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ECONOMIC EFFECT OF CONVEYOR-800 PROJECT ON THE SOUTH OF LEBANON

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ABSTRACT

OF THE THESIS OF

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Title: Economic Effect of Conveyor-800 Project on the South of Lebanon

Litany project was first implemented with the aim of encouraging small scale farmers to develop and grow and thus to boost the agricultural sector in the south of Lebanon. Conveyor 800 is a part of the project that is associated with the southern region that falls between elevations 400- 800 m, and which is still not implemented. The aim of this paper is to determine the potential economic impacts of Conveyor 800 on the south region, and if the availability of water for irrigation will impact farmers. To this effect, this study is based on original empirical data collected from farmers from the selected region in 2020. The data is analyzed using multiple regression analysis to find the relation between production and irrigation. The analysis shows that the access for irrigation water encourages farmers to adopt new cropping pattern and techniques and results in condensed and expanded production. Our regression results show that there is a positive significant relation between water available for irrigation and between production levels. Access to water for irrigation enables small scale farmers to increase their production and to shift towards producing high value crops and thus increases their income. The study concludes that if the project is successfully implemented with continuous monitoring then this will increase farmers' income, profits and will help them reach a sustainable livelihood.

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CHAPTER I

INTRODUCTION

Agriculture is considered as one of the components of the national economy; it is the pillar of rural development. The agriculture sector in Lebanon represents one of the most important sources of income and job opportunities in rural areas. During the seasons where rain fall is not enough, irrigation supplies the needed water demanded by agricultural lands and thus increases crops' production to support the rural community whom depends on lands for their income {Shamsedin, 1969 #9}. The act of improving the agricultural sector in Lebanon by securing the regular supply of water for irrigation was encouraged by all the authorities and this was the first objective for working on the Litany Irrigation Project that was first implemented by Engineer Ibrahim Abd El Al (Binaa 2018).

The project was implemented with the aim to invest in the water resource of the Litany River , the target of the project is to increase the agricultural production by intensifying the production for every cultivated hectare and also to increase the area of cultivated lands and to change the cropping pattern. Water for irrigation will be transported from the Qaraoun dam where the water of the upper basin of the Litany River is stored; this dam was built in the sixties in the Bekaa region in the Qaraoun synthetic Lake which is the

largest lake in Lebanon and has a capacity of around 858 meters. The water will be transported from the dam towards the south on a path that is estimated to be 52 Km long.

Conveyor 800 is a part of the Litany project that aims to transport around 90 million cubic meters to irrigate 15000 hectares of cultivated lands that fall between elevation 400 and 800 meters and that extends from Qelia and Marjayoun south of the dam to Bent Jbeil and Ayta Chaeb in the uttermost south. The irrigation regions are divided into twelve perimeters: 1- Qelia, 2- Marjayoun North, 3- Marjayoun South(3), 4- Al Taibe, 5- Markaba(3), 6- Majdal Selm, 7- Srifa, 8- Meis El jabal, 9- Chaqra(2), 10- Bnt Jbeil(3), 11- Aita Al Chaab, 12- Yarine(2) (AL-HANDASAH, 2001).

The implementation of the project is divided into two phases, the first phase is to construct the conveyor that is responsible for transporting water from the dam to the designated 76 villages, this phase involves a fixed part that guarantees the arrival of water to 20 main tanks (16000 cubic meter total), that are distributed among the 12 perimeters. The second phase involves secondary piping to transport water to all the villages.

The water path starts from Yuhmor tunnel ahead of Yuhmor heights and then it continues to the open canals in Qelia, the canal extends southward to Kawkaba towards Marjayoun, the path then continues towards Kfarkila and Markaba. The tunnel of Markaba starts at the end of Taibe and ends at Houla, the path then continues through Meis El Jabal, Chaqra and the through Ayta Chaeb towards Yarine (AL-HANDASAH, 2001).

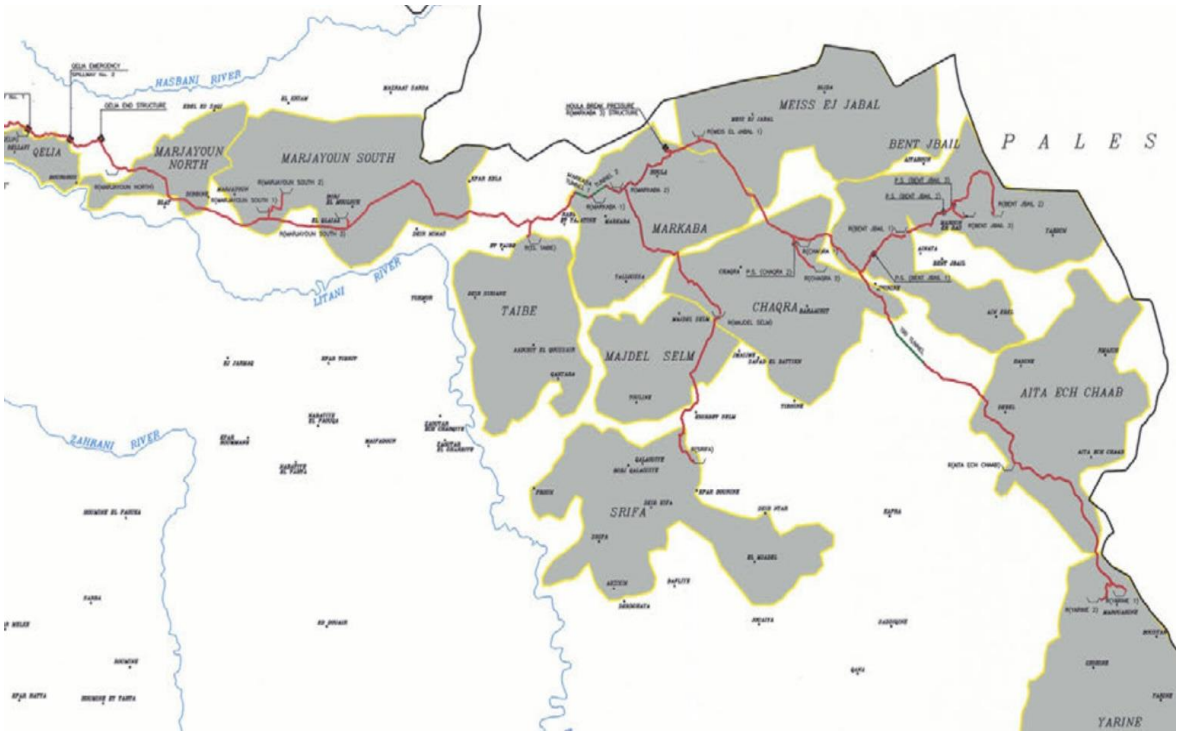


Figure 1 the pathway of Litany Project Conveyor 800 section through the south region

Economically the implementations of the project must have a lot of benefits, regardless of the increase in the yield, the improvement in its quality and the change in the cropping pattern, these benefits' returns must be seen by the increase in job opportunities and increase in the agriculture labor force as well as the development of the whole sector (AL-HANDASAH, 2001).

