The Assi Dam Project: Priority Issue of the Community's Sustainable Rural Development in Semi Arid Northern Region of Bekaa, Hermel Caza, Lebanon

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Abstract: The social conditions in Assi Dam project area, Hermel caza in Lebanon, are characterized by high unemployment, poverty, and depopulation as well as isolation from urban areas. This led to a massive migration from rural areas as well as emigration abroad. Today, agriculture is the most important livelihood for the population in Hermel caza. The Assi Dam planned to be built by the Lebanese government in Assi River have impacts on local live hoods in several ways. Since the end of the war, an increasing interest is given to fight the poverty and protect the environment.
The aim of this review is to focus on the Al Assi Dam's direct impacts on the targeted society (rural population in North Bekaa) and help in the developing of an integrated plan based on the region's characteristics, needs, and future projects that is more adapted for the successful of the Assi Dam's project. Thus, to improve the social and economic conditions of the rural population specifically the developmental capacities of health, education, and long-term financial security. It should applied not only in managing, improving of existence projects, but also in planning where suitable new schemes are to be under consideration.

Keywords: Al Assi River; Bekaa; Hermel; Sustainable development.

I. INTRODUCTION

Water is vital for the life since human beings cannot survive more than a few days without it. In many countries, water resources have become scarce due to the increasing demand on limited water resources. The importance of water resources management in water stressed areas, especially in arid and semi arid countries is sine qua non [1,2]. Historically in arid regions, the dwellings developed mostly along the rivers or some other water source as happened in many ancient civilizations, e.g. Iran (side of karoun River), Egypt (side of Nile River), Mesopotamia in Iraq (area between Tigris River and Euphrates River), and the Indus valley civilization in the subcontinent which covered a large part of Pakistan and northwestern India, situated around the Indus and the Ghaggar-Hkra rivers, respectively [3].

According to current estimates, by the year 2030, world population will rise from the present 6.2 billion to 8.7 billion. Almost 800 million people in developing countries today face chronic malnutrition and 199 million children under the age of five suffer from acute or chronic food deficiencies. At present, as many as 70 nations fall into the low category of low-income food-deficit countries [4]. Worldwide high benefits are being derived by those countries who have established

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sustainable irrigation systems in the arid regions. Currently 47.2% of the world and 45.8% of Asia fall in arid climate where no crops can be grown without irrigation. Irrigation is the essential part of the package of technologies, institutions and policies that underpins increased agricultural output in Asia. Post experience shows that this package, although broadly beneficial to societies, has not yet fully succeeded in banishing poverty [5]. The extensive review suggests that there are strong linkages between irrigation and poverty [6]. Multicriteria decision making models are developed for irrigation planning and irrigation scenarios are used to show the impact of different irrigation management [7]. Ortega et al. (2005) [8] have discussed Irrigation Advisory Service for Farmers. They have upgraded farmer's capacities and awareness thus minimizing the negative environment impacts of irrigation. According to Zarghaam (2006) [9] effective water management requires a comprehensive consideration of all related aspects, e.g., technical, social, environmental, political, and financial. Water resources management is essential for sustainable agriculture in a climate of water scarcity [10,11]. In this regard, water supply system is of great importance among hydro systems being built and operated to provide enough water to consistently meet the demands [12-14]. Due to the ecological, financial and environmental reasons, ecologically sustainable management of water supply systems is imperative in order to provide continuous and stable operation in meeting water demands not only by human society, but also by various ecosystems. This requires efficiently allocating water resources, utilizing renewable water sources, adopting water conservation measures, as well as reserving sufficient water for maintaining ecological, environmental and hydrological integrity [15-17]. One of the major challenges in the decision making of sustainable water supply is uncertainty. Such uncertainty originates from internal and external changes of water systems [18-19]. In many developing countries, increased agricultural productivity due to irrigation from dams has significantly reduced the socioeconomic problems that consequently led to reduction in poverty. Sustainable development, conservation and management of water resources are the key to increase food production and to reduce poverty in arid and semiarid countries. Good governance and monitoring are the key tools by which these impacts may be enhanced or alleviated. Stakeholders in development process sometimes act as through the elimination of poverty and economic growth are distinct from environmental goals. Where environmentally sustainable requirements have been identified, they are rarely fully integrated into the economic development and sector policies even where they make obvious economic sense. Schoups et al. [20] investigated some strategies. These strategies included conjunctive management surface water and groundwater resources, and engineering improvements [21,22]. In the past, emphasis was on construction of dams by the investors without any environmental consideration, however, since the last years, the effects of dams on population and the environment have become under greater scrutiny. In fact, the contribution and need of dams for sustainable development cannot be denied in arid and semi arid regions. Objection on construction of large dams has become a fashion of the day merely because of few adverse impacts which are more highlighted, whereas the positive ones are ignored. Overall objective of this study was to analyze the impact of Assi Dam Project on poverty reduction with regard to sustainable development in the rural areas using a set of indicators. Specific objective was to collect and analyze project data to underline the potential changes, both positive and negative in the biophysical and socioeconomic conditions. Development of proposed guidelines for sustainable development for poverty reduction and empowerment is another effort of this study. These guidelines may help the policy makers to achieve the Millennium development goals (MDGs) in Assi Dam region. There are many international agencies, organizations, and institutions which have provide methodologies for operation and management of irrigation projects to overcome the poverty. For example, the United Nations (UN) subcommittee on poverty alleviation for Asia and the Pacific has made various actions through United Nations work program to mitigate the rural poverty [23]. These programs were generally focused on poverty alleviation, food security and sustainable development through advisory services, training, information dissemination and exchange of experiences. International Institute for Sustainable Development developed a model

for poverty alleviation identifying five stakeholders consisting of community, family, individuals, private and public sectors [24] Similarly Asian Development Bank (ADB) developed a methodology for rural poverty alleviation in China. In this methodology various indicators were considered for reduction of poverty. The MDGs is another program which follows up eight goals to reduce the poverty by 2015. Experience elsewhere shows that bringing appropriate institutional change into disrupted water management coupled with required capacity building of the newly established participatory institutions can be crucial in bridging the gap for reduction of poverty [25].

Dams can be considered as part of the economic development and centerpieces of efforts to develop industrial and self-sufficient societies. Normally they are considered as the largest structures that have been constructed by human in the history. The number of large dams worldwide has increased in many countries since 1940. Development of dams provides electricity, water for irrigation, industries, recreation, and domestic uses. Worldwide role of large dams for reduction in poverty is of great concern. Evaluation of the research on the poverty shows that the poverty remains a major challenge for policy makers and eradication of poverty has been main aim in most of national and international programs.

Assi Dam Project and its impact on poverty alleviation with consideration of sustainable development in semi arid sub region, Assi basin-Hermel caza, is the main focuses of this research.

There are currently about 50,000 large dams in operation in the world (the definition of a large dam is one that is more than 15 m high, or a dam whose height ranges from 5 m to 15 m with a reservoir storage capacity greater than 3 million m^3). The geographical distribution of the dams for areas is illustrated in figure 1. It is clear from this figure that China, United States, India, Japan and Spain have highest number of dams. The remaining countries have only 23 percent of world dams' population.

