Rapid Market Assessment, Value Chain Analysis

of Agricultural Products and Sustainable Agricultural Livelihoods Assessment in Irbid Governorate of Jordan and Bekaa Valley of Lebanon

Linking Refugees and Host Communities to Agricultural Value Chains in the Bekaa Plain, Lebanon"Potatoes, Tomatoes, and Dairy products"

ICARDA
Science for resilient livelihoods in dry areas

CARITAS Schweiz Suisse Svizzera Svizra

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ICARDA's Address

Dalia Building, Second Floor, Bashir El Kasser St, Verdun, Beirut, Lebanon 1108-2010. www.icarda.org

Caritas Switzerland's Address

Adligenswilerstrasse 15, 6006 Luzern, Switzerland. www.caritas.ch

List of Abbreviations

CA	Cultivated Area
CDR	Council for Development and Reconstruction
CCIABML	Chamber of Commerce Industry and Agriculture in Beirut and Mount Lebanon
CCIAS	Chamber of Commerce Industry and Agriculture in Saida and the South
CCIAT	Chamber of Commerce Industry and Agriculture in Tripoli and the North
CCIAZ	Chamber of Commerce Industry and Agriculture in Zahle and the Beqaa
ELCIM	Euro-Lebanese Center for Industrial Modernization
EU	European Union
FAO	Food and Agriculture Organization
FCCIAL	Federation of Chambers of Commerce, Industry and Agriculture in Lebanon
GCC	Gulf Cooperation Council
GDP	Gross Domestic Product
ha	Hectares
HACCP	Hazard Analysis and Critical Control Points
HORECA	Hotel-Restaurants-Catering
ICARDA	International Center for Agricultural Research in the Dry Areas
IDAL	Investment Development Authority of Lebanon
IFAD	International Fund for Agricultural Development
ILO	International Labor Organization
IPM	Integrated Pest Management
ISO	International Standard Organization
LARI	Lebanese Agricultural Research Institute
LIVCD	Lebanese Industry Value Chain Development
LRA	Litani River Authority
MOA	Ministry of Agriculture
MOE	Ministry of Environment
MOEW	Ministry of Energy and Water
MOF	Ministry of Finance
MOI	Ministry of Industry
MOET	Ministry of Economy and Trade
NFLC	National Federation of Lebanese Cooperatives
NGOs	Non-Governmental Organizations
PCMA	Participatory Market Chain Approach
SMEs	Small and Medium Enterprises
TADs	Transboundary Animal Diseases
UNDP	United Nations Development Program
USAID	United States Agency for International Development
VC	Value Chain
WFP	World Food Program

Contents

List of Tables

List of figurs

Summary

The Syrian refugee crisis has put additional pressure on the Lebanese economy, particularly on the agricultural sector. At a regional level, the Beqaa plain, forming the longest border with Syria, represents the backbone of agriculture and agro-industry in Lebanon. In order to cope with the impact of the Syrian refugee influx into Lebanon in general, and the Beqaa in particular, international and local organizations are implementing development projects aiming at supporting both refugees and host communities.

This study is part of the joint efforts of CARITAS Switzerland and ICARDA to contribute in supporting the Lebanese hosting communities and Syrian refugees facing social, economic and humanitarian challenges in Lebanon due to the Syrian crisis. It aims at assessing the needs and gaps of three selected agricultural value chains to identify field-based sustainable interventions, which can contribute to improving the livelihoods of the hosting communities and refugees.

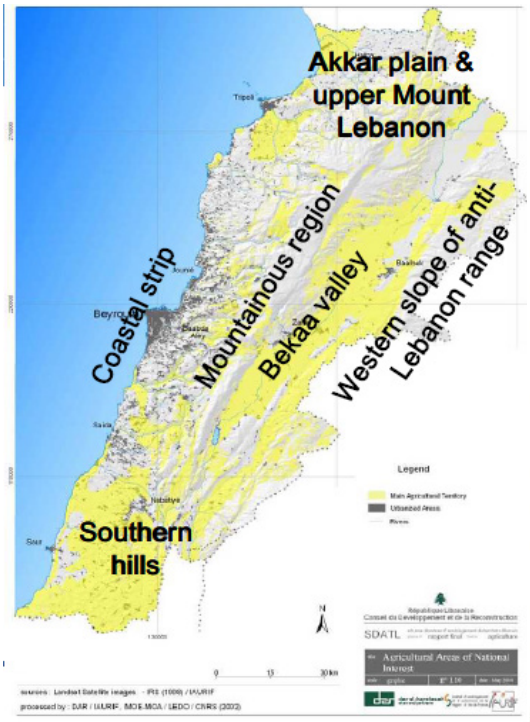
The study was carried out in two phases. A preliminary rapid assessment identified the three selected value chains in the Beqaa plain. It was carried out by following the Markets for the Poor analytical (M4P) framework. Potatoes, tomatoes, and dairy products were the three selected value chains.

The focus on the value chain approach as a means to develop interventions is based on the idea that greater enhancements of the production, processing and marketing of agricultural commodities will boost the local economy and, thereby, create more opportunities for the Lebanese and Syrian refugees. The methodology followed was adapted from the Participatory Market Chain Approach (PMCA).

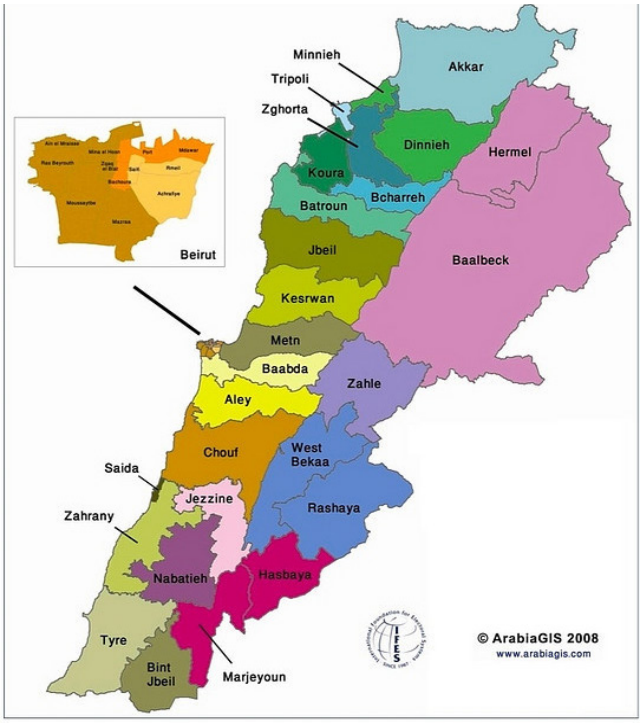
The present report is divided into six parts. Parts I and II are an introduction and a presentation of the methodology and objectives. Part III is a holistic analysis of the agricultural sector in Lebanon with a focus on the Beqaa plain. Part IV presents the impact of the Syrian refugees' crisis on the Lebanese agricultural sector, namely in the Beqaa plain. Part V is a detailed situational analysis of the challenges, needs, and gaps of the selected value chains, and the identification of the opportunities and potential interventions in each value chain, followed by the conclusion and recommendations.

Introduction

Lebanon is a small upper-middle-income[1] country located on the eastern Mediterranean coast, occupying an area of 10,452 km^2. Most of the Lebanese territory is mountainous with two mountain chains: Mount Lebanon to the west, overlooking the Mediterranean Sea, and the Anti-Lebanon to the east, forming the borderline with Syria. The two mountain chains are separated by the Beqaa plain, which occupies an area of 4000 km^2 (38% of the Lebanese territory). The plain is located at an average elevation of 900 m above sea level; it has an overall Mediterranean climate with a more arid tendency in the northern part. The Beqaa plain is divided into two governorates (*Mohafazats*) and five districts (*Cazas*) (**Map 1 & Map 2**):



Map 1. Beqaa geographical location



Map 2. Administrative divisions of Lebanon

- Baalbeck-Hermel governorate (north Beqaa): Baalbeck district and Hermel district;
- Beqaa governorate (central and south-west Beqaa): Zahle district, West Beqaa district, and Rashaya district.

The Lebanese economy is a free market economy that has traditionally been dominated by the services sector, with industry and agriculture lagging behind. Lebanon's population is estimated at 4.5 million[2] and the average family size is 4.8 individuals.[3]

At the beginning of the 20th century, agriculture was considered essential for the Lebanese economy and for the prosperity of rural areas. As for many other economic sectors, agriculture was severely affected by the war (1975-1990 war and July 2006 war) through direct loss of

1 In 2013 the World Bank estimated the Lebanese GDP per capita at 9,928 USD.
2 Excluding the 0.5 million Palestinian refugees and the 2 million Syrian and Iraqi refugees in addition to 0.3 million foreign workers; which makes a total of 6.8 million inhabitants in 2014.
3 www.cas.gov.lb

infrastructures, resources, and assets. In the post-war reconstruction programs, agriculture has been given low priority by the government. Moreover, Lebanon's agricultural policy is carried out in a highly fragmented and scattered manner without any long term vision. As a matter of fact, the country suffers from significant regional and socio-economic disparities between rural and urban areas.

Since the outbreak of the Syrian crisis in 2011, the flux of Syrian refugees has increased the number of people residing in Lebanon by at least 30%. Six years after the beginning of the crisis, the number of Syrian refugees in Lebanon reached almost 1.5 million, among which 1.1 million are registered with the United Nations High Commissioner for Refugees (UNHCR). Around 35.7% of these refugees are settled in the Beqaa plain, an area facing many social, economic, and environmental challenges. This situation is hindering the development of the agricultural sector, limiting its performance, and affecting both the hosting and the refugees' communities, which are becoming more and more vulnerable, in particular with regards to:

1. Shelter and living conditions;
2. Health, hygiene, and sanitation;
3. Access to water and other basic resources;
4. Agricultural production and marketing;
5. Livelihoods;
6. Food security and safety.

Unlike other value chain studies reviewed in this study (see the references), this study explores the potential for the Syrian refugees to be involved in and benefit from agricultural value chains beyond wage labor. This issue is a sensitive one, however, there are Syrians who are already engaging in sharecropping (both crops and livestock) and renting land as well as in small agro-industry. The balanced approach of supporting both communities with new ideas on how the Syrian refugees can benefit provides another tool for the humanitarian community in assisting the Syrian refugees.

Objectives and methodology

As response to the Syrian crisis in general, and its impact on the agricultural sector in particular, local and international organizations and NGOs have been working since 2012 on responding to the immediate and basic needs of the refugees, as well as to support the livelihoods of the hosting communities. Given the complexity of the challenges facing the agricultural sector, a more sustainable approach is needed to support both the hosting and refugee communities in order to increase their resilience, especially with regards to agricultural development, livelihoods, employment, and food security.

In this context, this study was conducted between March and June 2017 to contribute to the efforts of the International Center for Agricultural Research in the Dry Areas (ICARDA) and CARITAS Switzerland in identifying sustainable livelihood options in priority agricultural value chains for both communities. Its general objective is to analyze the circumstances and challenges of selected agricultural value chain (potato, tomato, and dairy with focus on smallholders) in the Beqaa plain and the impact of the Syrian crisis on this sector. The specific objective is to determine relevant interventions in those three major value chains that will improve the livelihoods of the two communities. The study methodology consists of two main phases:

- A general desk review of the agriculture sector in Lebanon with focus on the Beqaa plain. Secondary data was used to complete this part.

- A targeted field assessment of the three selected value chains adapted from the Participatory Market Chain Approach (PMCA) is performed. The assessment involved interviews of 33 key informants, representing 15 different stakeholder groups (c.f., **Table 1).** The different steps of the studied value chains are input supply, production, processing, trade, and supporting services. The results are presented as potential interventions that should improve the performance of each value chain (VC) and that can support the Lebanese producers as well as the Syrian refugees (*c.f.* **Annex 2. List of interviewed stakeholders and Annex 3. Survey questionnaire**).

Table 1. Categories of value chain stakeholders interviewed.

	Category of VC stakeholder interviewed	number
1	Potato growers	6
2	Tomato growers	5
3	Potato processors	1
4	Vegetable traders	2
5	Exporters	1
6	Small ruminant producers	4
7	Green house vegetable growers	2
8	Dairy processors	3
9	Cool storage services provider	1
10	Input suppliers	3
11	VC experts (small ruminants)	2
12	VC expert potato and tomato	2
13	Syrian sharecropper	1
14	Syrian refugee leaders	2
15	Agricultural and rural development experts, chamber of commerce members	4

Agriculture in Lebanon and the Beqaa plain

Agriculture: a sector at crossroads

Agriculture in Lebanon is at a crossroads, it can gradually extinguish itself or instead, revive and become a vibrant sector of the economy, providing economic opportunities and contributing to rural development and ensuring food sovereignty and security.

Most of Lebanon's agricultural value chains are facing an array of policy, structural, technical, environmental, economic, financial and institutional constraints, hindering their development and resulting in the low competitiveness and performance of the Lebanese produce. (**Table.1 & Figure.1**)

Table 1. Challenges facing the Lebanese agricultural sector

Dimension	Reason
Policy, structural, and institutional	• Absence of a concise and long term agricultural and rural development policy • Different political crisis and emergency situations, such as the latest Syrian crisis • Weak regulatory framework in the disfavor of small farmers and producers • High competition with imported agricultural produce • Marketing difficulties and control of the wholesale markets by big traders without any regulation • Weak cooperative work • Lack of farmers' access to social services (education, health and sanitation…)
Socio-economic and financial	• Rural-urban migration • Small-size farmers and producers • Dominance of the input suppliers • Demographic pressure • Real estate development in the disfavor of agricultural lands • Difficult access to credit for small and medium farmers
Environment and resources	• Degradation of natural resources • Decrease in soil fertility • Increase in soil salinity in the coastal plain • Un-sustainable water management and water scarcity • Climate change risks and effects • Desertification especially in the arid areas of the country
Technical	• Insufficient extension services • High production cost • Predominance of conventional agricultural practices • Low innovation and technology penetration • Obsolete machinery and post-harvest facilities and techniques

Source: (Author elaboration - Based on different references and field interviews and observation)

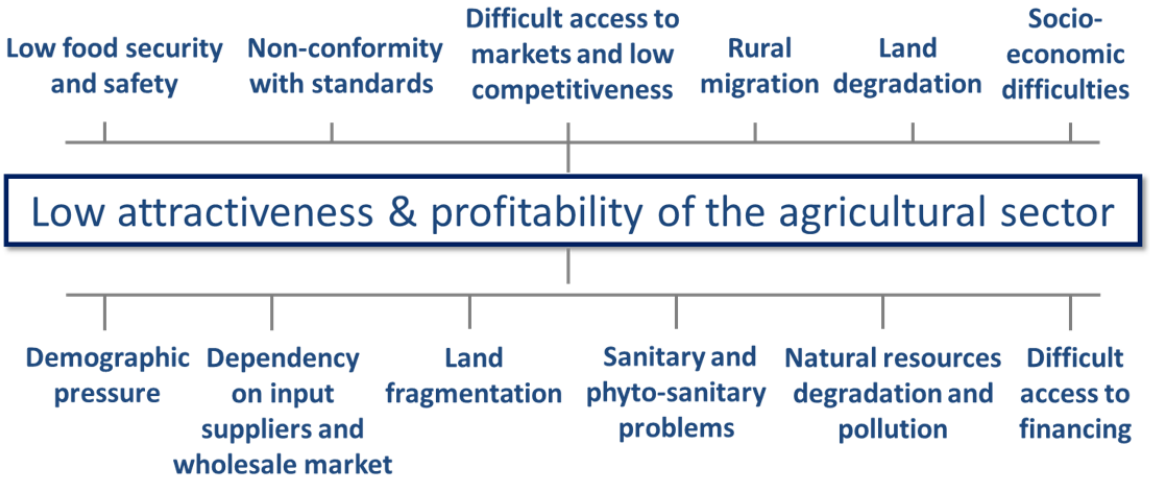


Figure.1. Problem tree of the Lebanese agricultural sector

Source: (Authors' elaboration - Based on different references and field interviews and observation)

The latest strategy published by the Ministry of Agriculture MOA (2015-2019) revolves around the need to increase the competitiveness of agricultural production by increasing its productivity, while ensuring conformity with international sanitary and phyto-sanitary requirements, thus facilitating access to international markets. The strategy has proposed eight lines of action:

1. Improve food safety and quality of locally produced and imported products;
2. Increase productivity and competitiveness of the Lebanese agricultural products,
3. Improve the good governance and sustainable use of natural resources;
4. Strengthen agricultural extension and education:
5. Strengthen agricultural research and laboratories,
6. Develop the cooperative sector and mutual funds;
7. Develop the capacities of the ministry of agriculture;
8. Respond to climate change impacts.

To better understand the performance of the agricultural sector in Lebanon, an analysis of the agrarian systems structure is presented in the following part, covering the socio-economic dimension of the sector, its production and trade systems, with the description of the institutional framework and the involved stakeholders.

Agriculture from a socio-economic perspective

Despite the challenges facing the agricultural and agro-industry sectors, they still play an important socio-economic role. In the last two decades, agriculture[4] has remained relatively stable in terms of its share of Lebanon's GDP at an average of 6% per year between 1994 and 2014. This is significantly less than in neighboring Arab countries and is consistent with Lebanon's higher income and its highly urbanized[5] and diversified economy. In terms of added value per square kilometer, agricultural production in Lebanon is higher than in many nearby countries, reflecting a higher intensity of production and greater focus on higher added value products, especially in fruits. Hence, agricultural production has decreased by 12% between 1970 and 2008. This is mainly due to the effects of the post-war economic

4 Agriculture covers: animal and plant production, fisheries and marine products, forestry and forestry products.
5 88% of the Lebanese population lives in urban areas.

crisis and due to the reconstruction and development policies favoring the services sectors (finance, tourism, construction), over the industrial and agricultural sectors (Asmar, 2011; FAO, 2012).

In terms of employment, agriculture and agro-industry employ 7% and 5% of the labor force, respectively. Together, they represented 11.6% of the 2014 Lebanese goods exports (3% for agriculture and 8.5% for agro-industry). The sector constitutes the main source of income for 30 to 40% of the population. However, regional variations are important; in North Lebanon, in the Beqaa, and in South Lebanon, agriculture remains the principal activity for an important segment of the population. In the poorest rural areas of Akkar, agriculture is reported to contribute up to 80% of the local GDP and represents the major income-earning and employment opportunity (FAO, 2006).

Although the majority of farmers in Lebanon are men, women farmers constitute an average 9% of the total farmers. Women are mainly involved in the production of dairy products, food preserves, and subsistence farming. In terms of age, the farmers' population in Lebanon is aging; only 11% of the farmers are below 35 years, while 23% of the farmers are over 65 years. Around 75% of the farmers in Lebanon do not have any kind of social coverage. More than half of the farmers rely exclusively on farming activities, while 33% work in the private sector and 15% in the public sector to ensure a complementary income (MOA, 2012).

Production systems

Agricultural area and holdings

Approximately, one third of the Lebanese territory is arable. The most fertile areas are located along the Beqaa plain and the coastal strip. The diversity of topography and climate zones enables the cultivation of a wide variety of vegetables, fruits, industrial crops, cereals, olives, as well as important livestock, poultry, and apiculture.

The results of the agricultural census for 2010, conducted by the Ministry of Agriculture, show that the total Cultivated Area (CA) is approximately 230,983 hectares (ha), of which nearly 50% is under irrigation (**Table 2 & Figure 2**).

Table 2. Distribution of agricultural and irrigated areas by governorate.

Governorate	Cultivated area (ha)	%	Irrigated area (ha)	%
Mount Lebanon	20,587	8.9	9,395	8.3
Akkar	35,352	15.3	15,648	13.9
North Lebanon	24,064	10.4	9,200	8.1
Baalbak Hermel	57,625	25.0	31,703	28.1
Beqaa (Central & West)	41,649	18.0	29,866	26.4
South Lebanon	25,611	11.1	12,202	10.8
Nabatiyeh	26,095	11.2	4,938	4.4
Total	**230,938**	**100**	**112,952**	**100**

Source: (MOA, 2012) Results of the agricultural census for 2010

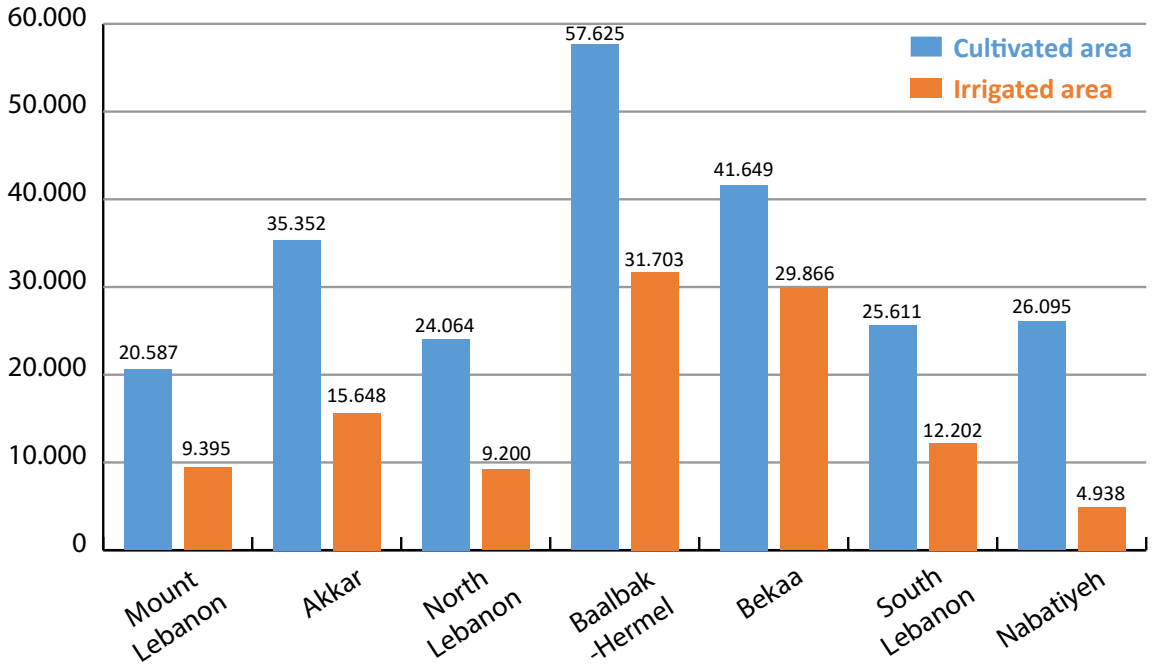


Figure.2- Cultivated and irrigated areas by governorate (in ha)

Source: (MOA, 2012) Results of the agricultural census for 2010

The available agricultural land resources are thus very limited, considering that Lebanon has a population of more than 6 million (4.5 Lebanese, 1.5 Syrian refugees, and around 0.5 Palestinian refugees). With almost 42.9% of the nation's agricultural area, the Beqaa plain (Beqaa and Baalbeck-Hermel governorates) has the largest cultivated area. North Lebanon (including Akkar) is second to Beqaa, with 25.7% of the cultivated area, followed by Nabatiyeh, South and Mount Lebanon, with 11.3, 1.11 and 8.9%, respectively (MOA, 2012).

Farming systems in Lebanon are mostly characterized by the prevalence of traditional cropping patterns, marked by the fragmentation and parceling of the agricultural holdings. The total number of agricultural holdings[6] is 169,695 among which 4,142 are exclusively for livestock without cultivated lands. The average farm size is 1.37 ha, but approximately 70% of the 165,370 crop farms have less than 1 ha and use 18.2% of the CA, while the other 30% use 82.8% of the cultivated area. The following table shows the distribution of agricultural holdings by governorate (**Table 3**).

Table 3. Distribution of agricultural holdings per governorate.

Governorate	Number of farmers	Percentage
Mount Lebanon	30,513	18%
North Lebanon and Akkar	55,939	33%
Beqaa and Baalbak-Hermel	34,085	20%
South Lebanon	22,036	13%
Nabatiyeh	27,122	16%
Total Lebanon	**169,512**	**100%**

6 The MOA fixed the following thresholds for considering an agricultural holding: > 1000 m2 for irrigated and non-irrigated lands; > 400 m2 for greenhouses; 1 cow and 7-8 goats for livestock.

Source: (MOA, 2012) Results of the agricultural census for 2010

The parceling and fragmentation of the small-size agricultural holdings do not allow economies of scale in production and marketing. Land tenure, mostly in remote rural areas, is still a complicated issue, where most of the lands are communal or public properties; which discourages long-term investment in infrastructure to improve productivity. Land management is highly dominated by individuals (85%). Groups of partners and enterprises or cooperatives constitute 12% and 3%, respectively. As for the land tenure and legal status, 71% of the lands are owned, 21% are rented, and 8% fall under succession or illegal exploitation (MOA, 2012).

Crop production

Crop production in Lebanon has evolved from traditional, less profitable cereals to high-value fruit and vegetable production, especially in the post-war period. According to the latest studies of the MOA, the value of crop production was approximately 1,476 million $ in 2009, representing 70% of the total agricultural production. Fruit trees constitute 44% of the total value of crop production, followed by vegetables (29%), then olives (8%), industrial crops (7%), cereals (6%), and legumes (2%). In terms of the share in cultivated area, three types of crops account for around 74% of the total cultivated area. Fruit trees occupy, by far, the largest area, covering 31% of the total cultivated area, followed by cereals (20%), olive trees (23%), and vegetables (17%). The remaining 9% are occupied by industrial crops, mainly tobacco, forage, and other small crops. The following table presents the distribution of the area per crop categories (**Table 4 & Figure 3**).

Table 4. Distribution of cultivated areas per crop categories.