However the project is not implemented yet; this study focuses attention on identifying the response of the farmers towards this implementation in order to assess the future effect on the region. An essential step is to determine whether the farmers will be willing to benefit from the services supplied by the project or not, and in response to that how will they change their farming behavior and how the availability of water for irrigation will

change their choice of the cultivated crops. The major questions that should be answered after implementing this study are “Will the implementation of the project effect the farming behavior of the farmers in the region? Will it cause a change in the cropping pattern adopted? And how will this response affect the farmers’ welfare?

A. Objectives:

Specifically, the objectives of this research are:

1. To analyze the current farming behavior in the south and to assess the welfare of the farmers there.
2. To study the response of farmers towards the implementation of Conveyor-800 project.
3. To study the effect of the implementation on the farmers’ welfare.

B. Hypotheses:

- Farmers will be willing to benefit from the service supplied by the project
- The implementation of the project will serve in the development of small scale farmers and will lead to a change in the farming behavior in the South of Lebanon.

CHAPTER II

LITERATURE REVIEW

A. Litany River:

The litany River is the largest of Lebanon's plentiful rivers, it rises in the Bekaa valley and has the largest length(172 km) and width and a water capacity of around 750 million cubic meters every year, its basin represents 20% of the Lebanese territory with an area of around 2175 Km square , and it passes through 263 villages that are distributed among 12 districts, the water in the Litany basin is equal to approximately 30% of the water in all the rivers in Lebanon (Shaban & Hamzé, 2018). Due to its geographic position, its dimensions elongates from the internal part of the country to the coastal area, it passes over several topographic areas in which a diversity of people live in. This river has always been identified as a key for the development of Lebanon on both the economical and social status (Shaban & Hamzé, 2018), and for this reason Lebanon has always tried to benefit from the wealth of this river. The importance of the Litany is not restricted to the basin of the river only, but it also extends as this river supplies water for irrigation for thousands of hectares of agricultural lands, in which it is reflected on attaining food security and helps in preserving the natural resources in Lebanon, and an important thing to highlight is its contribution in developing the agriculture sector and conserving employment opportunities(Shaban & Hamzé, 2018). The river also has a major rule in supplying

electricity for a significant portion of the Lebanese community(Shaban & Hamzé, 2018). In addition to all the physical factors that favor the Litany River over all other rivers located in Lebanon, political factors play an important role on focusing on the development of this river. The Litany River is the only river that flows within the borders of Lebanon, and thus represents a complex and accurate issue that involves sharing water rights with the neighboring countries {Abboud, 1969 #36}.

Several studies and projects were implemented to benefit from this wealth; the first study was done to implement the water reservoir at Karoun as well as manufacturing hydroelectric power. The second plan was the Taibe project that suggested pumping water from the Litany for domestic usage {Abboud, 1969 #36}, in addition to the large irrigation project that aimed to supply the Bekaa and the South region with water for irrigation and many other studies. All the implemented projects aimed to develop both the agricultural and electrical sectors as well as to reduce immigration from the rural areas to the cities (The Litani River Authority, 2019). In the 1940's, engineer Ibrahim Abed El al started a sequence of studies that are concentrated on the Litany River's hydrology and hydraulics, his studies were a stimulus for other projects to be managed and handled (Shaban & Hamzé, 2018).

B. Irrigation in Lebanon:

Lebanon is a country that is rich in water resources. There are 16 rivers in which their combined outflow amounts to 3350 million cubic meters annually, many of these rivers dry up in the summer, and some are recognized by the streaming out flow in the winter and the low outflow in the summer{Abboud, 1969 #36}. Rain fall is another source of water which is considered to be the major source of irrigation for agriculture production, but rain fall follows a seasonal pattern. The major part of the rain falls between the duration from December to February, where it starts to decrease after that and stops all the summer, but about two third of the amount is lost by evaporation. In order to avoid the loss of rain falls the idea of building reservoirs to store the amount of water fall for summer was initiated. The idea of building reservoirs ensure plentiful of water for irrigation in cheap prices to irrigate the arable lands appropriate for cultivation, and there lies the contribution of the Litany project to the agriculture production{Abboud, 1969 #36}.

The total arable land in Lebanon is estimated to be 332 thousand hectares; only 110 thousand of this space is cultivated and irrigated and this is due to the deficiency in irrigation (Binaa 2018). Agriculture in Lebanon is subjected to many problems; it mainly suffers from the low production per dunum of land and thus the maximum yield that should be produced is not reached and this is due to many factors, one of which is the absence of irrigation systems. Farmers prefer to depend on rainfall for irrigation, but since there is no rainfall in the duration from May to September, crops suffer from stress {Shamsedin, 1969 #9}.

From the figures stated above the ability to develop the agriculture sector and improve it quantitatively and qualitatively by supplying water for irrigation is wide, for this reason Lebanon has initiated the Litany irrigation project to overcome the restrictions set by the nature. There are several advantages of irrigation; it leads to the increase in the size of cultivated land by fixing lands that were not cultivated as a result for the lack in water. The increase in agriculture production can be seen after the exploitation of all the available lands intensively to reach higher and more stable yields {Abboud, 1969 #36}.

C. Irrigation projects in literature:

The American Water Analysis Council has identified several aspects to evaluate the success of any project, and two important aspects are the development of the national economy and the development of social welfare of the region(Kirsten & Van Zyl, 1990). The growth and the potential usage of water resources in agriculture establish a new economic situation that has a positive direct and indirect impact on the local economy. In any public project or service the benefits of this action cannot be limited to the direct receiver of the service, the benefits are usually targeted to the whole society or nation whether this benefit is tangible or it is reached in an indirect way. The direct effect is seen as an increase in the agricultural income, while the indirect effect can be seen on the other sectors due to the increase in agriculture income(Kirsten & Van Zyl, 1990).