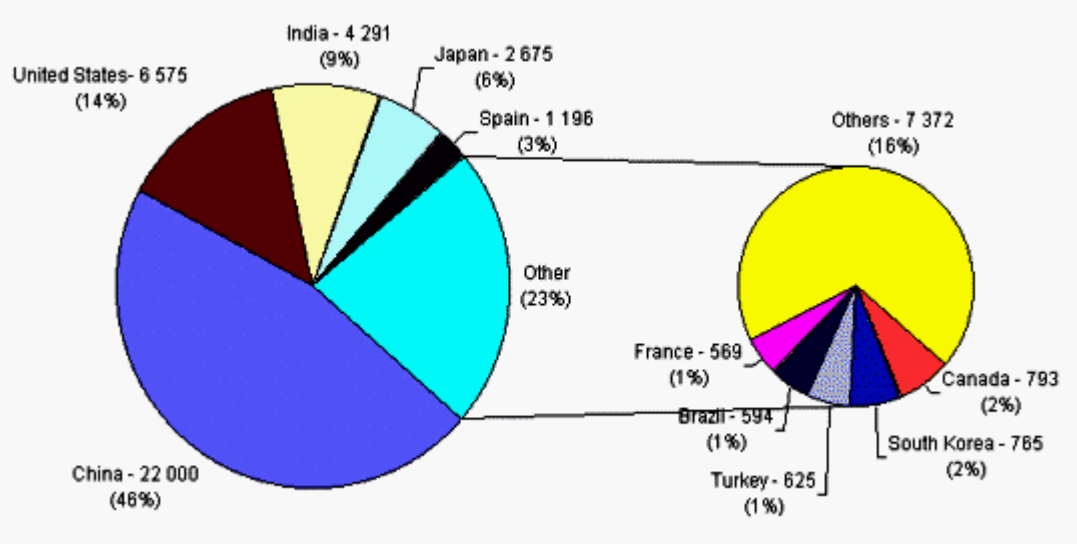

Figure 1 World population of dams in different countries.
Source: WCD estimates, based on ICOLD and other sources (2000).

The development of watershed techniques may consider as appropriate method to overcome the water crises difficulty in arid region. The implementation of watershed technique may provide more storage of water for irrigation. There is direct linkage between poverty and irrigation [26,27]. Increased agricultural productivity due to dam construction and its irrigation system in many countries have significantly reduced the socio-economic problems and more so the poverty. Irrigation plays a vital role for sustainable development in arid regions.

II. SUSTAINABLE DEVELOPMENT INDICATORS

A. Generalities

Sustainable development is defined as the development which meets the needs of present generation while not compromising the ability of future generations to meet their needs. Specific indicators called Sustainable Development Indicators (SDI) are often used as quantitative and qualitative measures to provide information for decision making including management and daily life decisions. An indicator may be defined as "a parameter which gives information about some system". In line with this description, it may be stated that all the indicators present specific information of the system under consideration. The reason of selecting these indicators was that they measure the performance of the Assi Dam Project and the same have been used and recommended in many studies. Human activities having severe negative impacts on the planet would be unsustainable if they continue unchecked. To avoid unsustainably, it is important to apply a sustainable development framework to answer the two questions: what we are trying to assess? And what is the dimension of sustainability for Assi Dam Project?

The concept of sustainable development received its first major international recognition in 1972 at the UN Conference on Human Environment, held in Stockholm and it continued by Brundtland Commission in 1983 which defined the sustainable development as the "development which meets the needs of the present (generation) without compromising the ability of future generations to meet their own needs". Rio de Janeiro Conference in 1992 and its recognition is articulated in chapter 40 of agenda 21, which calls on countries at the national as well as international levels, governmental and non-governmental organizations to develop and identify the indicators of sustainable development which should provide a solid basis for decision making at all levels. More recently, the World Summit on Sustainable Development was held in Johannesburg in 2002 to assess the progress since the Rio Conference. The development in sustainable development indicators is a continued process and these indicators were updated in MDGs by the UN in 2005. Some of these indicators were modified in the present study to suit the conditions in developing countries in general and particularly in Lebanon.

Thus, in numerous countries of the world, the experience and technical capacity gained in the construction and management of dams and reservoirs, together with the standards, regulations and laws of the country and of the international organizations, recommend the management of the existing dams and the construction of new dams, within the context of the Integrated Water Resources Management [28], taking into account their implementation within a framework of sustainable development, and adhering to the following *basic criteria:*

- *Technical, Economical, and Financial Feasibility*
- *Sustainable Development, Compatibility with the Environment*
- *Social and Political Acceptance*

Thus the International Commission of Large Dams (ICOLD) environmental policy focuses that the attention to the social and environmental aspects of dams and reservoirs must be a dominating concern pervading all our activities, in the same way as the concern for safety. We now aim at balancing the need for the development of water resources with the conservation of the environment in a sustainable way which will not compromise future generations.

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B. Framework for Sustainable Development and Poverty Alleviation

The framework which has been developed by specialist of International Institute for sustainable development is illustrated in Figure 2. The results of evaluation about the sustainable development and poverty alleviation in general are incorporated in this framework.

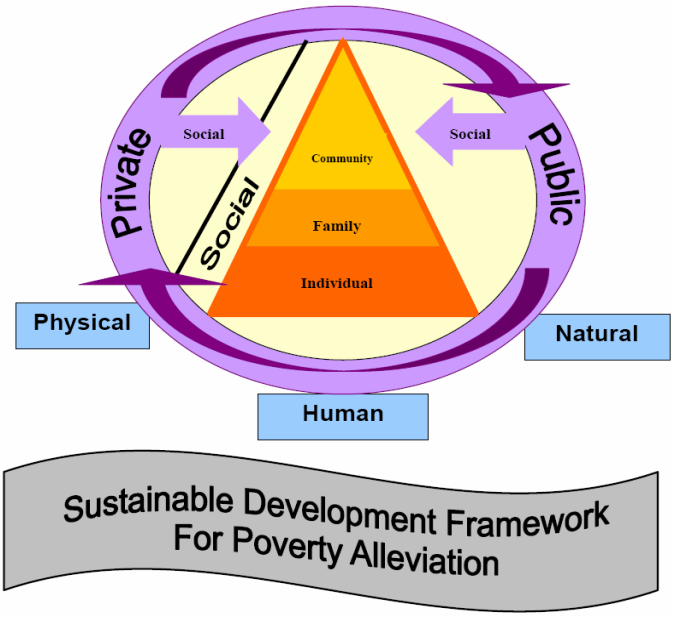

Figure 2. Sustainable development framework for poverty alleviation.
Source: International Institute for Sustainable Development (IISD) 2000

