

STUDY ON FINANCIAL BENEFIT
FOR SUSTAINABLE AGRICULTURE

**INCREASED FOOD SECURITY FOR
VULNERABLE COMMUNITIES THROUGH
SUSTAINABLE SMALLHOLDER FARMING**

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I. Executive summary

Within the scope of the “Increased Food Security for Vulnerable Communities Through Sustainable Smallholder Farming” led by Helvetas and Jibal, FTL implement the study component of this project, that aimed to provide a sustainable farming model, taking into consideration the current financial and economic crisis Lebanon is going through. The study was stretch over a period of 4 months, to allow experts working on it to cover most phases of the plantation process, including harvesting, pruning and others. The study was designed in such a way to compare the conventional and organic farming models, discuss their strength and weaknesses, and then conclude the reasoning by recommending a sustainable farming model.

Despite the interviewed sample being relatively modest (3 conventional farmers, 3 non-certified organic growers, 1 input supplier and 2 fruits and vegetables dealers), the collected data was indicative in regards to the responses received that were similar. It is worth mentioning that it is common among farmers in Lebanon to fail in bookkeeping and records. Thus, expert working on this study had to rely on the estimated numbers that were collected, and the weak information provided from public institutions, as well as on their knowledge and experience in the field.

The country is going through a severe economic and financial crisis and thus farmers, like all other professions, are suffering. In particular, the severe fluctuation of the national currency is affecting the agricultural sector due to its important reliance on imported input supplies, as well as the machines/tools, the labor costs and many other factors. Consequently, the recommended farming model provides mitigation measures that will help farmers to reduce the repercussions of the crisis on their businesses.

II. Background

For the past 4 decades, the agricultural sector in Lebanon has been neglected by all the successive governments: this is clearly translated in the Ministry of Agriculture (MoA) having one of the smallest allocated budgets when compared to other ministries, in addition to the labor law that does not cover agricultural workers who are in majority informal employees due to the seasonality of their work. The status of the sector was further aggravated since the start of the economic crisis in Lebanon in 2019: similar to all fields, many farmers and growers are no longer able to run profitable businesses, and some even had to close their businesses which have consequently led many workers to lose their jobs.

Within the turbulent circumstances in the country and the relatively weak agricultural sector, a niche market was able to grow for organic products in Lebanon (definition below): people who consume healthy fruits and vegetables were more and more able to find and buy these products in the Lebanese market mainly due to the shift in some of the consumers' behavior and their tendency to purchase healthier edible products. Despite securing a place on the shelves of Lebanese supermarkets and houses, the expansion of the organic market remains restricted, mainly due to the higher production costs and thus expensive shelf prices when compared with the products of the conventional farming method.

A turn of events in the past 2 years might shift this reality and what was once perceived as an expensive good could be now produced at competitive prices relative to conventional growing methods. After enduring a severe economic crisis since October 2019 coupled with a currency devaluation of the Lebanese Pound, the country has witnessed hyperinflation and an alarming price increase in all food products. This increase is mainly due to the trade deficit in the country, represented in importing 80% of its food supply while only exporting 20%,¹ leading to a large dependency of farmers on imported inputs such fertilizers and pesticides which led to a sharp increase in their cost. The weak local production in Lebanon that resulted in weak exports and an enormous reliance on imported food supply was one of the main reasons behind the governments' inability to control the currency devaluation and prevent hyperinflation.

Consequently, and within the context of the project led by Helvetas and Jibal entitled "Increased Food Security for Vulnerable Communities Through Sustainable Smallholder Farming", FTL is doing a study on the Financial Benefits of Sustainable Agriculture in Lebanon. This study aims to provide a sustainable farming model to farmers they could adopt in the financial crisis they are going through. To do so, the study will compare between the 2 most common farming methods in

¹ <https://investinlebanon.gov.lb/en/lebanon-at-a-glance/lebanon-in-figures/trade-performance>.

Lebanon, conventional and organic; then it will propose a farming model that considers the obstacles farmers and consumers are facing and advise farmers on strategies to overcome them. This study provides farmers an economically profitable, socially growing, and environmentally friendly model from which they would make a decent living as well as offer healthy products to the Lebanese markets. The process of adjusting the trade deficit that is paralleled with improving agriculture practices could be the silver lining of the current Lebanese crisis.

III. Methodology

Within the scope of the project, FTL assessed the 2 main business farming models in Lebanon, conventional and organic farming: each farming method is defined in section IV of this report, and studied in terms of the possibility of covering costs and generating profit for different land sizes, variety of crops, several geographical areas, as well as different sales channels. To implement this comparative study, FTL adopted a methodology that starts with a literature review: this phase was conducted by an expert in conventional farming and a second expert in organic farming; it highlighted the difference between the 2 farming practices according to the existing sources and studies. Following a thorough literature review, FTL proceeded with a data collection phase that included 9 Key Informant Interviews (KIIs) performed by the 2 experts with traditional and organic farmers, in addition to an input supplier and fruits and vegetable dealers. It is worth mentioning that the organic growers that were interviewed within the scope of this study are not certified but rather just use organic fertilizers and pesticides. Based on the data collected and on the literature review, experts evaluated each farming method in light of the current crisis and its effects on farming practices. After the completion of the comparative section, FTL provided a recommended sustainable farming model that could serve as a tool for farmers to encourage them to adopt a profitable agricultural business model while providing Lebanese consumers healthier products for affordable prices. The study was concluded by an example of a successful sustainable farming model that is organic certified with an intention to push Lebanese farmers to implement sustainable strategies that will allow them to remain in the field and generate decent incomes out of their businesses.

Implementation plan

Outcome 1: Data collection

Activity 1.1 – Literature Review. The study was initiated by a literature review phase that was conducted by a conventional farming expert and an organic farming one. This activity aimed to depict a general overview of the existing information of both farming practices in Lebanon, including but not restricted to planting duration, cost, health benefits, profits, distribution channels, market trends, consumption habits, and other relevant information that would serve the purpose of the project.

Activity 1.2 – Preparation of Questionnaires. Based on the literature review findings, each expert prepared a questionnaire for the Key Informant Interviews (KIIs) to was used with organic and conventional farming stakeholders: the questions were developed in such a way to compensate for the lack of available data in light of the recent changes in the country regarding high costs of conventional production, namely input supply and workforce.