The direct effect is resembled by the increase in agricultural yield; production of irrigated lands is greater than production under dry condition lands, statistics done in 1986

show that about half of the agricultural production for 35 years comes from irrigated lands and that the irrigated lands were productive as twice as the rain-fed land. Away from the increase in production, there is a relation between different sectors in the economy and this is where the indirect impact can be seen, each sector will react to the increase in agricultural production and thus ends with an increase in the local economy(Kirsten & Van Zyl, 1990).

The benefits of irrigation reflect in the decrease in food prices, increase in employment and development of agriculture and the economy.

Irrigation projects benefits' can be directly sensed by the farmers who are directly related to the services of these projects, but these benefits are lately reflected on the agriculture sector and the national economy as a whole(Margolis, 1957). The direct benefits can be summarized as the increase in production, increase in cropped land and the increase in farmers' profits. Some of the indirect benefits could be the profits of the wholesalers and retailers, the profits of all enterprisers between farmers and consumers, in addition to the increase in the value of the lands(Margolis, 1957).

Two natural and main assets upon which poor people depend are: land and water, and although water is not the only single reason behind poverty it plays an important and strong role in affecting food production and thus in defining poverty. In the water poverty discussion, irrigation water has its special belonging(Hussain & Hanjra, 2004). Out of the 1200 million poor people defined in 1985 that has a purchasing power of less than one dollar per day, three quarters live in the rural areas, and because fighting poverty is one of

the main steps to reach development it is important to look at investment in agriculture (Lipton, Litchfield, & Faurès, 2003). Statistics show that there is a big regional gap in the percentage of croplands that are irrigated and this gap coincides with the achievement or breakdown in fighting poverty, if you take a look over Africa only around 3% of the cropland is irrigated and Africa has one of least poverty reductions around the world, while those regions that have a large percentage of irrigated cropping lands as in East Asia have experienced a huge reduction in poverty(Lipton et al., 2003). With respect to agriculture, the availability of water for irrigation is an essential key for production and that is why it is considered to be a socioeconomic good, it increases productivity and helps in fighting poverty(Hussain & Hanjra, 2004). Irrigation water affects the socioeconomic status of rural communities or farmers through the increase in five main dimensions: production (increase in the yield, area of cultivation, intensity and diversity of cropping) , income and consumption (settlement of farm income and increase of consumption ability), employment (an increase on and off-farm job opportunities) and food security (increase food availability, increase the chance to produce and retain food for home consumption)(Hussain & Hanjra, 2004). The literature shows that the intensity of cropping is one of the factors that measure poverty between farmers, cropping intensity ranges between 111 to 242% in irrigated lands whereas for the rain fed lands it ranges between 100 and 168%, this difference indicates that farmers having access to water can plant an additional crop each year(Hussain & Hanjra, 2004), also the land productivity is another factor, if we take rice and wheat as an example the literature shows that farmers can produce an extra ton when they regular access for irrigation water(Hussain & Hanjra, 2004). It's important to mention also the rate of employment and wages, where it appears to be higher per hectare in

irrigated lands than in rain fed lands. Studies also proved that poverty rates in rain fed lands are greater than those in irrigated lands, where it ranges from 21-66% in the first and 18 to 53 % in the second. This means that poverty rates are lower by 5-10% in irrigated lands than in rain fed ones (Hussain & Hanjra, 2004).

The availability of water for irrigation can help poor people in different ways, for example it helps small farmers to increase their yields and eventually increases their income and it helps in increasing job opportunities through the need for more agriculture hands and finally it may help in reducing food prices due to the increase in national production(Lipton et al., 2003). Irrigation helps in increasing the lands' output due to the decrease in crop damage due to the insufficient supply of rain water, irrigation also opens the door for farmers to switch into several cropping patterns and high value crops and so if irrigation will not affect all poor people it will for sure reduce the poverty of small poor farmers(Lipton et al., 2003). And with respect to employment, the implementation of any project needs workers for construction, in addition when the farms' outputs increase this directly increases the need for farming hands. When food output increases, the need to transport from one region to another decreases and thus the prices of food will decrease, in addition any surplus in food produces will be transported to other regions and will eventually end up with additional income for the area of production(Lipton et al., 2003). On the other side, when farm outputs increase, farmers' income increase and the food prices decrease, the expenditure on non food products and services will increase and thus more employment opportunities will be available and the economy of the whole region will boost(Lipton et al., 2003). To determine the economic impact of any project it is important

to determine the changes in three main points, first the production of goods and services, the second thing is the salaries and the last thing is the employment(Haque, 1996). And in order to determine the social impact of a development project, it is important to assess the physical health, well being, welfare and lifestyle of people(Haque, 1996).

The Pembina valley water supply project is one of the development projects done in Canada for the purpose of boosting the macroeconomic growth in the country, the project aims to withdraw water from the Red and Assiniboine Rivers to supply industries and farms(Haque, 1996). This project is done in order to meet future water demands and to remove any water related constraints to economic development. The economic impact of the project is expected to be positive, reflected in an increase in employment, decrease in on farm water hauling (this results in a decrease in health risks caused by trace elements of pesticides, fertilizers and other chemicals found in the surface wells(Haque, 1996)). The other impact will be mirrored by the increase in the exported farm productions (grains, seeds, meat and dairy production). The production didn't only affect the economy but also affected the welfare of the citizens, this supply of water allowed many users to make important changes in their lifestyles, the number of washing machines, tubs and dishwashers has increased to about 45% (Haque, 1996). The supply of needed water allowed the users to benefit from more leisure time and to decrease the stress they used to live. Another example is the development project in the Juba valley; it aims to provide water for irrigation from the Juba river to increase the growth of crops such as cotton, nuts, sesame….(Samantar, 1986)