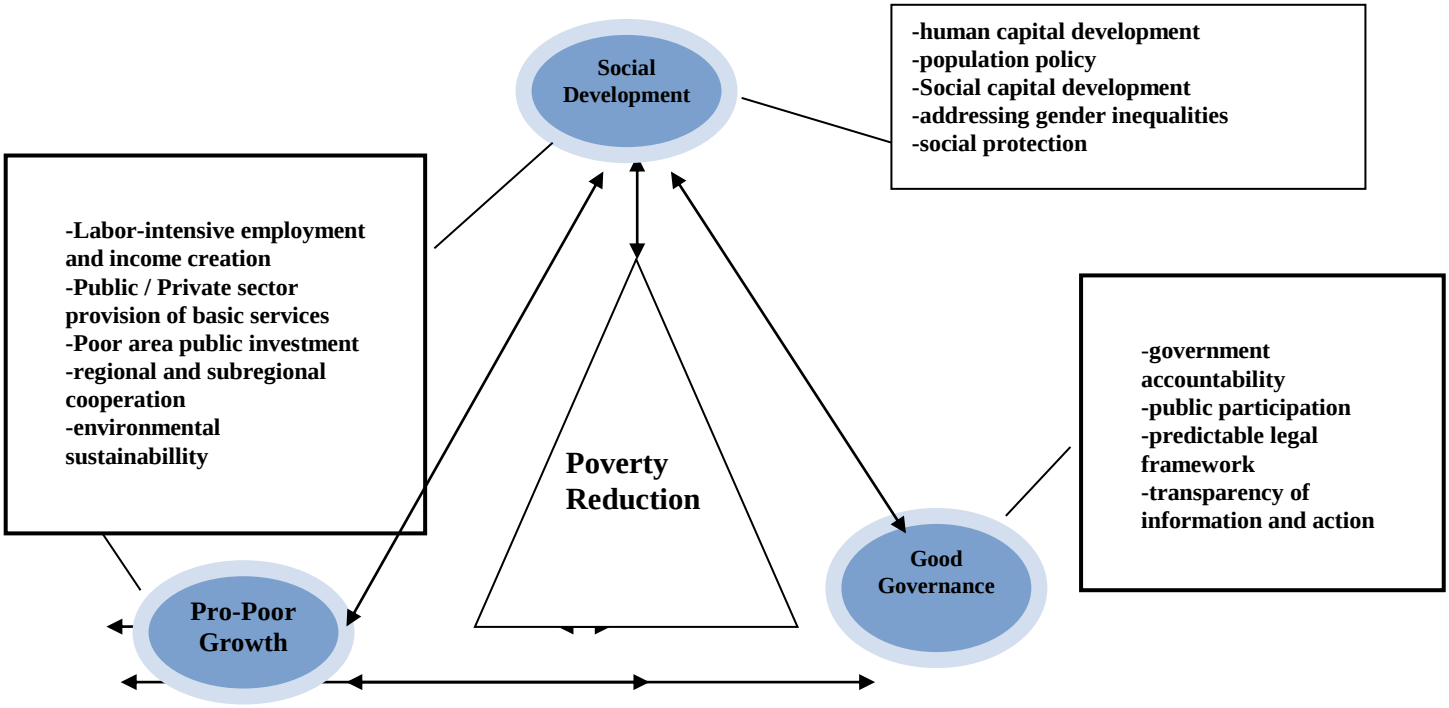

Figure 3. Components of the (ADB) poverty reduction strategy (ADB, 1999)

Asian Development Bank (ADB) provided various guidelines and high activity towards poverty alleviation in most of the countries especially in developing countries. To facilitate the researchers who are interested to work on poverty alleviation, a manual for poverty alleviation and social analysis has been published by ADB (ADB, 1999). From this manual general framework about the component, strategy and methods of social analysis are illustrated in Figs. 2. and 3.

In their global assessment of rural poverty, the International Fund for Agricultural Development (IFAD) identified eight broad components of poverty (Henninger, 1998) as detailed in Table 1.

Table 1. Components of poverty by IFAD**.**

Components of Poverty	Description And Scope
Material Deprivation	Poor education, lack of clothing, , fuel insecurity, poor health,absence of provisions for emergencies, poor nutritional status In adequate food supplies, lack of housing
Lack of assets	material assets (land, agricultural input, etc.) human capital (education, training, etc.) are categorized in this section
Isolation	Areas which are far from development and service institutions with very limited access to transport, roads, markets and communication links. Social, political and geographic marginalization.
Alienation	Alienation results from isolation and exploitative social relations and includes people that lack identify and control, are unemployed or underemployed, lack of Marketable skills, and have limited access to training and education.
Dependence	Poor people are often exposed to skewed dependency relationships that can be found for example between landlord and tenant, employer and employee, creditor and debtor, buyer and seller, or patron and bonded laborer.
Lack of decision making power	This is a result of limited participation and freedom of choice.
Vulnerability to external shocks	External shocks can be caused by factors found in nature (droughts, floods, cyclones, locusts, etc.), markets (collapse in commodity price, labor supply and demand, etc.), demography (loss of a household's earning member, death, divorce, etc.), health (illness of earning member), and war.
Insecurity	This is defined as the risk of being exposed to physical violence.

Review of literature shows that Development of agriculture by the irrigation dam become as a major engine for economic growth and poverty reduction. The growing scarcity and competition for water, however, stands as a major threat to future advances in poverty alleviation. Food production is likely to be adversely affected particularly in the arid regions. The development of dam irrigation has contributed significantly to the increase in food production and reduction in poverty.

As water is withdrawn from agriculture, in the management of irrigation systems, more attention must be given to water needs for multiple uses not only for agriculture, but for other domestic uses, and for environmental needs. Special attention must be given to implementing policies and developing technologies suitable for adoption by resource-poor farmers in water-scarce or marginal upland and rain-fed areas. Poverty eradication through sustainable development can be regarded today as perhaps the central goal of all researchers in development agencies. In this regard there is an urgent need for new strategies to improve the productivity of water in both irrigated and rain-fed agriculture, and ensure access to water and technologies by the poor. Irrigation through large dam has been played a major role historically in poverty alleviation by providing food security, protection against famine, floods and expanded opportunities for employment. The development roots in most of developed country may be originated from water resources development e.g. United State, China, Japan and Spanish. Estimation of the arid region on the world shows that currently 47.2 percent of the world and 45.8 percent of Asia.

C. Impacts of large Dams on the Environment

The impacts of large dams on environment have been studied by many organizations and researchers. The World Commission on Dams (WCD), 2000 [29] made an excellent effort to analyze the performance of large dams including their environmental and social impacts. Results of this study revealed that majority of the dams continue to generate benefits beyond their projected lives. On the other hand, some of the large dams have more negative impacts rather than positive impacts on the ecosystem. This was mainly "due to lack of attention given to anticipating and avoiding the impacts;

the poor quality and uncertainty of predictions; the difficulty of coping with all impacts; and partial implementation and success of mitigation measures" [30]. One of the important reasons of not achieving the targeted performance level in some of the irrigation systems was over emphasizing the physical infrastructures, while neglecting the social dimension [31]. Environmental degradation makes people poor through the lack of availability of natural resources, and natural resources management should include the full participation of local residents with government to ensure socio environmentally sustainable resource management [32]. The pressure of human population and patterns of development, frequently jeopardize the integrity of worldwide river systems. In such case, an integrated water resources management (WRM) approach is essential, as presented recently by Doummar et al (2009) [33]. In the past emphasis was on dam construction by investors without any environmental consideration, however since the last years, the effects of dams on population and the environment have come under greater scrutiny by the investors. In fact, the contribution and needs of dams for sustainable development especially in arid and semi arid regions cannot be denied.
We present on figure 4 the degrees of saturation according to Living Conditions Index in Hermel.