Activity 1.3 – Key informant Interviews. KIIs were conducted by the experts who attempted to capture as many insights as possible from the stakeholders and synthesized the interviews in preparation for the analysis phase. Experts assured the stakeholders of the confidentiality of the information. The interviewed stakeholders included:

- 3 conventional farmers;
- 3 non-certified organic growers;
- 1 input supplier;
- 2 fruit and vegetable dealers.

All interviewed farmers, whether conventional or non-certified organic, are part of the Helvetas / Jibal led project “Increased Food Security for Vulnerable Communities Through Sustainable Smallholder Farming.

Outcome 2: Data Analysis and Report.

Activity 2.1 – Data Analysis and Comparative Study. Based on the compiled data (primary and secondary), each expert assessed the farming method relative to his field of expertise. As an indicative list, this section dedicated to existing farming practices includes:

- Overview of the conventional and organic farming methods in Lebanon: conventional and organic
- Comparison of the conventional and organic farming methods, using the value chain approach to compare aspect by aspect.
- SWOT Analysis for both farming methods

Activity 2.2 – Recommended Farming Model/Pilot project.

Following the comparison of the most common farming methods in Lebanon, this section provides a sustainable farming model that is recommended for farmers to adopt: this model proves that agriculture businesses can be profitable, despite the economic crisis the country has been suffering from for the past 2 years.

Activity 2.3 – Report editing.

The final report includes an Executive Summary, the Background, the Methodology, the Data Analysis & Comparative Study, the Recommended Farming Model / Pilot Project, and the Table of Annexes (Literature Review, the Questionnaire, and KIIs Transcripts).

IV. Data Analysis & Comparative Study

A. Overview of Conventional and Organic Farming Methods in Lebanon

Following a literature review and a series of interviews with conventional and organic farmers, as well as input suppliers and fruits and vegetable retailers and wholesalers, this study will proceed by comparing the actual status of farmers. During the literature review, it has been noticed that data was not abundantly found on the updated situation of farmers and farming sector after the current economic crisis Lebanon is going through, despite the sufferings that are being mentioned in the news bulletin daily. Consequently, this section will attempt to show the actual status of conventional and organic farmers, shedding the light on the obstacles they are facing along the agricultural value chain: inputs and supplies, productions, target customers, sales channels, and financial parameters.

Firstly, to define the 2 types of farmers subject of the comparison of this study, conventional farmers are those who use chemical pesticides and fertilizers as well as use conventional tools and equipment to farm. These farmers rely entirely on imported materials such as fertilizers, pesticides, seeds, plastic mulch, and other inputs to produce and are majorly affected by the unstable currency rate in Lebanon today.

Organic farmers on the other hand use organic fertilizers and pesticides but use outdated techniques and equipment, instead of new and updated ones due to the high cost of such machines and tools that are mainly imported. These farmers also rely heavily on imported materials to farms such as pelleted fertilizers, liquid fertilizers, organic pesticides, seeds, and other inputs to produce and are affected by the unstable local currency rate. As mentioned in the methodology, the organic farmers that were interviewed are not organic certified; however, the case study at the end of the report is.

B. Value Chain Comparison of Conventional & Organic Farming Methods in Lebanon

1. Inputs and supplies

As a first step in the value chain, the following section will tackle the inputs and supplies for both conventional and organic farming in Lebanon. The main difference in that regard lies in the use of chemical pesticides and fertilizers in conventional farming, whereas organic farmers use organic fertilizers and pesticides.

Concerning conventional farming method, it requires heavy use of fertilizers and chemicals (N, P, K; herbicides; pesticides; fungicides) and in Lebanon, the demand for such inputs is relatively higher than the demand for organic pesticides and fertilizers because the majority of Lebanese growers and farmers are conventional ones. Nonetheless, the local supply for such inputs is almost null: it is still rarely locally produced and the agriculture sector in Lebanon is totally dependent on imported raw materials such as pesticides, herbicides, fertilizers, seeds, trays, and equipment (20-20-20; 46-0-0; 15-15-15; Abamectine, Emamectine, bacillus turigensis, Dimethoate, Chlorohynapyre, F1 seeds, etc...). To produce such raw materials, would require industries with big funds and capabilities, and the MoA's strategy overlooks supporting such projects because it is allocated one of the lowest budgets within the cabinets and therefore doesn't have the required funds. As a result, conventional farmers in Lebanon are unable to afford the imported raw material required for their farming businesses due to the devaluation of the local currency, and for those who can afford it, they had to considerably increase the prices of their products: this farming method thus became very costly and not sustainable. Unlike its common policy of subsidizing input material in the agricultural sector, Mr. Abbas Nasr, the manager of the agriculture center in Bireh region that is linked to the MoA, confirmed that no support was provided by the ministry for pesticides and other input supplies in the year 2021, due to the current financial crisis the country is enduring.

Regarding organic farmers, they are also almost entirely dependent on imported raw materials such as organic pesticides (BT and Neem Oil for example), and organic fertilizers (like liquid kelp, organic nitrogen-based liquid fertilizer, seeds, trays, equipment, and others). Similar to the conventional inputs, organic ones are not locally produced due to the high investment required for such industries. Therefore, farmers who use organic pesticides and fertilizers are either getting out of the business because they are not able to afford the input material, or increasing their prices in case they were able to buy imported material, or using cheaper alternatives to organic inputs such as compost that is locally produced. Whether organic or conventional growers, the current economic crisis has left them no choice but to "adapt or die" and consequently, the use of such alternatives came as a response of farmers who were looking for substitution of their imported

inputs. This attempt to farm without imported materials for conventional farmers, however, has been less about “going organic” or adopting innovative techniques, and more about damage control and “making do” with what is available: as such, conventional farmers switched to healthy alternatives instead of imported chemical raw material because they were forced to due to the current financial crisis and high costs of imports, and not because they intended to switch to a sustainable or healthier model. Consequently, farmers reverted back to using animal manure and compost, as well as producing their own pesticides and liquid fertilizers. Nonetheless, farmers were applying these alternatives using the same methods and equipment they used while planting conventionally, giving inefficient results: whether in quality or quantity, the farmers were not reaching the full potential of their land/work/businesses. All farmers interviewed in the KIIs, whether conventional or non-certified organic, have been suffering from these changes caused by the economic crisis. For example, the price for a pack of 1000 tomato seeds jumped from 75,000 LBP to more than 800,000 LBP while the selling price of tomatoes has only increased from 2,000 LBP per kg to 4,000 LBP per kg. This data was collected from the farmers interviewed as well as from the current prices today. Please note that the price for the seed pack is for F1 high quality seeds bought from companies such as Unifert and Debbane for greenhouse production and the price of tomatoes has increased since then, because of the local currency devaluation facing the dollars, but most importantly because the main season (summer) is over and tomatoes are now only grown in greenhouses. All raw materials needed for farming are now significantly more expensive (following the dollar rate on November 17th, 2021 (1\$=23,000 LBP): x 14 times)² while the selling price of products has not changed simultaneously. Studies show that the organic farms which most closely resemble conventional farms in structure and method are the farms that fare most poorly, and in which there is the largest yield gap when comparing equivalent conventional vs. organic farms. For many farmers, these results were predictably unimpressive and understandably discouraging.

