ostuene	44	-	46.96	-	1.59
Beyrouth	42	47.90	81.80	1.53	2.64
Damour	38	-	166.93	-	5.38
El Jaouz	38	32.26	44.61	1.03	1.43
El Kalb	38	154.08	189.32	4.90	6.07
Ibrahim	**30**	**208.55**	**329.16**	**6.63**	**10.49**
El Zahrani	25	19.20	17.50	0.62	0.56
El Bared	24	132.77	120.05	4.22	3.82
Hasbani	21	38.35	28.66	1.23	0.92
El Qasmieh	-	151.65	131.30	4.84	4.21
Wazzani	-	-	71.89	-	2.30

Source : ECODIT, (2010).

1.1.3 Water Dams in Lebanon

Lebanon has two dams, the Qaroun dam on the Litani, and the Chabrouh dam which collects rainwater and runoff from the Laban spring. Their respective static storage capacity is 220 million m3 and 8 million m3. Currently, only 30 million m3 of the Qaroun dam is used for water supply and irrigation, the rest being used to generate electricity. However, the Lebanese State approved and gave the green light for the construction of several dams and lakes according to the program of the Ministry of Energy and Water. According to the website of this ministry, five dams and a lake are in the pipeline.

Table 4: Artificial Dams and Lakes

Type	Name	Region
Dam	Janneh	Jbeil – Mont-Liban
	Mseilha	Batroun - Liban Nord
	Kaisamani	Falougha – Mont Liban
	Bekaata	Kesserwan – Mont Liban
	Balaa	Balaa - Liban Nord
Lake	Kouachara	Akkar - Liban Nord

Source:http://www.energyandwater.gov.lb/ar/listing/national-dams?l=3

In many arid and semi-arid countries, most of the water supplied for domestic use comes from dams that are built to ensure supplies during the dry season or during periods of low rainfall.

2. Infrastructure policies

Despite Lebanon having abundant water resources, the local agricultural sector lacks the water quantity needed to further develop its production. The country's water resources are wasted due to a lack of adequate infrastructure and surface water storage facilities. Several ministries have tried to consolidate their efforts to devise solutions to this problem and have therefore developed plans to this end. We can cite the 2000 ten-year plan initiated to set up irrigation and river alignment projects and ensure food security through the extension of agricultural areas. This plan turned out to be overly ambitious as it provides for the construction of 18 dams and 23 lakes to mobilize 1.1m3 of water annually. Due to this failure and the resulting deficit, the Lebanese State had to propose a new plan for the years 2010- 2025, focusing mainly on the treatment of wastewater to be able to use it in agriculture and seeking to initiate institutional, financial and commercial change. The execution of this plan is still in its preliminary stages, mainly because of political and economic instability, the lack of personnel specialized in invoicing techniques, etc., while sizeable financial resources have been mobilized for the

implementation of this project.

A third project, key for local agriculture, was initiated by the World Bank, and concerns water resources and wastewater in Baalbek. It aims to strengthen the capabilities of the authorities responsible for water and irrigation management, to treat wastewater, and enable inhabitants to obtain water in order to limit wastage and promote Agriculture.

However, as the neighboring countries covet Lebanon's water resources, they forcefully prevent it from fully making use of them. In order to help Lebanon develop its agricultural irrigation infrastructure, the World Bank has entrusted the Ministry of Agriculture with leading a project dedicated to the conservation of land and water resources, allowing the development of the Green Plan and the institutional work of the ministry. Thus, in 1998, an agricultural census was carried out at the national level, coupled with the creation of a management information system and the development of an agricultural strategy.

Another project was devised to rehabilitate and modernize irrigation in order to optimize production and create jobs and income sources in the most neglected areas. This requires a local support of public institutions responsible for irrigation, water management research and quality control. This project has allowed to set up a solid market-focused extension system in large irrigated areas, with the participation of the American University of Beirut.

All these local initiatives by the Lebanese state with the aim of developing the agricultural sector remain insufficient. The main reasons for their failure are as follows: Until now, no long-term water policy has been adopted in Lebanon. Consequently, irrigation water intended for agricultural areas is poorly managed. Farmers find themselves forced to buy water, thereby increasing their production cost, and undermining their competitive edge.

Likewise, Lebanese farmers often lack the knowledge on how to optimize irrigation water which results in wasting water resources, hence the need for modern irrigation techniques.

Locally, wastewater is often used as is for irrigation purposes because treating it proves very costly. This poses a substantial threat to public health and is a source of environmental pollution.

Finally, water resources have sharply decreased in Lebanon in recent years due particularly to global warming and the political situation in Syria.

3. Improve the infrastructure policy

Several solutions can be considered in order to improve the infrastructure policy in Lebanon and, consequently, to optimize water resources and develop agriculture.

A key component would be to devise in collaboration with international organizations such as FAO a strategy at the local level to continue the work on projects such as those devoted to Litani and Assi, with the aim of limiting water wastage and supporting farmers to encourage them to expand the cultivated area. It has become urgent to set up a Higher Water Council that brings together representatives of the public and private sectors, in order to design policies that would allow Lebanon to properly exploit its water resources, and support their smart use.

Reform agricultural property laws and regulations in force to prevent the fragmentation of those lands into smaller plots, and provide it with a developed irrigation system to assist farmers and alleviate their burden.

Reduce high operating costs in wastewater treatment plants so it can be used in irrigation, while in parallel raising the awareness of the local population against the pollution of rivers, particularly the Litani and Assi.

Finally, to prevent the water wastage environmental problem, billing techniques need to be improved and meters must be installed.

4. CONCLUSION

Today more than ever, Lebanon needs to develop its agriculture and optimize its water resources as part of a strategy of food self-sufficiency. In fact, due to its economic, financial, monetary and banking crises, which have worsened since the second half of 2019, its foreign currency reserves are about to run dry. This would prevent the country from heavily relying on imports for its household consumption as it had done before.

As Lebanon's agricultural and animal production does not cover its needs because of an insufficient State support of the sector for decades, prices of agro-food products have been on a staggering rise for almost a year now. This has fueled hyperinflation and plunged more than half the country's population into poverty and misery. Consequently, among the options available for Lebanon to step out of these crises, the development of its agricultural sector is key. The sector presents all the necessary conditions to this end, namely human capital, financial resources, water resources, a varied climate, and the needed areas. However, what it lacks is an adequate agricultural policy to mobilize these rich resources that make up its comparative advantage in the Middle Eastern agricultural realm.

REFERENCES

[1] CDR-NLUMP, (2004). National Land Use Master Plan, CDR.

[2] Comair F., (2010). Water Resources in Lebanon, MOEW.

[3] Lebanese Ministry of Agriculture, FAO (2010). Comprehensive results of the base module survey for agriculture 2010, Beirut, Lebanon: Ministry of Agriculture.

[4] MOEW, (2010). National Water Sector Strategy: Supply/Demand Forecasts, DRAFT, MOEW.