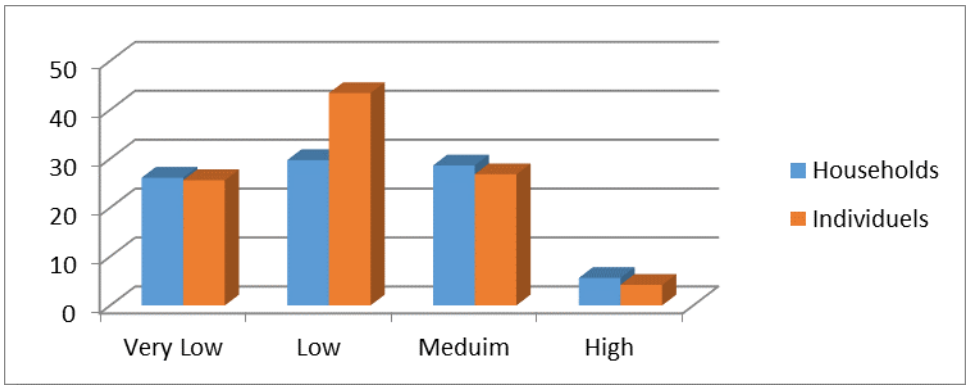

Fig 4. Degrees of saturation according to Living Conditions Index -% of families and individuals in Hermel

Assi Dam provides access to irrigation for agriculture by storing water in times of surplus and dispensing it in times of scarcity. One of the biggest uses of Assi Dam is in agriculture to provide irrigation water.

D. Sustainable Tourism Development

The most important challenge for sustainable tourism development concerns the perspective and expectations that all stakeholders, particularly government policy-makers, have about tourism's contribution at the local, regional and national levels. Many developing countries view tourism as a vehicle for economic development, given its potential to earn foreign exchange, create employment, reduce income and employment disparities, strengthen linkages among economic sectors and help to alleviate poverty. The challenge facing policy-makers is to have a broader perspective and better understanding that there can be both positive and negative effects from tourism development.

There are several reasons why tourism development could be a particularly effective tool of poverty reduction. First, tourism offers considerable employment opportunities for unskilled labor, rural people and lower-income women. Second, there are considerable linkages with the informal sector, which could generate positive multiplier effects to poorer groups that rely on that sector for their lively-hoods. Third, tourism tends to be heavily based upon the preservation of natural capital—such as, wildlife and scenery—and cultural heritage, which are often "assets that some of the poor have, even if they have no financial resources" [34].

Thus, countries and regions where the economy is driven by the tourism industry have become

increasingly concerned with the environmental, as well as the socio-cultural problems associated with unsustainable tourism. As a result, there is now increasing agreement on the need to promote sustainable tourism development to minimize its environmental impact and to maximize socio-economic overall benefits at tourist destinations. The concept of sustainable tourism, as developed by the World Tourism Organization (WTO) in the context of the United Nations sustainable development process, refers to tourist activities "leading to management of all resources in such a way that economic, social and aesthetic needs can be fulfilled while maintaining cultural integrity, essential ecological processes, biological diversity and life support systems" [35].

III. Socio-Economic Background

A. Introduction

The el Assi (Orontes) Dam can be better evaluated if we describe first the dimensions of the socio-economic problems facing rural areas in Lebanon specifically in the el Assi (Orontes) Basin in North Bekaa.

Until present, and particularly since the mid sixties, the agriculture sector in Lebanon is facing a crisis; the rate of growth of agricultural production and agricultural resources has failed to keep pace with the rate of population growth [36].

The el Assi (Orontes) Basin in Hermel caza (study area) is a semi arid region, with an average yearly rainfall of 240 mm [37] and therefore has to depend mainly on el Assi (Orontes) Water to irrigate the cultivated area. Only 10% of the irrigated cultivated areas use underground water [38]. Two inter-related factors have limited any substantial increase in agricultural production: a limited water supply and a small cultivated area relative to the total area of the el Assi (Orentes) Basin.

The cultivated area under study, according to the Agricultural Census conducted in 1998, is 94,600 dunums (25%) of the total areas of 381,510 dunums.

It is difficult to present a meaningful index of agricultural output for the same period due to the paucity of data.

In 2007, Lebanon's Gross Domestic Product (GDP) was $24 billion. Agriculture accounted for 6% of (GDP) [39].

The economically active population in agriculture is estimated at 35,000 (2005). The agricultural labor force declined from 25% in 1967 to less than 9% in 1990 and less than 3% of the total economically active population in 2005. However, agriculture remains an important source of income in rural areas and although it is difficult to estimate the number of full-time farmers, most families have agriculture as a part-time activity.

Two factors limited the extension of irrigable areas along the el Assi (Orontes) valley: the topography of the river and the amount of water available.

Regulation of the water supply in this region is extremely vital for its socio-economic improvement.

Cultivation has been carried on in the Nahr el Assi (Orontes) Basin since ancient time. Even today agricultural methods are relatively still primitive.

Although the majority of the people in the Nahr el Assi (Orontes) Basin lead an agrarian life, few actually live on the land. Most of the people reside in Hermel town and other villages; from which they move to the fields in the morning, and to which they return at night.

From a resource allocation point of view, the first major source of income in the region is agriculture. Agriculture in this region is a "family business" where woman and children contribute to the production process as unpaid laborers. Thus the family income earned from selling agriculture produce is definitely substantive for the survival of the family. However, two severe constraints are acting against any sizable increase in agricultural production:

- The ratio of irrigated area of the cultivated land in the region is estimated at one third of total cultivated area in el Assi (Orontes) Basin.

- High cost of production of fertilizers, pesticides, irrigation and transportation from the farm to the market.

Prior to the el Assi (Orontes) Dam Project, Lebanon agronomic policy was to increase agricultural production and to break the "poverty circle" via two routes:

- Increasing production *intensively* by increasing yields through the improvement of seed quality, more extensive application of fertilizers, and the introduction of multiple crop system.

- Increasing production *extensively* by land reclamation. Some of the new areas were reclaimed at high cost due to the costly irrigation techniques employed ranging the use of sprinklers to the digging of artesian wells at considerable depths.

The government was aware that most of these projects could not pass sound socio-economic evaluation and therefore treated them as experimental "model" projects in which cost elements were disregarded or given secondary importance. Only after the completion of the first phase of the el Assi (Orontes) Dam project did the government starts to undertake the socio-economic feasibility studies on new projects.

The first route, increasing yields, faced one main obstacle. The cost of production/dunum of land left little room for a further large increase in production.

The conclusion drawn from the analysis that the possibility of increasing agricultural output intensively to match the continuous increase in population is ruled out as long as the increase in the cost of production is combined with it.

Given these facts, the Lebanese government concluded that if optimality of resource allocation were to be observed [40], there was no socio-economic alternative to the use of *long-term storage* on the el Assi (Orontes) River to achieve optimal utilization of water supply to irrigate those dry land crops. This is to be distinguished from *annual storage* where water is stored in months of low level water during the same year. Long-term storage, in comparison, refers to the storage of water in years of high flood for use in years of low flood.

B. Importance of long-term water storage

The preceding analysis has pointed out the importance of regulating water supply as a crucial factor for increasing agricultural production both intensively and extensively. This in turn, created an interest in the technical and socio-economic feasibility of providing long-term storage of the el Assi (Orontes) River through the construction of dam to achieve two purposes:

To reduce the standard deviation fluctuation of the el Assi (Orontes) discharge.

To achieve a higher mean of water supply this could be utilized for irrigating additional areas.

The Lebanese Ministry of Energy and water conducted a series of experiments in the last two decades to determine the optimum relation between the reservoir content of the proposed dam and the amount of the el Assi (Orontes) Water quantity allocated to Lebanon (80 million m^3/year), according to the draft agreement between Lebanon and the Syrian Arab Republic concerning the distribution of the el Assi-Orontes Water signed in 1994. Under Dar El Handasa supervision, the el Assi (Orontes) Dam currently operates with a capacity of 37 million m^3.