² Due to the continuous fluctuation of the local currency, this number is subject to change accordingly.

2. Production

In terms of production, conventional and organic farmers use the same techniques in farming, particularly in relation to growing methods, machineries, tools, irrigation techniques, and plant maintenance. The main difference in the production process between these 2 farming methods lies in the inputs such as fertilizers, pesticides, and other raw materials, used particularly for heavy feeder crops. These types of crops such as cucumber, tomato, and eggplants, are prone to disease and pests which require heavy use of fertilizers and pesticides: therefore, conventional farmers using chemical fertilizers and pesticides were able to get better yields than organic ones. In some cases, the use of such chemicals allowed the conventional farmers to produce up to 3 times the amount of the organic farmers. It is important to note that organic farmers in Lebanon fail to use the proper organic techniques while planting and harvesting; they rather rely on conventional techniques that only enable them to produce almost half of their potential production volume.

Concerning light feeders such as lettuce and parsley and other greens, these crops are not as demanding in terms of fertilizers and pesticides therefore production amounts are similar for both types of farmers. This asserts the fact that conventional and organic methods in Lebanon are almost identical and what differs them is the use of inputs: light feeders don't require the use of pesticides and fertilizers and since techniques are similar in both farmers, results were similar too.

Charbel Merhej is among the 3 KIIs performed with conventional farmers: he is the owner of a 4,000m² farm located in Majd El Meouch, that has an altitude of around 1,000m. The main crops he plants include tomatoes, cucumber, eggplant, lettuce and parsley. As for Mohammad el Zohbi, he is one of the 3 organic farmers interviewed within the scope of this study: his farm is located in Saadnayel with an altitude of 900 meters approximately. The size of the cultivated area of the farm is 5,000m² and the primary crops are tomatoes, cucumber, sweet pepper and eggplant.

This table shows the production differences of these 2 farmers and indicates a considerable difference between conventional farming methods and organic for 1000 m². While the table below may not be representative of all farmers due to different levels of skills and knowledge among them, it is quite indicative for understanding the operations of farmers growing crops such as tomatoes and eggplant.

Item	Conventional Farmer (Charbel Merhej)	Organic farmer (Mohammad el Zohbi)
Tomato	3.5 T	900 kg
Cucumber	3.5 T	1.5 T
Eggplant	3 T	1.3 T
Lettuce	3000 units	3000 units
Parsley	3500 bundle	3500 bundle

3. Target customers

For conventional farmers, the target customers are individuals who are looking to buy products for the best price possible and are usually low to medium-income customers: these represent the majority of Lebanese citizens who belong to the low or middle class and who usually prioritize quantity and price over quality. Safety and healthy products are not a prime parameter for the targeted end consumer of conventional farmers due to their limited budget. Another target for the conventional farmer would be factories and cooperatives that work in food processing (mainly mouneh). These factories would accept imperfect vegetables and fruits that usually wouldn't sell in the market and processes them into ready food products.

Organic growers can be categorized under 2 types: certified and non-certified, while noting that both follow organic principles and techniques. The ones interviewed do not have an organic certificate, therefore, cannot sell their produce under an organic label. The target customers for these farmers are individuals who are looking for healthy and authentic products and are willing to pay a relatively higher price for their fruits and vegetables: safety and quality are essential parameters for such end consumer. These customers are usually happy to visit the farm occasionally to pick their own vegetables and fruits: they in fact spend time and effort to obtain such products as these are not found abundantly in the market as conventionally grown products, and are usually willing to pay around 25% more. In the case where the products are certified organic by an international certifying body, the target customers would be individuals that are looking for healthy products that are internationally certified. These customers are usually willing to spend 50% more than the conventional alternatives and having the international certificate would help the farmer have better chances in exporting his production abroad.

The comparison between certified and non-certified organic growers is based on observation and price evaluation in the Badaro farmers' market in the past 3 years. Farmers that do not have the certification but follow organic principles are being able to sell their products from 25% more than conventionally grown products in farmers markets and directly to consumers.

4. Sales

a. Sales Channels:

Concerning the sales channels, whether organic or conventional farmers both mostly rely on wholesale markets to sell their products. In such markets, like the “hesbe” (meaning accountability in Arabic) that is widely known in the Lebanese market, the profit margin is very low due to the unregulated imports of fruits and vegetables from Syria: some farmers are not even able to cover their operating costs with the revenue they are receiving from these markets. The percentage of how low profit margins can reach can't be quantified since farmers from whom the data was collected base it on their own experience without giving numbers. This is because farmers say that the volume of illegal/unregulated imported varies. The higher volume of such imports, the lower Lebanese farmers have to set their prices, and vice versa. Therefore, sometimes the profit can almost be null, where they are forced to meet the competitive illegal imported price. Even if this means that they might not even cover their costs, farmers consider it better than not being able to sell their produce at all.

In an attempt to eliminate the middle man, few farmers are diversifying their sales channels and providing small shops around the village with their products: these farmers succeeded in receiving better income from their production as they were able to sell at better prices than the wholesale markets. The wholesale market dealers usually add between 10 and 20 percent profit on products they sell. Shop owners when buying from the wholesale market are benefiting the dealer but now because of the fuel crisis, it is more feasible for them to buy straight from the farmer, therefore the farmer makes the extra 10 to 20 percent.