A study was done in 10 different villages in India in which each village belongs to a different agro-climatic zone, the results show that when irrigation increased by 40% poverty decreased in an equal manner as well as the increase in salaries and in education levels in addition to lifting the food production to reach a surplus. Studies prove that access to irrigation encourages farmers to adopt to choose new technologies and to condense production leading to an increase in production and eventually an overall increase in returns for farmers, this also opens more job opportunities on farms and outside farms and thus improves the quality of life in rural areas. The improvement in welfare can be noticed by attaining food security, increasing income and consumption. The study shows that all the farmers that are irrigating are always food secured, unlike the farmers that depend on rain fed agriculture and who sometimes are obliged to run after food (Tesfaye, Bogale, Namara, & Bacha, 2008). In linear to the speed of the increase in population, the power in increasing agriculture production is by increasing the access of farmers to irrigation, when the access to irrigation is available the national economy is benefited by the contribution of agriculture to food security, job opportunities, and the gaining of foreign exchange through imports and exports (Tesfaye et al., 2008). A study in Ethiopia states that the availability of small irrigation projects resulted in a growth in production and its diversity in addition to the growth in income. And according to this study the farmers revealed that the hunger period has decreased from 6 months to 2 months , where they are able to use the money they get from selling their products to buy food in the food shortage period (Tesfaye et al., 2008).

In Sub-Saharan Africa agriculture is the most popular job, two-thirds of the nation is employed in agriculture and this could be because 70% of the population live in rural

areas where crop production and animal raising are the main sources of food and income. Raising and varying food production as a source of salary helps in raising food security at the level of the household and this means producing food not only for consumption but also as cash crops (Peter, 2011). Swaziland is a country in South Africa and it is one of the lower middle- income countries, the poverty in Swaziland reaches around 70%, and around 90% of the poor community lives in rural areas. The economy of the country as a whole is based on agriculture; most of the farmers are small-scale farmers that depend on rain red agriculture. Water availability is the major obstacle that faces farmers and is the main reason behind food deficiency during a long period of the year and therefore they state that water accessibility is the key to reach food security(Peter, 2011). In this water- stressed region, enhancing irrigation directly reflects on the increase in agricultural productivity, on this basis an irrigation project was constructed in the region to support the livelihood of the farmers. A little bit increase in incomes and welfare was noticed and this is only because the farmers didn't use the water efficiently and not all were used for agriculture activities and thus restricted reaching the goals of the projects to maintain food security and decrease poverty (Peter, 2011).

In many cases such as in India and Pakistan, the division of the benefits of the availability of irrigation water is uneven among different socioeconomic groups, the benefits are distributed according to land resources. The farmers who own large lands benefit more than the smallholders. Whereas in cases like China where the distribution of lands is equal, the distribution of benefits will be likely to be equal overall farmers(Hussain & Hanjra, 2004). The landless farmers will mostly benefit from the job opportunities that

will be available then, and this gives apiece of evidence that the benefits whether direct or indirect may impact all the rural population whether they are landowners or not (Hussain & Hanjra, 2004).

CHAPTER III

DATA AND METHODOLOGY

A. Data

The data in this study is derived from a survey conducted in Lebanon; during the duration from April to June 2020, using a semi-structured questionnaire.

A sample of 72 farmers was chosen from the 72 villages that are included in the Conveyor 800 project. One farmer from each village was surveyed for consistency, all the villages will be represented in the same form regardless of their sizes or the number of farms located in it and this was one of the limitations of the study. The only condition for the sample was that the farmers should be practicing farming in the recent time.

The survey was divided into three sections:

1. The first section contains socio-demographic questions about the farmer (age, whether married or not, income sources) and questions about the size of the land and the ownership of their farms.
2. The second section contains questions about the production process (yield, inputs, costs, returns)
3. The third section contains questions about the project and the farmers' response towards it (their knowledge with its goals, their willingness to buy from it, their future response).

B. Data Collection

Data collection was supposed to be face to face through direct interviews, but because of the current situation and Covid- 19 crisis it was hard to contact the farmers on a personal level and directly. As a substituting method the surveys were done through phone calls after explaining the reason and the purpose of the study for every respondent.

C. Methodology

The analysis in this paper relies on descriptive analysis that depends on frequencies and percentages. To determine the economic impact of the project it is important to take into consideration an important approach, the availability of water for irrigation would possibly affect the output due to irrigation itself, and thus leads to changes in the production of goods as a result of the change in available water. This study starts by analyzing the farming behavior in the south of Lebanon and the welfare of the society there to understand the major obstacles that face farmers and prevent them from developing, and then the analysis focuses on understanding the response of farmers towards the implementation of the project in order to determine its future effect. The analysis depends on a secondary econometric regression analysis that assures the positive relationship between yield and between available water, in order to prove that the increase in water can affect the change in yield. And since yield is a variable that can be affected by different inputs, the linear multiple regression models was used. Multiple regressions is a statistical

technique that provides a path to understand the relation between different factors, a dependent variable that is affected by means of multiple independent variables(Orme & Combs-Orme, 2009). The explanation of the variables and the results of the regression analysis can be found in the appendix, table 1 and 7 respectively.

CHAPTER IV

EMPIRICAL RESULTS AND DISCUSSION

A. Descriptive Results

Before discussing the results of the regression analysis, it is important to present some important descriptive results that show a glimpse of the conditions that farmers in the south live and to try to understand the basic problems that they face and that prevent them from expanding and growing.

Land Size	*Freq*	*Percent*
<= 20 D	57	81.43
>20 D	13	18.57
Total	70	100

Table 1: Tabulation of land sizes

The idea of a small scale farmer can be defined from different points of view, in general small scale farmers are those who do not have access to resources, technology and market, according to the World Bank definition small holders are those cultivating a land with an area less than 20 Dunums (Murphy, 2010)

Table 2 shows the distribution of the land sizes among the 70 farmers interviewed, as the table shows more than 80% of the farmers own lands that are smaller than 20 Dunums and are then categorized among small holder farmers, while only 18% can be categorized as large farmers.

Table 2: The distribution of land sizes according to ages

	Land Size		
Age cat	=<20 D	>20 D	Total
40-50	24	4	28
50-70	32	8	40
>70	1	1	2
Total	57	13	70

Table 3 shows that this sector in the south is mostly adopted by old age people, while the youth population is missed and this presents a gap in the sector as the youth are the most active segment of the population and the ones that do the productive work of the nation. They are also identified to be the major key for any state that dreams to accomplish

development in rural and agriculture projects; they represent the essential force in the agriculture production process. The youth are the chance and opportunity to grow and develop (Ahaibwe, Mbowa, & Lwanga, 2013).