IV. Prospects of Improving Utilization of Land and Water Resources

Because the principal weakness of the Lebanon economy, as has been pointed out, is the heavy reliance on the somewhat precarious economic activities of trade and services, the economy would be in need of substantial expansion in the production of goods for affecting a better degree of balance and stability. Expansion in the production of goods means the development of agriculture and industry. This development need not take place at the expense of trade and services or in any way retard their future progress. But it would require a more vigorous program and greater coordination of public and private effort in developing agriculture and industry on a nation-wide scale.

Lebanese agriculture is somewhat unique in that depends on a very high degree on land. The natural productivity of which has been greatly improved by liberal outlays of capital in the form of irrigation, terracing, and sometimes transport of soil. It is clear, therefore, that expansion of land resources in Lebanon can be affected mainly through extension of irrigation and terracing. Private initiative have succeeded in extending irrigation to such an extent that it has become very difficult to effect further advances short of resort of large schemes which are normally undertaken by the state. Work is already in progress on one such scheme on the Litani River. Preliminary studies are also available for major streams offering possibilities for development. The area which can be brought under irrigation as a result of all these schemes is estimated at 45,000 hectares [42].

The greater part of this area will fall in plain and valley lands. It will undoubtedly constitute the most valuable addition to the agricultural resources of Lebanon. In all probability priority of use of such land will be given to fruits and specialized vegetables. It may be advisable also that part of it be used for raising certain industrial forage crops like sugar beets.

Another natural resource connected with land and water and offering a fair possibility for development is fishing instead of being a fish exporter, Lebanon imports fish. Furthermore, the price of fish on the local market is rather high as compared to other kinds of meat. Studies have been made of the possibility of developing Lebanese fisheries. The conclusions of such studies seem to favor national investment for the purpose of expending and organizing Lebanese fishing and fish markets.

With the expansion of agriculture and fishing goes the possibility of expanding industry, particularly those industries which are based on raw materials produced in the country, or which rely mainly on the domestic market for the sale of their finished products.

Thus, such industries are to produce fertilizers. Its products can also be absorbed by the local market. A number of other industries can be introduced and may have a good chance of success. Some of the good industries are based on the agricultural products to contribute to the promotion of agriculture, such as canning, the manufacturing of sprayers, pipe coupling, soda ash, fractional horse, power motors farm, garden tools, and farm machinery.

V. Some Cardinal Points of the Agricultural and Industrial Policy

Many measures taken recently by the Lebanese government indicate both a desire and effort of the government to bring about feasible and desirable developments in agriculture. The conclusions reached by this study first confirm the existence of considerable potential for development in the use of land and water resources. Secondly, the conclusions point to some fundamental questions which need thorough consideration by the government in the formulation of a determined and well defined policy of agricultural development.

A. A definite Irrigation Development Policy is Needed to Establish the Magnitudes of Investment and a Schedule for the Execution of the Various Projects

The water resources development being contemplate by Lebanon and including second phase of

Litani, Nahr el Assi and many smaller river basins involves a considerable amount of expenditure. Irrigation development in most of the Lebanese projects is correlated with generation of power. It happens that if Lebanon is to take full advantage of its water resources, the state will need to enlarge its organization that is to deal with further studies, planning, and execution of the works. Early consideration seems fully justified for the Nahr el Assi project which will irrigate 7,000 hectares of good land. The projects involving combined power and irrigation development might be studied as to formulate soon a long-term program. The decision needed concern not only the order and rate development but such questions as equitable distribution of costs; irrigation water charges including the desirability and extent of subsidizing irrigation of the objectives such subsidy; need for low cost power as a basis for industrial development, organization for maintenance, and operation of the completed projects.

B. The Manufacturing Fertilizers Should be Viewed Not Only as a Promising Line of Industrial Development but Also as a Mean to Serve Agriculture with Lower-Cost Fertilizers

Lebanon has made remarkable progress in the use of chemical fertilizers. The annual consumption increased rapidly in the last decade. The present consumption level would justify the establishment of an industry sufficiently large as to efficient operations. The manufacture of fertilizers might prove to be one of the most promising lines for industrial development as concluded by the industrial institute of Beirut [43]. It may also be assumed that locally manufactured fertilizers will be offered to farmers at prices comparable to those paid by farmers in producer countries.

Low cost fertilizers will not only help the Lebanese farmers earn more from their use but will also encourage them to increase applications to benefit of the natural economy.

VI. Eradication of Illicit Crops: Rehabilitation of the Agriculture Sector in Hermel Caza

A. The Cultivation of Illicit Crops and Their Impact on the Region of Hermel

The cultivation of cannabis was first introduced by the merchants of Zahle into the areas around their city before the French mandate, which later forced them to move this crop to villages in remote Northern areas, namely Deir el Ahmar and Btedhi.

The areas allotted to this crop soon grow, especially in the North-Western areas where resistance to the mandate during the 1920s met with support from the clans of the region [44].

Because development in the Baalbek-Hermel areas was marginal during the economic reform era following independence, cannabis remained the choice crop, whereas any other crop entailed the tackling of many risks (i.e., climate, vicissitudes, unavailable or expensive agriculture inputs, and unprotected markets among others). As a result the area planted with cannabis spread from around 2,000 hectares in 1929 to around 6,000 hectares in the mid-1960s.

During the latter part of the 1960s, sunflower was introduced as an alternative to cannabis, and the 6,000 ha previously cultivated with the latter diminished to around 600 ha in 1971. The area of sunflower-growing lands increased from 800 ha in 1966 to 5,300 ha in 1971. Unfortunately, the decreasing purchasing power of the subsidized prices for sunflower, the hectic bureaucratic process involved in obtaining the crop from the formers and paying them, along with the outbreak of the civil war in Lebanon and the opening of the borders between Egypt and Israel increased the demand for Lebanon Hashish, encouraged the recultivation of cannabis. Under this new condition cannabis cultivation reached its peak levels between 1985 and 1989. Cannabis cultivation covered an area approximately 15 to 20% of the total cultivated lands in the four district areas of Bekaa except for Rachaya.

Thus, cannabis cultivation spread out from the 40 villages it had covered before the civil war, in the region of Baalbeck-Hermel, to almost all the villages in the Northern Bekaa after the war, and reached 16 villages in the district of Zahleh and Western Bekaa (Southern Bekaa).

After this widespread cultivation of illicit crops and the saturation of the market with these products, especially in 1987 and 1988, profit started to decrease; cannabis and opium poppy cultivation decreased also. According to the survey on the evolution of illicit crop cultivation performed on the villages of Baalbeck and Hermel, the area cannabis cultivation inside and outside the villages ebbed from 75,000 dunums in 1989 to 51,000 dunums in 1990 and then to 38,000 in 1991, Witnessing a decrease of approximately 50%. These details are shown in table 2.

Table 2. Changes in Areas Planted With Illicit Crops in (dunums), 1989-1991

	1989	1990	1991
Cannabis	74,800	51,000	32,400
Opium Poppy	33,121	20,725	19,650

Source: United Nation Economic And Social Commission For Western Asia

Integrative Islam, with its strong religious influence, and the individual and family aids offered as an intensive to convert from the cultivation played a major role in decreasing the area of illicit crop cultivation in the plains and hills of the Eastern mountain range. The people of these regions, as an alternative, returned to smuggling goods other than drugs to and from the Syrian Arab Republic.