Online or digital sales channels were completely absent in the business model assessed during the KIIs: whether conventional or organic growers, they all rely on traditional selling methods and don't invest in developing online platforms to sell directly to end consumers.

b. Factors/Parameters that affect the pricing and how the pricing strategy is defined:

Traditionally, the value of organic products is higher because it represents the image of a clean and healthy product: organic agriculture is more environmentally friendly (unlike the conventional method that is harmful to the environment) and therefore considered to be more difficult and challenging to get results from due to the imperfection in products due pest attacks or limited production amounts from using organic fertilizers. Nonetheless, while interviewing both types of farmers, it was noticeable that the price of similar items, whether conventionally or organically grown, was the same in the wholesale market. Due to the high costs of inputs on both farmers and their inability to use imported pesticides, fertilizers, and the like, their production costs and volume

are very similar and thus they are both selling their products for the same price while the value of organic-grown products is higher than conventionally grown products. Another issue with selling to the wholesale market is the daily fluctuation in prices. The prices in the wholesale markets are subject to change daily depending on demand and products availability, and most importantly the illegal and unregulated imports from Syria affect majorly the fluctuation of prices: the prices in the wholesale market are subject to change daily depending on the demand and availability so when Syrian products enter the market, (they do so in large quantities) this creates an oversupply of products driving the dealers to drop prices. Farmers are having to sell their products at the wholesale market because they are lacking the skill and knowledge needed to find better sales channels. Although the prices of the wholesale markets are low, the farmer can be sure to sell all of his production and be paid on the spot.

c. Competitive set for each of the 2 methods using the above parameters to define pricing:

Based on the interviews as well as FTL's experience, there is a clear differentiation of competitive set between the 2 methods. In the conventional method, the competitive set is composed of several entities such as the normal neighborhood grocery store, the big scale supermarkets, and the "hesbe" markets. This competitive set counts on providing more quantity, a very competitive price regardless of the quality or safety of the product. In the organic method, the competitive set is composed of organic shops, specialized shops, and special areas inside a large-scale supermarket. This competitive set counts on providing products with higher prices than normal products, providing trust to the customers by providing healthy products. The positioning in either of these methods would directly affect the pricing target and thus study the product positioning to the correct competitive set.

5. Financials

		Conventional Farmer			Organic Farmer		
Revenue	Item	Quantity	Unit Price	Total	Quantity	Unit Price	Total
	Tomato	10,000 kg	2,000 LBP / kg	LBP 20,000,000	7,400kg	LBP 5,000	LBP 37,000,000
	Parsley	8000 bundles	LBP 1,000	LBP 8,000,000	8000 bundles	LBP 1,000	LBP 8,000,000
Total revenue				LBP 28,000,000			LBP 45,000,000
COGS							
	Inputs (plants) - Tomato	2000 to 2500 seedlings	LBP 1,500	LBP 3,000,000	2000 seedlings	LBP 1,500	LBP 3,000,000
	Inputs (seeds) - Parsley	1 kg	LBP 350,000	LBP 350,000	1 kg	LBP 350,000	LBP 350,000
Total COGS				LBP 3,350,000			LBP 3,350,000
Gross Profit				LBP 24,650,000			LBP 41,650,000
Expenses							
Agriculture				LBP 13,000,000			LBP 7,850,000
	Pesticides	7 sprays	1,000,000 LBP	LBP 7,000,000	9 sprays	LBP 130,000	LBP 2,600,000
	Manure	100 bag	15,000 LBP	LBP 1,500,000	350 bags	LBP 15,000	LBP 5,250,000
	Fertilizers	15 Sprays	300,000	LBP 4,500,000	0	LBP -	LBP -
	Other inputs			LBP -			LBP -
Packaging				LBP 1,000,000			LBP 1,000,000
	Packaging	100 package	10000	LBP 1,000,000	100 package	LBP 10,000	LBP 1,000,000
	Labeling	0	0	LBP -	0	LBP -	LBP -
Utilities				LBP -			LBP -
	Diesel			LBP -			LBP -
	Water			LBP -			LBP -
	Electricity			LBP -			LBP -
Admin				LBP 200,000			LBP 200,000
	Phone			LBP 150,000			LBP 150,000
	Internet			LBP 50,000			LBP 50,000
Salaries				LBP 3,550,000			LBP 2,450,000
	Manager			LBP -			LBP -
	Engineer			LBP -			LBP -
	Workers	3	850000	LBP 2,550,000	1 (remaining workers are family members who don't have salaries)	LBP 600,000	LBP 600,000
	Labor fees (plowing, etc.)	1	1000000	LBP 1,000,000	1	LBP 1,850,000	LBP 1,850,000
Total expenses				LBP 16,750,000			LBP 10,500,000

% of Net revenue		
Revenue		
COGS	4%	7%
Gross Profit	96%	93%
Expenses	49%	34%
Net Profit	47%	59%

In the conventional method, due to the sales channel and quality, then revenue is lower than the organic one by 38%. Just by changing a method, we can win 38% while moving from conventional to organic. When a farmer is working with the conventional method, he will be looking for the cheapest input and count on the fertilizers and pesticides for better production, the reason why we see very high gross profit in the conventional and drops by 50% when we remove all the expenses related to pesticides, fertilizers. Also, when using this method, we see an increase in the labor cost

of workers to perform all these works, while in the organic method, labor cost is less by 76%. The main expense that is found in the conventional and not found in the organic is the fertilizers.

Please note that all farmers interviewed are owners of the farms rather than employees. Hence their income is from the profits of the business, rather than from a salary, meaning that they don't have salaries that were calculated within the expenses.

C. SWOT Analysis

1. Conventional Agriculture

Strengths	Weaknesses
<ul style="list-style-type: none"> ● High production volume ● Low fail rate ● Availability of qualified agriculture engineers ● Capability of cultivating large plots of land due to large machineries 	<ul style="list-style-type: none"> ● High operation cost due to increased import costs of mainly pesticides, fertilizers & seeds ● Scarcity of local raw materials manufacturers ● Absence of common good agricultural practice guidelines ● Outdated techniques and machineries ● Difficulties in selling all the production
Opportunities	Threats
<ul style="list-style-type: none"> ● Increased demand in the Lebanese market for locally grown fruits & vegetables to replace imported products ● Increased and sustained interest from the MoA, as well as from international donors for the development of the agricultural sector in Lebanon. 	<ul style="list-style-type: none"> ● High cost of diesel needed for operating machineries ● Economic instability and risk of further devaluation of the local currency ● High cost of fuel for transporting products ● Weaknesses in laws that protect Lebanese products from imported ones. ● Illegal imports from Syria where the agricultural sector is subsidized by the government and thus fruits and vegetables are cheaper than Lebanese ones (that are costing more due to the Lebanese crisis.)