Category	Cultivated area in ha	%
Annual crops	102,471	44.1
Perennial crops	125,928	54.2
Greenhouses	3,801	1.7
Total Lebanon	**232,200**	**100**

Source: (MOA, 2012) Results of the agricultural census for 2010

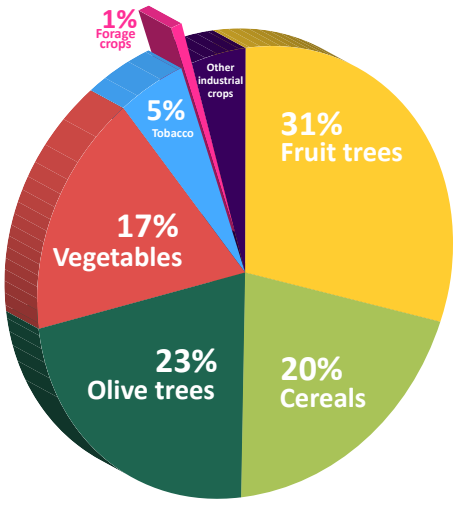


Figure 3. Distribution of the cultivated area per major crop types

Source: (MOA, 2012) Results of the agricultural census for 2010

The diversity of climatic and agro-ecological zones has contributed to a diversity of crop production systems. Lebanon's agricultural lands, from the interior Beqaa plain to the middle and high mountain areas, and narrow valleys sweeping down to the coastal plain, enable farmers to grow a wide range of fruits, vegetables, legumes, and tropical crops. Agricultural production in the coastal plains is dominated by citrus fruits, vegetables, figs, and banana. Middle and higher altitudes support the production of apples, pears, peaches, cherries, and olives. Tobacco and figs are mainly grown in the southern hills. Cereals, legumes, potatoes, fruits, vegetables, and forage crops are cultivated in the Beqaa plain, Marjayoun and Khyam plain in South Lebanon, and Akkar plains. More exotic crops, namely avocados, are cultivated near coastal areas in the South and Mount Lebanon. Table and wine

grape production is mainly located in the Beqaa and in Mount Lebanon. **Table 5** shows the top ten Lebanese fruits and vegetables.

Table 5. Production volume and value of the main fruits and vegetables crops in 2014.

Fruits	Volume (tons)	Value (Million $)	Vegetables	Volume (tons)	Value (Million $)
Apple	126,128	128	Potato	440,000	195
Banana	160,000	80	Tomato	274,372	139
Orange	85,633	53	Cucumber	129,861	61
Peach, apricot	99,143	98	Onion, garlic	79,183	30
Grape	80,588	45	Lettuce	37,709	16

Source: (FAOSTAT)

Animal production

The diversity of agro-ecological zones has also contributed to a diversity of animal and livestock production systems. According to the last agricultural survey conducted by the MOA, the value of animal production is estimated at 639 million $ in 2009, representing 30% of the total agricultural production in Lebanon.

The 2010 agricultural census estimated the total number of herders at 15,800, raising mainly cattle, sheep, and goats, separately or together[7]. Another 12,416 are raising poultry. Around 19% of the herders do not possess agricultural lands and, consequently, they do not have any crop production activity.

The following table shows the output value of animal production for 2009, calculated based on the 2005 agricultural census (**Table 6**).

Table 6. Output value for animal production in million USD in 2009.

Product	Value	%
Milk	160	25
Red meat	102	16
Poultry meat	217	34
Eggs	64	10
Honey	32	5
Fish	64	10
Total	**639**	**100**

Source: (MOA & FAO)

The poultry industry is one of the most developed sectors in animal production in Lebanon. Since its beginnings, this sector has been controlled by the private sector with little interference from the public sector, namely the MOA. Before 1975, the Lebanese production covered a significant part of the needs of Arab countries (Kuwait, Saudi Arabia and Iraq) that were lagging behind in production technology (MOA, 2003).

The poultry VC and production system is divided between conventional small farms and big industrials farms. The conventional free range poultry accounts for 412,000 chickens raised by

7 The livestock and dairy sector are analyzed in details in part V.

12,416 farmers at the household level or in very small poly-culture and livestock farms.

The industrial farms have around 450,000 breeding hens, producing about 4 million layers and about 45 million broilers per year. The FAO classified the poultry production systems in the Near East Region, including Lebanon, into 4 categories (FAO, 2013):

1. **Industrial integrated system**: has farms that are part of an integrated broiler production enterprise with clearly defined and implemented standard operating procedures for bio-security (peri-urban areas);

2. **Commercial poultry production system** with moderate to high bio-security: farms with birds kept indoors continuously, strictly preventing contact with other poultry or wildlife (peri-urban and rural areas);

3. **Commercial poultry production system with low to minimal bio-security** and a caged layer farm with birds in open sheds: farms producing chickens and eggs with poultry spending some time outside the sheds; and

4. **Village or backyard production with minimal bio-security** and birds/products consumed locally: all neighboring countries.

Due to the vertical integration of this VC in Lebanon and to the high fluctuations in market prices, the majority of the medium and big industrial poultry farms are operated for the benefit of large producers and traders who provide all the agricultural inputs at a fixed price with a special arrangement for price increase. Currently, two major producers and traders, namely Hawa Chicken and Tanmia, control about 50% of the poultry sector and market. The rest is divided among around 20 big producers and traders, including Wilco, Shuman, Maalouf, Freiha, Sayyed, Yaseen, Ashour, and others.

The large-scale producers are almost closing their production circuits and control the major nodes of the VC, namely: import of primary feed ingredients and additives feed import; preparation of feeds; import of breeder chicks for egg production; hatching the eggs; raising the birds for meat or table egg production; slaughtering and processing of broilers; marketing of carcasses, cut-up parts or as a processed product and/or marketing table eggs through the traditional marketing lines and their own outlets. These firms are also imposing their production techniques on farmers by giving them all their needs and buying their produce at a prefixed price.

In addition to livestock and poultry, animal production in Lebanon comprises:

- **Swine (pigs)**: there are around 51 swine farms in Lebanon, raising 7,735 swine with an average of 152 per farm. More than half of the swine farms are located in Mount Lebanon (55%), followed by North Lebanon (26%), and the other 20% are equally distributed among the remaining governorates.

- **Beehives and honey production**: in 2010, there were 6,183 beekeepers exploiting 169,308 beehives (average of 27 beehives per beekeeper). North Lebanon accounts for 25% of the beehives, followed by Mount Lebanon (18%), Nabatiyeh (16%), Akkar (13%), Baalbak-Hermel (12%), South Lebanon (11%), and only 5% in the Bekaa governorate.

- **Fisheries**: this sector is a less exploited and developed sector despite its socio-economic importance for the coastal areas especially in the northern and southern parts of the country. There is no accurate data and figures about fishing and fisheries in Lebanon.

Agro-industry and food processing

The Lebanese agro-industry and food processing sector is characterized by a heterogenic structure with large competitive investments on the one hand, and family and/or cooperative based small production units on the other hand. The sector constitutes an important component of the Lebanese economy in general and the Lebanese agricultural sector in particular. According to the statistics of the Ministry of Industry (MOI), it represents 18.2% of industrial enterprises in Lebanon, about 26% of the total industrial output, and 27% of the value added of the sector, which makes it the largest contributor to the Lebanese industry. Moreover, the sector employs 23% of the industrial workforce (Darwish, 2008).

The majority of the food industries and processing units are modest. According to the MOI, the number of registered food industries was 736[8] in 2007 (MOI, 2010). These establishments are concentrated in the governorates of Mount Lebanon (32.9%), Beirut (17.9%), North Lebanon (17.2%) and the Beqaa (16.2 %). A survey by the MOI in 2007 reported only 10 firms having more than 100 workers and only 7 with more than 250 workers.

In addition to the registered food industries, different experts and studies estimate the number of food industries between 2,000 and 3,000, most of them being small and artisanal producers, operating as family businesses at the household level without any official registration.

The food processing enterprises produce a variety of food and beverages, including typical Lebanese products. The main product lines are:

- Beverages (alcoholic and non-alcoholic)
- Confectionery
- Bakery products
- Jams
- Olive oil
- Pickles and vinegar
- Spices and condiments
- Processed and canned fruits and vegetables.

Agriculture finance, services, and cooperatives

Public expenditures

Since 1990, public expenditures primarily focused on financing the reconstruction program, targeting the country's physical infrastructure in particular with less consideration to investing in sustainable development and productive sectors.

The latter has resulted in large budget deficits, and thus tight budgetary expenditures with negative socio-economic implications: further decrease in public spending and less foreign direct financing going to the agriculture sector. Despite its socio-economic importance and role in creating a balanced growth and development between rural and urban areas, the Lebanese government allocates less than 1% of the national budget for the Ministry of Agriculture on a yearly basis.

8 This number takes into consideration only the large and medium industries with at least 5 workers per industry. Another 618 small food industries were surveyed by the MOI in 2007.

Mechanization and extension services

The number of famers using agriculture mechanization (tractors and harvesting machines) is 109,596 (65% of the total holdings). The majority of the farmers rent the machinery (88%), which increases their production cost, while only 11% of them are owners. Around 20,000 farmers using 22% of the total cultivated area benefit from agriculture extension services (12% of the total holdings); 86% of them receive these services from the private sector (mainly input suppliers) and they consequently highly depend on them. Other farmers benefit from extension services provided by the MOA extension centers located all over Lebanon, the Lebanese Agricultural Research Institute (LARI), as well as by some NGOs implementing agricultural and rural development projects.

Cooperatives

The International Labor Organization (ILO) paper on cooperatives in the Arab states, published in 2010, estimated the existence of 1,200 active cooperatives in Lebanon. The large majority belongs to the agriculture sector, followed by housing and credit.

According to the National Federation of Lebanese Cooperatives (NFLC), there are 799 general agricultural cooperatives (crop, animal, and food processing), 49 for beekeeping, and 42 for fishing. The majority of cooperatives are located in South Lebanon, followed by North Lebanon and the Beqaa region (ILO, 2010).

According to the MOA census of 2010, the agricultural cooperatives regroup 162,731 farmers and food processors (MOA, 2012). They are mainly based at village or regional level and specialized in specific value chains. Hence, most of them are not efficient, with many fictive ones created just to benefit from aids and development projects.

Agricultural trade and food security

According to FAO, the Lebanese agricultural production only meets 20 to 30% of the local food demand. About 70 to 80% of the Lebanese food demand is covered by imports. The food bill amounts to 20% of total imports. According to the MOA, Lebanon is only self-sufficient in poultry production and fruits. It is estimated that vegetable production meets 73% of the needs of the local market. The country produces only 10% of its sugar and 15% of its wheat needs. On the other hand, Lebanon imports 84% of its red meat, 78% of its fish, and 35% of its milk needs (Plan Bleu, 2000; UNEP, 2005; FAO, 2006; Darwish, 2008, MOA, 2012).

Terms of trade

The Lebanese agriculture terms of trade are similar to those of developing countries. They are characterized by a regional comparative advantage in fruits and vegetables and a large trade balance deficit for cereals, livestock, and related products (e.g. dairy products, eggs, meat cut). In 2014, the cereals trade deficit was $368 million and it decreased to $281 million in 2016. As for livestock and livestock products, it decreased from $1,025 million to $824 million in 2016. The reason for this drop is the decrease in both imports and exports. This trade deficit is rendering Lebanon vulnerable to fluctuations in international cereals prices (especially wheat).

The Lebanese government is subsidizing wheat production and has implemented a fixed price system for bread. Governmental programs and projects by international donors are supporting the livestock and dairy production sectors. However, the sustainability of such interventions in the intensive dairy sector has been questioned by several experts.

According to the FAO rapid assessment of the impact of the Syrian crisis on food security and agricultural livelihoods in neighboring countries, the deterioration of bilateral trade between Syria and Lebanon and the reduced trade through Syria to the Gulf countries have made it extremely difficult for Lebanese farmers to export their products.

Vegetables and fruits: Regarding the vegetables and fruits trade, Lebanon's exports are valued at $79 and $63 million respectively in 2014, compared to $147 and $159 million for imports. In 2016, vegetables and fruits exports recorded $56 and $73 million respectively and for imports it was $143 and $180 million. Although the balance of trade for vegetables remains negative, Lebanon is considered to be almost self-sufficient in terms of raw vegetables production, especially that a significant part of important vegetables is used for agro-industrial purposes. The balance of trade for fruits is positive when nuts are excluded. Potato is the leading vegetable export and apple is the leading fruit export.

Agro-industry: Regarding foreign trade, agro-food products (excluding tobacco) account for 60% of the value of the Lebanese agricultural exports against 32% for imports. Agro-industry is an exporting sector of the Lebanese economy. Agro-industrial exports have been growing in value from $303 million in 2009 to $573 million in 2014 (13.6% annual growth rate). Products classified under agro-industry range from milling products, vegetables and fruits preparation, to alcoholic and non-alcoholic beverages. Agro-industry either imports raw materials or directly procures from local famers.

In total, the general agricultural trade deficit increased from $2.3 billion in 2010 to $2.7 billion in 2013, to decrease again to $2.5 billion in 2016. As shown in **Table 7**, prepared food, beverages and tobacco occupy the first place in both imports (44%) and exports (65%). Vegetables, fruits, and other crops constitute 25% of the imports and 27% of the exports. Live animals and animal products constitute 25% of the imports and only 2% of the exports.

Table.7. Agricultural and food imports/exports from 2010 to 2016 in billion USD

Agricultural and food products	2010		2011		2012		2013		2014		2015		2016	
	Imp.	Exp.	Imp.	Exp.	Imp.	Exp.	Imp.	Exp.	Imp.	Exp.	Imp.	Exp.	Imp.	Exp.
Live animals and animal products	0.9	0.02	0.9	0.02	0.8	0.02	0.9	0.02	1	0.03	0.9	0.04	0.8	0.02
Crop products	0.7	0.15	0.8	0.16	0.9	0.17	0.9	0.22	0.9	0.21	0.9	0.18	0.8	0.19
Animal and vegetables fats and oils	0.1	0.02	0.2	0.02	0.2	0.03	0.2	0.04	0.18	0.03	0.16	0.03	0.16	0.04
Prepared foodstuffs beverages, and tobbaco	1.1	0.32	1.3	0.38	1.4	0.39	1.4	0.45	1.4	0.5	1.3	0.5	1.4	0.46
Total	2.8	0.52	3.2	0.58	3.3	0.61	3.4	0.73	3.48	0.77	3.26	0.75	3.16	0.71
Deficit	-2.3		-2.6		-2.7		-2.7		-2.7		-2.5		-2.5	

Source : www.customs.gov.lb

Trade markets

The opening of the Arab markets and the free trade agreements, to which Lebanon is a signatory, are negatively affecting agricultural production and trade by allowing the import of cheaper fruits and vegetables from neighboring countries. It will become increasingly difficult for Lebanese agricultural products to be competitive, especially in more conventional crops, since other countries in the region have lower costs and subsidized production, mainly in relation to the cost of energy. At the same time, the opening-up of new markets other than the traditional Arab markets is very difficult given the absence of quality norms and products not suitable for such markets.

Vegetables exports: The Gulf Cooperation Council countries (GCC) market absorbs 63.5% of Lebanon's export of vegetables, followed by regional Arab countries (Syria, Jordan and Iraq, whose shares add up to 27.7%). Overall, regional Arab countries account for 91.2% of Lebanon vegetable exports. Lebanon's agriculture has not yet been able to diversify its export markets for its vegetables production. This is due to two main factors:

- With the exception of potatoes, which actually represent 62% of the raw vegetable exports, Lebanon does not produce a significant surplus of vegetables;
- Lebanese farmers need to improve and implement innovative agricultural practices to ensure compliance with international phyto-sanitary standards.

There are opportunities in diversifying market exports to large and growing markets, such as the Russian as well as to the EU markets that provide Lebanon with preferential tariffs rates and quotas for agricultural commodities including potatoes.

Fruits exports: As for fruit exports, around 37.5% are directed toward GCC countries, while Syria absorbs 21.4% and Egypt up to 15.2% of these exports. Syria absorbs 70% of Lebanon's export of bananas, which constitute 20% of Lebanon fruit exports, while Egypt imports around 71% of apple exports which also represent approximately 20% of total fruit exports. Lately, Lebanese fruit producers have been able to enter the Russian and the EU markets, especially with grapes and cherries. Today, European markets represent 5% of total Lebanese fruit exports and there are many opportunities for increasing this share.

Agro-industry exports: The market for agro-industrial preparation of fruits and vegetables is more diversified than both raw vegetable and fruit export markets.

The non-GCC and regional Arab countries[9] markets account for up to 40% of Lebanon fruit and vegetable exports. As a matter of fact, Lebanon exports agro-food products to more than 70 countries, of which a significant 6.3% share goes to the United States market. Most of these exports are pulled by demand from the Lebanese diaspora. There is, however, a growing international demand for ethnic food and delicatessen, a demand that the Lebanon food industry may answer thanks to the comparative advantage of the "Lebanese food" brand in that matter. There is high scope for development project intervention in support of increased linkages between farmers and the agro-industry to produce for export to the United States and to Europe, both higher value markets and faster growing markets compare to GCC markets.

Focus on agriculture in the Beqaa plain

The diversity of the micro-climate and agro-ecological zones in the Beqaa plain enables the cultivation of a wide variety of vegetables, fruits, cereals, legumes, industrial crops, grapes, as well as important livestock. The Beqaa plain is divided into three major agricultural zones:

- ***Northern Beqaa (Baalbek and Hermel)***: characterized by its aridity and low rainfall. The main crops of this zone are: cereals, forage crops, fruit trees, vegetables, and legumes. Northern Beqaa is also known for its important livestock sector and dairy sectors with sedentary, semi-nomadic and nomadic herding systems.
- ***The central part of the Beqaa (Zahle)***. The main crops of this zone are: wine grapes, table grapes, potatoes, forage crops, cereals, fruit trees, vegetables, and legumes. This area is mainly known for dairy farms and processing units and some poultry farming.
- ***The south-western parts of the Beqaa (West Beqaa and Rashaya)***. The main crops of this zone are: wine grapes (West Beqaa), table grapes (Rashaya), fruit trees, and olives. It has mixed dairy cows, sheep, and goat herds, as well as apiculture.

9 Egypt, Syria, Jordan, Iraq.

The fertile soils and the two rivers crossing the Beqaa plain, Litani to the south and the Orontes "Al Aassi" to the north, make it the most important agricultural region in Lebanon with the highest share of the total irrigated area (54.5%). **Table 8** summarizes the main characteristics of the agricultural systems in the Beqaa plain.

Table 8. Number of holdings and agricultural area distribution in the Beqaa plain.

Number of farmers & agricultural area	Beqaa			Total	Baalbeck-Hermel		Total Baalbeck-Hermel	*Total Beqaa Plain*
	Rashaya	West Beqaa	Zahle	Beqaa	Baalbeck	Hermel		
Holdings	3,123	4,818	4,575	**12,516**	16,850	4,719	**21,569**	*34,085*
Share of Beqaa plain holdings	9%	14%	13%	**37%**	49%	14%	**63%**	*100%*
Share of Lebanon holdings	2%	3%	3%	**7%**	10%	3%	**13%**	*20%*
Agricultural area (ha)	5,904	16,818	18,926	**41,649**	48,343	9,282	**57,625**	*99,274*
Share of Beqaa plain agricultural area	6%	17%	19%	**42%**	49%	9%	**58%**	*100%*
Share of Lebanon agricultural area	3%	7%	8%	**18%**	21%	4%	**25%**	*43%*

Source: (MOA, 2012) Results of the agricultural census for 2010

Beqaa plain agricultural production

A significant number of Lebanese households in the Beqaa plain rely heavily on agriculture as a primary or secondary source of income. As shown in **Table 9**, agriculture in the Beqaa regions embody the livelihoods and productive activities of around 30,872 agricultural holdings, distributed over approximately 92,194 ha - i.e. 45.8% of Lebanon's total agricultural land - and divided into approximately 70,701 plant production plots and 8,926 animal production units.

Table 9. Distribution of agricultural holdings by type and region in the Beqaa plain.

Holdings patterns	West Beqaa	Central Beqaa	Baalbeck-Hermel	Total
Crops-only farms	83.8%	80.3%	80.5%	
Animal husbandry-only farms	8.6%	12.5%	3.1%	
Mixed farms	7.6%	7.2%	16.4%	
Total farms number (a)	**4,818**	**4,575**	**21,479**	**30,872**
Total agricultural plots (a)	9,333	9,777	51,591	70,701
Total animal husbandry unit (b)	1,413	1,258	6,255	8,926
Total agricultural area in ha (c)	**17,672.9**	**21,178.8**	**53,342.9**	**92,194.2**
Average holdings (Lebanon:1.4 ha)	4.1 ha	4.6 ha	2.1 ha	
Share of Lebanon Agricultural land	7.3%	11.2%	27.3%	

Source: (MOA, 2012) Results of the agricultural census for 2010
(a) Larger than 0.1ha
(b) Including Beekeeping and fisheries
(c) Does not include grazing area, animal production units, and plots less than 0.1ha

Crop patterns: Table 10 presents cropping patterns and land use by region in the Beqaa plain. The most striking fact in terms of land cover is the significant difference in the share of permanent crops (fruits, grapes and olives) in each region, thus reflecting the previously mentioned difference in the agricultural mode of production between regions.

Permanent crops, especially those with low water requirements (such as olive and cherries), tend to be more present in Baalbeck-Hermel, where they constitute 43.3% and 42.6% of land cover respectively. This figure drops to 23.4% in West Beqaa and to 24.4% in Central Beqaa. Cereals are the main crops in terms of land use; they constitute about 45% of land cover in West Beqaa. Nonetheless, high value field crops such as vegetables and potatoes are particularly important in the three regions. The combined share of vegetables and potatoes adds up to 20.9% of land cover on average, reaching up to 36.3% in Central Beqaa.

Table 10. Cropping patterns in the Beqaa plain.

	West Beqaa		Central Beqaa		Baalbeck- Hermel		Total	
Land use	**Area (ha)**	**%**	**Area (ha)**	**%**	**Area (ha)**	**%**	**Area (ha)**	**%**
Cereals	8,073.7	45.7%	5,885.2	27.8%	13,191.8	24.7%	27,150.7	29.4%
Legumes	627.7	3.6%	769.8	3.6%	3,523.1	6.6%	4,920.6	5.3%
Vegetables	1,579.6	8.9%	3,964.7	18.7%	6,154.9	11.5%	11,699.2	12.7%
Industrial crops	518.7	2.9%	432.1	2.0%	3,719.3	7.0%	4,670.1	5.1%
Potatoes	1,791.3	10.1%	3,723.6	17.6%	2,033.0	3.8%	7,547.9	8.2%
Bulbs and tubers	783.1	4.4%	1,454.8	6.9%	1,596.3	3.0%	3,834.2	4.2%
Wine grapes	1,003.5	5.7%	250.6	1.2%	712.0	1.3%	1,966.1	2.1%
Table grapes	263.1	1.5%	1,443.4	6.8%	2,777.7	5.2%	4,484.2	4.9%
Olive	1,394.1	7.9%	96.4	0.5%	4,141.5	7.8%	5,632.0	6.1%
Fruits	1,638.1	9.3%	3,158.2	14.9%	15,493.3	29.0%	20,289.6	22.0%
Total	**17,672.9**	**100%**	**21,178.8**	**100%**	**53,342.9**	**100%**	**92,194.6**	**100%**

Source: (MOA, 2012) Results of the agricultural census for 2010

Animal Husbandry: there are a total of 14,026 animal production units in Beqaa regions, including bee-keeping (**Table 11**). The striking fact about the animal production sector is its dichotomy between relatively large investments and small-scale production directed towards home consumption and/or local markets and collection centers. In section V, the report will detail the different animal husbandry subsectors and dairy production VC.

Table 11. Animal Production by region and type in Beqaa plain.

		West Beqaa	Central Beqaa	Baalbeck- Hermel	Total
	Total number head	**8,338**	**8,916**	**10,644**	**27,898**
	Total number farms	408	338	1073	**1,819**
Bovine (a)	Of which ≤ 5 heads	37.3%	18.3%	65.1%	50.2%
	Of which >5 and ≤ 25	40.7%	48.2%	29.4%	35.4%
	Above 25	22.1%	33.4%	5.6%	14.4%
	Total number heads	**36,665**	**49,520**	**100,464**	**186,649**
Ovine	Total number herds	322	413	1,199	**1,934**
	Of which ≤ 10 heads	18.6%	6.8%	37.2%	27.6%
(b)	Of which >10 and ≤ 50	31.4%	25.9%	36.8%	35.7%
	Above 50	50.0%	67.3%	26.0%	36.7%
	Total number head	**52,265**	**20,155**	**105,971**	**178,391**
	Total number herds	343	279	1,643	**2,265**
Caprine	Of which ≤ 10 heads	21.3%	13.3%	31.6%	27.8%
	Of which >10 and ≤ 50	39.7%	50.5%	39.6%	41.0%
	Above 50	39.1%	36.2%	28.8%	31.2%
Poultry	**Total number farms**	**233**	**131**	**1,214**	**1,578**
Including free range	Of which ≤ 50 heads	69.9%	37.4%	71.9%	68.7%
	Of which >50 and ≤ 500	20.6%	22.1%	11.5%	13.7%
	Above 500	9.9%	40.5%	16.6%	17.6%
	Total hives	**2,575**	**2,553**	**20,034**	**25,162**
	Total Beekeepers	107	97	1,030	**1,234**
Bees	Of which Under 10 hives	45.8%	33.0%	46.9%	45.7%
	Of which >10 and ≤ 50	49.5%	58.8%	46.6%	47.8%
	Above 50	4.7%	8.2%	6.5%	6.5%

Source: (MOA, 2012) Results of the agricultural census for 2010
(a) Liban Lait company gather alone around 20% of total dairy cows in Baalbeck-Hermel area.
(b) Two large farmers gather around 10% of all sheep in Baalbeck-Hermel area.

Beqaa plain land tenure

Control of agricultural land in Lebanon is highly concentrated. The distribution of agricultural land reflects modes of production in the different areas. Agriculture in West and Central Beqaa tends to be more intensive and mechanized with the largest estates and high capital investment. In these regions, agriculture is more polarized between small-scale farmers and large investments, whereas in Baalbeck-Hermel, agriculture is still a livelihood option for medium-sized farmers. This is also reflected in land tenure systems and plot size distribution (**Table 12 & Table 13**).

Table 12. Land tenure by regions in the Beqaa plain.

Tenure type	Share	West Beqaa	Central Beqaa	Baalbeck Hermel
Farmed by land owner	Share of land	33.0%	57.5%	64.8%
	Share of farms	67.2%	79.1%	74%
Leased out	Share of land	50.3%	36.6%	14.7%
	Share of farms	11.1%	16.5%	6.4%
Share cropping	Share of land	11.0%	5.4%	3.3%
	Share of farms	3.5%	3.1%	1.5%
Other	Share of land	5.7%	0.4%	17.1%
	Share of farms	18.2%	1.4%	18.1%

Source: (MOA, 2012) Results of the agricultural census for 2010

Table 13. Distribution of plots size by region in the Beqaa plain.