Table 3: Number of farmers who have income sources other than agriculture

Income Sources	*Freq.*	*Percent*
Other Income Sources	45	64.29
No other Income Sources	25	35.71
Total	70	100

Table 4 shows that 64% of the sample has income sources other than agriculture and that they don't depend only on agriculture for living, as most of them indicated that the returns from agriculture are not enough to ensure a proper life for themselves and their families. And as we saw before, large population of the farmers are small farmers and this explains the need for having other income sources.

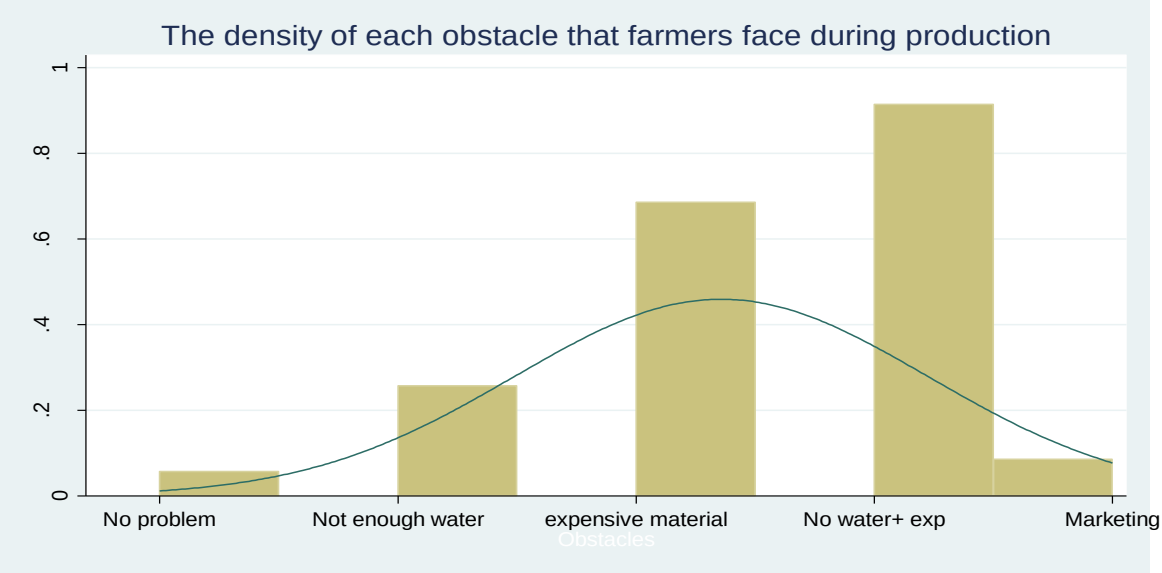


Figure 2 the density of each obstacle that farmers face during production

In order to understand the major obstacles that challenge farmers during production, or the ones that prevent them from growing and developing, they were asked to choose one of five options: (1) they don't face any problem, (2) water shortages, (3) expensive inputs, (4) is options 2 &3 combined, (5) they are not able to find markets enough to sell all their yields. Figure 1 show that both water shortage and expensive inputs, option (4) is the most common problem that challenges farmers and prohibits them from growing and developing. And In order to understand more how much water shortage and the cost of applying an irrigation system affects their budgets and restrains them, they were asked if the irrigation cost resembles half of the cost of their production or not, but 62% of the sample didn't state that the cost of irrigation accounts to half of the cost of production. Despite the fact that the irrigation cost is less than the half of the total cost of production, 60% of the sample

indicated that they face water shortage most of the time of the season and the rest 40% stated that only in summer they suffer water shortage. After knowing that 60% of the sample faces a big water shortage problem, they were asked how much water for irrigation they buy each week.

Table 4: The amount of water in cubic meters that farmers use weekly

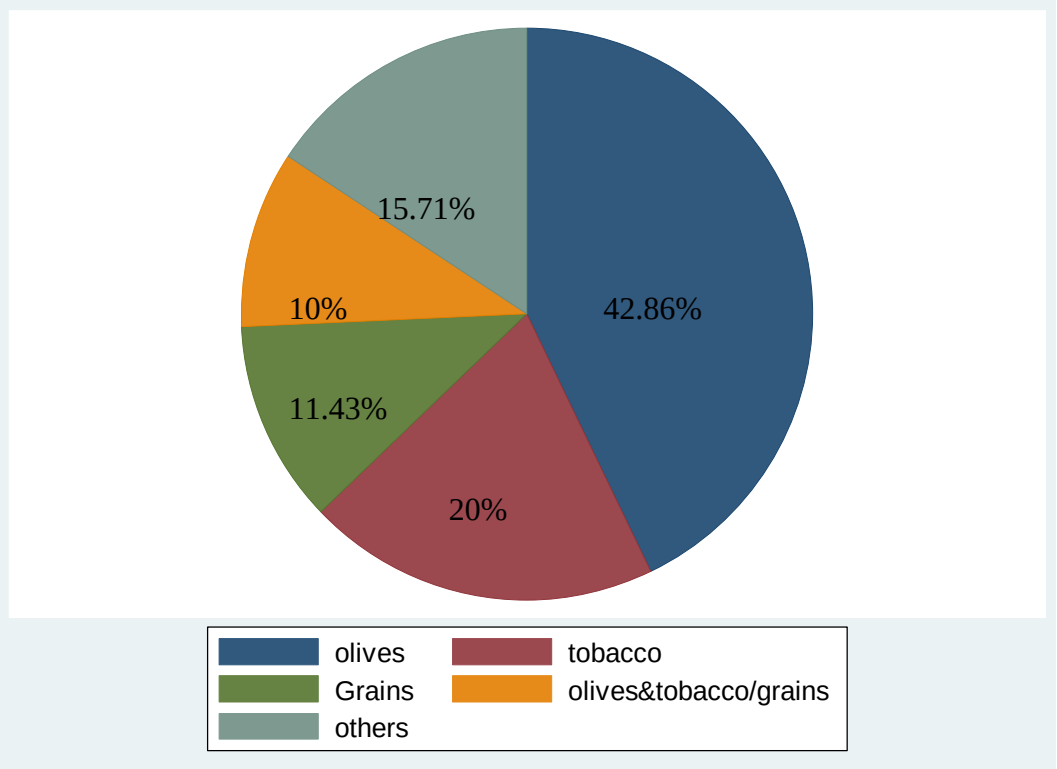
Water Usage (cubic meter/week)	*Freq.*	*Percentage*
More than 3000	22	31.43
Between 2000-3000	13	18.57
Less than 2000	35	50
Total	70	100

Surprisingly, half of the sample doesn't buy water as they stated that buying water for irrigation is very expensive and they prefer to depend on rain water for irrigation and very few of them have their own sources and only 33% of the population uses more than 3000 cubic meters of water weekly. Studies show that when the price of water increases above a certain threshold that farmers can afford they may respond in different ways either by shifting to rain fed farming, or by improving water use efficiency or by switching to

water saving crops(Shah et al., 2009). It is clear that half of the sample and due to water shortage and expensive inputs has switched into rain fed irrigation.