2. Organic agriculture

Strengths	Weaknesses
<ul style="list-style-type: none"> ● Higher value for organic products ● If certified, it is easier to export ● Possibility of producing the raw materials needed for the entire sector 	<ul style="list-style-type: none"> ● Absence of experts in the field ● Outdated techniques ● Outdated equipment ● Absence of local manufacturers of raw materials and equipment
Opportunities	Threats
<ul style="list-style-type: none"> ● Increased demand for locally grown vegetables and fruits ● Manufacture the raw materials needed due to the lack of raw materials in the country ● Expensive imports 	<ul style="list-style-type: none"> ● Economic instability and risk of further devaluation of the local currency ● High cost of diesel for operating machineries ● High cost of fuel for products transportation

V. A Recommended Business Model

After assessing the conventional and organic farming methods in Lebanon in light of the current economic crisis the country is undergoing, this study will aim to find a sustainable farming model that would provide solutions for farmers and circumvent the difficult obstacles they are facing, all while offering to the Lebanese market healthy and safe products. Sustainable farmer: Farmer that produces house, as many of the inputs he would need to farm as possible such as compost, pesticides, liquid fertilizers, organic mulch, seeds and uses sustainable techniques to farm. These techniques include but are not limited to rainwater harvesting, low tillage, raised beds, biodiverse production, nursing crops, etc. Farmers that are using this type of farming method are not very affected by the unstable dollar rate.

A. Location

Concerning the location, Lebanon is fortunate since its geological formation allows farmers to have up to 4 seasons per year: the altitude segregation below will give an overview of the different geographical locations' particularities.

1. Farms at an altitude from 0 to 400 m:

Farms that are located between the coast and the mountains for up to 400m altitude can benefit from year-round production without having to install greenhouses but open field summer production for these farmers between June and September would be decrease due to the high temperatures and humidity. In the case of plantation within greenhouses, and to protect these from potentially strong wind, especially in coastal areas like Damour and others, farmers are advised to plant conifers trees at the peripheries of their farms or at the surroundings of the greenhouse. The trees would serve as windbreaks and should be planted with a distance of 1 meter each: it will prevent any damages to the plastic and/or metal from which the greenhouse is constituted.

2. Farms at an altitude from 400 to 800m

For farms located at altitudes between 400m and 800m, year-round production is still possible but greenhouses and polytunnels will be needed. Farming at this altitude proves to be ideal for farmers in Lebanon since the weather is ideal for growing vegetables: the temperatures rarely go under 5 degrees Celsius in winter and above 33 degrees in summer, and humidity is lower than in coastal regions.

3. Farms at an altitude above 800m

For locations above 800m, only 2 seasons per year are possible due to the harsh weather conditions and low temperatures in winter. This nonetheless presents an opportunity for farmers whose lands are located in high altitudes to grow cold-loving greens and root crops in summer when these crops are scarce and not available in the market and because of the high altitude and the harsh weather conditions in winter, pests and other harmful elements perish making it easier to grow organically. All crops can be planted at this altitude in the right season.

B. Organization structure

Even though little attention is usually given to the organization structure, it nonetheless remains an essential step towards the success of a sustainable farming model. Forming the appropriate team will be the starting point to achieve success in any business, including an agricultural one. The most crucial position a farm requires is an engineer, agronomist, or expert farmer: he or she will plan all phases the farm will go through, starting from the pruning, type of crops to be planted, possibility of several waves of planting, application of fertilizers and pesticides, harvesting, and all other steps which the farming business has to undergo. a second essential position in the farm is the worker(s): these will be following the plan that has been set by the expert and their work is valuable since farm owners rely primarily on their efforts to reach their desired goals. When farms get bigger, a sales manager becomes a requirement as the crops harvesting would be difficult to manage by the farm owner himself. The table below shows that regardless of the farm size, 1 agricultural expert is enough; the main difference lies in the larger farms that require a bigger number of workers and a sales manager.

Farm Size	500 to 1,500m ²	1,500 to 4,000 m ²	5,000 to 10,000 m ²
Engineer/Agronomist/Expert farmer	1	1	1
Skilled Agriculture Worker	1	2	3
Sales Manager	-	1	1

C. Value chain:

1. Inputs and supplies

- a. Fertilizers and Pesticides: this table compares the use of fertilizers and pesticides for conventional, organic, and sustainable farmers for 1000 m² of tomatoes. (during the data collection phase for this study, the black-market rate of the Lebanese pound was 20,000 for \$1)

Input	Conventional Farmer (Charbel Daoud Merhej)	Organic Agriculture farmer (Mohammad el Zo3bi)	Sustainable farmer
Fertilizers	<ul style="list-style-type: none"> Compost Unit: bag Quantity: 100 Unit Price: 13,000 LBP Total: 1,300,000 LBP (equivalent to \$65) Chemical fertilizers Unit: bag Quantity: 3 Price per Unit: \$30 Total: \$90 	<ul style="list-style-type: none"> Compost Unit: bag Quantity: 200 Unit Price: 13,000 LBP Total: 2,600,000 LBP (equivalent to \$130) 	<ul style="list-style-type: none"> Compost Unit: bag Quantity: 400 Unit Price: 13,000 LBP Total: 5,200,000 LBP (equivalent to \$260)
Pesticides	\$700/season (\$35/week)	\$300/season (\$15/week)	\$200/season (\$10/week)
Yield	3.5 Tons	740 kg	6.5 Tons
Total	855 USD	430 <u>USD</u>	460 USD

The total above does not represent all of the operation cost and capital investment, it is only for reference. Pesticides and fertilizers that are mostly imported represent one of the highest costs for both organic and conventional farmers; this is continuously being aggravated by the incessant currency devaluation the country is facing. The reason why the cost of the pesticide is low for the sustainable farmer is that all pesticides and liquid fertilizers used are homemade except for BT, Sulfur, and Copper.