		0.1ha to 0.2ha	0.2ha to 0.5ha	0.5ha to 1ha	1ha to 2ha	2ha to 5ha	> 5ha	Total
West Beqaa	Share of land	2.7%	5.1%	6.7%	7.8%	13.8%	63.9%	100%
	Share of plots	34.8%	13.5%	15.4%	9.1%	7.4%	7.8%	100%
Central Beqaa	Share of land	1.1%	4.7%	9.1%	11.0%	21.8%	52.3%	100%
	Share of plots	15.2%	25.3%	23.5%	15.0%	13.6%	7.5%	100%
Baalbeck Hermel	Share of land	4.0%	11.5%	16.4%	18.6%	26.7%	22.9%	100%
	Share of plots	28.0%	30.3%	20.5%	12.1%	6.8%	2.4%	100%

Source: (MOA, 2012) Results of the agricultural census for 2010

In Central Beqaa, the less equalitarian region in terms of agricultural land control, 63.9% of agricultural land is within plots larger than 5ha, and only 33.0% of land and 67.2% of farms are farmed directly by the owners. These farmers are mostly small-scale producers with limited land ownership. Leased out farms represent only 11.1% of total farms, but they cover 50.3% of the land.

This reflects both the existence of absentee landlords owning a large amount of land, and the capacity of agricultural entrepreneurs to rent large areas of land for field production, such as cereals and potatoes. In addition, the significant incidence of share cropping agreements (on 11.0% of the total land) further reflects the dominance of absentee landlords in the region.

Beqaa plain water and irrigation

Agriculture is the largest water consumer with estimates reaching up to 60% of the total water withdrawal. Irrigated areas differ between the three regions, reaching as high as 86.2% of agricultural land in central Beqaa, 74.9% in West Beqaa, and 55.0% in Baalbeck-Hermel. Irrigation methods also differ between regions, with gravity irrigation being used in 20.9% of West Beqaa. Drip irrigation is widespread in Baalbeck-Hermel, where it accounts for 35.2% of irrigated land, although gravity is still used for 42.5% of irrigated land. In terms of water sources, around 60% of irrigated land utilizes water from artesian wells in Beqaa. (MOA, 2012)

Beqaa plain agricultural labor

Table 14 presents agricultural labor requirements in the Beqaa plain. The data does not take into consideration the farmer's (owner of the land or holder of the lease agreement) labor or that of his family. It is estimated that agriculture employs 19,000 permanent workers, and requires approximatively 4.26 million working days from seasonal workers, or the equivalent of 68,055 workers who are working on a 25% part-time equivalent. Based on field observations, it can be assumed that 90% of these workers are Syrian, which leads to the estimation that approximately 78,350 Syrian workers are employed either on a full-time or part-time basis by the agricultural sector in the Beqaa plain.

Labor intensity differs between regions, because there is a significantly higher demand for permanent labor in West Beqaa at an average of 1 permanent worker for 3ha of land, whereas in Baalbeck the rate is of 1 worker for approximatively 6.6 ha of land. This difference is mainly explained by the relatively higher presence of family/household-based agriculture in Baalbeck-Hermel compared to West Beqaa.

Table 14. Permanent and Seasonal Labor demand per region in the Beqaa plain.

Labor patterns and characteristics		West Beqaa	Central Beqaa	Baalbeck Hermel	Total
Demand for permanent labor (workers)		5,879	4,476	8,647	19,002
Demand for seasonal labor (in days)		655,729	1,648,145	1,955,770	4,259,644
Demand for seasonal labor (25% Part time equivalent)		12,610	25,356	30,089	66,055
Overall Labor demand intensity	Permanent workers	0.33 / ha	0.21 / ha	0.16 / ha	
	Seasonal labor days	37 / ha	78 / ha	36 / ha	
Labor demand intensity for vegetables including potatoes, bulbs and other tubers	Permanent workers	0.50 / ha	0.42 /ha	0.37 / ha	
	Seasonal labor days	146 / ha	147 /ha	116 / ha	
Fruits trees, including olives	Permanent workers	1.3 / ha	0.64 / ha	0.32 / ha	
	Seasonal labor days	61 / ha	258 / ha	47 / ha	

Source: (MOA, 2012) Results of the agricultural census for 2010

In terms of demand for seasonal workers, averages are higher in Central Beqaa, reaching up to 258 days of seasonal labor per ha. This figure is in part due to:

- Vegetable production is particularly highly demanding in terms of seasonal labor and accounts for up to 18.5% of Central Beqaa land cover, compared to 8.9% in West Beqaa;
- Table grape production is significantly important in Central Beqaa and requires 352 days of seasonal labor per ha.

In terms of skills, permanent labor tends to be comprised of semi-skilled or skilled agricultural workers, while seasonal labor constitutes unskilled workers mostly used during sowing, weeding, and harvesting. Any intervention aiming at working with Syrian agricultural workers should, as one of its objectives, improve the skills and capabilities of semi-skilled and skilled Syrian workers. This will benefit the overall level of technology and innovation of agricultural practices in Lebanon, as well as benefit the Syrian workers that carry their skills if they decide to change employer or return to Syria. However, direct short-term benefits beyond wage labor needs a new strategy. We will discuss some options in this regard in a special section for the Syrian refugees.

Impact of the Syrian crisis on the Lebanese agriculture

The historically fragile Lebanese economy has faced numerous shocks since the onset of the Syrian crisis. With no end in sight, Syria's conflict continues to generate refugees who face long-term displacement. Despite being the smallest of the countries neighboring Syria, Lebanon hosts the largest population of Syrian refugees. According to the UNHCR, 1.1 million displaced Syrians have been registered in Lebanon. By the end of 2015, around 1.5 million Syrian refugees were estimated to have been settled in Lebanon, among which 75% are women and children. This significant population of displaced Syrians amounts to one quarter of the Lebanese population (FAO, 2015; UNHCR, 2014).

The threats of the Syrian war and the massive influx of refugees on the Lebanese agricultural sector are immense and could have long-term repercussions if unaddressed. Agricultural production and food security has been negatively affected through increased pressure on scarce natural resources, such as water, pastures and forests, increase basic food demand, increase competition for Lebanese wage labor, uncontrolled entry of diseased plants and animals from Syria that could devastate the region's food chain. The economic repercussions and the unstable security situation due to the Syrian crisis have particularly impacted the agriculture economy and its food production capacities. Moreover, the surplus of Syrian labor is reducing local employment and wages, and increasing social tensions. Lebanese farmers, who have lost cross-border trading opportunities, are facing many challenges to export their products. In the bordering areas with Syria, such as in Akkar and Northern Beqaa, many farmers cannot access their lands and lost many seasons due to insecurity and violence.

Since the beginning of the Syria crisis in March 2011, the Beqaa Valley in Lebanon has hosted a large number of Syrian refugees. The latest updates of the UNHCR show that the number of Syrian refugees in the Beqaa plain constitute 35.7% of the total registered refugees in Lebanon by the end of 2016 (1,011,366). The regional distribution of these refugees and their density in the Beqaa plain is presented in the following figure and maps. Syrian refugee settlements are mostly concentrated in Central Beqaa with the highest concentrations (around 20,000 refugees) in the towns of Qab Elias and Bar Elias. Baalbeck-Hermel, Baalbeck, and Aarsal have the highest number of refuges with more than 50,000 refugees in both towns (**Figure 4, Map 3, Map 4**).

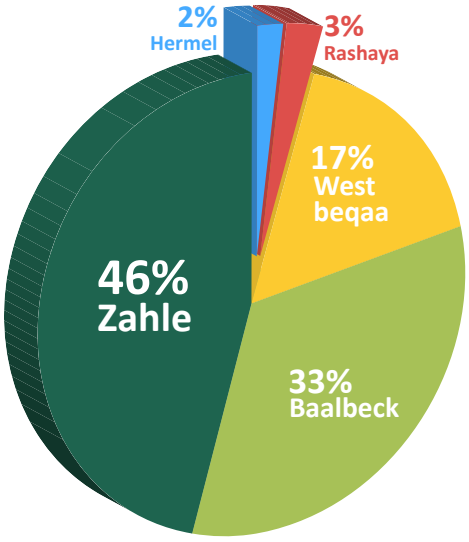
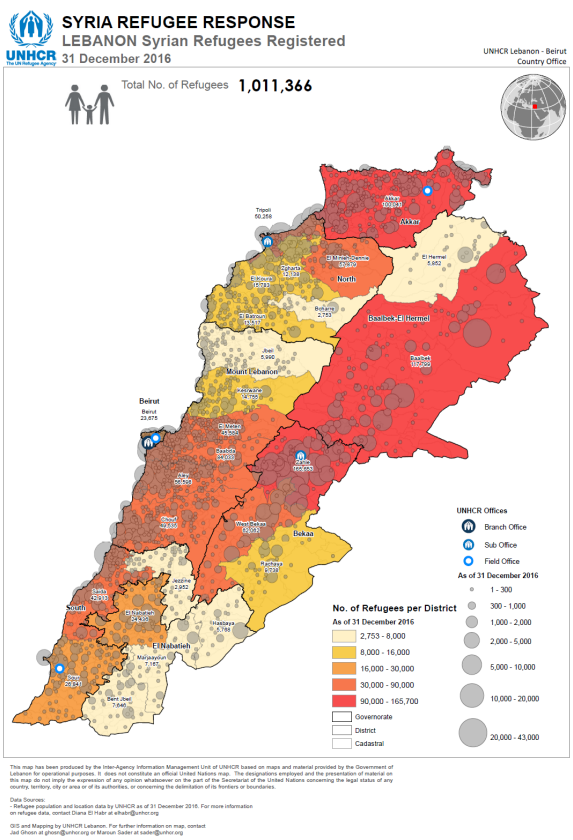
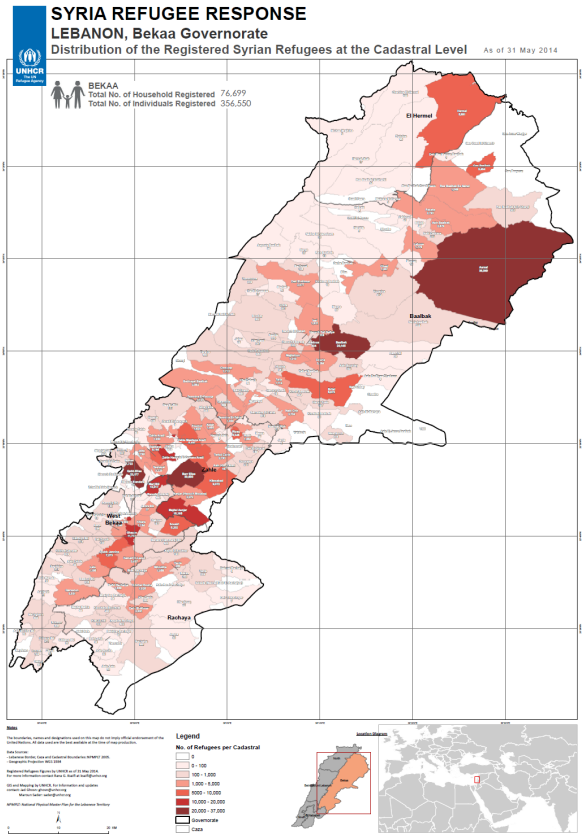


Figure 4. Distribution of Syrian refugees in the Beqaa plain by region.

Source: (UNHCR)

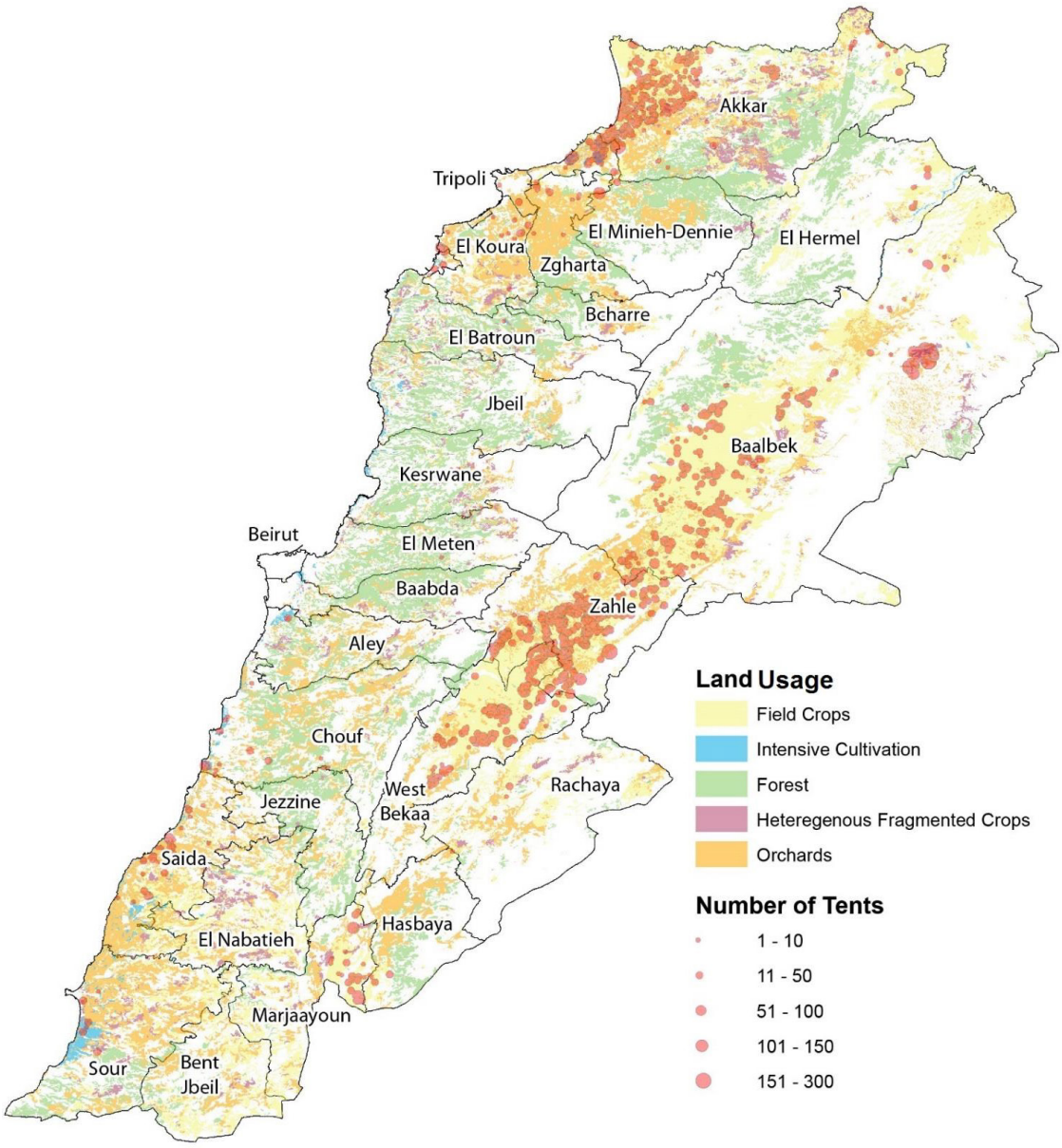


Map 3. Syrian refugees' distribution and density in Lebanon.



Map 4. Syrian refugees' distribution and density in the Beqaa.

The presence of these settlements in an agricultural zone has started to affect the region's landscape and its land use patterns. **Map 5** shows the high concentration of Syrian refugees' settlements in Central Beqaa (FAO, 2014).



Map 5. Distribution of informal settlements on agricultural lands in Lebanon.

(Source: MOA)

The following section presents the main impacts of the Syrian war and Syrian refugee crisis on the Lebanese agricultural sector, as described by the FAO in three different reports (FAO, 2014; FAO, 2015; FAO, 2016).

Borderline farmers

At the border areas of Hermel, Baalbeck and Akkar in Northern and Eastern Lebanon, farmers suffered from significant losses in farm income because of forced abandonment of farmlands or limited/un-timely access to fields to plant, irrigate, weed, and harvest their crops (as a result of hostilities in border areas). Today, farmers, who have traditionally relied

on agricultural inputs and services at subsidized or inexpensive rates from Syria, face a rapid increase in input costs and are struggling to maintain production. Farmers and pastoralists are increasingly abandoning their livestock, as they are unable to cope with escalating feed prices and decreasing market prices of their animals and animal products.

Export decline and food prices

The decline of agricultural trade and the export industry due to the closure of the trade routes via Syria to the GCC has been one of the major and severe economic impacts on the sector. The increased demand for basic products in Lebanon (by Syrian refugees as well as the hosting communities), coupled with the inability to import cheaper foods from Syria, have pushed prices upward, resulting in the increase of household food expenditures.

Labor market

The massive and continuous influx of Syrian refugees has increased labor supply by 30 to 50% (with the largest impacts on women, youth and unskilled workers) and it drove down agricultural wages substantially. In some villages of the Beqaa, daily wages of laborers have dropped by up to 60%. Syrian non-skilled laborers are replacing the skilled Lebanese labor force, especially in the agricultural sector. The World Bank projected the overall unemployment rate in Lebanon to increase by up to 10%. An additional 220,000-324,000 Lebanese were expected to become unemployed, thus doubling the unemployment rate to over 20%. These dynamics have led to an increase in tensions between refugees and the inhabitants of hosting communities in many areas.

Production cost and farmers' income

The Syrian refugee crisis shows significant negative impacts on Lebanese agriculture and farmers' income, thereby exacerbating pre-existing high structural cost. Agricultural structural cost is high due to the mountainous nature of much agricultural land; a limited domestic market and small, fragmented holdings that exclude economies of scale; a high proportion of hired labor; inefficient or absent irrigation schemes which make life difficult for farmers living in isolated communities where also drinking water is scarce; and intensive use of fertilizers and pesticides, which is encouraged by input suppliers. The biggest impact of the Syrian crisis comes from the loss of the Syrian market and the closure of the trade routes to Iraq, Jordan, Turkey, and the GCC countries and the loss of subsidized input supplies. In bordering areas between Syria and Lebanon, Lebanese farmers used to import most of their agricultural inputs at low prices from Syria, where agricultural production inputs were largely subsidized by the government. However, lowering wages due to increased labor supply has a positive impact on labor cost for agriculture.

Products crossed the border formally or informally, including pesticides, herbicides, local seed varieties, forage seeds and fodder, fertilizer, diesel to pump water for irrigation and transport goods, as well as machinery spare parts and equipment. Most of these items are now difficult to find on the market; the price of those items still available for sale has increased dramatically. The price of some fertilizer has more than doubled. One striking example is the price of Sulphur, used for pest control, increased more than fivefold.

Lack of supervision and illegal competition

The Lebanese agricultural marketing and sales system does not have any type of regulation or control. Consequently, when farmers sell their products in the wholesale market, they cannot control the quantity of products sold and at which price. Recently, due to the Syrian

crisis and illegal competition of some crops imported from Syria, the offered prices are too low and do not cover the production cost, with a 20 to 40% net decrease in farm-gate prices.

On the other hand, increases in market prices have been noticed when it comes to both agricultural inputs. Moreover, the Syrian crisis led some Syrian refugees to take on agriculture in Lebanon, through land rental or partnerships with Lebanese farmers.

In comparison to Lebanese farmers, Syrian farmers seem to have more access to cheap labor, due to the fact that they are being helped by their family members on the lands they are cultivating, and also cheaper agricultural inputs since they have the ability to access markets, both officially and unofficially, in Syria.

This, in addition to the belief that Syrian farmers are accepting to sell their produce at a much lower price, is leading some Lebanese farmers to switch crop types to ones that are currently not being planted by the famers, such as orchards or illegal narcotics crops (especially in Northern Beqaa) that have proven to be very beneficial to farmers due to their high level of profitability. The Syrian crisis has also pushed some Lebanese farmers to give up on their agricultural lands and switch their land use to rent it to Syrian refugees or start some residential units, since there is now a higher demand due to the severe population increase, especially on the coastal areas of Akkar. However, no such case was reported in Central Bekaa.

Food safety and plant health

The informal traffic of fresh and processed food from Syria to Lebanon was not affected by the crisis. Important quantities of products are informally sold in Lebanon and do not follow food handling standards during processing or transport, which is causing high health hazards. Inspection and quality control that should take place at the border is not properly performed and the risk of pest and disease outbreaks has increased due to the low capacity of the Lebanese quarantine and border control units.

The limited capacity to inspect plant imports and to secure the production of healthy plant material locally at competitive prices is increasing the risk of pest and disease transfer from Syria. In the medium and long terms, crops will be more vulnerable to diseases affecting crop yield and quality, consequently reducing food security and sovereignty of Lebanon.

Livestock

Lebanese herders face enormous obstacles, including increased market prices of feed supplies (over 25%), higher grazing rents in rangelands, and high costs of veterinary visits and drug supplies, compounded by shortages in veterinary services.

The price of animal feed (previously purchased at subsidized prices from Syria) has almost doubled. The number of animals estimated to have crossed from Syria into Lebanon since the crisis began is equivalent to around 20% of Lebanon's dairy cattle and 40% of its small ruminants.

Milk produced by Syrian herders, who fled to Lebanon, is informally sold on the Lebanese market and is competing with the local milk; its price is half of the price fixed by the Lebanese government (500 LBP instead of 1000 LBP).

Due to the above mentioned challenges and problems, and with the illegal competition of

the Syrian milk (informally imported from Syria or produced in Lebanon), many smallholder farmers are selling their animals and quitting this activity.

Veterinary services inside Syria (e.g. animal disease surveillance, vaccination programs and quarantine facilities) collapsed. Syrian livestock have not been vaccinated against Transboundary Animal Diseases (TADs) in the last three years. Unvaccinated sheep, goats, and cattle entering Lebanon illegally are threatening the health of livestock and people, particularly as the veterinary services in Lebanon are unable to cope with the increased threat of TADs, which is increasing the risk of diseases breaking out, including foot-and-mouth disease, brucellosis, "peste des petits ruminants", and lumping skin disease.

Water and natural resources

In addition to water shortages over the last 5 years due to climate variations and lower precipitation levels, worsened by the mismanagement of available water resources, the Syrian refugee crisis is exacerbating this problem even further. The amount of water used for irrigation has increased, due to the increased demand for seasonal crops.

Potato and vegetable growers are trying to meet higher demand; for example, farmers in Al Qaa (North Beqaa) confirmed that the groundwater table has dropped by 10 to 20 metres. Many rivers, water streams, and wells are running dry, and most of the remaining water bodies have become polluted or have been infiltrated by salt water in coastal areas. The lack of water means that farmers now need to purchase water for irrigation, therefore increasing their agricultural production costs.

Other natural resources are being over-exploited and depleted; in the last three years Lebanon witnessed an increase in land degradation and habitat destruction of indigenous fauna and flora in many sensitive areas. Refugees' livestock are depleting the already degraded rangelands. The presence of refugees stimulates a higher demand for wood fuel in addition to the dramatic increase of solid waste along the rivers and coastlines, and the pollution and deterioration of both potable and irrigation water (particularly in Beqaa). Combined with a year of water scarcity and haphazard land use, these factors are affecting living conditions and agricultural production, resulting in low-wage livelihoods for many Lebanese and Syrian refugees.

Food security

Food security is a major concern in crisis situations. The crisis in Syria is posing a significant challenge to food availability in neighboring countries at the national, local and household levels. The crisis is affecting food availability in neighboring countries through: (i) the negative effect on local food producing capacities, mostly due to the security situation in border areas; (ii) the increased demand for food as a result of the growing influx of refugees and returnees from Syria and the increased fiscal burden to maintain food subsidies; and (iii) the considerable fall in imports of food products from Syria (FAO, 2013).

Despite the humanitarian aid to the refugees, as well as the support of the hosting communities, the increasing needs and the deteriorating economic situation are putting the vulnerable and poor communities, especially in North Lebanon, in a very sensitive situation with regards to food security. Most of the refugees and a very high proportion of the hosting population living in rural areas and belts of poverty around major cities in Lebanon, are food insecure and suffer from malnutrition.

There are no formal refugee camps in Lebanon. The majority of the Syrian refugees are sheltered among the poorest communities of Lebanon, sharing scarce resources with

many Lebanese, who live below the poverty line. Syrian refugees are spread over 1,700 neighborhoods, towns, and villages across the country. In many rural areas and villages, their number is higher than Lebanese hosting community.

They live in Informal Tented Settlements and collective shelters predominantly located in the Bekaa (33%) and North Lebanon (29%), where agriculture is the main economic activity, followed by Beirut and Mount Lebanon (25%), and South Lebanon (12%) (FAO, 2014; FAO, 2015; WHO, 2014).

A study done by the FAO in 2015 on food security and livelihoods showed that agriculture has seen a dramatic decrease in crop yield in 2014 and 2015, threatening food security as well as the livelihood source of those involved in the sector. The results showed that 42% of Lebanese crops are currently yielding less than 50% of what they did before the crisis. The main factor for the decrease in crop yield was the reduction in access to water (FAO, 2015).

According to official estimates, more than 35% of the Syrian refugees are considered vulnerable, especially women, children under the age of 12, and the elderly. The vast majority of the refugee population is poor with low educational level, few assets and limited employment opportunities. More than 50% of the Syrian refugees have previous experience in farming. Almost half of the Syrian refugee workers are involved in agriculture or domestic services, followed by 12% who are working in construction. These are low skilled occupations that provide little income, social protection, and job security. Many Syrian refugees with farming background have brought their livestock into the country, as one of the few kinds of valuable assets (FAO, 2014; ILO, no date).

Based on a vulnerability assessment of Syrian refugees in Lebanon, conducted by the World Food Program (WFP) in 2013, almost 57% relied on employment/temporary labor as their main source of income. Another 30% percent of the interviewed refugees depend primarily on assistance (food vouchers). Of those, very few who had access to land, only a small percentage had cultivated plots (mainly with vegetables) due to limited access to inputs, irrigation water, small tools and equipment, and technical know-how. The same study revealed that nearly 70% of the households were food insecure.

Physical access (accessibility and availability) to food is most problematic in the Beqaa plain, while economic access (affordability) is compromised all over Lebanon. The immediate response to the Syria crisis from the Lebanese Government and the international community focused primarily on humanitarian assistance programs.

Selected value chains analysis and potential interventions

The three selected value chains for this study are presented in this section with their general characteristics for Lebanon and the Beqaa plain. The challenges and potential interventions for each VC are identified at each phase of the chain.

General agricultural value chain model

Before analyzing each VC, a general description of the agricultural value chains and the enabling institutional environment is needed to understand the sector dynamics. **Figure 5** presents the general analytical model of agricultural value chains and the involved stakeholders, described in the following sections and in sections V2, V3 and V4 for each corresponding VC.