The fact that water shortage is faced by the whole sample regardless of the duration of shortage and that these farmers prefer not to buy water, it was important to ask for the type of crops each farmer chose to cultivate. The results are presented in figure 2.

Figure 3 the pie graph represents the percentage of different crops cultivated

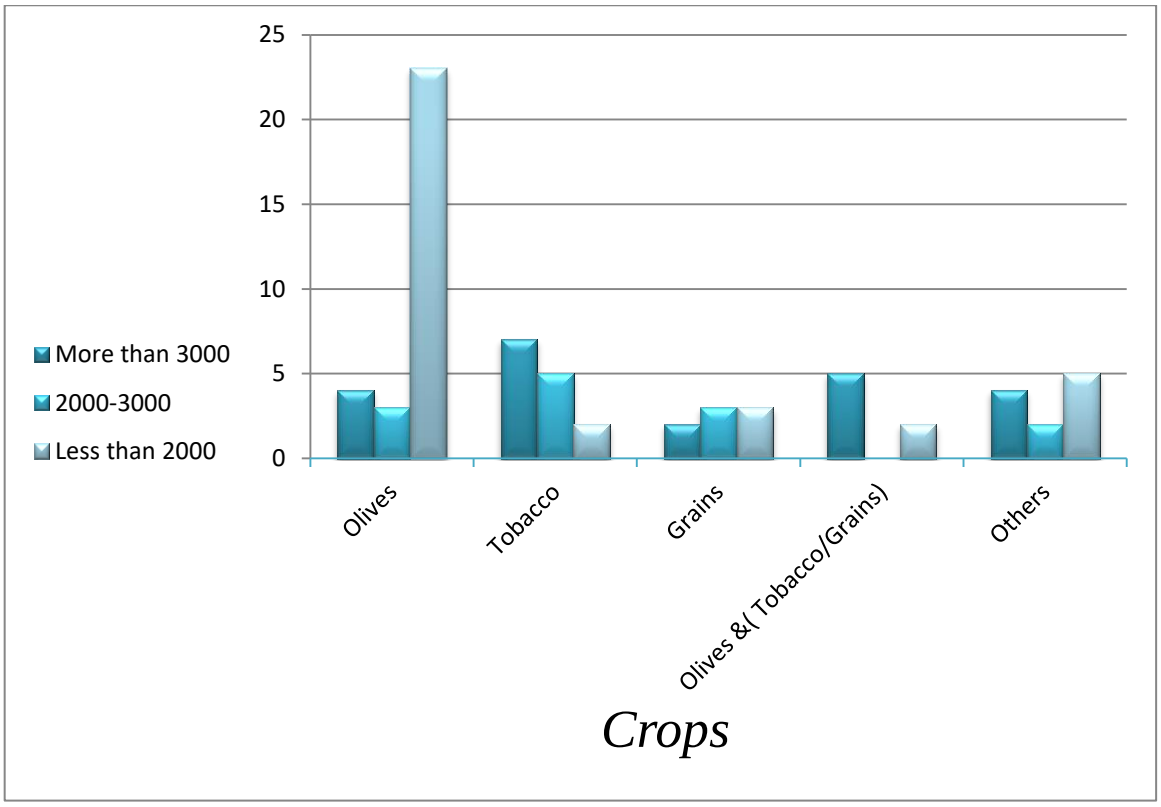


As shown in the pie chart most of the crops cultivated are those that can be planted in a rain fed system, olives which is the most popular crop grown in the region is

considered to be a drought tolerant tree that can survive depending only on rain fall, however the size of the fruits and the oil production vary with respect to irrigation and this difference appears in the yields cultivated at the end of the season (Correa-Tedesco, Rousseaux, & Searles, 2010). And just like olives, legumes are special for their ability to resist drought and this is related to their interaction with N fixing bacteria as their ability for N2 fixation increases their drought resistance increase,(Daryanto, Wang, & Jacinthe, 2015) . Around 55% of the sample has shifted into a rainfed system in response to the water shortage and expensive inputs. 20% of the sample cultivates tobacco, 80% of this population indicated that they find a market to sell their yields and this could be a reason that stimulates farmers to choose tobacco, as this crop is considered as a cash crop that is demanded in the market.

There is a very little variation in the cropping pattern as well as the obvious absence of the cultivation of high value crops and this could be a path that farmers choose to take in order to reduce their costs. But depending on rain fed systems rather than on irrigation results in lower yield. Grains isone of the crops that can be grown ina rain fed system , in developing countries the yields from rainfed grains is 1.5t/ha compared to around 3 t/ hafor irrigated lands and the only reason that causes the increase in production is to expand the area of land cultivated (Wani, Rockström, & Oweis, 2009). Water shortage is the main problem for rain fed systmes, and it resembles the key reason behind the low land productivity (Wani et al., 2009).

Figure 4: The varaition of water usage in cubic meter per week as a function of crops

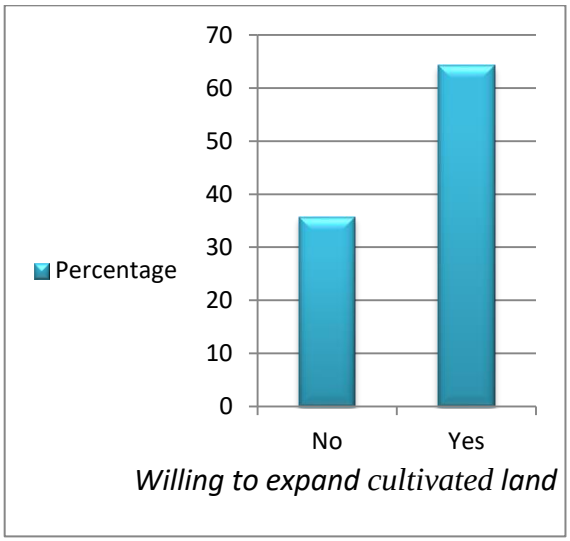


The data in figure 3 shows a good relation between the crops cultivated and the amount of water used weekly, 23 farmers out of 30 of those who cultivate olives don't irrigate and rather depend on rain fall. While when looking at tobacco cultivators one can notice that almost all of them choose to irrigate, the market of tobacco depends on the quality of its leaves and thus farmers cannot take risk of water stress and thus explains the reason behind the attained results.