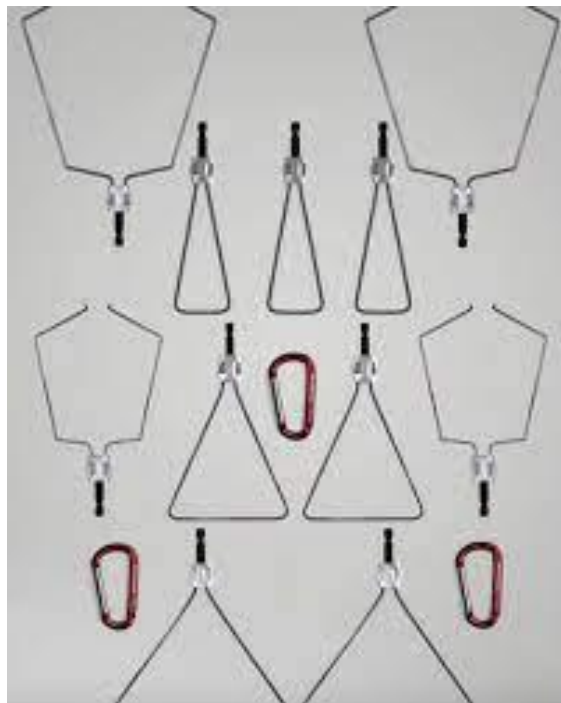
- b. Seeds: another cost that can be considerably reduced is that of seeds. Currently, seeds in Lebanon are mostly imported and therefore present a burden on the farmer who should provide dollars to purchase these seeds. Therefore, sustainable farmers could save seeds from crops like beans, parsley, coriander, chard, and others; this would eliminate the cost of buying seeds the next season.

- c. Introduce animals to the system: animals such as chickens, rabbits, or sheep are essential for becoming sustainable. The largest expense for any organic farm is compost and weeding. When managed correctly, and through the use of organized rotational grazing, these animals can accomplish two main labor-intensive elements of farming: weeding and fertilizing. They save farmers large amounts of money, effort, and labor. Whereas conventional farmers do not have the habit of such activity because pesticides are used to get rid of the unwanted weeds, organic ones have the tendency to adopt the introduction of animals to the system.

2. Production

As mentioned in the previous sections, the overwhelming majority of farms both conventional and organic are run using outdated and bad agriculture practices in Lebanon. Little attention is paid to the innovation and progress that is taking place abroad. There have been major developments in tools and techniques that reduce the labor needed for everyday chores such as weeding and land cultivation to be able to direct more efforts towards plant maintenance and management to improve production. Taking into consideration that such updated machines and tractors are expensive to buy in today's, economic crisis there are still some hand tools created that are affordable to buy (not over 150 USD) and others that can be easily replicated and manufactured locally. It is essential to note that modernizing the agriculture techniques and tools will help immensely in cutting down on operation cost, time and more importantly boosting the quality and quantity produced.

- a. Wire weeders: Simple invention that was able to reduce the time needed for weeding by over 90%. This tool is easy to manufacture locally and it is being used in many farms across Lebanon and has proven its effectiveness in the field.



- b. Earthway seeder: Simple and inexpensive seeder (150USD) capable of placing a wide variety of seeds from different sizes and shapes efficiently. Using this seeder will allow the farmer to form straight lines with evenly spaced crops making it easier for weeding later and especially if a Wire Weeder is used.



- c. Green Harvester: in addition to wire weeders and earthway seeders, the green harvester is another tool that could be used to improve the performance of farmers and increase their productivity. The greens harvester is ideal for any farm that grows greens intensively. This machine can harvest a 30m long bed of arugula in under 5 minutes while cutting it with a knife, blade or scissors would require a skilled and experienced worker up to 40 minutes. The downside of this tool is the fact that it is not locally produced and should be imported at a relatively expensive price that is set around 500 USD (excluding tax and shipping fees).



- d. Jang seeder: this tool is also among the seeder that enhances the production of farmers as it is a professional seeder and extremely precise that is ideal for farms that grow greens and salads. Nonetheless, this tool is imported as well and costs around 600 USD (excluding taxes and shipping fees) which could be a barrier to many farmers, in these current circumstances.



The table below shows the impact that modernizing techniques have on farming:

Task	Time needed using conventional hand tools	Time needed using specialized hand tools	Production using conventional growing techniques and spacing (season)	Production using modern techniques and spacing (season)
Planting Lettuce Romain	Weeding a 30 m bed of lettuce: 35 min	Weeding a 30 m bed of Lettuce using a Wire Weeder: 5 min	In 24m ² (equal to 1 bed 30m long x 80cm wide: 2 rows = 240 Lettuces	In a 80cm x 30m bed using offset techniques: 3 rows offset = 360 Lettuces
Planting Tomatoes	Weeding a 30m bed of tomato: 20 min	Weeding a 30 m bed of tomatoes: 3 min	Harvest per plant without pruning or trellising techniques (in a greenhouse): 2 to 3 kg	Harvest per plant using proper pruning, trellising, and fertilizing techniques (in a greenhouse): 6 to 7 kg and in some cases up to 10 kg

To spot the difference between those who use new tools such as the ones listed above and those who don't, we can take the example of planting a 30-meter bed of tomatoes. A farmer using a conventional hand tools and growing techniques and spacing would require 20 minutes to perform the weeding activity and yields should be around 2 to 3 kgs because the harvest of plants was done without pruning or trellising techniques (in a greenhouse). Results were significantly higher with the farmer who uses specialized hand tools and modern techniques and spacing: in this case, the weeding of a 30-meter bed of tomatoes is completed in 3 minutes and the harvest per plant using

proper pruning, trellising, and fertilizing techniques are around 6 to 7 kgs per plant, and in some cases can go up to 10 kgs.

Concerning the affordability and profitability of these tools, the wire weeder can be made by the farmer him/herself and wouldn't cost much and would save time for weeding process. As for the earthway weeder, it costs 150 dollars which is expensive to the farmer relatively to the exchange rate: this tool remains beneficial since it lasts over 20 years, assists the farmer in planting efficiently, and saves time and workers fees. However, the green harvester and jang seeder, are expensive for small farmers but if available would result in an efficient plantation process and is considered a long-term investment as well.

As seen in the table above, farmers who are still using outdated techniques and equipment and are not using sustainable techniques like Mohammad and Kassem Zohbi, have yields that are significantly lower than the sustainable farming model. When such tools are used, farmers will be able to redirect the efforts usually spent on weeding and planting into pruning, plant maintenance, and care, detailed in the sections below.

1. Pruning and plant maintenance: to reach optimal results, the farmer should adopt proper pruning techniques to improve air circulation, train a plant to grow a certain way, improve the yield and quality of flowers and fruit. Pruning vegetables is not a practice that is commonly used by farmers in Lebanon but in the past 5 years it has been more adopted by greenhouse farmers for tomatoes and recently for cucumber but the technique being used is old and can be improved.
2. Plant spacing and bed management: another important consideration that should be taken into the sustainable farmer's account is the new spacing standard that has been recently introduced (in the past 10 to 15 years) and all agriculture tools and machineries manufacturers around the world have been basing their products accordingly. Using the permanent beds spacing (80cm bed – 40cm walkway) the tools and machineries would perform properly and efficiently.