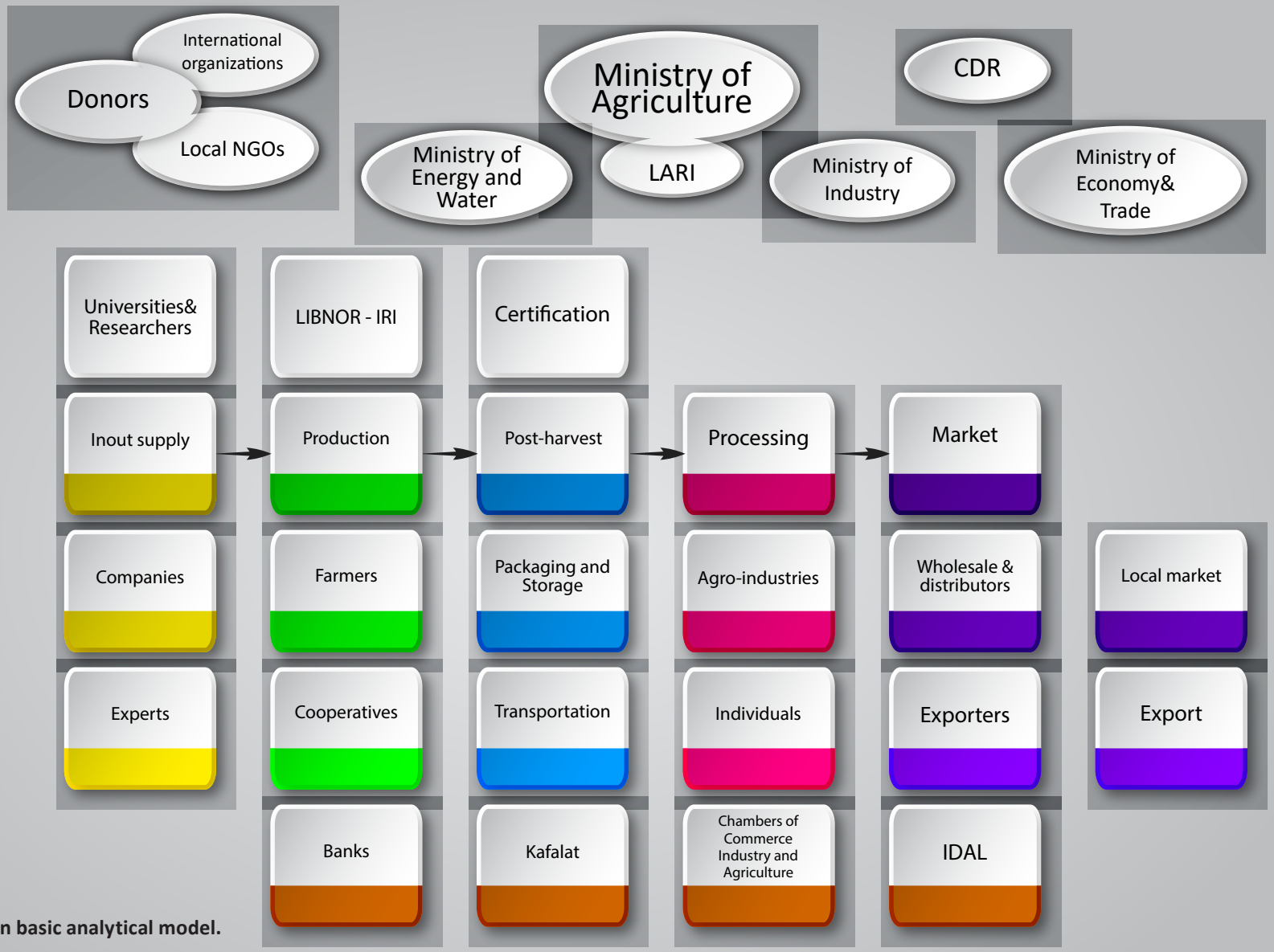


Figure 5. Value chain basic analytical model.

Source: (Author elaboration)

Agricultural value chain stakeholders in Lebanon can be divided into three groups:

1. ***Chain operators***: stakeholders that have a subsequent position in the value adding process, they include input suppliers, farmers, cooperatives, producers, packers, distributors, wholesalers and traders, local market agents, and exporters;

2. ***Chain supporters***: stakeholders that support the VC in a technical and financial way (donors, research centers, banks, chambers of commerce, etc.);

3. ***Chain influencers***: stakeholders from the institutional and governmental environment working on strategies and policies.

Chain influencers and supporters

a. Ministries and public institutions

The Ministry of Agriculture (MOA) is the main institutional actor influencing the agri-business environment. The ministry's mandate can be summarized as follows:

- Regulating the agricultural sector in terms of production, processing, marketing, as well as export and import trade (including agro-industrial food products).

- Controlling and monitoring the implementation of laws and regulations.

- Supporting the sector development including:

    - The provision of extension services related to production, harvest, storage, and transformation of agricultural products;
    - Planning and coordinating projects related to the sector;
    - Documentation, statistics, and socio-economic research.

In addition to the General Directorate for Agriculture, 3 institutions are attached to the MOA:

- The Green Plan Authority: an entity that could be considered as a department for rural development, operating in autonomy but under the tutelage of the Ministry of Agriculture. It is an executive body in charge of rural infrastructure, i.e. farm-level irrigation, rural roads, and reclamation of agricultural land.

- The Lebanese Agriculture Research Institute (LARI). LARI has its own independent budget and it is in charge of research and the provision of extension services to farmers. It is generally considered to be an efficient institution, with research programs well directed towards providing answers to farmers' production concerns and needs. LARI laboratory is performing analysis and testing for food quality and safety, supporting the ministries of Agriculture and Health, as well as providing services to farmers testing their products for export. LARI's department of food safety for analytical and microbiological test methods, as well as its department of animal diseases laboratories are seeking ISO 17025 accreditation.

- Such an accreditation, would allow LARI's laboratories analysis to be internationally recognized, facilitating export trade of Lebanese products. Unfortunately, no laboratories in Lebanon have this accreditation yet.

- The General Directorate for Cooperatives covers all cooperatives and not just agricultural cooperatives. Its impact and efficiency are usually reported by agricultural stakeholders as very limited. Its mission includes:

- Legal and financial control over cooperatives;
- Technical formation of cooperatives leadership;
- Economics and statistical follow-up of cooperatives.

However, some important issues related to agriculture and rural development do not fall under the direct responsibilities of the MOA. Large irrigation programs and water resource management are the responsibility of the Ministry of Energy and Water (MOEW) through the Litani River Authority (LRA). Existing subsidy programs are also outside of the mandate of the MOA – the wheat and sugar beet subsidy program is under the responsibility of the Ministry of Economy and Trade (MOET); tobacco monopoly is under the tutelage of the Ministry of Finance (MOF). Furthermore, issues related to food safety fall under the common jurisdiction of the MOA, the Ministry of Public Health, and the MOET. This has taken important policy tools and budgets away from the MOA. As a matter of fact, the limited budget of the ministry does not allow it to fully undertake its mandate. Therefore, it has relied on projects funded by international donors. Trade policy is in the hands of the MOET, which is supported by a Trade Agreement Committee at the Federation of the Lebanese Chambers. However, there is no national or sector export strategy. The MOET has a Trade Information Centre that provides trade statistics, import/export regulations, tariffs, trade partner search and outsourcing opportunities.

The Council for Development and Reconstruction (CDR) depends directly on the Prime Minister. On its creation in 1977, its mission was to rebuild infrastructure after the war of 1975. Since 1990, it is responsible for fundraising and negotiating with donors, for the distribution of funds to the different ministries, as well as project management. The CDR has contributed to the development of agricultural roads, implementation of irrigation systems (canals and small lakes), co-financing cooperative dairy processing, etc.

b. International organization and donors

International donors have also contributed to the enhancement of the Lebanese agricultural sector through the implementation of projects directly with the MOA, local NGOs, and/or the private sector.

In these projects, the focus was often directed towards rural development and improvement of livelihoods and/or increasing quality and compliance with international standards. Projects implemented in cooperation with the MOEW and the LRA are related to irrigation infrastructure and water resource management with the objective of improving rural economies. The FAO, UNDP, as well as the EU and the Italian Cooperation are the main partners of the MOA. Their main interventions included:

- The Olio del Lebanon project for the development of the olive oil VC and its export opportunities (Italian cooperation, 2011-2014).
- The Agricultural and Rural Development Program (EU, 2011-2016) aims at strengthening the capacity of national institutions to work on a coherent agricultural development vision, and to better implement agriculture strategic orientations, and at supporting and empowering local rural actors (farmers as well as cooperatives) by increasing access to credit and to infrastructure, including road and irrigation.
- The Recovery and Rehabilitation of Dairy Sector in Beqaa Valley and Hermel-Akkar Uplands (FAO, 2009-2016, two phases, see details in section V4).
- The UNDP “art gold” project series (implemented between 2007 and 2013 with a total budget of $12.8 million aimed at empowering local authorities and communities to actively participate in the design and implementation of development processes, including support for environmental

preservation, agricultural activities and building capacities, especially of women and youth.

The US Agency for International development (USAID) remains the main international organization, in terms of project numbers and funds, in the agricultural sector. The focus of USAID is quality increase and compliance with international standards in order to access export markets.

Currently, USAID is funding the Lebanese Industry Value Chain Development (LIVCD) project (2012-2017, with a total budget of $42 million). The project aims at creating export-oriented competitive agricultural value chains including: table grapes, avocado, cherries, apples, beekeeping, and selected processed food. Other USAID-funded projects are the Farmer-to-Farmer program that provides peer-to-peer technical support to farmers and agro-industries with senior experts from the US and the BALADI program, working closely with municipalities and cooperatives.

Chain supporters

a. Extension services and NGOs

The lack of extension services is one of the most important constraints to agricultural development. Any intervention in the sector should provide technical support and extension services. As a matter of fact, public extension services in Lebanon have historically suffered from a lack of sufficient human and financial resources. The weakness of the extension services of the MOA has opened the space for several politically affiliated, as well as civil society grass-roots based NGOs to step in the agricultural sectors through the provision of agricultural extension services. The most influential in the Beqaa are:

- Politically affiliated powerful organizations:
    - Jihad Al-Binaa: The development arm of Hezbollah works in South Lebanon and the Beqaa. Between 2005-2014, it was working closely with the ministry of agriculture since the ministry was run by a Hezbollah minister. The NGO is a partner of EU and FAO programs implemented in regions with a predominance of the Shia community.
- Grass-roots and civil society based NGOs
    - arcenciel, a Lebanese NGO established in 1984, which participates in sustainable development by supporting fragile communities and integrating marginalized individuals, has developed several rural development projects. Today, it is managing the Domaine de Taanayel in Central Beqaa and is providing extension services to local farmers.

b. Finance, credit, and export subsidies

Private sector financing and bank loans to the agriculture sector are limited. This results in a lack of investment, which is detrimental to the performance and competitiveness of agricultural activities and production. In 2010, only 1% of the farmers and holdings used the conventional agricultural credit and financing services provided by the banks. According to Darwish 2008, bank loans to farms account for only 2% of bank credit. Small farmers have very limited access to agricultural credit due to the high degree of risk associated with the management of small loans to agriculture.

In the post-war period, an important number of small and medium farmers benefited from micro-credit programs managed by small enterprises and NGOs. According to the FAO,

women account for about 20-35% of micro-credit recipients.

Wholesalers in the fruits and vegetables market act as lenders to small and medium farmers with the loans covering up to 70% of the value of the crop. Farmers use the money to cover the costs of production and harvesting. In most cases the loan includes a mutual agreement for the famer to sell the product to the wholesaler at market price (USAID, 2014a).

Kafalat: in an attempt to address the problem of agricultural financing, the government established "Kafalat" in 2000 in partnership with private banks. Kafalat is a Lebanese capital firm of public interest. Its objective is to help farmers and Small and Medium Enterprises (SMEs) in having better access to finance. It provides loan guarantees based on feasibility studies that demonstrate the viability of the proposed economic activity. According to the type of production, farmers can benefit from a grace period ranging between 1 and 3 years. Kafalat loans can reach up to $300,000 per project.

The nature of agricultural projects, usually requiring long-term financing, the general weak organizational and managerial skills of Lebanese farmers, and the conditions of bank credit pertaining to the availability of collateral all hinder access to credit and thus hamper the establishment and development of agriculture-related businesses. Nonetheless, several formal and informal credit systems exist in Lebanon, some of which have been financing agricultural projects and providing support programs for the establishment of agricultural enterprises. The Kafalat government-backed program, whose purpose is to support funding of small and medium enterprises in various sectors through commercial banks, is providing credit to agricultural investment, including loans designed for orchards start-up. In fact, agriculture's share of Kafalat loans in 2012 was the highest among all economic sectors reaching 38.7% of total loan numbers, followed by industry 28.3%, while tourism accounted for 177 projects, representing 17.3% of loans. Setting the Kafalat interest subsidy programs aside, banks are more reserved when it comes to funding agricultural businesses, and the credit approval decisions remain largely in the bankers' hands. The challenge remains to make loans accessible to a larger number of farmers, especially the owners of smaller farms.

The marginalization of poor farmers from access to commercial bank loans has led to the expansion of informal credit systems and networks, where the main actors are input suppliers who give credit to farmers often in the form of deferred payment. Despite the fact that such credit is usually accompanied by very high interest rates, it is sometimes the only option for farmers. In addition, loans from relatives or friends form an important source for working capital financing for small farmers. These loans are most often interest-free.

IDAL: The Investment Development Authority of Lebanon (IDAL) is the national investment promotion agency, established in 1994 and working to promote and facilitate investment in Lebanon, as well as to market Lebanese exports including agricultural and agro-industrial products. In 2001, IDAL and the Lebanese government established a program of export subsidies "Export Plus" in order to improve the Lebanese agricultural exports. Its objectives were the following: (1) the increase in agricultural exports; (2) the opening of new markets; (3) the improvement, quality control, and the use of new packaging techniques; (4) the transfer of knowledge to farmers and exporters.

In 2011, another program "Agri Plus" was established by IDAL to support agricultural exports, with a budget of $33.3 million for export subsidies, aiming at opening new markets for Lebanese agricultural produce. Additional subsidies of $20 million were voted by the government in order to support sea road export additional cost after the closure of the Syrian-Jordanian border.

c. Federation of Chambers of Commerce, Industry and Agriculture in Lebanon

The Federation of Chambers of Commerce, Industry and Agriculture in Lebanon (FCCIAL) was established in 1997 as the national umbrella of the four regional Chambers in Lebanon:

- Beirut and Mount Lebanon (CCIABML): more than 15,000 members
- Saida and the South (CCIAS): 7,000 active members
- Tripoli and the North (CCIAT): 6,000 members
- Zahle and the Beqaa (CCIAZ): 15,000 members.

The regional Chambers, including the Federation are active organizations with useful services for their members. Agriculture and agro-processing are priority sectors, which results in various services, such as:

- Support members in export development and export promotion (trade fairs);
- Training and workshops on themes such as management skills, food safety, business development and financial management;
- Providing information on market access requirements and consumer needs as well as specific market information on request;
- Laboratory services (in the north, in the Beqaa and in the south);
- Technical assistance and extension.

The Lebanese Chambers of Commerce were founded by special governmental decree No. 36 of 1967, which regulated their activities representing the commercial, industrial and agricultural sectors. In the Beqaa, the Chamber is a not-for-profit public utility organization, specialized in supporting trade, industry, agriculture and services. The agricultural department in the CCIAZ is an active stakeholder in the sector and is the main partner and implementer of different development projects, especially in the fields of dairy products, quality control, agri-business, and marketing.

d. Agricultural cooperatives

The International Labor Organization (ILO) paper, published in 2010, on cooperatives in the Arab states, estimated that 1,200 active cooperatives existed in Lebanon. The large majority belongs to the agriculture sector, followed by housing and credit. According to the National Federation of Lebanese Cooperatives (NFLC), there are 799 general agricultural cooperatives (crop, animal, and food processing), 49 for beekeeping, and 42 for fishing. The majority of cooperatives are located in South Lebanon, followed by North Lebanon, and the Beqaa region (ILO, 2010).

According to the MOA census of 2010, the agricultural cooperatives regroup 162,731 farmers and food processors (MOA, 2012). They are mainly based at village or regional level and specialized in specific value chains. Hence, most of them are not efficient, with many fictive ones created just to benefit from aids, rather than to have a development objective for a certain VC or market.

e. Research and education

Lebanon has a well-developed public and private university level education with five

Universities offering a degree in agricultural engineering, as well as good research centers and laboratories affiliated to ministries and Universities. The agricultural technical education suffers from several weaknesses, including the lack of interest in this field of education, insufficient budgets of the MOA, underdeveloped capacities of teaching staff, inadequate facilities and poor curricula, that do not comply with the sector requirements and market demands in terms of new specializations.

f. Certification bodies

Certification helps farmers and producers to improve the quality of their products and to access markets with higher prices. Certifiers are usually hired by farmers, processors, and some cooperatives that require a certain certification, most of the time in the framework of development projects.

In Lebanon, the certification market is still underdeveloped, there are only a few operators who provide this service: Bureau Veritas and TUV (Global GAP), IMC (organic production and IPM-Integrated Pest Management). Regarding standards and norms, LIBNOR is the public institution that sets all criteria related to safety and hygiene for processed food.

Chain operators

a. Input suppliers

Input supply in Lebanon (seeds, seedlings, rootstocks, irrigation systems, fertilizers, pesticides) is controlled by the private sector. Inputs are available on the market with more than 200 suppliers and distributors located all over Lebanon (among which 10 are large suppliers). The Beqaa plain has more than 100 input suppliers and distributors.

A striking fact is that more than 90% of input sales are made on credit, as farmers need supplies at the beginning of the season, but are unable to pay until harvest time. Thus, input suppliers provide farmers with loan facilities to cover the costs at the start of the season. They also provide extension services to farmers along with the promotion of their products (CBI, 2016).

b. Packaging, sorting, and storage facilities

There are around 100 sorting, packing, and storage facilities in Lebanon with different sizes and capacities; among which 45 have cold storage. They handle fruits and vegetables for export markets, high-end retail shops or supermarkets in Beirut. Despite the effort invested by some private sector operators and in the framework on development projects with local NGOs and cooperatives, these facilities remain unequally distributed in Lebanon (predominantly in the Beqaa and Mount Lebanon) and are underdeveloped and insufficient in terms of capacity and quality of refrigeration (ILO, 2015; CBI, 2016; interviews).

c. Wholesale markets and distributors

There are seven main wholesale markets in Lebanon and two smaller ones, covering all production regions from north to south. Wholesale markets in the main agricultural areas of Lebanon (such as in Akkar and the Beqaa) are typically consignment markets that connect local supply with domestic outlets and export markets. Outside the production season, these markets change into trade markets, supplying the regional markets with mainly imported produce.

All wholesale markets are run and managed as a private business. The market infrastructure and facilities are underdeveloped and the price-setting mechanism is far from professional

and transparent. Most of the trade is done on consignment. The official commission fee in the market ranges between 7 to 10% of the sales value. There is no system of quality regulations at the national level, nor at the wholesale market level.

National, regional, and local distributors buy from the wholesale markets and from importers (sometimes directly from big farmers) and then distribute to the retail market and restaurants and catering operations.

d. Local market retailers and HORECA

The local market is formed of small and medium shops, supermarkets, and some F&B specialized shops. It has shown a fast development during the last two decades with an increasing number of retail outlets, particularly super- and hypermarkets. The HORECA market (Hotel-Restaurants-Catering) has also an important share of the agricultural fresh and processed products.

e. Packers and exporters

There are around 60 active agricultural exporters in Lebanon. They mostly source their products from wholesale markets and/or directly from medium and big farmers. Very few big farmers have an export position by themselves. The majority of packers/exporters also supplies the domestic market. Exporters are not used to cooperate in export marketing.

Potato value chain

Potato is one of the major cash crops in the Beqaa plain, with 70% of the Lebanese production (the remaining 30% is produced in Akkar plain). According to the FAO, between 2010 and 2014, the total area cultivated with potatoes in Lebanon increased from 11,131 ha to 17,352 ha (an increase of 56%). Potatoes are mainly concentrated in the West and Central part of the Beqaa plain adding up to 73% of the plain' production, while Baalbeck-Hermel accounts only for 27%. In 2014, potato production reached its highest level in the last five years with 440,000 tons and ranked first in the top ten agricultural commodities produced in Lebanon. This is in complete contrast to the local perceptions that potato production and profitability is declining.

The potato VC in Lebanon is complex with many stakeholders playing more than one role. For instance, one person can be at the same time a farmer, trader, importer of seeds, owner of a shop at the wholesale market, or chairman of a cooperative (ILO, 2015).

More than 60% of the potato farmers in the Beqaa plain are specialized farmers working on leased land. According to the 2010 MOA agricultural census, the following three potato farmer profiles could be identified in the Beqaa plain:

- Large scale farmers/traders (5% of potatoes farmers in the Beqaa) cultivating land plots larger than 50 ha and controlling around 26% of the potato cultivated area (CA).
- Small and medium scale farmers constitute 95% of the potato farmers in the Beqaa:
    - Medium farmers' average cultivated plot vary between 5 and 50 ha, they control 54% of the potato CA.
    - Small farmers cultivate lands plots varying between 0.5 and 5 ha and occupy 20% of the potato CA.

Figure 6 is a representation of the potato VC structure, which will be detailed in the following sections.

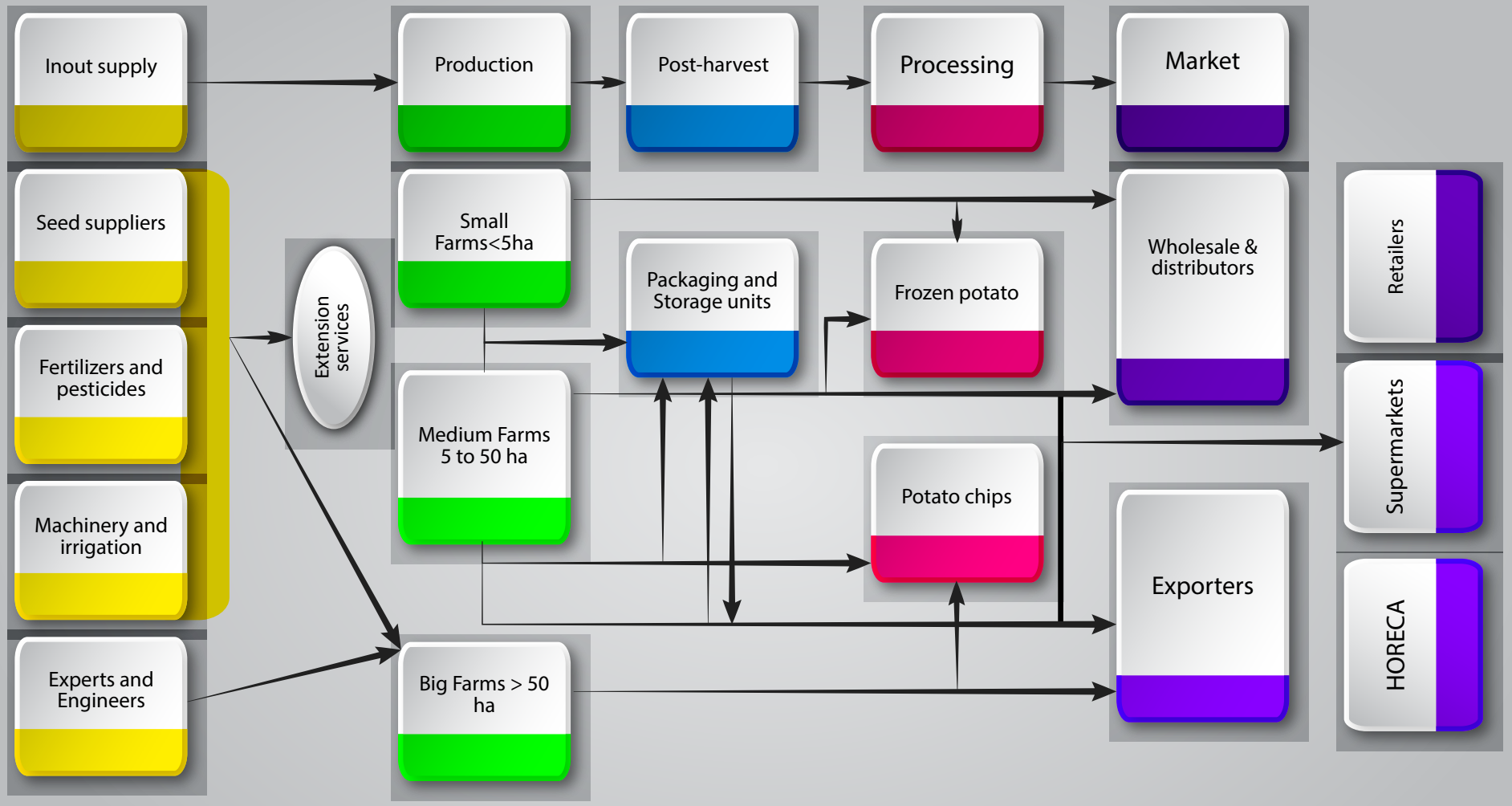


Figure 6. Potatoes value chain structure.

Source: (Author elaboration)

Input supply for potatoes VC

Inputs supply includes land, seeds, water, equipment, fertilizers, and pesticides. These production factors are key elements of the potato VC in the Beqaa plain. Land appropriated for potatoes is relatively scarce since it requires deep soils; therefore, leased land is overexploited and requires high input of fertilizer, and intensive weed and pest management. Land rental prices have been trending upwards in the Beqaa plain, especially in West and Central Beqaa due to increased demand for land. The cost of some agricultural inputs has also increased since the beginning of the Syrian crisis in 2011, particularly in border areas where fertilizers and pesticides were imported from Syria.

In terms of seed production, Lebanon does not produce any certified seeds and there are no gene banks or potato breeders. Certified seed potato is imported mainly from European countries (70% from the Netherlands). Other source countries are Belgium, France, Germany, and Denmark. Currently, around 35 companies are importing potato seed into Lebanon, including some big farmers who import their own seeds. A comprehensive system is in place for controlling the import of certified seed by the Government (ILO, 2015; CBI, 2016).

Specialists at LARI argue that better varieties than the most commonly grown spunta are available. LARI evaluates all potato varieties imported into the country for 3 years before they are officially released for commercial production. The purpose is to determine if new varieties are suitable for the Lebanese conditions and perform better than local checks. These evaluations are done on farmers' fields. The new varieties are evaluated for their physiological traits, plant height, tillering, leaf color, lea surface area, tuber size and volume, tuber skin color, tuber flesh color, dry matter, yield, yield stability and sensitivity to chemicals (herbicides and pesticides). After satisfactory performance over available checks, the new variety is released for production and traders are allowed to import.