After understanding the farmers behavoirs and their reasons behind choosing their cropping patterns and irrigation systems, it was important to understand their response to conveyor 800 project and their future prospects towards its implementation.

93% of the sample have knowledge about the project, they heard about it and they know its goals the rest that lacked knowledge have been informed about the project and its targets before continuing the survey. When asked if they are willing to buy irrigation water from the project, 63% of the sample indicated their willingmes to benefit from the service supplied by the project while the rest stated that they lack trust in any of the state's projects and they think that it will be more economical for them not to change their irrigation pattern. This result validates the first hypothesis that the farmers will be willing to benefit from this service.

Around 65% of the sample indicated that if water for irrigation is available with prices that can be affordable they will be willing to expand their lands and increase their production, and around 60% indicated that they will be then willing to shift for cultivation of higher value crops and for diversification in their cropping pattern. Crop diversification is one of the essential ways to increase farm income, to secure livelihood. When this diversification is moved towards high value crops it is considered to have a positive contribution on increasing farm income and job opportunities, farmers with more crop diversification have higher incomes (Lama), in addition to its effect on the level of the farm diversification also helps in increasing the level of self sufficieny on the country level (Abro, 2012).



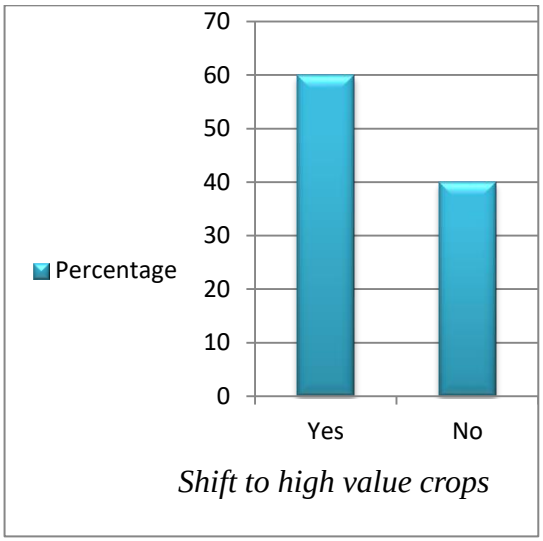


Figure 5: The percentage of farmers that are willing to expand their lands

Figure 6: The percentage of farmers that are willing to shift their cultivations toward high value crops

As the above figures show, when ever water for irrigation is available farmers will be willing to expand their production and change their cropping pattern and shift to high value crops and this result validates our second hypothesis.

As both of our hypotheses are validated, the implementation of conveyor 800 project should result in an increase in the production per dunum of land and this is because farmers are willing to adopt new irrigation techniques and according to the regression analysis (table 7) that is presented in the appendix, the positive relation between irrigation and production exists, the results of the analysis show an evidence that when crops are irrigated their production will increase. In addition to that there must be a significant change in the state of the agriculture sector in the region. The increase of the cultivated lands and the shift to high value crops requires additional labor and thus job opportunities.

When estimating the benefits of conveyor 800 project, several things should be taken into consideration such as the increase in small scale farmers' income and their shift into high value crops means additions in job opportunities, however it is very hard to estimate how much will the income increase and depending on that how much will the employment rate increase and this is due to the irrational fluctuation in the Lebanese pound and the Lebanese market. Other indirect benefits will also occur, for example when shifting to high value and starting to plant different types this will result in diversity in the crop production and may increase the self sufficiency in the Lebanese market (Anagnostopoulos & Petalas, 2011).

Despite the fact that production quantity, quality and diversification will increase, we cannot forget the fact that starting irrigation means adopting new irrigation systems and

thus implies an increase in the cost of production. 80% of the farmers that are willing to benefit from the project reported that they will build a drip irrigation system and this means an increase in their costs. However the reservoirs are not implemented yet and the distance separating the source from the lands cannot be estimated and the estimation of the cost is difficult to be predicted. The costs must include the investment cost of getting larger areas and diversification of crops and the main cost will be the cost of irrigation systems that will be implemented once the farmers have access to irrigation water.

Some farmers from kazaa of Sour that are not part of conveyor 800 but rather another section of the litany project that is actually implemented were interviewed, and this is to have an idea about the weak points of the project and the challenges they face. The general perspective was that small scale farmers that were supposed to be the major population to benefit from the project are extremely out of way from benefiting, despite of this foreign investors are the number one recipient and they are actually moving toward high value crops as they started to cultivate mango, avocado, and others.

The reason that prevents small scale farmers from benefiting from the project as they indicated was the very high cost requirements, first of all they are obliged to pay 70 thousand Lebanese lira annually for each dunum of land, second they have to pay for transporting water into their lands in addition to the cost of implementing an irrigation system. This huge cost the farmers has to afford is then faced by shortage of water in the canals in certain periods during the year, low quality of water as they indicated that the canals are always full of trash and there is a lack of supervising and follow up.

In order to avoid such problems when implementing conveyor 800 and to attain the goals that are assigned to this project and to help small scale farmers to benefit and develop, these problems should be monitored and followed. The water service should be ongoing and in good quality and for this target to be accomplished technicians responsible for the availability of good service must be hired to keep on following and monitoring. In addition to that there should be an attention to the market availability to guarantee for farmers that are willing to grow that there yields will not be lost but rather they will have the opportunity to sell it all and increase their profits.

The successful implementation of the project will not only affect the farmers' incomes and profits but it will also help families in rural areas that depend on farming to reach sustainability and this can be directly linked to the fact of increasing yields. The nature and quality of lives will certainly develop and improve, as well as less urbanization in the region and lively communities (Anagnostopoulos & Petalas, 2011).