As for the impact of cannabis and opium poppy cultivation on these regions that had been severely marginalized by the economy, they were prominent in the prosperity of the real estate market and in the construction and commercial sectors that grow with the standard living. Moreover, the “new rich” started to invest in technologically advanced irrigation projects that were competing with cannabis production, but once more inflation and the stagnation of the fruit and vegetable market compelled the owners, especially in the Kaa plain (100 projects), to revert in part, to cannabis cultivation and some to the establishment of rain fed vineyards and olives groves.

Although the profits from illicit crop cultivation were considerable (estimated at 4 billion Lebanese pound (LL) in 1991 for cannabis and at LL 9 to 10 billion for opium poppy), they were not able to compensate for the government total neglect of the region infrastructure.

B. Factors Encouraging Cannabis Production

Upon the absence of low and order and marketing facilities that have encouraged cannabis production, there were encouraging factors. Such factors include the relatively low labor requirements needed for its production. Thus, table 3. compares the cost and labor needed per dunum (1,000 meters) of the following products: cannabis, wheat, tomato, potato.

Table 3. Comparison Table 1991

product	cost/dunum	men-day/dunum	net return/dunum
Cannabis	LL 91,000	9	LL 69,000
Wheat	40,000	2	25,000
Tomato	180,000	27,5	70,000
Potato	359,000	7	16,000

The advantages of cannabis production were attractive to about 80% of the farmers. This is especially true for poorer farmers who normally produce other less attractive crops whose prices are further depressed by dumped produce from external markets. The profit from hashish production did not escape the notice of the none-farming community and was not restricted to poor farmers or those

with diminutive farms. Wage workers and professionals as well as farmers with large farms understood very well that money could be made in this field of production where competition from neighboring countries was virtually non-existent.

VII. Eradication of Illicit Crops: Rehabilitation of the Agriculture Sector in Hermel Caza

Restraining the growing of illicit crops requires profitable alternatives to farmers. To increase the profitability of agricultural enterprises in the Hermel region would demand action to overcome most of the obstacles against farmers. The construction of El Assi (Orentes) Dam would have to provide the proper incentives to attract legal farmers that should be assured of adequate water. Thus, because according to the surveyed farmers, irrigation is a major problem constraining agricultural development. They identified expensive fuel, maintenance of pumping machines, lack of drained water, badly maintaining draining systems, and the monopoly of drained water by more powerful neighbors as the main difficulties concerning irrigation.

VIII. How the El Assi (Orontes) Dam Project Originated

The el Assi (Orontes) Dam Project can be viewed as the application of the concept of long term storage to the problem of water control in Lebanon. A number of missions, consulting firms, and individuals have made investigations and studies relating to the problems involved in the development of the natural resources of Lebanon. In 1946, the United States-Lebanon Agriculture Mission was organized jointly by the United States Departments of State and of Agriculture, at the request of the Lebanese Government. Its assignment was to assist Lebanon on problems relating to agricultural development. The report of this mission, after intensive study, included recommendations and suggestions to the Lebanese Government for alleviating agricultural problems.

On December 27, 1946 the Lebanese Government entered into an agreement with the firm of Sir Alexander Gibb and Partners, Consulting Engineers, of London, England, to "investigate and report on the economic development of Lebanon" [45]. The report by this firm contains a study of the economics of Lebanon and recommendations regarding land and water utilization, communications, industry, and commerce. It proposed a "Long Term Plan" for the development of the country.

In December 1949 the United Nations Economic Survey Mission for the Middle East was prepared by an Economic Survey Mission of the United States under the chairmanship of Gordon R. Clapp [46]. This mission was established by the United Nations Commission for Palestine to "examine the economic situation in the countries affected by the recent hostilities and to make recommendations to Commission for an integrated program …" This Mission secured the services of a staff of experts who made a rapid study of the refugee problem, the economy of the Middle East area, and of various measures which might be undertaken to alleviate some of the economic problems in this area. The mission reported in part, in connection with the survey of Lebanon, as follow:

"… Complete development of the water resources of the country is essential to the future economy, as it will be the means of increasing agricultural productivity through irrigation, as well as creating opportunities for a greater industrial development by utilizing low-cost hydroelectric power".

In 1951 "La Planification Intégral des Eaux Libanaises" [47] report was published by Maurice Gemayel, a Lebanese layer. This report cover studies made over a period of years by Albert Naccache, a Lebanese engineer. It presents a plan for a unified development of Lebanon's water resources for power production and irrigation use, which includes the development of the Nahr el Assi-Orontes Basin.

" L'Equipment Electrique du Liban" [48] report was prepared by Omar Ajam, Chief of Electric Service, Ministry of Public Works, Lebanon, in 1952. The section covering the Nahr Litani Basin was based largely on the data contained in the Litani River Project Reconnaissance Report, as prepared by the United States Bureau of Reclamation in 1951. It does, however, contain data relating to other rivers of Lebanon, including the Nahr el Assi, in addition to that relating to the Litani River.

"Development de L'Ectricité au Liban" [49] is the report of the French Technical Assistance to Lebanon, prepared by Henry Olivier and presented to the Lebanese Government by the French Ambassador to Lebanon, on March 31, 1953. This report covers various aspects of the hydroelectric problem in Lebanon and suggests general solutions for the development of hydroelectric power. The Nahr el Assi Basin is one of the basins for which a proposed plan of power development is proposed.

"Water and Electricity in Lebanon" [50] report was prepared by Hanna Chidiac, a Lebanese Consulting engineer in Beirut. It proposed a scheme for power development in Lebanon which includes a development of the power potential of the Nahr el Assi.

"Maasry Electricity Company" [51] made an advanced project report (Definite Plan Report) in October 1954 on the development of two hydroelectric power plants in the Nahr el Assi Basin. The first of these to be constructed is the "Yammoune Plant" which will use water diverseted from the Yammoune Basin. The other plant known as the "Hermel Plant" will be on the Nahr el Assi near Hermel.

Under the general provisions of the Special Projects Agreement between the Bureau of Reclamation and the Foreign Operations Administration for Technical Assistance in Water Resources Development, Lebanon, signed September 1, 1954, the Bureau of Reclamation has prepared the "Water Resources Investigations for the Nahr el Assi" report which covers a water resources reconnaissance of the Nahr el Assi in Northeastern Lebanon and indicates the water and land resources potentialities of that basin. The Ministry of Public Works for Lebanon has been jointly responsible for this investigation and report, and has contributed funds and personnel to assist in its execution and completion. Mr Ibrahim Abd-el al, Director General of Concessions, and representative of the Ministry of Public Works, and his staff have cooperated with the Operations Mission to Lebanon.

In August 1994, the Lebanese and Syrian governments reached a water-sharing agreement concerning the Assi (Orontes) River, according to which Lebanon receives 80 million cubic meters/year if the Assi (Orontes) River flow inside Lebanon is 400 million cubic meters or more during the given year. If this figure falls below 400, Lebanon's share is adjusted downward, relative to the reduction in flow. Wells in the river's catchment area that were already operational before the agreement are allowed to remain in use, but no new wells are permitted.