In the Beqaa plain, potatoes are irrigated from artesian wells mainly; each crop is irrigated 4 times on average. Small and medium farmers often use old equipment and machinery. Without proper equipment, potatoes can be hard to manage; they are prone to disease and subject to tuber degeneration. Crop rotation is not widely practiced, which increases the risks of soil-borne diseases and pests, in addition to lowering the soil quality and fertility.

V.2.2. Potato production

Potatoes are grown in two seasons in the Beqaa plain, planting of the spring crop occurs in February through March, with harvest in June through July. A late crop is planted in July or August and harvested in October through November. However, potato can be planted any time from February to July. Large holder producers are most likely to favor potato production because they can afford to store part of it for later sales with better market prices. Also some large producers are exporters or have good marketing strategies, such as direct marketing or contractual agreements with the processing industry. Potatoes can be classified into three groups by the duration of their growing periods: (1) early varieties with a growing period of 80-90 days, (2) medium 100-120 days, and (3) long cycle taking over 140 days. The later varieties are often used for making chips.

Potato farmers in the Beqaa plain mainly grow the following varieties: Spunta and Lady Rosetta for consumption on the local market and for exports (85% to 90% of the production), Asterix, Agria and Diamond for agro-industries producing chips and frozen fries (10 to 15% of the production). They also grow other varieties such as Fabula, Silvana, Hermes, Disco, and Fontana. Spunta is by far the most popular variety estimated to cover about 70%, with an average yield of 3.5-4 tons/dunum. Spunta is grown for domestic consumption and for exports, with a creamy skin color and yellow flesh. Agria covers about 3%, with an average yield of 5-6 tons/dunum and mainly destined for local consumption and for processing fresh

French fries. It has a yellow skin and light-yellowish flesh and the main variety for making potato chips. Asterix is also grown on smaller areas under contractual arrangements with the processing industry for making frozen French fries. Some farmers consider Fabula to be an important variety, with a yield of about 4 tons/dunum, which has been exported in the past to Jordan and Bahrain. It has a yellow skin and light-yellowish flesh.

To better understand the potato value chain in Lebanon, the production cost is calculated here based on field observations and interviews for 1 dunum of land. Since production costs vary, especially between the Beqaa regions and the farmers' profile, average prices are taken into consideration for each factor.

An estimate of the potato production cost is given in Box 1, which shows that the crop is profitable. The production per ton for a yield of 4 tons per dunum is about USD216, this will go up to USD288 per ton for a lower productivity level of 3 tons per dunum. These results indicate that current prices of USD300 per ton are only good for farmers getting higher yields. Given the fact that the market is competitive and farmers have no control over the prices they receive, increasing productivity whilst keeping costs down is the only way that farmers can achieve profits. Interventions at the producer level should make this a major objective. Some costs, such as land rent, are fixed and outside of the control of farmers. By using new and higher yielding potato varieties, improving management practices and reducing the intensity of input use, farmers can increase productivity and reduce the cost of production. By storing the potatoes and paying the cold storage cost for three months, the price can reach up to USD500 per ton which can quadruple net farm income.

Box 1. Estimated potato production cost per dunum in USD.

Items	Value
Land rent	300
Land preparation	23.2
Seeds	150.0
Labor	80.0
Sowing labor machine	23.0
Fertilizer	150.0
Pesticides	30.0
Energy for irrigation	30.0
Harvesting	50.0
Transportation	26.5
Total	862.8
Yield (tons)	4.0
Price (USD/ton)	300.0
Revenue (USD)	1080
Profits (USD)	217.2
Unit production cost @4t	216
Unit production cost @3t	288

Potatoes post-harvest and processing

There are around 60 sorting, packing, and storage facilities in the Beqaa plain of different sizes and capacities. They handle fruits and vegetables (including potatoes) for export markets, high-end retail shops, or supermarkets in Beirut. Around 10 of these facilities are well equipped, while the others (small and medium size) are old and semi-automated. Among the 60 facilities, 8 specialize in processing potatoes and are all located in Central Beqaa. It is worth mentioning that most of the post-harvest facilities are family businesses of export traders who compete with one another (ILO, 2015; CBI, 2016).

Daily workers are hired for sorting and packing. The post-harvest facilities employ both Lebanese and migrant workers (including Syrians), males and females, generally at equal levels in terms of working conditions. Men are frequently paid more than women, as men are involved in loading and unloading of produce, which is considered as more physical

work. Lebanese workers are paid 5% to 10% more than Syrian workers and are usually more trusted in handling sensitive products. The level of activity of these facilities is directly related to the demand level in export markets. The higher the demand, the more workers are hired to fulfil the orders (ILO, 2015).

In terms of processing, there are three large-scale potato-processing units in the Beqaa plain (producing mainly chips) and around 15 small and medium size units (producing chips and frozen potatoes). There are only 4 processing companies specializing in frozen French fries, which demand more complex processing procedures, while there are many companies in Beqaa that make fresh French fries. There are only 5 large-scale potato chip producing companies in Lebanon. Normally, processing requires potato with high dry matter. In addition to French fries and chips, another product is potato powder, which is used in food processing. One company we interviewed processes 4t of potato per day, but its capacity can reach up to 8 or 9 tons per day showing underutilization. The variety Agria is good for fresh potato used for French fries and the variety Asterix, which has a red skin, is used for frozen French fries. These products are for the local, mainly fast food market. There have been exports of processed potato products to Syria and Jordan, which has now stopped. The processing industry has a sufficient supply of potatoes. The purchase price is US$270-300 per ton. This is after 10% of the production is deducted because of impurities. The selling price after processing is US$ 600 per ton for fresh and US$1200-US$2000 for frozen French fries. The transformation rate for the fresh product (French fries) is 1:0.75, meaning 1 ton for raw product (potatoes) for every 750 Kg of the final product (french-fries) and 1:1 for frozen product. The difference is that the frozen requires the removal of oil. For one interviewed company in the central Beqaa, the frozen product has a much bigger demand, accounting for 70% of the company's production whereas the freshproduct only accounts for 30%. Some processors contact farmers in order to agree the varieties for production and prices before planting. Processors do not require any global or national good agricultural production practices because, as the processor put it, there is no demand in the market. This particular processor employs 25 Syrians, of which 20 are female, at the rate of LB14,000 per day for 8 hours.

Potatoes market

a. Local market (55% of the production)

Potato farmers in the Beqaa supply the local market through different channels:

- Very small farmers do direct sale to retailers, restaurants, and small traders, as well as to final consumers (less than 1% of the local market production). The average price for this market channel is around 600 LBP per kg.

- Small and medium farmers sell to the wholesale market in Qab Elias, located in Central Beqaa (the biggest in Lebanon), and to traders and distributors, who sell to retailers/supermarkets/and HORECA customers (around 65 to 75% of the local market production). The farm level prices differ significantly from one season to the next and vary with production volume, quality, and the farmers' capacity to negotiate. Prices could reach a low of 200 LBP and a high of 800 LBP with a typical average of around 450 LBP. Market middlemen (traders, storage facilities, wholesalers, distributors, transporters) add around 60% to the basic price, then retailers (shops and supermarkets) add about 50%, to have a consumer price averaging between 1000 and 1250 LBP/kg. In this case, farmers are often dependent on traders, who have the upper hand when negotiating prices because the farmer is constantly in debt to the trader for the cost of seeds, fertilizers and pesticides that were received in advance.

- Medium- and large-scale farmers, who sell part of their production to distributors, traders, or are traders themselves (around 25% of the local production), have also:

    ° Yearly contracts with supermarkets in Beirut. In this case, the price is fixed in

advance and the average is 450 LBP; and/or

- Their own outlets in wholesale market and distribution tracks. In this case, they have the ability to control the price and to avoid the commissions of the middlemen.

- Medium and big farmers specialized in cultivating potatoes for processing (5 to 10% of the local production). They sell their production to processors through contracts with fixed prices (average 500 LBP).

The contract farming system represented by sales to supermarkets and/or to processors based on yearly or seasonal contracts has its advantages and disadvantages. The farmer can guarantee a fixed price that may be higher than the market price in some seasons; however, in other seasons the market price could be higher than the contract price. As a consequence, according to field interviews, it was revealed that in both cases some contracts are not respected and conflicts may arise between the two parties. Contract farming is important for the processing industry which requires specific varieties and potato grades. Effective farmer cooperatives could be helpful in maintaining contract farming arrangements.

Direct marketing of production to consumers or retailers is an option but not that suitable for potatoes because it is a bulky crop. Direct marketing is more applicable for high value specially crops, for example, organically produced commodities ,which may face challenges in selling at the common markets. Farmer's market day is a concept, where farmers can do direct marketing, which can yield much higher prices than wholesale prices. Another area that offers more opportunity is the use of cold storage. Although large scale farmers, some of who are also traders, use cold storage to manage potato marketing, small holder farmers are not frequently using it. The reason is that smallholder farmers need immediate cash to pay their expenses. More awareness building would be needed for smallholder farmers to use cold storage facilities. There is sufficient cold storage infrastructure and interest in increasing that capacity by some large scale farmers. Arcenciel (national humanitarian organization) has a cool storage facility with a capacity of 1600 tons, which can store potatoes and apples for farmers and improve their marketing options and incomes. During the time of this study, Arcenciel had been storing 1400 tons of potato for farmers. The fee for cold storage is US$45-50 per ton for the first 3 months and then US$15 per ton for every month after that.

b. Exports (45% of the production)

Potatoes are one of the major exported crops, representing 21% of the entire agricultural fruits and vegetables export. According to IDAL, there are 102 registered exporters of potatoes in Lebanon, 70% of them are located in the Beqaa plain (the rest are in the North, Mount Lebanon and Beirut Suburbs). More than half of the Beqaa exporters are medium- and large-scale farmers (IDAL, 2016).

The quantity of potatoes exported from Lebanon has varied a lot in the last seven years. After recording 109,000 tons in 2010 (41% of production) and 118,000 in 2011 (43% of the production), potatoes exports dropped to 98,000 in 2012 (35% of the production). In 2013 and 2014, it increased significantly with 192,000 tons (47% of the production) and 238,000 tons (54% of the production) respectively, recording the highest export value of 37 and 49 Million $. In 2015 and 2016, it dropped back to 144,000 and 135,000 tons (41% of the production). These fluctuations in the exports are related to the situation in the Middle East and the market dynamics of the importing/exporting countries (**Figure 7**).

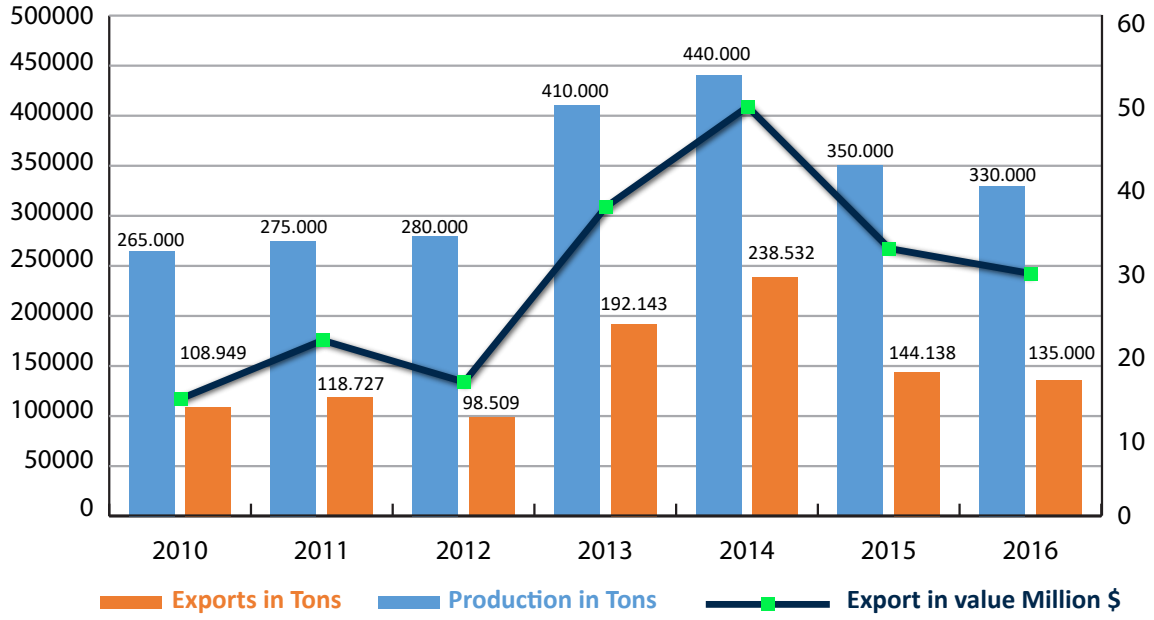


Figure 7. Potatoes production and exports quantity and value.

Source: MOA and FAOSTAT

Lebanon's potatoes are mainly exported to neighboring Arab and GCC countries in addition to Russia and some African countries. However, this has been affected by the closure of trade routes by land through Syria. Most export markets show growing imports of Lebanese potatoes, but the strongest growth in value is registered in exports to the United Arab Emirates and Jordan, especially between 2013 and 2014 (ILO, 2015; IDAL, 2016).

Potatoes export from Lebanon has been greatly affected by the Syrian crisis during the last five years. The collapse of the Syrian agriculture has increased the demand from GCC countries for Lebanese agricultural products. However, export road routes to GCC countries have been closed since May 2015 and potato exporters have to take the more expensive sea route.

Land transportation costs have greatly increased to cover additional expenses to pass through the Syrian territories when roads are open, and security issues have created a great threat to goods transported through Syria. Some exporters have tried to transport potatoes via sea ferries to the Gulf countries in order to avoid driving through Syria. Some exports are now being done by sea but considered to be more expensive. Currently, some large farmers export up to half of their production by sea.

Competition of potato imports comes mainly from Egypt, which is only allowed during the "off season" in Lebanon, from February to March. Potato imports are not allowed outside that brief window. However, producers complain that traders import huge quantities during that period and store it for sales after the import windows is closed. Although, some interviewed farmers are pessimistic about potato production because of trade disruptions via Syria, high transportation costs by sea, and higher costs of production in Lebanon relative to competitors like Egypt, potato still remains a major crop in the region.

In 1998, Lebanon agreed a yearly free quota of 50,000 tons with the EU. It took until 2013 to overcome obstacles concerning residues and phyto-sanitary problems (Phytophtora). In August 2013, the EC published their decision (2013/413/EU) and paved the way for the export of Lebanese potatoes to the EU. The decision allows EU imports of 50,000 tons of potatoes

not intended for planting. The possibility to export into the EU was expected to provide substantial economic opportunities. However, the price of potatoes in the local market almost rose to the same level of export prices, which led to a huge decrease of potatoes available for export to the EU. Furthermore, Lebanese potatoes have to be shipped to the EU through a designated point of entry (currently only Italy) in order to ensure effective controls and fulfil phyto-sanitary requirements (ILO, 2015; CBI, 2016).

Additionally, any consignments need to be accompanied by a phyto-sanitary certificate issued by the competent authority in Lebanon, which is the Ministry of Agriculture. Support was provided by the European Union and Member States, notably Italy and its Embassy to Lebanon through a €400,000 project implemented with the L'Istituto Agronomico Mediterraneo di Bari between 2010 and 2012. Unfortunately, despite this opportunity, the price of Lebanese potatoes is not competitive and is even higher than the price of potatoes already available in most export destinations. Until now, not a single kilogram of potatoes has been shipped to the EU (ILO, 2015). However, it is important to note that the option of the EU market is not for Beqaa, as its harvest times overlap with those of Europe. However, the option is possible for Akkar, where the harvest season begins much earlier. The impact of such intervention should target small and medium farmers in the Akkar region, where the sector is less dominated by large-scale farmers and potatoes are ready to be harvested prior to Europe's harvest. Consequently, a market window could be available in April/May.

Potatoes VC analysis and potential interventions

With an increase in production costs, tough competition from cheap Egyptian and Syrian produce in domestic markets, and blocked transit roads for export, Beqaa plain potato farmers are in a critical situation. Their products are not competitive and cannot compete on the external markets. In the last five years, potato farmers could barely cover the production costs and traders are always concerned about their capacity to export. Seeds are the most expensive item in the overall costs of potato production.

Overall, potato production is highly demanding in terms of high cost of seeds, mechanization, and/or seasonal labor, especially during harvest. However, a more rational use of inputs can reduce the cost of production. Farmers are not getting sufficient and independent advice from extension services[10]. Typically, farmers receive advice from input suppliers, who link their services to increasing the sales of their products. Implementing good agricultural practices and improving phyto-sanitary practice are essential in potato production since this is a major factor influencing exports. The adoption of high yielding potato varieties could decrease the cost of production, enabling farmers to increase their profits and allowing exporters to compete in the international market. These changes require effective programs of building small and medium farmers' innovative capacities through experiential learning of new practices with the aim of reducing costs and increasing net income. There is a substantial reservoir of knowledge of efficient production by large-scale farmers, who are also traders, who can transfer that knowledge to small and medium farmers through the mediation of public and civil society institutions.

In terms of market mechanisms, the sector suffers from overproduction, especially after the government has stopped subsidizing beetroot production, inducing a farmer shift towards potatoes. An excess supply of potatoes reduces the farmers bargaining power, often leading to very low farm gate prices and limited farmer profit. The introduction of new varieties to small and medium farmers, especially for processing is also a good strategy to avoid market risks and to have a guaranteed price through contract farming with processing units. On the marketing side, small-scale and medium-scale farmers have to use cold storage more often to obtain higher revenues later in the season and increase their incomes. Specific actions in all these aspects, linking major constraints and corresponding potential interventions of the

10 In Lebanon, less than 11% of farmers receive it, of which 86% get it through input providers (MoA, 2012), who are thus able to control the farmers and the whole VC.

potatoes VC in the Beqaa plain, are presented in **Table 15**.

Table 15. Potatoes value chain constraints and potential interventions.

VC phase	Constraints	Potential interventions
Input supply, extension and production	High cost of production and high level of input use. Farmers have no confidence in the quality of inputs. Farmers depend on input suppliers who have strong control through debts and extension services related to the sales of their products. Input suppliers advise farmers about input use levels. Due to lack of effective extension system. This leads to improper and excessive use of pesticides leading potentially to high residues, high cost, water contamination. Also low adoption of higher yielding varieties.	Establish demonstration fields in a farmer participatory manner as innovation and learning platforms to demonstrate more rational and optimal use of agricultural chemicals, organize farmer participation similar to the Famer Field Schools and peer to peer farmer communication that shows reduction in the cost of production and increased yields, while adhering to the principles of good agricultural practices. The latter is now increasingly being demanded by importing countries as consumers become more aware of the health, environmental and ethical considerations. ICARDA, LARI and Arcenciel can collaborate on this intervention.
		LARI can participate in demonstrating new potato varieties, their productivity, and different uses so that farmers can evaluate and adopt. Arcenciel can be provide the experience of more efficient production practices at their farm and provide farmers trainings and hands on experience in their farm and this will add value to demonstration fields mentioned above.
		ICARDA with its strong research and vast experience can provide water management guidelines and monitoring and provide farmers with practices for more efficient use of water. This should be part of the demonstration and learning fields mentioned above. The effect of water quality on product quality should also be measured and farmers made aware of that.
Post-harvest	The most difficult problem here is the fall in prices at harvest because of high supply, this cuts into farmers' net returns and makes potato uncompetitive.	Many large scale farmers use cool storage as a marketing strategy and gain from higher prices later in the season, small scale farmers do not see that so often because they need to pay expenses immediately. There is sufficient cool storage available and there is interest to invest more in that capacity. The awareness of small scale farmers to use cool storage should be raised and they should be assisted to develop a strategy to cover their expense needs without losing value of their potato by selling at low prices in the high supply season, rather than storing at least a part of their harvest. A special awareness program for small and medium farmers is essential in a participatory manner to explore ways of using cold storage.
Marketing	The process of cleaning the tubers is not efficient and affects its marketing.	Awareness and support for the deployment of more efficient cleaning machines and better packaging is needed to improve marketability particularly for export markets. Large-scale farmers who are also traders have good practices, small-scale farmers can be exposed to these practices through a farmer-to-farmer learning program. Direct marketing to consumers could be an option particularly for small-scale farmers, if it is organized by farmer organizations, municipalities, or public and civil society organizations. Such efforts should be supported. Arcenciel have experience in organizing direct marketing for farmers.
Syrian refugees	Lack of knowledge of good agricultural practices and optimization.	Syrian refugees can benefit from training in better use and management of chemicals and other inputs, and from learning more efficient management practices as human capacity development. Besides this capacity development, options for the Syrian refugees to directly benefit from the thee value chains are discussed at the end of the concluding section.

Tomatoes value chain

Tomato is one of the major vegetable crops in Lebanon and is ranks as the second vegetable crop after potatoes in terms of cultivated area, production volume, and value. According to MOA and FAO, the total cultivated area as 4,380 ha in 2010 and dropped to 3,460 ha in 2014. However, the production volume remained almost stable with 281,117 tons in 2010 and 274,372 tons in 2014. This could be explained by the decrease of the open field tomato cultivation (located mainly in the Beqaa plain and in some mountain areas up to 1,500m above sea level) and the increase of greenhouses in areas located mainly on the coastal zone, which is considered to be more efficient and profitable.

In 2010, the Beqaa plain accounted for 37% of the total cultivated area in Lebanon[11] (16% in Central and West Beqaa and 22% in Baalbeck-Hermel). The local climate and the soils in Beqaa plain tend to favor open field production of tomatoes, covering 97% of the cultivated area in the region; while only 3% is cultivated in greenhouses (**Table 16**).

Table 16. Tomatoes cultivated area distribution in the Beqaa plain in 2010.

Beqaa governorate	Open field area (ha)	Greenhouse area (ha)
Baalbeck-Hermel	930	26.6
Central Beqaa	406	7.5
West Beqaa	271	9.8
Total	1,607	43.9

Source: (MOA, 2012) Results of the agricultural census for 2010

Tomato yield is estimated at between 5 and 7 tons per dunum for open field and 20 tons per greenhouse on average, with the total production in the Beqaa plain of around 100,000 tons.

Tomato farmers in the Beqaa plain are characterized by their diverse profiles and farm sizes. In Hermel and West Beqaa, 70% of the farmers are small-scale and have less than 0.1 ha. The remaining 30% have land plots varying between 1 and 2 ha and are considered medium farmers. Farmers in these two areas (West Beqaa and Hermel) usually practice farming as a secondary source of income on owned lands and have combined cropping systems with multiple vegetables and sometime fruit trees (Mercy Corps, 2014a).

In Central Beqaa and Baalbeck, 47% of the farmers have less than 0.1 ha and they have the same profile as Hermel and West Beqaa farmers. The remaining 53% have land plots varying between 2 and 5 ha and are more specialized in vegetable production in general. They tend to use agriculture as their main source of income. They cultivate on their own land and rent additional plots to increase their production volume. Some big tomato farmers also act as traders/exporters at the same time (Mercy Corps, 2014a).

Figure 8 is a representation of the tomatoes VC structure, which will be detailed in the following sections.

11 The remaining tomatoes CA is distributed as follow: 26% in North Lebanon and Akkar, 17% in Mount Lebanon, 10% in Nabatiyeh, and 9% in South Lebanon.

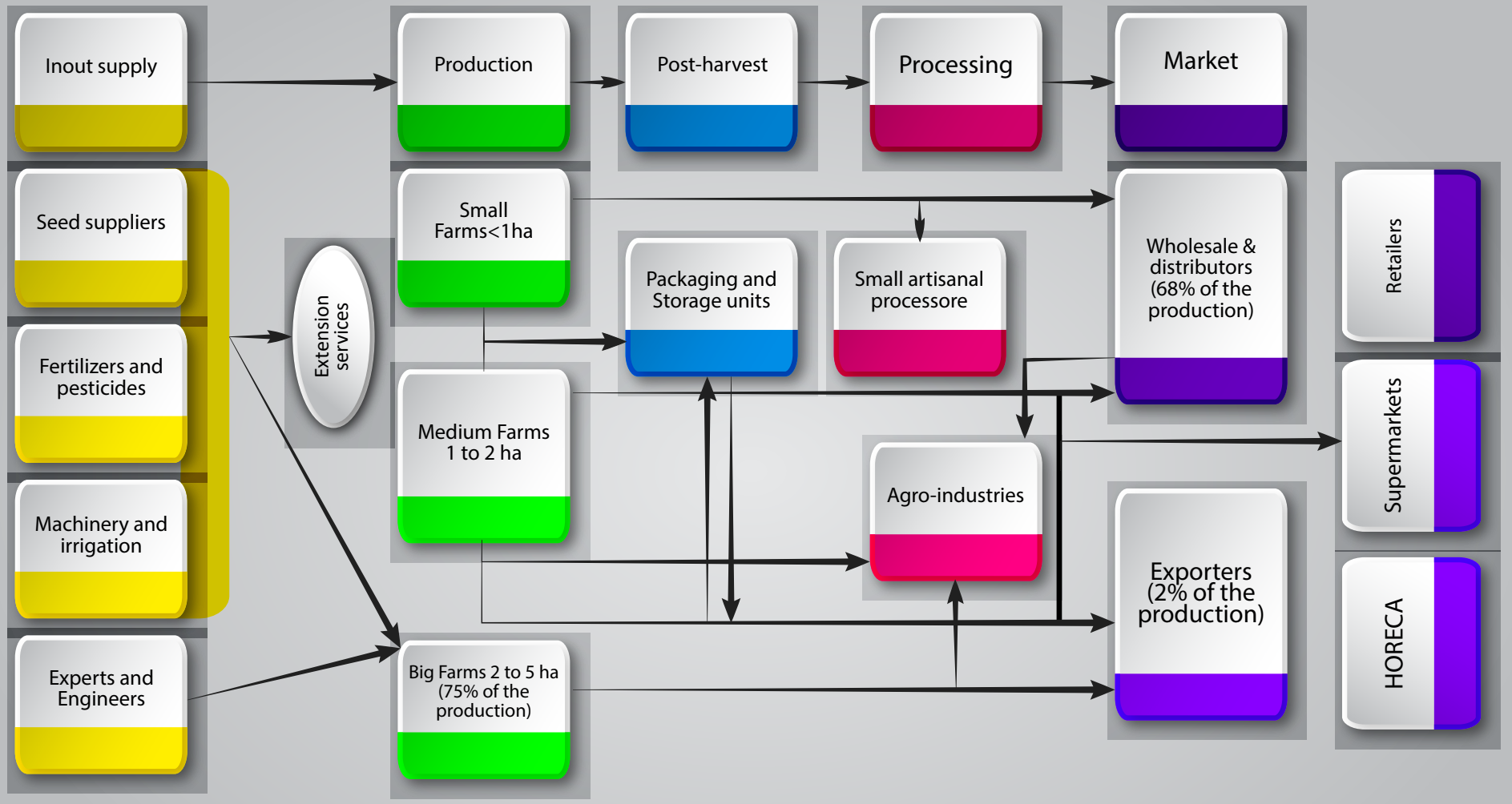


Figure 8. Tomatoes value chain structure.