The project will eventually have an impact on the national economy, first of all the money that will be spent on the construction is paid as wages and salaries, and second the addition of such a big investment will add to the development of service industries, and as the purchase power of the neighboring population increases the benefits of the project increases and so on until the public benefits gained will lead to a stability in the national economy(AL-HANDASAH, 2001).

B. Limitations:

Several limitations existed while performing this study, the limitations results from the sample size, the method of collecting data and the precision of data.

Sampling errors occurred because the sample doesn't reflect the appropriate population, one farmer was selected from each village, but the villages differ in size and in the number of farms is contains and thus the number of samples interviewed from each village should depend on the size and the contribution of the village in the farming production. In addition to that the sample size is not sufficient to get significant results out of the survey, the larger the sample is the more convenient and significant the results are. The last limitation was about the precision of the data available, all the answers given were estimates done by the farmers and not real number and accurate information. All these limitations prevented the study from reaching reliable and significant results to analyse.

CHAPTER V

CONCLUSION

The economic consequence of the Conveyor 800 project will be reflected in the south region by its contribution to the agriculture production capacity and the standard of living of the farmers in the region. The increase in agriculture production will be as a result of shifting to the irrigated system, during periods where rainfall is not enough crops will not suffer from water stress and thus the yield will not be affected {Shamsedin, 1969 #9}.

After conducting a survey with a sample of farmers who own farms located in the region of the project, the descriptive results show that 80% of the sample are considered to be small scale farmers and that these farmers are headed toward rain-fed cultivation rather than irrigated cultivation and this is due to water shortage and the high cost of inputs. The largest portion of the sample cultivates crops that can tolerate stress and thus can survive the periods of water shortage; these crops are olives and legumes.

Almost all the samples have another source of income, the thing that explains the low return in income that farming produces and thus reflects the poor standards of living for them. The sample showed positive feedback to the implementation of the project and to the availability of irrigation water, they showed their willingness to shift toward expanding their production and toward cultivating high value crops and crop diversification. This result validates both our hypotheses that claim that when water for irrigation is available

then farmers will be willing to benefit from this service and crop diversification will start to appear.

The benefits of the projects can be summarized by the increase in smallholders' income and the sustainability of their lives, while the costs can be summarized by the additional cost of investment and the cost of adopting a new irrigation system, It is difficult to estimate the benefits and the costs of conveyor 800 due to the fluctuation in the Lebanese pound and in the Lebanese market and due to the late implementation of the second phase of the project which makes it difficult to estimate the cost of transporting water and placing an irrigation system.

APPENDIX

A. Farmers Survey:

Personal Questions:

1- From what town are you?

2- How old are you?

3- Is your land owned or rented? O☐ R☐

A- What is the size of your land?

B- Do you use the land for agriculture use or you invest in other activities? Agri☐ Others☐

4- Where is the farm located?

5- Are you married or single? M☐ S☐

6- Do you have other sources of income? Yes☐ No☐

Production Questions

1- How many workers do you hire during the production process?

2- What is the weekly amount of water you use for irrigation?

< 2000 cubic meter ☐ 2000-3000 cubic meters ☐ > 3000 cubic meters ☐

3- What is the average price for each cubic meter?

Less than 4$ ☐ 4-6$ ☐ more than 6$ ☐

4- How often do you experience shortage in water for irrigation?

Rarely ☐ Sometimes ☐ Often ☐

5- How much is your seasonal production in kg?

6- What crops are cultivated on the land?

7- Does the irrigation cost accounts for more than half of the total production cost?

Yes No

☐ ☐

8- Are you able to sell all your products?

Yes ☐ No ☐

9- A-If the needed help is provided for marketing and financing would you be willing to grow other types of crops?

Yes ☐ No ☐

B- If No, What is the reason?

10- What is the primary obstacle that makes it difficult for your farming operation to be more profitable?

a) Shortage of water

b) Absence of agriculture guidance

c) Absence of needed markets

d) Natural obstacles

11- Would you expand your cultivated area if water supplies are improved?

Yes ☐ No ☐

12- Would you move to higher value crops if water supplies are improved?

Yes ☐ No ☐

13- What is the total production cost?

14- What is your profit percentage?

Conveyor 800 Questions

15- Have you heard of conveyor 800 project?

Yes ☐ No ☐

16- Do you know what are the goals of the project are?

Yes ☐ No ☐

17- Would you prefer to buy from the supplied water for irrigation?

Yes ☐ No ☐

a- if No what is the reason?

b- If yes what irrigation system will you be willing to adopt?

c- How far is your land from the source of water?

C. Regression Analysis Results:

$Yield=\beta0+\beta1\ (Age) + \beta2\ (Water\ U) + \beta3\ (Labor) + \beta3\ (ownership)$ Equation 1

The coefficient of each parameter indicated in equation 1 will be estimated using STATA (statistic data analysis).

	Dependent Variable	*Categories*
Produ	How much does the farmer produce per dunum of land (kg)	Open ended question
	Explanatory Variables	
Age	Age of the farmer in years	Open ended question
Water U	How much the farmer consumes water on weekly basis(cubic meter)	3= less than 2000 2= between 2000 and 3000 1= more than 3000
Labor	How many workers they use for the production process	Open ended question
Ownership	The land is owned or not	Yes= 1 No=0

Table 5: Description of Model's Variables

Produ	*Coef.*	*Std. Error*	*t*	*P > t*	*[95% Conf.*	*Interval]*
Wu	43.04708	17.59526	2.45	0.017	7.896501	78.19766
Labor	-.0552255	7.856696	-0.01	0.994	-15.75078	15.64033
Age	2.432279	1.265256	1.92	0.994	-.0953616	4.959919
Ownership	-18.92784	58.03686	-0.33	0.745	-134.8698	97.0141

Table 6: Regression Table

The linear regression model here, illustrates the relation between each variable in the model and the production per dunum of land, among these variables tested we found that only water usage is statistically significant while labor, age and ownership don't show any significance in their relation with production which means that the variation in production is not affected by their variation.

The coefficient of water usage indicates that when the weekly water usage increases by 1 cubic meter the production per dunum increases by 43 kg, and since P value is less

than 0.05 this value indicates that this relation is significant and that production increases as irrigation increases but this is up to a certain limit.

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