Plants spacing in 80cm beds

Item	Rows in an 80 cm bed	Number of plants per 30 m bed
Lettuce Romain	3 (offset)	450
Lettuce Iceberg	4 (offset)	600
Kale	3 (offset)	450
Cucumber	1	150
Tomato	1	150

Parsley	5	
Radish	6	1800 unit
Eggplant	1	150 unit
Zucchini	2 (offset)	300 Unit
Peppers	1	150 unit

3. Target Customers

Similar to the organic target customers mentioned in the organic section above, the sustainable farming model's products would attract consumers who have already acquired the required awareness of healthy eating habits and whose purchasing behavior is aligned with this lifestyle. Thus, the targeted customers of sustainable farming would be those willing to pay a relatively higher price for their fruits and vegetables, in return for receiving healthy and organic products. Due to the current crisis, acquiring an organic certificate would be advisable for farmers who intend to export and/or supply organic certified companies such as Biomass and La Recolte for example whose clientele base is local and international: without the certification, it would be more difficult to sell large quantities of organic produce since there are no vegetable markets "the equivalent of Hesbe" but for organic produce.

4. Sales

To have a successful farming operation, farmers should not rely only on the wholesale market exclusively to sell their products, but rather diversify the sales channels. A general rule to follow would be not to sell more than 40% of the farm production to one customer. As such, the ideal scenario would be to sell 30% of production to the wholesale market (usually used to cover daily operating costs and workers weekly salaries), 40% of production to local shops and supermarkets (usually used to cover capital expenses), and 30% straight to consumers (profit). This way the farmer would ensure an adequate income for his production as well as multiple sales windows for security. Unlike what might be considered as a waste of time because the farmer will have to distribute his/her produce to the neighboring shops, many farmers who have been using this method beg to differ. Moreover, this model is extremely effective, even more today in light of the immense increase fuel prices: shop owners that used to purchase their products from the wholesale markets are choosing to rely on neighboring farms and looking for farmers that are located close by. Using this method, a farmer can expect to improve their income by up to 30% without adding more space, investment or labor.

The tables below show the benefits of using the proposed sales strategy mentioned above:

Product	Quantity	100 % sold in the wholesale market at 4,000 LBP per Kg
Tomato	1000 Kg	4,000,000 LBP
Eggplant	1000 Kg	4,000,000 LBP
	Total	8,000,000 LBP

Product	Quantity	30% sold at the wholesale market at 4,000 LBP per kg	40% sold for retail shops at 5,500 LBP per Kg	30% sold straight to the consumer at 7,000 LB per Kg
Tomato	1000 Kg	1,200,000 LBP	2,200,000 LBP	2,100,000 LBP
Eggplant	1000 Kg	1,200,000 LBP	2,200,000 LBP	2,100,000 LBP
	Total	2,400,000 LBP	4,400,000 LBP	4,200,000 LBP
	Total	11,000,000 LBP		

These tables show a clear increase in profit between the farmer who diversified his/her selling channels and the one who only relies on the wholesale market. The latter sold a 1,000kg of tomatoes and 1,000kg of eggplant at 4,000/kg for each, earning a total of 8,000,000 LBP, whereas the latter earned 11,000,000 LBP for selling the same amount of produce, showing an increase of 3,000,000 LBP.

The table below compares sales between farmers who deal with wholesale markets and farmers who sell directly to consumers or other channels such as restaurants and other establishments.

Item	Charbel Dawood Merhej (wholesale market)	Mohammad el Zo3bi (wholesale market)	Sustainable farmer
Tomato	4,000 LBP per KG	4,000 LBP per KG	6,000 LBP per KG
Sweet pepper	5,000 LBP per Kg	5,000 LBP per KG	6,000 LBP per KG
Cucumber	6,000 LBP per kg	6,000 LBP per KG	12,000 LBP per KG
Lettuce	2,000 LBP per unit	2,000 LBP per Unit	4,500 LBP per Unit
Parsley	1,250 LBP per bundle	1,250 LBP per bundle	2,500 LBP per Bundle

In the case where the farmers have organic certification, it will allow them to be able to sell his products for better prices (up to 50% more) to companies such as Biomass and La Recolte. These companies sign an APP (agriculture pre-determined contract) stating the quantities and prices needed before planting. This way farmers would ensure that their products would be sold for a decent price once harvested.

For a sustainable farming model, it is always advised to diversify sales channels: currently, conventional and organic farmers sell most, not to say all, of their produce to the wholesale market to ensure the sale of all their harvest. By selling at wholesale prices that are unregulated, and subject to fluctuation depending on the illegal Syrian imports, this method risks the continuity of their business as they are not generating a good profit. Multiple channels could consider potential customers such as restaurants and bars, catering services companies, university cafeterias, coffee shops, factories, online market farms, and others. These channels would increase the income of the farmer by a margin of 30%.