Source: (Authors elaboration)

Input supply for tomatoes VC

Input supplies include land, seedlings, water, equipment, fertilizers, and pesticides. These production factors are key elements of the tomato VC in the Beqaa plain. Land rental for tomato cultivation varies between $125 in Baalbeck-Hermel and $300 in West Beqaa, whereas central Beqaa has an average price of $200 to $300 per dunum depending on location, market proximity, and land quality. Farmers buy tomato seedlings, fertilizers, and pesticides from more than 100 local distributers in the Beqaa plain, who buy the inputs from around 20 large national suppliers. The cost of some agricultural inputs has also increased for the tomato producers in the Beqaa plain. Before the Syrian crisis began in 2011, fertilizers and pesticides were imported from Syria.

In the Beqaa plain, most of the tomato farmers use drip irrigation. Open field tomatoes are irrigated 2 to 3 times per week (depending on weather conditions). Greenhouse tomato needs less irrigation due to reduced evaporation. Black plastic mulch is used by farmers to prevent weed growth and evaporation.

Tomatoes production

The Beqaa tomatoes are mainly destined for local fresh consumption, and to a lower extent for agro industry and export. Tomato farmers in the Beqaa plain use indeterminate tomatoes inside greenhouses, and determinate tomatoes for open field production. Improved varieties of tomatoes, led by the Vale F1 variety, are adopted in greenhouses, which increases the crop resistance to diseases and results in better yields. In open field production, a wider range of varieties is used, including Cristal, Baladi/Jabali, and Ammani (Jordanian), which is the most popular for both the fresh and processed markets. In general, farmers buy the seeds from input suppliers and give them to local nurseries to germinate them. Seeds cost between $15/1000 seed for the Baladi variety and $60/1000 seed for the Vale variety; germination in the nursery costs on average 0.2$/seedling (Mercy Corps, 2014a).

Except for the few farmers who grow tomatoes in greenhouses, the production is generally limited to one season in the Beqaa plain, due to the need for crop rotation. In the open field system, tomatoes are planted in April and May and harvest begins at the end of June and peaks towards the end of July and early August. Greenhouse farmers plant tomatoes in April and harvest between mid-May and mid-August for the first season. For the second season, they plant in mid-September and harvest in November and December.

The average cost of tomato production is $1,000 per dunum in open field, and the same value for a greenhouse with the size of 330 m^2, excluding the investment cost of the greenhouse and the irrigation system (around $3,500/greenhouse). The detailed estimation of the tomato production cost for one dunum in open field is calculated below based on field observations and interviews:

- Land rental = 300,000 LBP per season
- Seedlings = 350,000 LBP
- Fertilizers = 200,000 LBP
- Farming operations = 100,000 LBP
- Plastic mulch = 100,000 LBP
- Pesticides = 200,000 LBP
- Irrigation = 150,000 LBP
- Harvesting = 100,000 LBP

The total cost for 1 dunum of tomato is LBP 1,500,000 (or US$ 995.0 at the rate of LBP 1507.0 per USD, on 3rd July, 2017). If the minimum production per dunum is 5 tons, then the cost of 1 kg of tomato is around 300 LBP. On the output side, prices fluctuate and can reach up to LBP 600,000 and drop to as low as LBP 300,000 per ton. Based on the above cost estimates, farmers will make losses at those lower end prices. Although drip irrigation and fertigation are used in Beqaa, pesticides are applied quite intensively on tomatoes. There is little consciousness on integrated pest management and many farmers had no practical experience or training in the use of IPM (Box 2).

Box 2. Small scale tomato grower in Central Beqaa

This farmer mainly grows tomatoes, which he has been growing since he was young as far back as he can remember. He has 32 dunum of land and, this year (2017), he cultivated 18 dunum of tomatoes and last year he cultivated 20 dunum of tomato. He also grows a variety of other vegetable crops. In addition to the tomatoes, this year he cultivated cucumber on 4 dunum, green beans (lubia) on 4 dunum, peppers on 2 dunum, yellow melon on 2 dunum, and zucchini on 2 dunum. Wheat was grown in the winter season before tomato, which is one of the common crop rotations in Beqaa. Last year, he cultivated 20 dunum of tomato. Tomato is a priority for this farmer to which he allocates about 60% of his land. He gets about 600 boxes of 17Kg each (equal to 10.2 tons) per dunum on open field and sells at a price of LBP7000 per box (LBP412,000). This farmer has no problem in marketing. He sells tomatoes at his brothers' wholesale vegetable store in a nearby town. Pesticide applications are needed every 12 days during the growing period. Harvest lasts about 4 months (July to October). Planting starts in mid-May and harvesting starts in mid-July. He also applies Sulphur powder for pest control. There is no concept of IPM and he has not received any training in tomato pest management, but he received training in cucumber pest control. This farmer is thinking of shifting more to plastic house production which can give two crops per year. The farmer has 8 Syrian female workers (3 younger girls and 5 older women) at a wage of LB16,000 per day of two shifts of 5 hours each (which means LB8000 per shift of 5 hours). This farmer gets water from Anjar, which is 2 km away. Water is pumped from a spring 2 km away and is collected in a pond at the farm, which is 8 m deep and 10 X 10 m dimensions. The municipality of Anjar sells water at the rate of LB100,000 per (US$66) dunum, meaning water is not sold by volume but by land area. The farmer applies drip irrigation in all of his vegetable crops to economize water. Fertigation is also used on this farm.

Tomatoes post-harvest and processing

Tomatoes for fresh consumption are hand-harvested in the early morning, packed, and sent directly to the wholesale market in order to preserve their quality and freshness and to receive the best price. Heat damage resulting in soft fruit usually occurs during transportation, especially when small and medium farmers use open bed pick-ups. Sorting the harvested tomatoes per size and quality is not a common practice. Big farmers employ full-time Syrian workers, while small and medium farmers rely on both family labor and daily Syrian workers for the harvesting operation. Cold storage is not used for tomatoes (Mercy Corps, 2014a).

In terms of processing, around 10% of the Beqaa tomatoes are destined for processing (grown exclusively in open field). Paste and sauces constitute around 90% of the processed tomatoes. The medium and big processing units are mostly supplied by traders and from the wholesale market, and to a lower extent from some medium farmers directly. However, contract farming does not exist except for one case where the processor provides a group of growers with all the needed inputs and buys back their production. On a small scale, around 30 women cooperatives and small processors buy very limited quantities from small farmers and produce high end tomato products such as pickles, sun dried tomatoes, and jams, which are products highly demanded by some restaurants (Mercy Corps, 2014a).

Tomatoes market

Tomato prices are affected by quality, size, and color of the fruit. Traders in the wholesale market and exporters prefer medium to large size red-colored tomatoes (green-colored ones are avoided). Tomatoes should be ripe, but firm, and undamaged.

Tomato farmers, especially small and medium size, are often dependent on traders. Traders have the upper hand when negotiating prices because the farmer is constantly in debt to the trader for the cost of seeds, fertilizers and pesticides that were received in advance.

a. Local market (99% of the production)

Depending on their size, tomato farmers in the Beqaa plain supply the local market through different channels (Mercy Corps, 2014a and field interviews):

- Very small farmers, who produce around 10% of tomatoes in the Beqaa plain, sell most of their production directly to retailers, restaurants, final consumers, and artisanal processors, and to a lower extent to the wholesale market. They also sell to small-scale wholesale shops in the Beqaa towns. The average selling price varies from 500 LBP when sold directly and 400 LBP when sold in the wholesale market.

- Medium farmers, who produce 15% of tomatoes in the Beqaa plain, sell to the wholesale markets in Ferzol and Qab Elias, both located in central Beqaa, to traders and distributors, who sell at their turn to retailers/supermarkets/and HORECA as well as to processors. The farm level price of tomatoes varies with production volume, quality, and farmers' capacity to negotiate. The average farm gate price is between 400 and 500 LBP. In periods of oversupply, the farm gate price reaches the lowest level of 300 LBP/kg (equal to the cost of production).

- Greenhouse tomatoes have a higher value than open field tomatoes. They are sold at an average price of 750 LBP/kg and may reach 1000 LBP for grade A tomatoes and in times of market shortage. The market middlemen (wholesalers, distributors, transporters) add around 50% onto the basic price, then retailers (small shops and supermarkets) add around 50 to 60%, to have an average consumer price of 1,250 LBP/kg for open field tomatoes and 1750 LBP.

- Big farmers, who produce around 75% of the tomato production, sell most of their products to the wholesale market, to distributers, traders, or are traders themselves.

b. Exports (1 to 2% of the production)

Exports of tomatoes are not as important as potatoes, other fresh fruits, and vegetables[12]. In the last five years, the trade balance of tomatoes increased between 2012 and 2013, decreased in 2014 and 2015, and it has witnessed a drastic decrease in both imports and exports in 2016 mainly due to the Syrian crisis and the closure of the border. In fact, Lebanon imports tomatoes mainly from Jordan, and that was significantly affected by the border closure (**Figure 9**).

12 According to IDAL the top exported crops after potatoes are apples, citrus, banana, apricot, and lettuce.

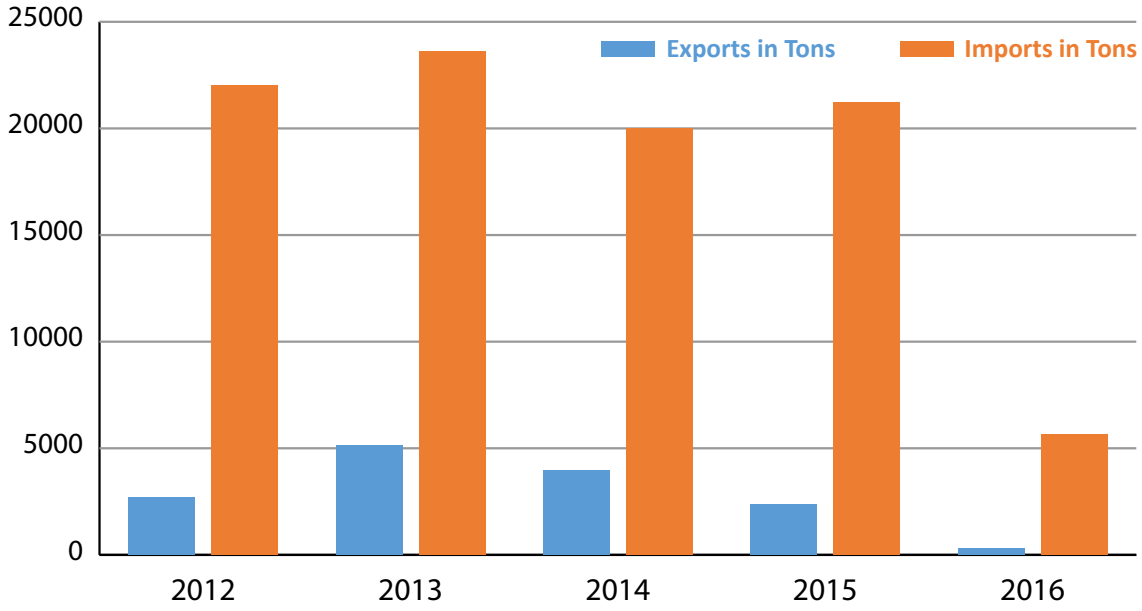


Figure 9. Tomatoes production and exports quantity and value.

Source: MOA and FAOSTATS

The Figure shows that Lebanon is a net importer of tomato and there is still a significant domestic market that can be exploited, if the production is efficient and competitive with imports. The emerging trend of greenhouse production in Beqaa raises expectations that the domestic production will be more competitive and will utilize this market opportunity.

Tomatoes VC analysis and potential interventions

Tomato farmers face the same challenges as most Lebanese vegetable growers. Vegetable production in general, and in particular tomato production, is highly labor and knowledge intensive, especially when carried out in greenhouses. There is a need to improve all farming practices, including better and more adequate irrigation, improved soil and pest management, and a generally more effective use of agricultural inputs and of water for irrigation. Reducing the production cost and increasing yields through the use of new varieties and more greenhouses, will help farmers to increase the profitability and competitiveness of their tomatoes.

Tomato farmers in the Beqaa face market problems due the high supply in the main season, market control by middlemen, mismatch between supply and demand by the agro-industry, and mismatch between product quality and export market demand. Therefore, the introduction of new varieties that are suitable for niche export markets and/or local agro-industries is recommended.

Based on field observations and interviews, the main challenges and constraints hindering the development of this VC were identified:

- Increased cost of production in both open field and greenhouse (especially for heating during winter season in the Beqaa);
- Old farming practices and excessive use of inputs related to extension services done by input suppliers;

- Improper harvesting and post-harvesting practices, which affect the quality of products;
- Limited use of new varieties with better yield and higher market value for both fresh consumption and processing (for example cherry tomatoes highly demanded on the market);
- Inability to compete in external markets and lack of market information;
- Competition on the local market from imported tomatoes at lower prices (mainly from Jordan and Saudi Arabia);
- Control of the market middlemen and high commission in a non-organized and monitored wholesale and distribution system;

The detailed constraints or challenges and the corresponding opportunities and potential interventions of the tomato VC in the Beqaa are presented **Table 17**.

Table 17. Tomatoes value chain constraints and potential interventions.

VC phase	Constraints	Potential interventions
Input supply, extension **Production**	The agronomic practices and input use, especially chemical pesticides, and low considerations of integrated pest management techniques is a main concern, which is also driving up costs. These practices also affect product quality and water pollution.	• The tendency towards greenhouse production in Beqaa should be encouraged particularly for smallholder farmers, because of its high efficiency, specifically water use, higher yields and better quality products. However, this needs startup investment costs for small holder farmers. • Efforts should be made to link small holder farmers to national farm financial services. • Production practices in open fields should be optimized and particularly integrated pest management techniques should be applied to curtail the intensity of chemical use. This requires establishment of demonstration fields in a farmer participatory approach as learning and knowledge sharing platforms between farmers. • Framers should be made aware of more modern varieties with higher yields. • The demand for products with certified production is now limited to specific niche markets, but certification could add substantial value and provide marketing advantages.
Post-harvest and marketing	Low prices during the high supply season is a major concern and net returns could be negative. The market is very competitive with many local farmers and imports.	• Farmers should be encouraged to grow, at least partially, specialty tomatoes, for example, cherry tomatoes, which has growing niche markets. One large producer that was interviewed has been successfully doing that for the last few years. • Farmers can be supported to engage in direct sales to retailers and consumers with specific product qualities and packaging as an another important option. • Small-scale farmers, could go for higher value products, for example, sun dried tomatoes are an important product that is demanded in the higher end restaurants and food industry which could provide good opportunities.

Dairy products value chain

The 2010 agricultural census estimated the total number of herders at 15,800. Around 19% of the herders do not possess agricultural lands. Consequently, they do not have any crop production activity. Cattle (mainly dairy cows) and small ruminants (goat and sheep for meat and milk production) are the major components of the livestock production.

The production of ruminants is secondary in the Lebanese agriculture, with less than one agricultural holding in eight being involved in animal husbandry. Dairy cows, sheep and goat milk production represented 7% of the total value of the agricultural production; while meat production remains very limited, representing 4% of the total agricultural value, with livestock imported from different countries and slaughtered in Lebanon. Although the production of milk and meat is relatively low, the demand for such products and their by-products remains very high. This demand is mainly being met by the import of: more than 90% of the demand for bovine meat; more than 80% of the demand for ovine meat; and more than 60% of the milk and dairy products consumed in Lebanon (Asmar, 2011; MOA, 2012).

Despite its low contribution to the agricultural production value, livestock production remains very important, mainly when it comes to goats and sheep because of their strong ability to utilize pasture and fallow lands.

The control of zoonotic diseases and hygiene of meat and milk products are not well mastered. Brucellosis is quite frequent with some 13% of the livestock affected in 2002, and a high level of infection in humans. Other sanitary problems are also present and have a serious impact on the livestock population[13] (Asmar, 2011).

Figure 10 is a representation of the livestock and dairy products VC structure, which will be detailed in the following sections.

13 High quality beef meat is mainly imported chilled or frozen from the EU and Latin America, in addition to some low quality meat imported and sold at very low prices.

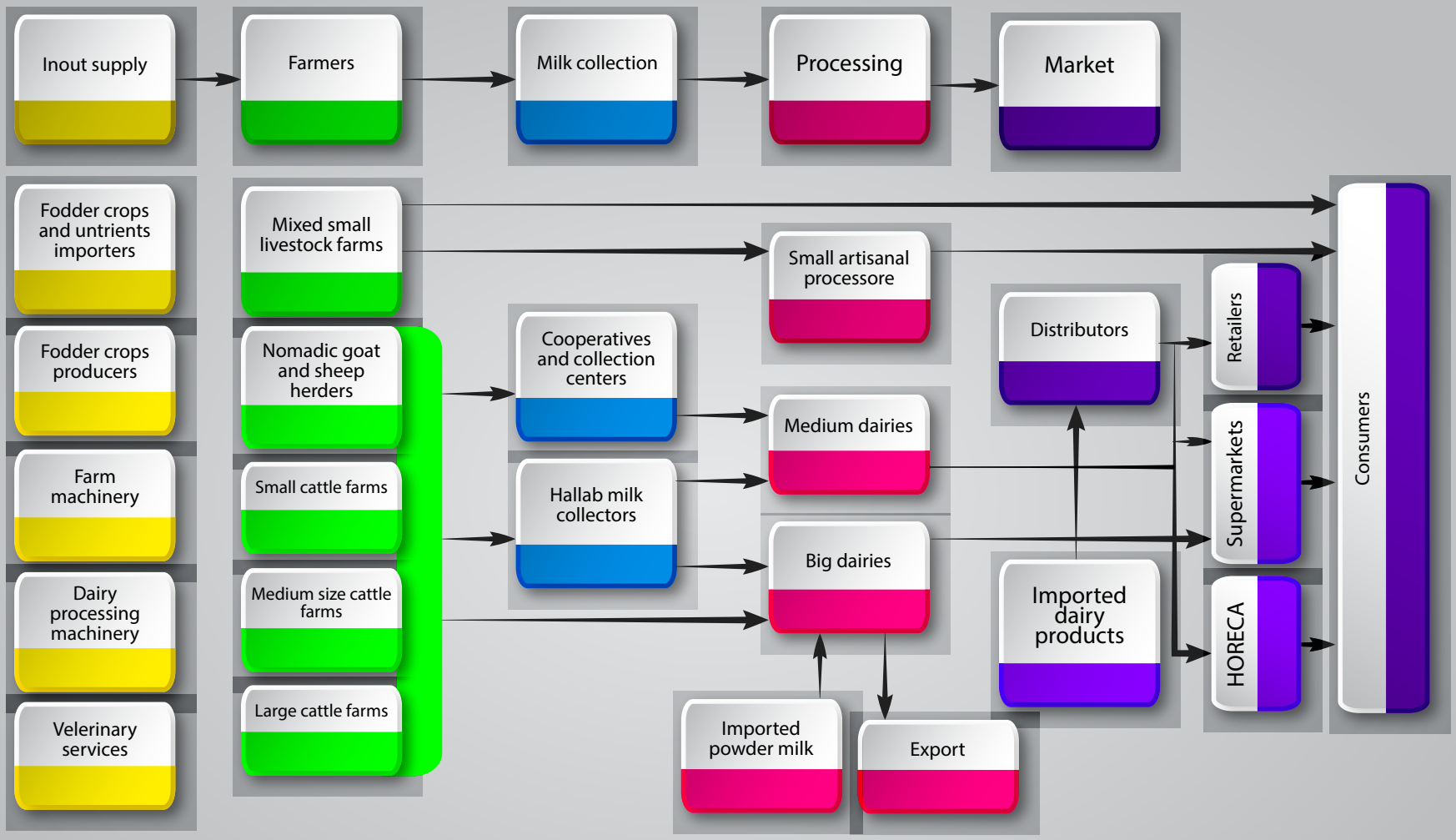


Figure 10. Dairy products value chain structure.

Source: (Author elaboration)

Livestock and herders' characteristics

a. Cattle and dairy cows

The 2010 agricultural census estimated the total cattle herd at 68,568 heads (among which 40,160 are dairy cows), distributed over 10,410 herders and farms (67% of total herders). The Beqaa plain contains 43% of the cattle, followed by North Lebanon and Akkar (26%), and between 7 to 13 % for the other governorates. According to FAO estimates, the total cattle herd increased to 87,000 heads in 2014 (among which around 52,000 are dairy cows).

Cattle are mainly raised for milk production, with the majority of the stock concentrated on large farms and being of the Holstein breed. There are four main large-scale farms in Lebanon having more than 500 cows, some 10 medium-scale farms with 50 to 200 cows, and around 50 small-scale farms with 25 to 50 cows. Most of these have a cultivated area between 5 and 50 ha planted with fodder crops. Despite that, they all have to import fodder and feed additives to compensate for the lack of animal feed production in Lebanon. The rest consists of smallholders operating at the household level or in small poly-culture farms with an average of 8 heads of the local "*Baladi*"[14] breed, Baladi-Friesian crossbreed, or even Holstein breed.

Based on field surveys and observations, the following characteristics for the dairy cows' production were depicted:

- ***Micro-scale systems*** exist everywhere in Lebanon, especially in Mount Lebanon North Lebanon, South Lebanon, and to a lower extent in the Beqaa plain. The herd size ranges between 7 and 11 cows and an average of 80 kg of milk is produced per day. Part of the production is consumed at the household level and the rest is sold in the village as fresh milk or in the form of basic dairy products (Labneh and yoghurt). Milking is done manually and the quality of milk is very heterogeneous with low hygienic control, resulting in risks on human health.

- ***Small-scale diversified systems*** have slightly larger herds of 12 to 25 cows and an average production of 400 kg of milk per day, alongside with other livestock (goats and/or sheep), beehives, and crops (fruits, potatoes, tobacco and cereals). This system is especially prevalent in the plains, including Beqaa and Akkar. Part of the production is consumed at the household level and the rest is sold in the neighboring villages in the form of basic dairy products (Labneh, yoghurt, and white cheese). Milking is done manually or with small milking machines. The quality of the milk is slightly better than the one produced by the micro-system; hence it remains heterogeneous with low hygienic control and health risks.

- ***Small-scale farms specialized in dairy cows*** have herd sizes ranging between 25 and 50 cows, mainly raised in the open field with some intensive farm models, producing an average of 800 kg of milk per day. This type of farms is mainly located in the Beqaa plain and in Mount Lebanon. These farms either sell their milk through the milk collection centers and milk collectors to big dairy producers, or they have their own semi-industrial dairy processing unit, where they produce an important range of typical Lebanese dairy products sold on the local and national market. Milking is done with small machines or small old milking units. Milk quality is controlled and tested in some cases to guarantee the safety of the products.

- ***Medium-scale farms specialized in dairy cows*** have herd sizes ranging between 50 and 200 cows, raised in intensive farming, and producing an average of 3 tons of milk per day. This type of farm is mainly located in the Beqaa plain. They usually process all their milk in industrial dairy processing units and produce a wide variety of typical Lebanese products in addition to other dairy products, such as butter, fruited yoghurt, yellow cheese, and ice cream.

Their production is mainly sold on the local and national market with some exports. Milking is done in industrial milking units. The quality of the milk is controlled and

14 Baladi means local or national in Arabic. In the last five years, the Baladi breed is gradually being replaced by more productive breeds.

tested in a small laboratory on the farm to guarantee the safety of the products. Some of these farms have recently started to apply for food quality certification.

- ***Large-scale farms specialized in dairy cows*** have more than 500 cows per farm (3 in the Beqaa and 1 in Mount Lebanon) and there are only four of these large-scale dairy cow farms in Lebanon. These farms have industrial milking units and sophisticated dairy processing plants with a capacity to process around 12 tons of milk per day, in addition to advanced laboratories for quality control. They produce a wide variety of typical Lebanese dairy products in addition to innovative products (butter, fruited yoghurt, yellow cheese, ice-cream, etc.). They all have ISO and HACCP certification and their production is sold on the local and national market with important exports.

b. Small ruminants

The number of small ruminants was estimated by the 2010 agricultural census at 669,206 heads. The small ruminants' herders are distributed as follows:

- **Sheep**: 119,266 heads and 1,924 herders. The sheep herds are mainly located in Baalbak-Hermel (38%), and in Central and West Beqaa (34%), followed by Akkar (10%).
- **Goats**: 261,478 heads and 3,677 herders. Geographically, 26% of the goat herds are located in Baalbak-Hermel and 25% in Central and West Beqaa, followed by Nabatiyeh (17%).
- **Sheep and goat together**: around 2,170 herders raise 146,079 sheep and 142,383 goats together. They are mainly located in the Beqaa plain and on the eastern slopes of Mount Lebanon and on the Anti-Lebanon slopes.
- **Milking goats**: among the 403,861 goats, there are 241,467 milking goats (60%).
- **Herders**: 70% of the small ruminant's herders have less than 50 heads.

The production of meat and milk from small ruminants decreased between 1999 and 2010, in parallel with a decrease in herd size (Asmar, 2011; MOA, 2012; Mercy Crops, 2014b). According to FAOSATS, herd size increased between 2010 and 2014 due to the Syrian crisis and the introduction of a large number of goats and sheep from Syria in legal and illegal ways (**Figure 11**).

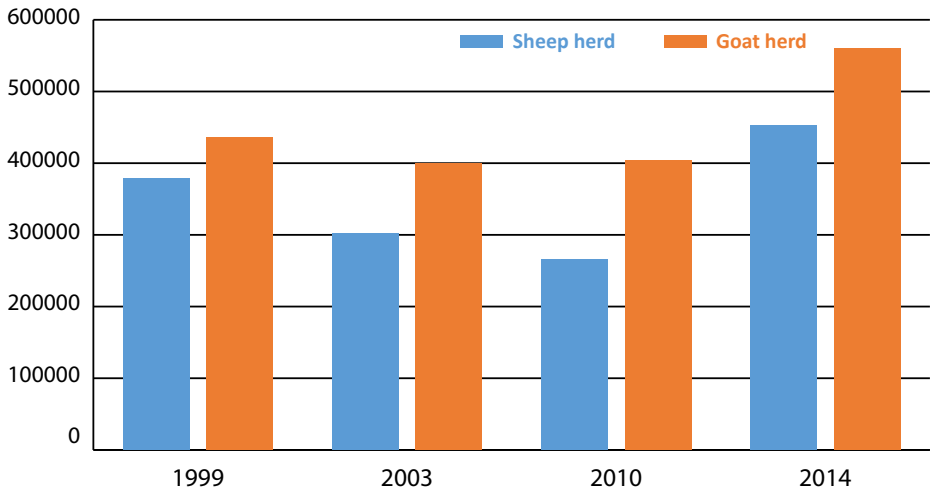


Figure 11. Evolution of small ruminants' herd between 1999 and 2014.