IX. Conclusion

A different approach to assessing the overall impact of Assi Dam, and one we can take, is to examine how Assi Dam project will affect the welfare of the rural poor. Agriculture is the main occupation of a majority of rural poor, and Assi Dam's plan documents show that an explicit aim of public investment in irrigation is to increase agricultural productivity, reduce instability in crop production, and enhance the welfare of the rural poor. Thus, considering the government intervention in developing the agricultural sector, one finds that the government rarely follows a realistic plan in tasks related to the development of the agricultural sector. Lack of positive beliefs about the government intervention to improve the agricultural sector is revealed clearly in respondents' beliefs about the nature of the Lebanese economy, since the majority agreed that the government must organize the agricultural sector. One point to mention is that respondents had a strong agreement that the absence of water projects, especially irrigation projects, is one of the reasons that caused slow progress in the Lebanese rural areas as it is rain fed.

In order to understand factors affecting government intervention, two ways can be developed: multiple regression analysis and cross-tabulation methods, this is natural since as these levels increase, the ability to analyze and evaluate increases.

After analyzing aspects related to the government intervention and the evaluation of Assi present contribution to irrigation, the purpose of this part is to examine the respondents' concern of future development which would change the structure of Hermel's society as well as its economy.

In addition, an approach more consistent with economic theory, which yields a meaningful economic interpretation, is the application of economic theory of optimal intertemporal choice. According to this theory benefit stream and cost stream of a certain project should be discounted to the present before any conclusion can be drawn as to its economic success or failure. All in all, the social role of Assi Dam can be described as follows:

Assi Dam construction will secure in minimum a decent standard of living for the farmers in its basin as dams' experience shows in different countries of the world. As per the same experiences dams normally secure a respectable standard of livings for the families of the agricultural laborers.

Similar to other large dams, Assi Dam plays a significant social role by securing career opportunities for its employees. Not only this but also jobs creation by the numerous new businesses (such as agro-industries, fertilizer industries, hotels, micro, small, and medium enterprises, and so on) generated following Assi Dam construction can be looked as a social hedging tool against the large unemployment waves in Assi region. Also, Assi Dam project is considered to have a major contribution to resolving the problems pertaining to the unemployment of special categories such as women and fresh universities graduates who are usually migrate looking for a work.

Assi Dam has a remarkable contribution to the growth and development of various sectors in the national economy especially the agricultural and tourism sectors in Hermel region. In fact, Assi Dam project will employ the labor force (human capital) as well as savings (financial capital) for investments purpose and production of services. The final outcome is an increase in output and employment hence economic development and social stability. In other words, the economic function of new businesses generated during and following the Assi Dam construction can be alternatively described by saying that these businesses are on one hand creating demand for human as well as financial capital and are on the other hand creating supply of goods and services within the economy. The above can simply summarized by saying that the share of economic activity of Assi Dam construction in the region's economy is significant; the Assi Dam made significant strides towards supporting economic and developing industrial units in Hermel region.

REFERENCES

[1] Dikiana, O., Areola, O., Comparative Analysis of Heavy Metal Concentration in Secondary Treated Wastewater Irrigated Soil Cultivated by Different Crops, Int. J. Environ. Sci. Tech., 7(2), 2010, pp. 337-346.

[2] Brahim, N.; Blavet, D.; Gallali, T; Bernoux, M., Application of Structural Equation Modeling of Assessing Relationship between Organic Carbon and Soil Properties in Semi Arid Mediterranean Region. Int. J. Environ. Sci. Tech., 8(2), 2011, pp. 305-320.

[3] Marco, M.; Dorian, Q.F., Palaeoecology and the Harappan Civilization of South Asia: Reconsideration, Quatar, Sci. Rev., 25(11-12), 2006, pp. 1283-1301.

[4] FAO, Low Income Food-Deficit Countries (LIFDC): Food and Agriculture Organization Country Profiles and Mapping Information, UAS, 2011.

[5] Hussain, I., Pro-poor Intervention Strategies in Irrigated Agriculture in Asia: Issues, Lessons, Options and Guideline, J. Irrigat. Drain, 2007, 56(2-3), 2007, pp. 119-126.

[6] Hussain, I.; Hanjir, A. M., Irrigation and Poverty Alleviation: Review of the Empirical Evidence, J. Irrigat. Drain., 53(1), 2004, pp. 1-15.
[7] Max, B.; Karin, B.; Joes L.A., Integrated Water Resources Management for Sustainable Irrigation at the BasinScale, Chilan J. Agri.res, 69(1), 2009, PP. 69-80.
[8] Ortega, J. F.,; de Juan. J. A.., Tarjuelo., J. M., Improving Water Management; The Irrigation Advisory Service of Castilla-La Manncha (Spain), Agric Water Management, 77(1-3), 2005, pp. 37-58.
[9] Zarghaami, M., Integrated Water Resource Management in Polrud Irrigation System, Water Resource. Manage. 20 (2), 2006, pp. 215-225.
[10] Ashraf, M. A.; Kahloun; A. Ashfaq., Impact of Small Dams on Agriculture and Groundwater Development; A Case Study from Pakistan, Agri Water Manag., 92 (1-2), 2007, pp. 90-98.
[11] Khalkheili, D., Poverty, Inequality, and Populist Politics in Iran, Department of Economics Virginia Tech Version.
[12] Brookshire, D. S.,; Whittington D., Water Resources Issues in the Developing Countries, Water Resour. Res, 29 (7), 1993, pp. 1883-1888.
[13] Lee, Y. W.; Bogardi, I.; Kim J. H., Decision of Water Supply Line Under Uncertainty, Water Resour. Res, 34 (13), 2000, pp. 3371-3379.
[14] Mousavi, H.; Ramamurthly, R., Evaluation of Ecotourism Potential in The Northern Coastline of The Persian, Gulf. Environ. Geo, 55 (3), 2008, pp. 681-688.
[15] Louks, D. P.; Stakhive, E. Z.; Martin, L. R., Sustainable Water Resources Management , J. Water Resour. Plann. Manag. 126 (2), 2000, pp. 43-47.
[16] Chang, N. B., Sustainable Water Resource Management Under Uncertainty, Stoch. Environ. Res. Risk Assess, 19 (2), 2005, pp. 97-98.
[17] Nouri, J.; Fatemi, M. r. ; Danekar, A. ; Fatemi, F. G. ; Karimi, D., Determination of Environmentally Sensitive Zones Along Persian Gulf Coastlines Through Geographic Information System, J.Food Agr. Environ., 7 (2), 2009, pp. 718-725.
[18] Huang, G. H.; Linton, j. d.; Yeomans, J. S.; Yougalingam, R., Policy Planning Under Uncertainty: Efficient Starting Population for Simulation-Optimization Methods Applied To Municipal Solid Wast Management, J. Environ. Manag., 77 (1), 2005, pp. 22-34.
[19] Tan, Q.; Huang, G. H.; Cai, Y., Radial-Interval Linear Programming for Environmental Management Under Varied Protection Levels, J. Air Waste Manage. Assoc., 60 (9), 2010, pp. 1078-1093.
[20] Schoups, G.; Addams, C. L.; Minjares, J. l.; Gorlick, S. M., Sustainable Conjunctive Water Management in Irrigated Agriculture: Model Formulation and Application to the Yaqui Valley, Mexico, Water Resour. Res., 42 910), 2006, pp. 10417-10419.
[21] Abbaspour, M.; Mirbagheri, S. A.; Monavveri, M.; Javid, A. H.; Zarei, H., Conceptual Hydrosalinity Model for Prediction of Salt Load from Wastewater Flows into Soil and Groundwater, Int. Environ. Sci. Tech., 6 (3), 2009, pp. 359-368.
[22] Calvache, M. L.; Duque, ,C.; Gomez, Fontalva, J. M. ; Crespo, F., Process Affecting Groundwater Temperature Patterns in a Coastle Aquifier, Int. J. Environ. Sci.Tech., 8 (2), 2011, pp. 223-236.
[23] United Nations, Compendium of United Nations Work Programmes on Rural Poverty Alleviation, Inter-Agency Subcommeittee on Poverty Alleviation for Asia and the Pacific, USA, 2000-2001.
[24] Duraiappah, A. K., Sustainable Development and Poverty Alleviation Exploring the Links Alleviating Poverty: Five Decades of Under-Achievement International Institute for Sustainable Development, 2000.