5. Financials

		Conventional Farmer			Organic Farmer			Sustainable Farmer		
Revenue	Item	Quantity	Unit Price	Total	Quantity	Unit Price	Total	Quantity	Unit Price	Total
	Tomato	10,000 kg	2,000 LBP / kg	LBP 20,000,000	7,400kg	LBP 5,000	LBP 37,000,000	12,600 kg	LBP 6,500	LBP 81,900,000
	Parsley	8000 bundles	LBP 1,000	LBP 8,000,000	8000 bundles	LBP 1,000	LBP 8,000,000	8000 bundles	LBP 1,000	LBP 8,000,000
Total revenue				LBP 28,000,000			LBP 45,000,000			LBP 89,900,000
COGS										
	Inputs (plants) - Tomato	2000 to 2500 seedlings	LBP 1,500	LBP 3,000,000	2000 seedlings	LBP 1,500	LBP 3,000,000	3150 seedlings	LBP 3,500	LBP 11,025,000
	Inputs (seeds) - Parsley	1 kg	LBP 350,000	LBP 350,000	1 kg	LBP 350,000	LBP 350,000	1 kg	LBP 350,000	LBP 350,000
Total COGS				LBP 3,350,000			LBP 3,350,000			LBP 11,375,000
Gross Profit				LBP 24,650,000			LBP 41,650,000			LBP 78,525,000
Expenses										
Agriculture				LBP 13,000,000			LBP 7,850,000			LBP 9,000,000
	Pesticides	7 sprays	1,000,000 LBP	LBP 7,000,000	9 sprays	LBP 130,000	LBP 2,600,000	5 sprays	LBP 750,000	LBP 3,750,000
	Manure	100 bag	15,000 LBP	LBP 1,500,000	350 bags	LBP 15,000	LBP 5,250,000	350 bags	LBP 15,000	LBP 5,250,000
	Fertilizers	15 Sprays	300,000	LBP 4,500,000	0	LBP -	LBP -	0	LBP -	LBP -
	Other inputs			LBP -			LBP -			LBP -
Packaging				LBP 1,000,000			LBP 1,000,000			LBP 1,000,000
	Packaging	100 package	10000	LBP 1,000,000	100 package	LBP 10,000	LBP 1,000,000	100 package	LBP 10,000	LBP 1,000,000
	Labeling	0	0	LBP -	0	LBP -	LBP -	0	LBP -	LBP -
Utilities				LBP -			LBP -			LBP -
	Diesel			LBP -			LBP -			LBP -
	Water			LBP -			LBP -			LBP -
	Electricity			LBP -			LBP -			LBP -
Admin				LBP 200,000			LBP 200,000			LBP 200,000
	Phone			LBP 150,000			LBP 150,000			LBP 150,000
	Internet			LBP 50,000			LBP 50,000			LBP 50,000
Salaries				LBP 3,550,000			LBP 2,450,000			LBP 3,150,000
	Manager			LBP -			LBP -			LBP -
	Engineer			LBP -			LBP -			LBP -
	Workers	3	850000	LBP 2,550,000	1 (remaining workers are family members who don't have salaries)	LBP 600,000	LBP 600,000	3	LBP 1,050,000	LBP 3,150,000
	Labor fees (plowing, etc.)	1	1000000	LBP 1,000,000	1	LBP 1,850,000	LBP 1,850,000	no plowing	LBP -	LBP -
Total expenses				LBP 16,750,000			LBP 10,500,000			LBP 12,350,000

% of Net revenue			
Revenue			
COGS	4%	7%	12%
Gross Profit	96%	93%	88%
Expenses	49%	34%	21%
Net Profit	47%	59%	67%

In the sustainable model, we see a completely different cost distribution compared to the conventional and organic models. While we had in the other 2 models an average gross profit of 95%, in this model we see a gross profit of 88%. This is due to the choice of high-quality inputs of tomatoes. The more we invest in the quality of the input, the better it is in the long run. In the models of conventional and organic, we saw a total expense constituting from the revenue respectively, 49% and 34%. While in the sustainable model, we see a total expense of 21%. So, the expenses in the sustainable model show a drop of expenses of 57% compared to the conventional model and a drop of 38% compared to the organic model. Financially speaking, we recommend this sustainable model having a balanced P&L with a logical distribution of costs.

D. A Successful Sustainable Farming Business Model in Lebanon: The Green Van

The Green Van is an organically certified sustainable farm that produces vegetables and fruits without the use of chemical pesticides or fertilizers. In 2019, the farm was first located in Zefta, Nabatieh, at the elevation of 300m: it was built on an abandoned football field and consisted of 25 greenhouses (Chappelle) measuring 45m long x 9m wide as well as 14,000 m² of fruit trees varying from Mango, Pomegranate, Pomelo, Oranges, Almonds, Walnut, Berries and 400 chicken, 6 sheep, 25 rabbits, and 12 ducks. The main purpose was to create a highly productive and self-sufficient farm that produces a wide variety of vegetables and fruits that can cater for more than 100 families with a diverse choice of products all year long. The main reasons behind this self-sufficiency desire were as follows:

- Self-sufficiency means to be able to provide as many of the materials needed for production using available materials found on-site and without relying on imported products. This also means that the operation cost will be lower, therefore, generating more profit.
- The farm was intended to serve as an educational center for other farmers aspiring to switch from conventional practices as well as students or young individuals interested in starting their own project.

The Green Van's structure is:

- The farm total size: 18,000 m²
- The staff consisted of 1 expert in sustainable farming and 1 sales manager, 1 workers manager; 4 agriculture workers, and 1 animal worker:

The Green Van inputs include:

1. Compost: All vegetable and fruit leftovers are fed to the animals and collected later to be composted and all dry matter such as leaves, twigs, etc. are processed and crushed using a machine. The manure is then mixed with the dry matter and composted for 3 months before using it in the greenhouses.
2. Liquid fertilizers: All liquid fertilizers used for production such as nitrogen-based fertilizer, phosphate-based fertilizer, Calcium based fertilizer, and Amino acid fertilizer are made on-site from different types of compost and other materials.
3. Pesticides: Except for BT, Sulfur, and Copper, all pesticides used for production at the farm are made from materials found at the farm and sourced materials from surrounding farms and forests such as Nettle, Azadarakh, Tobacco, and others.
4. Animal feed: 80% of the feed used at the farm was grown at the farm using a hydroponic sprouting system and Mealworm farm.
5. Seeds: Except for Tomatoes, Eggplant, Sweet pepper, and cucumber, all seeds used at the farm were harvested from the first season crops and were germinated on-site in our nursery and using homemade potting soil made from compost and sand.

Concerning the Green Van's production machines, tools, and systems installed at the farm were manufactured in-house, except for the 2-wheel tractor and seeder. The list includes various weeding tools in various sizes, flame weeder, broad fork, cultivating tools, hydroponic sprouting system, fertilizer mixers, nursery, pest traps, heating for greenhouses, and more.

The Green Van's target customers are individuals who are interested in establishing a relationship with the farmer, meaning they love to build a trust relationship and sometimes a friendship. Also, the target customers are conscious of the source and quality of their food and the effect of its production on the environment.

The Green Van's main sales channels includes farmers markets: it used to participate in 3 farmers' markets weekly before the restrictions imposed by Covid-19: Fridays in "Nature: by Marc Beiruty in Kaslik, Saturdays in Souk El Tayeb in Beirut, and Sundays in Badaro Urban Farmers in Badaro. Due to an increase in rent at these markets, the Green Van had to pause this sales channel for a while and will resume its activities within such markets in the near future, in collaboration with FTL in its sustainable agriculture project which will be adopting the farmers' market as one of its sales channels.

The farm also delivers straight to the consumers' homes using a delivery system and WhatsApp application for placing the orders. The farm was also targeting small boutiques shops and restaurants around the country and especially in Beirut. These shops are great at selling bulk products at good prices when there are excess or small amounts of delivery orders.