Source: (FAOSTAT)

The production of sheep meat and milk suffers from competition of imported meat from Australia, Turkey and Syria. The artisanal production of sheep milk is not constant over the year and, therefore, the dairy and cheese factories have to depend on other sources to maintain their output. Goat production seems to be suffering as well, although the demand for goat meat and milk products remains large and some 10,000 families have this production as their major source of income (Asmar, 2011).

Sheep and goat have always been an integral part of the rural mosaic in Lebanon. Sheep are mainly of the regional *"Awassi"* breed with local characteristics, and goats are mainly of the local "*Baladi*" breed and the Damascus, or "*Shami*", breed. Both sheep and goat are managed under nomadic and semi-nomadic systems, feeding on native pastures, woodland species, and crop residues[15] (Mercy Corps, 2014b).

Awassi sheep produce an average of 150 L of milk per year over 150 days, depending on whether it is selected for milk production or for feeding its young. Goat herds produce 120 to 140 L of milk per year over 180 days (LACTIMED, 2014).

Depending on the availability of grazing, finance, and technical background, different production systems can be seen for small ruminants (FAO, 2013):

- **Nomadic system**: animals depend on natural pasture as flocks move from one place to another, on foot or by truck, in search of grazing or water (largely practiced in arid and semi-arid regions);

- **Semi-nomadic or transhumant system**: animals move between semi-arid grazing areas and cropping areas, depend partially on natural grazing and partially on crop by-products, and spend the winter mostly around the homesteads;

- **Settled (semi-extensive) system**: sheep and goats graze natural pasture during the day, return to their (fattening) units each day and feed on crop by-products while supplementary feeds are provided as required.

Changes in land use practices, the shifting from rural to urban livelihoods and the severe fragmentation that the woodlands, rangelands and pasture lands are witnessing because of the urban sprawl, has seen herds decrease in number and pastoralism is no longer an important part of the rural mosaic. In some parts of the country, mismanagement practices and overgrazing have led to the deterioration of the pastures and woodlands and to an increase in forest fire risks.

Small-scale semi-extensive small ruminant production system of 150-200 sheep and goats for both meat and milk operate in Beqaa. The flock size is constrained by a lack of grazing lands. Animals rely on open grazing of crop residues and close mountain ranges for 8 months (from March to October). Crop residues include wheat straw and vegetable residues: potato, lettuce, cabbage, and other crops. These crop residues are mostly used without charge. This integration with the cropping system is a good way of reducing feed costs, which is an important factor in making small ruminant production sustainable in Beqaa. During the 4 months of winter, animals are fed with concentrates, wheat bran, and straw; and the total cost is estimated at US$100 per head per month. The demand for small ruminant milk is high in the spring and summer (May/June to September) when households prepare the popular local food called "Kishk", made of bulgur (precooked and cracked) wheat mixed with yogurt. Goat milk is preferred for this product, but mixtures are also used. Kishk is prepared in spring and summer, and stored for consumption in winter. During the Kishk season (from June to September), goat milk sells at about US$1 per Kg and this is a good opportunity for small ruminant producers in Beqaa.

15 Recently two new modern goat farms have been established in Mount Lebanon with the objective to produce high end goat cheese products.

The profitability of these systems depends on many factors. The first one is the integration with the cropping system, which provides an inexpensive source of feed during 8 months. In addition to milk sales, income also comes from the sales of replaced old ewes and born lambs, which can be fattened to add extra value, and some operators also purchase additional lambs for fattening. An average example of such enterprises based on the collected data from the field is presented in **Annex 1**. The data show that small ruminant enterprises in Beqaa can be profitable if well managed. A flock of 150 sheep can yield about 36 million LBP or about 24,000 USD a year. These farms sell milk, male lambs, and replaced old ewes for meat. Some of them purchase lambs for fattening as a source of additional income. Their profitability can increase if the farmer targets the festival periods (for example the two major Eid events) and the efficient management of the feeding system. ICARDA and LARI have a small ruminant research flock, based in Terbol, which can provide essential information for farmers in Beqaa. The most important concerns for producers are the lack of grazing space and problems of animals ingesting plastic, while grazing on crop residues. Analysis of information received from small ruminant keepers show that feeding may not be done in an optimal way. ICARDA and LARI can therefore provide knowledge and experience to manage these units efficiently in all aspects of flock management, including feeding, health, and marketing. Most small ruminant farmers in Beqaa are aware of the ICARDA-LARI research flock and have received rams for breeding. Following up on the changes in flock performance by the introduction of improved rams is an important element in supporting this production system. Another problem is the lack of interest from the youth.

Fodder production

Livestock is highly dependent on imported fodder (feed concentrates). Asmar 2011 estimated the value of livestock feed in Lebanon at approximately $175 million, of which 90% is attributed to the import of these foods. The acreage of fodder crops remains limited compared to the needs of livestock. Cultivated grasslands are almost absent. Cattle are mainly raised in intensive systems and fed with concentrates and crop by-products. Small ruminants are mainly fed with stubble and a mixture of barley and vetch from late June to mid-November in sedentary or semi-nomadic farming (MOA, 2012; LACTIMED, 2014).

In Beqaa, small ruminants rely on grazing of limited rangelands, but rely mostly on crop residues for about 8 months, mostly without charges. Most land owners want to let animals come and “clean” the fields to be ready for the cultivation of the next crop. They rarely ask for payments. Small ruminants are fed with concentrate mixtures for 4 months in the winter period. The access to crop residues offered by the intensive cropping of the Beqaa valley is a good cost-reducing factor for small ruminant producers in the Beqaa.

The feed cost in Beqaa is affected by the availability and prices of feed elsewhere in the country. The trends of areas cultivated with fodder crops are given in **Table 18**. According to the MOA census in 2010, barley represents 4.60% of the total agricultural land in Lebanon, 0.86% is corn silage, 0.35% is alfalfa, and 0.25% is vetch. Approximately one-third of the barley-cultivated land is irrigated, which also corresponds to supplementary irrigation. Cultivated fodder acreage between 2010 and 2014 is detailed in **Table 18.**

Table 18. Evolution of the cultivated area of different fodder crops.[16]

Year	2007	2008	2009	2010	2011	2012	2013	2014
Barley	15,750	14,500	14,400	10,685	11,000	19,638	19,735	18,605
Vetch	2,700	1,900	1,000	583	481	500	505	520
Corn	900	900	1,928	1,645	1,650	N/A		
Alfalfa	750	750	750	750	750	N/A		
Sorghum	410	370	290	228	230	240	250	237
Oat	180	185	190	188	190	142	130	119

Source: (MOA and FAOSTAT)

The data in the table show that most of the fodder-crop-cultivated areas have been fluctuating. The barley area decreased from 2007 to 2010, followed by an increase until 2014. The vetch area was in continuous decline, corn has increased between 2007 and 2011 (no figures available after 2011), sorghum and oat had a slight decrease, and alfalfa is stable. This fluctuation is due to:

- Evolution of world diesel prices (used for irrigation), as well as livestock and fodder;
- Climatic factors that impact the production and the yield of non-irrigated regions;
- Crop rotation practiced by farmers.

According to the census of the MOA 2010 census:

- Distribution of the alfalfa production by governorate ranks the Beqaa in first position with 73% of the cultivated area, followed distantly by Akkar (15%) and Baalbeck-Hermel (10%);
- Distribution of the vetch production also ranks the Beqaa in the lead with 38% of the cultivated area, followed by Akkar (26%) and Nabatiyeh (20%) with Baalbeck-Hermel occupying 10% of the acreage;
- Nearly 81% of barley acreage is located in Baalbeck-Hermel, of which much is left to fallow land for grazing small ruminants (sheep and goats), especially in the arid north of Baalbeck-Hermel, where livestock is fed from crop by-products (cereal straw and barley grown secretly in the plains);
- The Beqaa contributes 57% of the total acreage of maize fodder (with fully irrigated land), followed by Akkar (37%) and Baalbeck-Hermel (6%).

Thus, 67% of cultivated alfalfa and vetch acreage, 8% of barley and 63% of corn fodder are located in the Beqaa and Baalbeck-Hermel governorates.

In the Lebanese mountains bordering the Beqaa plain (eastern slope of Mount Lebanon and the western side of the Anti-Lebanon), the bush land is suitable for the development of sheep and goat farming, which are the only farmers of the maquis, garrigue, cherry, plum and wild vetch (LACTIMED, 2014). Cattle, sheep, and goat herds are fed in an extensive mode in the fields of the Beqaa with agricultural residues from cereal crops, legumes, and vegetables.

Milk production

Milk and dairy production has increased sharply since the early 1990s, mainly through the expansion of dairy cow farms. However, the local supply satisfies only a third of the Lebanese market demand. In the last few years, large (and some private) investments have been put into the dairy products value chain. Several new dairy plants are delivering

16 Alfalfa and vetch production is entirely devoted to livestock feed. The majority of barley production is exploited for fodder. Corn is divided into sweet corn and silage corn. Finally, sorghum and oats production, in small quantities, is used both for human and animal nutrition.

fresh and UHT milk to the Lebanese market in addition to a wide range of dairy products (yogurt, traditional Lebanese cheese and some types of yellow cheese). Other investments are public, mainly through the International Fund for Agricultural Development (IFAD) project (now phased out), and focused on the rehabilitation of small livestock producers and the establishment of milk collection centers in Beqaa. After the troubles in 2006, the dairy sector has suffered important losses, but the private sector has managed to recover and rehabilitate the affected plants; FAO is bringing substantive support to the livestock production sector through assistance projects.

In addition to the integrated circuits, milk is commercialized through three main channels: independent milk-men (the hallabs), milk-men appointed by the dairy plants, and collection centers. Both are public and are currently facing financial and technical problems due to inadequate and non-efficient management, whereas private plants are functioning well (Asmar, 2011).

a. Milk quantity and cost of production

According to the MOA 2010 census, the value of milk production in 2009 was $121 million, thus representing 18.9% of animal production and 5.7% of the total agricultural production. **Table 19** depicts the evolution in volume and value of milk production from 2007 to 2014.

In 2013, the cost of producing 1 L of cow milk was estimated at 900 LBP ($ 0.60). In a modern farm, this cost is distributed amongst the different components (LAC) as follows: feed 65%; salaries 10%; health treatments 9%; energy 9%; and overheads 7%.

Table 19. Evolution of milk volume and value between 2007 and 2014.

Year	2007	2008	2009	2010	2011	2012	2013	2014
Cows' milk quantity (tons)	183,600	163,800	168,200	165,000	168,000	187,000	193,200	195,000
Cows' milk value (million $)	97	94	99	103	117	112	116	120
Sheep milk quantity (tons)	24,700	17,400	14,800	13,000	23,000	23,000	23,000	23,700
Sheep milk value (million $)	13	10	9	8	12	11	10	10
Goat milk quantity (tons)	34,000	21,200	21,700	32,000	43,000	43,000	43,000	44,000
Goat milk value (million $)	19	13	13	20	30	30	30	31
Total milk value	**129**	**117**	**121**	**131**	**159**	**153**	**156**	**160**

Source: (MOA and FAOSTAT)

b. Milk pricing system

Over the last 10 years, the average price of 1 L of cow milk has increased significantly. Before 2012, this price was determined according to market law. In 2012, the MOA established a committee for the organization of the dairy chain in Lebanon (decision no.1/684 dated August 9, 2012), whose role was to set the price of raw cow milk, to track sales contracts between cooperatives and the industry, and to define standards for raw milk. In 2013, the price of 1 L of chilled cow milk was set at 1,050 LBP. It is adjusted each year. On average, the milk producer's profit is 15% (LACTIMED, 2014).

Despite the MOA decision to set a fixed priced for milk, the market control by big farms and milk collectors is still influencing the price of cow milk and, in many cases, the price set by the MOA is not respected, especially when the quantity and quality of milk does not match the demand of the processing units.

Goat and sheep milk production cost is subject to strong seasonality. Under the best conditions, it extends from April to July for sheep and from May to November for goats.

The price of small ruminant milk is determined by the market, varying with the seasonality and the quantity of milk available (Mercy Corps, 2014b). Over the course of this study, sheep milk prices of 1,000 LBP and goat milk prices of 1,200 LBP per kg were recorded in Beqaa.

c. Milk collection

In the 1960s, the Department of Animal Production of the Ministry of Agriculture set up three milk collection centers in Baalbeck-Hermel (Hermel), in the South (Tyr) and in the North (Abdeh) in order to organize the dairy chain in Lebanon. This initiative should have been extended to the whole of Lebanon at a later stage. In 1975, with the beginning of the Civil War, these three centers were closed down. Subsequently, milk was collected by peddlers in an out-of-control and chaotic fashion, causing major health issues for consumers (LACTIMED, 2014).

In 2000, the "Small livestock farms rehabilitation project", financed by the IFAD, built 12 collection centers with a budget of $5.5 million, including four in the Beqaa and Baalbeck-Hermel. During this period, the collection system changed considerably, milk quality improved and its price increased. After the project terminated in 2007, the collection centers were closed and the equipment became the property of the Lebanese state. Milk quality again deteriorated and malfunctions in the collection system increased. In July 2010, the Council of Ministers authorized the Ministry of Agriculture to lease the collection centers, established under the IFAD project to the private sector, municipalities or international organizations, where the tenants ensured the maintenance of the premises and the milk quality standards. In this context, the proposed "Recovery and Rehabilitation of Dairy Sector in Beqaa Valley and Hermel-Akkar Uplands Dairy project", implemented by the FAO in cooperation with the MOA, leased certain equipment of the centers to cooperatives and cooperative groups created under the project in the Beqaa and Baalbeck-Hermel (LACTIMED, 2014).

Milk-men, or milk collectors (known as "Hallab") play a very prominent role in the dairy industry, linking milk producers to processors. In many cases, the milk collector is also a producer and ensures the collection, transportation, and sale on behalf of a network of producers. These collectors buy goat and sheep milk at a price that depends on the quality of milk (mostly fat content) and the transportation involved. On average, they add a 20% mark-up when selling to processors. Prices are generally the same for good quality sheep and goat milk, but falls as supply increases.

However, as the milking season ends, prices rise as farmers begin using supplemental feeding with semi-intensive production systems. Payment to producers is usually made within 2 weeks, after the processor, who buys the milk, pays the collectors. Some collectors have long-term relationships with processors, which guarantees the supply and quality for the processors, and incentivizes the collectors to promote high quality milk production and transport (BLOMINEST BANK, 2016).

In the Beqaa plain, about 80% of milk is delivered by the Hallab in the districts of Zahle and West Beqaa, against only 53% in the districts of Baalbeck, Hermel, and Rashaya (Kayouli, 2010). Some private companies have built their own collection centers in the Beqaa with their processing plants located in Beirut and Mount Lebanon. In particular, this is the case for Taanayel Les Fermes and Dairy Khoury (LACTIMED, 2014). However, the small-scale units of small ruminants in Beqaa mostly deliver the milk directly to the processors.

Milk processing and dairy products

In Lebanon, processing organizations are almost non-existent in the dairy chain due to conflicts of interest between large plants and small to medium-sized plants. Their vision for the future and the structure of the industry are opposing. The attempt to organize the dairy chain in the Beqaa has resulted in the creation of a group of dairy processing plants in 1991, gathering around 30 processors. The main objectives of the group were to improve the quality of milk and to stabilize its price. Unfortunately, all activities were subsequently suspended for the above-mentioned reasons, which led to its dissolution by the MOA in 2012 (LACTIMED, 2014).

a. Processing units

Most of the dairy units in Lebanon are traditional and managed by families, which do not have good control over milk quality and have a low innovation capacity in terms of cheese and dairy products (Asmar, 2011). Some dairy units integrate upstream (livestock and milk production) or downstream (own distribution unit) activities. Few companies export, and on an irregular basis and in small quantities (LACTIMED, 2014). Based on field observations and interviews, the Lebanese dairy production system can be divided into five categories:

- 4 large-scale dairy plants (owned by the big-scale livestock farms) processing around 15 tons of milk per day. They usually use the milk produced in their farms in addition to imported powder milk. They all have certification (ISO and HACCP), resulting in a consistent quantity and quality of products.

- 6 large-scale dairy plants that do not have a farm. They buy the milk from medium-scale livestock farms. They all have certification (ISO and HACCP), resulting in a consistent quantity and quality of products.

- Around 25 medium-scale dairy plants (owned by the medium-scale livestock farms) processing 3 tons of milk per day. They usually use the milk produced on their farms. Processing is done in a semi-industrial way. The products quality is somehow good but needs a lot of improvement.

- 100 small-scale dairy processing units with or without livestock, processing between 500 kg and 1 tons of milk per day. Processing is done in a semi-industrial way and the quantity and quality of their products is highly fluctuating.

- More than 200 artisanal small dairy processing units at the household level, processing between 200 and 400 kg of milk per day. Their production suffers from non-consistent quantity and uncontrolled quality.

Box 3. Small-scale dairy processing unit in Terbol.

	Units	Quantity	Price LBP per unit	Value
Variable costs				
Cow milk	Kg	100	1000	100,000
Sheep milk	Kg	200	1200	240,000
Electricity	LBP	300	1	400
Water	LBP	300	1	400
Gas	LBP	3500	1	3,500
Rent	LBP	10000	1	10,000
Hired labor all family		0	0	0
Fixed costs				
Fridge	LBP	164	1	164
Boiling container	LBP	82	1	82
Gas bottles	LBP	49	1	49
Plastic containers	LBP	21	1	21
Total daily operational cost	LBP			354,616
Daily sales				
Cow cheese	Kg	4	9000	36,000
Cow Yogurt	Kg	71	2000	142,500
Sheep Yogurt	Kg	190	2000	380,000
Total daily revenue	LBP			558,500
Daily net income	LBP			203,884

According to LACTIMED 2014, it is difficult to precisely determine the number of dairies operating in the Beqaa plain. According to experts working in this sector and to the field interviews, in 2013, there are around 150 processing units in the Beqaa plain:

- 42 dairies were registered with the Ministry of Industry;
- 102 dairies were registered with the Ministry of Agriculture (for the purpose of health and safety approval).

There are also small-scale dairy processing units scattered around Beqaa, which take milk directly from small scale producers. These are family operations and both male and female members of the family work. An average daily activity, milk processed, products made and sales of small-scale dairies in Beqaa, is presented in Box 3. This average budget shows that small-scale dairies are functional and remain viable family businesses in Beqaa. However, they need much support to ensure that they comply with national food safety and quality standards. Strengthening the link between small-scale livestock producers and these family-based dairy enterprises can also serve local communities better, where they're not served by the large-scale industry.

b. Dairy products

The major dairy products of Lebanon can be divided into three categories:

1. **Fermented milk**: yoghurt (Laban) and strained yogurt (Labneh) from goats and cows are the most popular protein sources in the Lebanese culinary habits. These products have a short shelf life of

around 10 days for artisanal production and 20 days for industrial production. Labneh made from goat milk can be preserved in olive oil for a long period.

2. **White cheese**: Halloumi and Akkaoui cheese and their serum produced by-product Double Cream, which can be preserved for a few months in a refrigerated environment; Karisheh, which is also a serum by-product however, cannot be preserved for a long period of time.

3. **Specialized products** made mainly from goat milk can be preserved for a long period. Chanklish is a highly fermented cheese and Keshek is a powdery mixture of dehydrated milk and mashed wheat, which can be preserved for several months and consumed in the form of soup. Some farmers still process the milk into cheese and labneh and keep them to strain and mature in the animal skin (Ambriss and Dharfyieh Cheese), following a traditional ancestral technique. The end product, with a very pungent yet highly appreciated taste, is sometimes conserved in olive oil for a longer shelf-life. These products are only sold at the farms and are produced in relatively small quantities. The traditional goat cheese, also called "green cheese" (Jebneh Khadra) or "Baladi Cheese", is processed with raw milk. Although the end product is exquisite, it is very risky due to the diseases linked with raw milk and the artisanal way of processing.

Cows' milk and dairy products

The distribution of dairy products in equivalent kg of cow milk is (BCTI-CNE, 2003):

- 15% for "*Laban*" (yoghurt);
- 35-40% for "*Labneh*" (typical Lebanese product);
- 35-40% for different Lebanese cheese (white cheese);
- 5% for other types of cheese (yellow cheese); and
- 5% for *"Ayran"* yogurt (mixed with water and salt) and flavored yogurts.

Small ruminants' milk and dairy products

The seasonality of dairy production is very acute, due to the scarcity of intensive production systems for small ruminants. The largest part of small ruminant milk production (sheep: 92.4%, goat: 87.6%) is sold by the herders as fresh milk to manufacturers for processing or directly to consumers. The remaining part is either consumed by the herder or processed into dairy products (mainly, preserved Labneh, Keshek, and Chanklish) to be sold afterwards directly to distributors or consumers (LACTIMED, 2014; Mercy Corps, 2014b).

Dairy products market

The Lebanese dairy sector has grown and diversified over the years, proving its economic standing as a key player in the agro-industrial sector. Foreign and institutional investors have entered the market, advertising has increased, and competition is fierce. The prices for dairy products are determined by the market.

a. Market size and characteristics

According to the Lebanese Dairy Board, the size of the dairy market in Lebanon is approximately $200 million, with a total production estimated to be at 62,000 metric tons per year. However, Lebanon has a much higher production capacity of around 160,000 metric tons per year, of which 31.25% is UHT liquid milk (ultra high-temperature milk that has been pasteurized at a higher temperature, but for a shorter time, to preserve taste and nutrition), 18.75% yogurt, 15.63% Ayran, 12.5% white cheese, 9.37% Labneh, 6.25% ice-cream, 5% Halloumi, and 1.25% flavored yogurt (BLOMINVEST BANK, 2016).

Nonetheless, Lebanon is far from being self-sufficient in milk and dairy products. The figures differ according to sources. According to Asmar 2011, imports account for over 63% of the needs of the population in milk and dairy products, while the FAO estimate is about 78% of the demand is covered by imports.

Lebanese consumption of dairy per capita consists of 14 L of fresh and powdered milk, 24 kg of cheese, and 20 kg of Labneh, annually. This is equivalent to a high demand of almost 189 L of equivalent milk per capita. According to the BLOM 2016 report on the dairy sector, demand is rising annually for two reasons: the increase in the number of Lebanese nationals and the influx of Syrian refugees (BLOMINVEST BANK, 2016).

In the last five years, the trade balance for dairy products has registered its highest deficit in 2014 with a value of $398 million for imports and only $10 million for exports. The Lebanese dairy products have been following a decreasing trend since 2013 and it registered the lowest volume and value in 2016. The reason behind this decrease is the closure of the Syrian borders and the loss of the main market for these products in the Iraq and the GCC countries (**Table 20**).

Table 20. Evolution of Lebanese dairy products imports and exports.

Year	2012	2013	2014	2015	2016
Dairy products imports (Tons)	82,000	89,500	95,800	82,400	82,750
Dairy products exports (Tons)	2,000	5,575	4,888	1,800	1,357
Dairy products imports value (Million $)	297	348	398	305	288
Dairy products exports value (Million $)	6	10	10	6	5
Dairy product trade balance	-291	-338	-388	-299	-283

Source : www.customs.gov.lb

Lebanon mainly imports its dairy products from the Netherlands, Denmark, and France (14.5%, 12% and 11% of dairy imports respectively) and an important illegal quantity from Syrian dairy products flooding the Lebanese market, with their low quality and cheap produce. In term of exports, Iraq is the main destination of Lebanese dairy product exports with a share of 47.24%, followed by Qatar (8.45%), Ivory Coast (6.33%), UAE (6.29%) and Kuwait (4.11%) (BLOM, 2016).

b. Local market and distribution channels

According to the LACTIMED 2014 study, fresh milk produced on the farm has four distribution channels:

- Auto-consumption, mostly in livestock farming villages;
- Direct sales to households, both in villages and in towns: milk is kept in plastic, aluminum, or stainless steel containers and transported in cars or trucks, often non-refrigerated, every morning to a well-known customer area;
- Industrial processing on the farm (considered as an upstream vertical integration strategy for some farms);
- Sale to processing units through hallabs (milk-men).

The distribution of Lebanese farmers by distribution channel is estimated as follows:

- 75% sell their milk to cooperatives of which they are members, to collection centers or to intermediate

collectors, who distribute it to the dairy. The latter avoids multiple contacts with small farmers, thus reducing their transaction costs. In this case, the intermediate collectors must ensure the quality of the milk delivered to dairies through controls and the selection of the suppliers. However, the milk quality is not always desirable for the dairies;

- 25% sell their milk to dairies and households, or process it themselves.

When it comes to processed products in the dairy sector, the majority of medium and large processing units and farms distribute their products themselves. The distribution channels are (LACTIMED, 2014):

- Large-scale distribution, very demanding in terms of time, delivery rate, and in terms of payment (customer loan requests can be up to six months);
- Hypermarkets, located in major towns with large areas devoted to dairy products;
- Supermarkets and small retailers, according to the industrials' accounts, are more interested in price than quality. It should be noted that in Lebanon, the prices in supermarkets and hypermarkets are not always lower than those of local stores;
- HORECA sector consisting mainly of hotels, restaurants, cafes, and catering services;
- Farms and processing units owned outlets, some of which are limited to small areas with a refrigerator presenting the range of products, while others are designed as convenience stores or cafe-snack bars.

b. Dairy products quality

The quality of the finished product is closely linked to the quality of the raw material (fresh milk collected from farms or powdered milk). The microbiological quality of milk collected from farms by milk processing units is unstable. It depends on the health and safety conditions of livestock operations (washing milking equipment, etc.) and transport conditions (agitation or immobility, warming or cooling). Milk delivered by the Hallabs or by a cooperative, often collected from multiple vendors, results in a mixture of milk produced under heterogeneous conditions. Thus, the milk is not compliant with standards and may be contaminated (Brucella, somatic cells, antibiotics, etc.), potentially resulting in serious consequences (LACTIMED, 2014).