[25] Yakubov, M., Mainstreaming Rural Poor in Water Resources Management Preliminary Lessons of a Bottomup WUA Development Approach in Central Asia, J. Irrigat. Drain., 56 (2), 2007, pp. 261-276.
[26] Hussain, I., 2004. Irrigation and Poverty Alleviation: Review of the Empirical Evidence. Journal of Irrigation and Drainage, Netherlands.
[27] Latif M. 2007. Spatial productivity along a canal irrigation system in Pakistan. The journal of the international commission on irrigation and drainage, 56: pp.509-521.
[28] Burton, J. 2003. Integrated Water Resources Management on a Basin Level – A Training Manual, UNESCO.
[29] World Commission on Dams, Clarke C., (2000), Cross-Check Survey, Consultant to the Secretariat, South Africa. Available at: http://www.swissdams.ch/Commettee/Dossiers/wcd/La rg e% 20 Dams %20Cross-Check %20 Su rvey%20-% 20 Main % 20 Page htm.
[30] Birds, J.; Wallace, P., Dams and Development-an Insight to The Report of The World Commission on Dams, J. of Irrigt. And Drain., ICID, 50 (1), 2000, pp. 53-64.
[31] Kusou, H., An Assessment of The Irrigation Management Transfer Program: Case Study in The Mustafakemalpassa Irrigation Schem in Turkey, J.Irrigat. Drain., 57 (1), 2008, pp. 15-22.
[32] Manzoor, M.; Chowdhury, S. A., Poverty-Environment Nexus: An Investigation of Linlkage Using Survey Data, Int. J. Environ. Sustain. Develop., 9 (1-3), 2010, pp. 91-113.
[33] Doummar, J.; M.A. Massoud; R. Khoury ; M. Khawile, Optimal Water Resources Management : Case of Lower Litani River, Lebanon, Water Res. Manage., 23(11), 2009, pp. 2343-2360.
[34] Ashley, D. Roe and H. Goodwin, 2001. Pro-Poor Tourism Strategies: Making Tourism Work for the Poor, London, ODI.
[35] UN, 200a. Sustainable Development of Tourism, Report of the Secretary-General (Document No. E/CN.17/2001/PC/21), New York, UN.
[36] FAO Project, Agricultural, Homogeneous Zone –Summary Study, Beirut, 2006, pp. 3
[37] UNDP, Strategic options For Lebanon's Agro-Food Industry in Dynamic Monographs Global Environment: With Specific Reference to Sustainable Development of The Baalbeck-Hermel Region, The Lebanese Center For Policy Studies Consultants and Research Institute and UNDP, Beirut, UNDP, 1998, p. 65.
[38] FAO Water Report, Irrigation in The Middle East-Region in Figures, AQUASTAT Survey, 2008, pp. 266-267
[39] Moumen, Ali, First Conference on The Fight Against Desertification in Lebanon, 2011, p.129.
[40] Mediterranean Development Project Country Study: Lebanon, July 159, Part III, p. 7.
[41] Mediterranean Development Project Country Study: Lebanon, July 1959.
[42] 1. El-Moussawi, Ali, Baalbeck-Hermel Region and Cannabis Cultivation.
[43] Green Plan, Report on the Project of Replacing The Illicit Crops by Legal Economic Crops, 1971.
[44] Baroud, A., "File of 1970s, No. 6 on Hashish in Lebanon".
[45] United States Department of Agriculture – Report of the United States – Lebanon Agriculture Mission – Office of Foreign Agricultural Relations – Washington, D. C., September, 1948.
[46] Gibb, Sir Alexander, and Partners –The Economic Development of Lebanon- Beirut, Lebanon, 1948.
[47] United Nations, Final Report of the United Nations Economic Survey Mission for the Middle East, Lake Success, New York, Dec28, 1949.
[48] Naccache, Albert, and Maurice Gemayel, La Planification Intégral des Eaux Libanaises, Bierut, Lebanon, 1951.
[49] Ajam, Omar, L'Equipment Electrique du Liban, Bierut, Lebanon, 1952.
[50] Olivier, Henri, Développent de L'Electricité au Liban, Paris, France.
[51] Chidiac, Hanna, Water and Electricity in Lebanon, Beirut , Lebanon, 1950.

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- Hiyam sujud & Boutheina Hashem, "Islamic Versus Commercial Banks in Lebanon: An Empirical Study of Credit Risk Management", International Journal of Economics and Finance, vol. 10, no, 8, 2018.
- Hiyam sujud & Boutheina Hashem, "Reality and Future of Islamic Banking in Lebanon", European Journal of Scientific Research, vol 149, no 4, July, 2018, pp. 410-422.
- Hiyam sujud & Boutheina Hashem, "Effect of Mergers and Aquizitions on Performance of Lebanese Banks", International Research Journal of Economics and Finance, Issue 166, March, 2018.

- Hiyam Sujud & Boutheina Hashem, "Effect of Bank Innovations on Profitability and Return on Assets (ROA) of Commercial Banks in Lebanon", International Journal of Economics and Finance, vol. 9, no, 4, 2017.
- Hiyam Sujud, Youth in The Civil Society, Lebanon. Present Status and Futur Perspectives; Arab network publication, Sixth Annual Report, Chabaka, Cairo, 35 pages.
- Hiyam Sujud, NGOs' role in Woman Empowerment in Lebanon; Arab network publication, Fourth Annual Report, Chabaka, Cairo, 40 pages.

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Selected papers

1. **T Hamieh**, MB Fadlallah, J Schultz, Journal of chromatography A 969 (1), 37-47, 2002
2. D Mnayer, AS Fabiano-Tixier, E Petitcolas, **T Hamieh**, N Nehme, C Ferrant, X Fernandez, F Chemat, Molecules 19 (12), 20034-20053, 2014
3. **T Hamieh**, M Rageul-Lescouet, M Nardin, J Schultz, Journal de chimie physique 93 (7-8), 1332-1363, 1996
4. M Hamieh, S Al Akhrass, **T Hamieh**, P Damman, S Gabriele, T Vilmin, E. Raphael, G. Reiter, The Journal of Adhesion 83 (4), 367-381, 2007
5. I Kabalan, G Rioland, H Nouali, B Lebeau, S Rigolet, MB Fadlallah, J Toufaily, **T Hamieh,** J T Daou, RSC Advances 4 (70), 37353-37358, 2014
6. **T Hamieh**, J Schultz, J Chim Phys 93, 1232-1331, 1996
7. A Haddarah, A Bassal, A Ismail, C Gaiani, I Ioannou, C Charbonnel, **T Hamieh**, M Ghoul, Journal of Food Engineering 120, 204-214, 2014