The physical quality of milk is also variable, in particular concerning the fat content. Traditional dairies only perform a visual and olfactory examination of the raw milk collected, while most semi-modern and modern dairies practice physical and microbiological laboratory analyses. The latter also analyze their finished products in an internal or external laboratory. Powdered milk is used by many dairies for two main reasons: 1) it is cheaper than fresh milk; 2) it is technically advisable to mix it with fresh milk for a better quality of certain types of cheeses. Powdered milk is imported from France, Germany, Czech Republic, Holland, Argentina, India, Australia, and other countries.

In addition, fraudulent practices mislead consumers about the origin of the raw material. Some dairies use artificial and already industrialized materials (powdered milk, gelatin, and hydrogenated oils) and market their goods as fresh and natural production. Thus, competition between these dairies and those using fresh milk becomes unfair (LACTIMED, 2014).

The Department of Consumer Protection under the MOET is responsible for monitoring the quality and authenticity of the products on the Lebanese market. The working procedures and the effectiveness of this service may be questioned.

Livestock and dairy products development projects

Different development projects to support and improve the livestock and dairy value chain in Lebanon and in the Beqaa in particular were implemented in the last ten years by international organizations, NGOs, as well as research centers and the MOA. The most important projects are (MOA, 2012; LACTIMED, 2014):

- ***Fodder production and livestock development project***: the project was launched in 2012 with a $100 million budget. Implemented by the MOA in coordination with FAO, it aims to:
    - increase investment and employment opportunities in the agricultural sector;
    - improve soil fertility through crop rotation and reduced fodder production costs;
    - increase domestic fodder production to reduce feed concentrate imports and thus positively affect the trade balance (an incentive to barley production was introduced to provides barley seeds after multiplication at subsidized prices);
    - develop livestock farming by improving animal health and the quality of milk produced on the farm;
    - increase the amounts of milk and meat produced.
- ***Small livestock farms rehabilitation project***: co-financed with $21.9 million from the IFAD and the OPEC, the project was implemented from 1993 to 2002 under the Ministry of Agriculture, with the main goals to: 1) stabilize milk prices throughout the year taking into account its quality and its fat content; 2) improve and control milk quality; and 3) support small livestock farmers. To achieve these objectives, several actions were undertaken:
    - import of dairy cows with high efficiency and their distribution to small farmers (two cows per farmer) under subsidized loans;
    - subsidized loans to farmers to purchase local breeds of sheep and goats;
    - provision of subsidized credit to farmers, cooperatives and rural women;
    - installation of 12 milk collection centers, including four in the Beqaa and Baalbeck-Hermel (Hermel, Douris, Bar Elias and Kherbet Rouha), supplied morning and evening by the surrounding farms. The milk collected was subjected to microbiological analysis, and analyzed for pH, density, wetting, and fat, protein and dried rates, then cooled before being distributed to dairies. After completion of the project, the management of the collection centers was entrusted to the Ministry of Agriculture. In 2007, the state decided to close them.
- ***Recovery and rehabilitation of the dairy sector in the Beqaa valley and Hermel-Akkar***: implemented by the FAO in cooperation with the MOA, the project's budget was $2.5 million, funded by the Stockholm Conference for the Reconstruction of Lebanon. Launched in 2009, it aims to improve the quality of milk and dairy products in order, firstly, to protect consumers and, secondly, to improve the price of milk. The project activities were:
    - creation of 23 dairy farmer associations in 300 villages in Akkar, Baalbeck-Hermel and the Beqaa, and 32 equipped collection centers;
    - distribution of 370 electric milking machines with cleaning detergents and disinfectants;
    - organization of training sessions, mainly on milk hygiene, good milking practices and food.

Based on field observation and interviews, these projects and initiatives were scattered in time and were not integrated within the whole livestock and dairy products VC. Thus, they did not succeed in improving the sector, which is still suffering from many constraints and challenges at different levels of the value chain presented below.

Livestock and dairy products analysis and potential interventions

The livestock and dairy value chains are among the most important sectors of the Lebanese agricultural and agro-industry systems. The Beqaa plain, considered as the dairy region of Lebanon, has great potential for the development of this sector. The area is known for the ancestral knowledge and experience related to traditional products (mainly from goat and sheep milk) and for the important investments in modern farms and medium and large-scale processing units, operating in accordance with international quality standards (for milking cows).

From a market perspective, demand for milk and dairy products is increasing and local markets and distribution networks are well-established, hence exports are still underdeveloped. At the institutional level, the dairy VC in the Beqaa plain has a good structure with more than half of the processing units registered by the Ministry of Agriculture or the Ministry of Industry.

Despite these facts, the livestock and dairy sectors still face serious challenges and constraints hindering their development. These problems depend largely on the profile of the farm/processor and on the production scale.

The most common problems with dairy cows are related to nutrition, animal health, reproduction, veterinary care, homogeneity of the milk quality, and consistency in quantities. All these problems may be easily solved in large-scale farms, while they may persist and negatively affect the health of the herd and the milk production of the small and medium farms in terms of quantity and quality.

As for the small ruminants (goat and sheep milk and dairy products) the main problems are related to the degradation of grazing land, due to concentration of herds in smaller areas, the lack of veterinary services, the lack of shepherd know-how in terms of proper feeding and management practices, unstable milk quality and quantity, and lack of processed products quality control.

Interventions in the livestock and dairy sectors should take into consideration the farmers profiles and scale of production. They should focus on:

- supporting and improving fodder production for milking cows and pasture management for small ruminants to reduce raw milk cost and to provide consistent production with high quality;
- improving extension services and technical advice on feeding practices and health control for livestock;
- enhancing the knowledge and skills of farmers and processors in order to improve milk quantity and quality, as well as to produce innovative dairy products for the local and export markets.

Improving the sector can generate income to host communities and Syrian refugees with significant impact on the livelihood of small famers and producers. There is a consistent demand for permanent skilled labor in dairy production; there is a need to form skilled labor to work for mid-sized dairy holdings. Furthermore, Lebanese producers can benefit from the experience of Syrian refugees in that matter, while further trained Syrian refugees can apply their newly acquired skills upon return to Syria.

The following table presents the detailed constraints/challenges and corresponding opportunities/potential interventions of the livestock and dairy VC in the Beqaa plain (**Table 21**).

Table 21. Livestock and dairy value chain constraints and potential interventions.

VC phase	Constraints	Potential interventions
Input supply, extension, and livestock management and milk production	The most important constraint of the dairy sector is the management of the animals in terms of feeding and health. The low local production of fodder and high cost of imports are leading to high cost of milk production mainly due to feeding cost. This could also lead to low milk yield per animal and inconsistent quantity of raw milk. On the animal health side, insufficient (and sometimes not-accessible) veterinary services, especially for smallholder farmers is a concern. Management of livestock systems can be complex and would need a knowledge-based management system. Livestock are mostly managed by Syrian shepherds with only traditional knowledge and without training in animal husbandry and health.	A knowledge-based animal management system should be introduced addressing all aspects of feeding and health, and considering the tradeoff between meat and milk production. Some farmers let animals suckle for a long period as a fattening strategy, however, this may not be the optimal strategy. This will also include genetic improvements of animals. For example, improved rams have been distributed to small ruminant farmers in Beqaa by ICARDA and LARI. These two organizations have a research flock of small ruminants, which can provide scientific information that can help develop management strategies. Specific demonstration flocks can be established to apply total improvement program as a learning platform but with clear short-term benefits to farmers and higher learning impact to all small ruminant farmers. The business side of the livestock and quantitative analysis of the benefits and costs will be an essential part of this learning program. Syrian labor for the animal production should be given training on the basic knowledge of animal husbandry, including feeding and health, which will be beneficial for their current work and will be human capital development that will be beneficial when they return.
Processing	Small-scale family-run processing industry is important and relevant for smallholder producers. This sector serves in areas where the large industry may not serve. But this small scale industry may face problems of food safety, hygiene, and quality control compliance challenges.	The small-scale dairy processing units should be given a training and awareness building program on food safety, hygiene, and quality control compliance requirements, they should be given a business model and enabled to explore the production of new products that are popular with consumers. For example, goat cheese is very popular in Lebanon and has a market. Similarly, the production of Kishk, which can be locally commercialized as specialty product should be explored. ICARDA has a dairy specialist with expertise on local dairy products and can contribute to this effort in collaboration with LARI and others. The effects of these interventions on the small-scale livestock keepers' access to market through these processing units will be monitored.
Marketing	Lack of access to high-end markets limits the income flow of the small scale dairy processing.	Strategies to develop direct marketing should be explored. This low cost family-based processing industry can add more skilled labor to prepare high end products, which can be labelled and directly marketed to retailers, restaurants, and consumers. Syrian refugees and Lebanese workers can be trained with the skills to make these products and can be a win-win situation for the labor and the processing unit owners.

The opportunities for the Syrian refugees

The role of the Syrians in agricultural value chains beyond wage labor

Syrians had a well-established role in the Lebanese agricultural value chains before the civil war, providing labor in different segments of all value chains. This role has increased with the refugee crisis as more work-seeking Syrians enter the country, wages dropped, and farmers can afford to hire more labor from the refugees. The involvement of the Syrians in the Lebanese agriculture and the mutual benefits for the two sides is not new. What is new in the context of this study and the CARITAS objectives is how the agricultural value chains, particularly those three selected in this analysis, can be used to improve the livelihoods of the Syrian refugees in a way beyond wage labor, which is already happening. It is important to note that as more refugees seek jobs in agricultural labor, declining wages mean wage income can no longer support family livelihoods. From the discussions with the refugees and Syrian farmers, who are currently working with Lebanese land owners, it became clear that wages from agricultural labor are not enough to keep these households above the poverty line, even when more family members, including children who are missing school, are working. Therefore, the only way that Syrian refugees can benefit more from the agricultural value chains is to have access to land, either through renting or sharecropping. There are already Syrians, particularly those with previous social networks, who are engaged in either sharecropping or renting agricultural land. There is no clear legal or social barrier of either activity as far as we could determine. The main barrier would be access to capital in order to enable the renting of land. Sharecropping is more difficult as it requires established social networks, relationships, and trust. Renting is possible in areas with large landholdings. However, the critical question is which value chains should the Syrian refugees be involved in, once the idea of access to land is accepted. Investigating this question by interviews and discussions with the Syrian refugees and Syrians currently sharecropping, we conclude that first renting of land by the refuges is possible in an indirect way. A civil society organization can rent the land and make it available to the Syrian refugees. Once access to land is realized, we found that Syrians are not likely to grow potato or tomato, due to a need for a large area and a long growing period. Syrians prefer a mixture of vegetables with short growing cycles that they can harvest multiple times during the year. The same Syrian refugees will continue to work on potato and tomato fields and thus they will benefit from improvements in these two value chains. For example, the kind of crops, that Syrians grow sharecropping, are presented in Box 4 below.

Box 4. Syrian sharecropper

A sharecropping arrangement is where the landlord and the tenant each provide 50% of the inputs, crops are jointly decided, and the sales are divided 50:50 between the land owner and the tenant. This means land (including water) and labor are considered to have contributed equal shares of the production value. One Syrian farmer we interviewed is sharecropping two pieces of land: 15 and 8 dunum with two Lebanese land owners. He has been coming to Lebanon since 1998 before the Syrian conflict and has strong connections with the Lebanese land owners. He has a large family with adult children having their own families within this extended family. Currently, this Syrian farmer is producing cucumber, green beans (lubia), zucchini as share cropping. Renting is preferred by the tenant than sharecropping, because of more freedom to use the land and maximize profit. Rent of irrigated land in Beqaa is US$200 -400 per dunum per year (11 months). He sells to wholesale traders in the main market and gets paid weekly every Saturday. Prices of fresh vegetables vary within a day. The farmer diversifies the crop composition. During the survey, the farmer was asked which crops he has planted in the current season and provided a very diverse cropping pattern as shown below.:

Syrian sharecroppers' land allocation:

Plot 1	**Crop**	**Tomato**	**Squash**	**Cucumber**
	Area (Dunum)	2.5	3	2.5
Plot 2	**Crop**	**Faba beans**	**Squash**	**Squash**
	Area (dunum)	5	5	5

Discussions with Syrian farmers and refugees revealed that the minimum acceptable land size for a refugee farmer to make an acceptable level of income is 5 dunum. This requires a total investment of at least US$1500 for one year as the initial rent. Land rent varies and depends on the type of land, proximity to markets, and access to good quality water. However, the overall average reported is US$300 per dunum. During the course of this study, 10 Syrian tenants who are mostly sharecropping and some renting were reported in the vicinity of Terbol village in the central Beqaa. Syrians can be involved in sharecropping without the need for much initial capital, such as rent costs. All that is needed is to find willing landowner and to establish trust. Arrangements are possible to deduct all expenses from the sales after harvest. Syrian tenant farmers, who are already engaged in share-cropping or renting farmland, can train others who want to engage in this way. They can train refugee farmers both in production technology and, more importantly, they can be mentors in developing arrangements and on social relations necessary to create successful partnerships. The views of Syrian refugees in their involvement of agricultural values chain though access to land and livestock is presented in Box 5. The refugees were enthusiastic about access to small ruminants, due to their expertise and the perceived benefits. Some are already keeping a few animals in the camps. However, they conceded that if they hold more animals in the camp, then they would have to rent land in order to keep the animals off the campsites or to avoid associated hygienic problems and complains. Shared herding arrangements can be made.

Box 5. Syrian Refugee views of their role in selected value chains.

Syrians do all the potato production work, starting with cutting potato manually and planting using tractors, with female workers maintaining desired spacing. Syrians, mainly men, do the irrigation. Pesticide spraying and fertilization is often male labour. Weeding and harvesting are mostly done by women. The role of men here is limited to carrying goods. Wage is lower than Lebanese at 6000 LBP for women for 5-6 hours and 8000 LBP for men, plus 3000 LBP for over time. Children are involved in agriculture labor, starting at an age of 10 years, deprived of schooling in order to help their families to survive. Schools are limited, few and unavailable. Syrians also work in potato chips factories. The wage of chips factory is 500,000 LBP for women and 600,000 LBP for men. It may increase with experience.

Tomatoes are different from potatoes because tomato is more sensitive to marketing. Potato can be kept for a long time and some kinds of small potato are available for storage and export. Tomato requires more work and workers. Also, more chemicals are used for tomatoes than potatoes. Central Beqaa depends more on open farms than greenhouses.

In the case of raising animals or establishing a dairy-processing unit, this is possible and refugee families can work on processing, packing, and marketing with the support of organizations. The sale will be for refugees in the same camp and for other camps at a cheaper price. However, the refugee families would have to rent land for raising sheep. Animals can rely on grazing in the mountains and on crop residues for 7-8 months a year. There is no impediment to leasing land with the exception of financial resources. Sharecropping with a Lebanese farmer is usually 60% for the owner and 40% for the Syrian worker. Land rent varies from region to region, according to fertility and water loss. In Terbol, it is $ 350 per dunum whereas it is $ 150 in Riyak.

With regard to access to land, the idea of 10 dunum for ten families, with each family 1 dunum, is a good idea. Each family can grow their choice of crops. This is can supplemented with UN food assistance. They can plant short cycle crops, including parsley, mint, radish, lettuce, green beans, cowpea, cauliflower, onions, tomatoes and potato multiple times a year. This can be sold within the camp and the surplus can be sold at the local vegetable market. Some refugee members prefer raising sheep to crops for farmers.

Potential interventions for the Syrian refugees in agricultural value chains in Beqaa

Syrian refugees in Lebanon are facing significant food insecurity and poverty. Their main income from agricultural labor is not sufficient to provide living conditions above the national poverty line. Access to nonagricultural jobs is very difficult as they are considered to be competing with the Lebanese workforce. Syrian refugees are already engaged in agricultural value chains as wage labor, but that is not sufficient to improve their food security or pull them out of poverty. The only remaining option is to find ways in they

can have access to agricultural assets: land and livestock. The following interventions are proposed for the Syrian refugees:

1. **Access to land**: Civil society organizations can rent land on behalf of the Syrian refugees, who will use it for agricultural production to enhance their livelihoods. To ensure that the impact of the scheme is spread widely across the refugees, a group of Syrian refugee families would be assigned to cultivate 1-5 dunum each, depending on the amount of land rented or initial funds available. These families will cultivate the land with short season vegetable crops of their choice and with multiple harvests in a year. The tenants will reimburse the rent over time as they harvest the crop. In the second year, a new group of refugee families will be given the chance to cultivate the land. The role of the civil society organization is crucial here to maintain commitments and payment of the rent to the land owner and to make sure that the program runs smoothly. The effects of the program on the livelihoods of the refugee family can be easily monitored and measured.

2. **Training**: The Syrian refugee households that receive the rented land will be given intensive training on vegetable production and agronomic management by other Syrians, who are already farming in Beqaa through sharecropping. This training shall be organized by research or development organizations with posts in Beqaa, like LARI, Arcenciel, and others.

3. **Access to small ruminants**: Many Syrian refugees had small ruminants before they came to Lebanon. They know how to raise animals and and how to utilize them. Some are already keeping a few animals in the camps. This intervention would provide a few goats or ewes (the exact number to be determined based on minimum income to be generated) to each family. The refugee families that receive the animals shall be given training on animal husbandry, health and feed management. The families will have a shared shed, and joint grazing to minimize the impact of the animals in the area.

4. **Dairy processing teaching workshop:** Syrian women have good skills in processing milk and making different products which can be sold internally. A small dairy processing workshop with standard tools shall be established in Terbol or in other small towns that have high concentrations of refugees. The aim of this facility is first to provide a training facility to women and the second aim is to allow women who are able and willing to bring their own milk and process it under hygienic and safe standards and sell it through their social networks within the refugee camps. If the Lebanese find these workshop products interesting, they can also become a market. The dairy training workshop shall be managed by an international or national organization with capacity and know- how.

Conclusion

This report presents diagnoses of three value chains: potato, tomato, and dairy with a focus on smallholder livestock and dairy. The results are based on a literature review and interviews of key informants, representing different actors along each value chain, as well as Syrian refugees. The report presents specific potential interventions in the three value chains for both the Lebanese farmers and the Syrian refugees. These interventions are based on the main constraints identified in the analysis. It is important to note that while identifying interventions for Lebanese actors along the value chain was not difficult, interventions for the Syrian refugees needed unconventional thinking. It was obvious that Syrian refugees could not benefit from any agricultural value chain beyond wage labor without access to assets. Thus, interventions that can enable Syrian refugee families to access land and livestock are proposed.

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Annexes

Annex 1. Example of budget for small scale small ruminant production unit in Beqaa.

Items	Units	Quantity	Price	Tot Value	Notes
			LBP	LBP/year	
Hay (fattening) (6 rams+ 60 young he bought)	Kg/day/ head	33	450	1,336,500	0.5 kg/head in ideation to crops residuals for 3 months
Concentrate mixed feed for ewes	Kgs/day X heads	105	500	6,300,000	This feed is a mixture of grain (barley and wheat), bran, oilseed cakes, salt, Minerals and other supplements @(0.5-1.5) kg/head, on av. 0.7Kg/ day/ head -140 kg= 150*0.7 for 4 months + 0.7*150*500*4*30
Tot fodder for fattening	1Kg/day / head	60	500	2,700,000	(1-1.5) kg/head and 2kg at the last month, the fattening period of (2- 4 month)
Pasture(dry)	Dunum	30	0	0	Mostly free, the rent 1000 LBP for dunum, Wheat residue
Crops residual	Dunum	65	0	0	Mostly free, the rent 1000 LBP for dunum
Vaccines/Boost	Head	266	3000	798,000	All animals once a year
Remedy/Urgent	Head	40	4500	180,000	
Vet cost/case of need	Visit	2	30000	60,000	Herder has high expertise
Ewe replacement	Head	30	Born	Born	For the size of his flock, 30 ewe lambs are fairly enough
Young sheep (fattening)	Head	45	150000	6,750,000	These are bought from outside
Wool Mowing	Head	206	2000	412,000	
Marketing	Lorry	0	0	0	
transportation	Lorry	0	0	0	
Other 1	0	0	0	0	
Other 2	0	0	0	0	
Workers' wages	Working Syrian family /month	1	600,000	7,200,000	One whole family lives and works on the animals providing all labor needs
Total Variable costs	**LP**			**25,736,500**	**All variable cost +wages**
Output					
Milk	Kg	9600	1,000	9,600,000	80-90 kg /head/season
Wool	Kg	450	-		No demand/ no processing
Fattened sheep-Born	Head	60	175,000	10,500,000	The weight is around 20 kg, since Syria crises
Purchased and fattened lambs	Head	60	412,500	24,750,000	It may be twice a year sales

Young ewes	Head	30		-	Kept them, since these are for replacement of capital livestock, so it adds to capital and not to an income stream. (the number is 50 and their vale is 300,000 or 350,000 per head).
Young ewes sold	Head	24	250,000	6,000,000	assuming 10% loss, 0.9*60=54 female lambs, it is recommended that he can keel about 30, then he should be selling 24)
Aged ewes	Head	40	250,000	10,000,000	Sold replaced ewes
Aged rams	Head	2	600,000	1,200,000	This year
Fertilizer(Dung)	Lorry	0	-		
Gross Income				**62,050,000**	
Profit				36, 313,500	

Annex.2. List of interviewed stakeholders

No	Name	Role in the Value Chains
1	Georges Bou Khater	Potato farmer
2	Ihab Dahdouh	Potato farmer
3	George Saccer	Large-scale grower of potato, tomato, and other vegetables, exporter, and small ruminants sharecropper with Syrian family; restaurant owner.
4	Omer Abu Khateb	Grower of potato, tomato producer, cherry tomato producer, green house vegetable grower, experience in less chemical use for production.
5	Hadi Messelmani	Greenhouses vegetables producer and cooperative manager.
6	Bilaal Zughbe	Tomato and potato grower, West Beqaa
7	Sami Bou Rjaily	Vegetable farmer
8	Iliya Ghura	Arcenciel. Tomato & potato producer, expert on agriculture in Beqaa, dairy cow farm, dairy processor, provider of cold storage services.
9	Georges Doummar	Vegetable farmer/trader
10	Nour El Dine Hayek	Vegetable farmer/trader
11	George Faraj	Potato processor
12	John Jabbar	Small scale small ruminant producer
13	Michael Faraj	Small ruminant producer
14	Boutros Bou Maroun	Small ruminants' farmer
15	Vatche Ashkarian	Large scale small ruminant producer (1300 sheep)
16	Hena Shughayra	Small scale dairy processor
17	Mahmoud Jaber	Dairy processing and outlet owner
18	Said Bou Ghannam	Dairy processing and outlet owner
19	Ahmed Al Mukhtar	Syrian sharecropper ((both male and female members were interviewed)
20	Wessam Zenati	Tomato grower
21	Abo Kazem	Syrian refugee camp leader, camp #006 (both male and female members were interviewed)
22	Abo Mouhammad	Syrian refugee camp leader, camp #017
23	Chefic Estephan	Potato expert, LARI
24	Dr. Khaled	ICARDA-LARI small ruminant expert
25	Cyril Khoury	Dairy industry expert (input supplier)
26	Karim Awada	Agricultural engineer (input supplier)
27	Pierre Nacouzi	Agricultural engineer (input supplier)
28	Fadi Sarkis	Agriculture and business development expert
29	Jamal Khazaal	Veterinary expert
30	Mabelle Chedid	Small ruminant specialist
31	Said Jadaoun	Chamber of Commerce, Industry and Agriculture in the Beqaa
32	Wajdi Khater	Agricultural and rural development expert

Annex.3. Survey semi-structured questionnaire

Date: ––––––––––––––––––––––––––––––
Location: ––––––––––––––––––––––––––––––
Reference: ––––––––––––––––––––––––––––––

I. Stakeholder profile

1. Name/function: ––––––––––––––––––––––––––––––
2. Address and coordinates: ––––––––––––––––––––––––––––––
   Phone/Fax: ––––––––––––––––––––––––––––––
   Email: ––––––––––––––––––––––––––––––
   Web: ––––––––––––––––––––––––––––––
3. Value chain(s)/Sector(s): ––––––––––––––––––––––––––––––
4. Producing or trading since (or years of operation): ––––––––––

I.5. Target market(s): Local National International

II. Common questions

II.1 What do you understand by value chain?

II.2 Do you consider yourself integrated in the value chain you work in?

II.3 What are the major problems and challenges of your value chain on the following levels?

Input supply:

Production systems:

Post-harvest/collection:

Processing:

Distribution:

Market:

II.3 What could be done to improve your value chain on the following levels?

Input supply:
Production systems:
Post-harvest/collection:
Processing:
Distribution:
Market:

III. Specific list of questions for different actors

Producers

1. Production systems ----------
2. Input levels and input use ----------

3. Costs ----------
4. Productivity (yields) ----------
5. Prices ----------
6. What prices do they get at the wholesale market? ----------
7. Marketing strategies? ----------
    a. Where they sell? Farm gate, wholesale market, retail, producer, direct sales ----------
    b. Sorting and packing facilities they have? ----------
    c. Kind of Sorting and packaging they do on farm? ----------
    d. Use of cold storage ----------
8. Relationships: What relationships do they have with:
    a. traders? ---------- exporters? ---------- retailers? ----------
    b. What fees they pay to traders after the sales? ---------- what taxes they pay? -------- what other costs they pay at the market?
9. Problems they face in inputs, production and marketing?
10. Quality:
    a. Consciousness about god agricultural practices? ----------
    b. What qualities standards do they use?
11. Challenges/constraints of the whole value chain ----------

Traders and exporters

1. Arrangements between traders and producers:
    a. What arrangements are there between farmers and traders (sales, input supplies, loans, etc)?
    b. What is the relationship between traders and exporters ------ farmers-------retailers ------?
2. Prices:
    a. What prices do they pay at the wholesale market? From -------- to ----------
    b. What prices do traders sell to retailer, malls and restaurants?
    c. In which seasons are prices lowest? ---------- and highest? ----------
    d. How prices are set by publicly announced bids or auction?
3. Market practices:
    a. How do the traders operate buying, selling, commission?
    b. How the auction works? Who manages the auction (independent body, municipality?)
    c. Is the auction seen as open and competitive?
4. Quality issues:
    a. What qualities do exporters require?
    b. What is the relationship between exporters and producers?
    c. Who sets the standards?
    d. How do they verify that quality standards are met?
5. What is the major challenges facing the Value chain?
6. What is the overall market outlook?

Processors

1. What quantity do they require? Daily? Monthly, yearly? By season?

2. How do the procure:
    a. contractual farming
    b. from who open market via auction
    c. from traders
    d. from farmers?
3. What quality standards do they apply and what quality do they look for?
4. What is the purchase price? How much is the premium for the good quality?
5. What is the selling price?
6. Trends in the demand?
7. Challenges/constraints in the supply of raw materials?
8. Challenges/constraints to marketing?

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