LACTIMED

Promoting Mediterranean Dairy Products

Developing the typical dairy products of the Bekaa and Baalbeck-Hermel

Diagnosis and local strategy

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ENPI CBCMED
CROSS-BORDER COOPERATION IN THE MEDITERRANEAN

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LACTIMED aims to foster the production and distribution of typical and innovative dairy products in the Mediterranean by organising local value chains, supporting producers in their development projects and creating new markets for their products. The project is implemented under the ENPI CBC MED Programme, and is financed, for an amount of EUR 4.35 million, by the European Union through the European Neighbourhood and Partnership Instrument.

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The European Union is made up of 27 Member States who have decided to gradually link together their know-how, resources and destinies. Together, during a period of enlargement of 50 years, they have built a zone of stability, democracy and sustainable development whilst maintaining cultural diversity, tolerance and individual freedoms. The European Union is committed to sharing its achievements and its values with countries and peoples beyond its borders.

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ACRONYMS

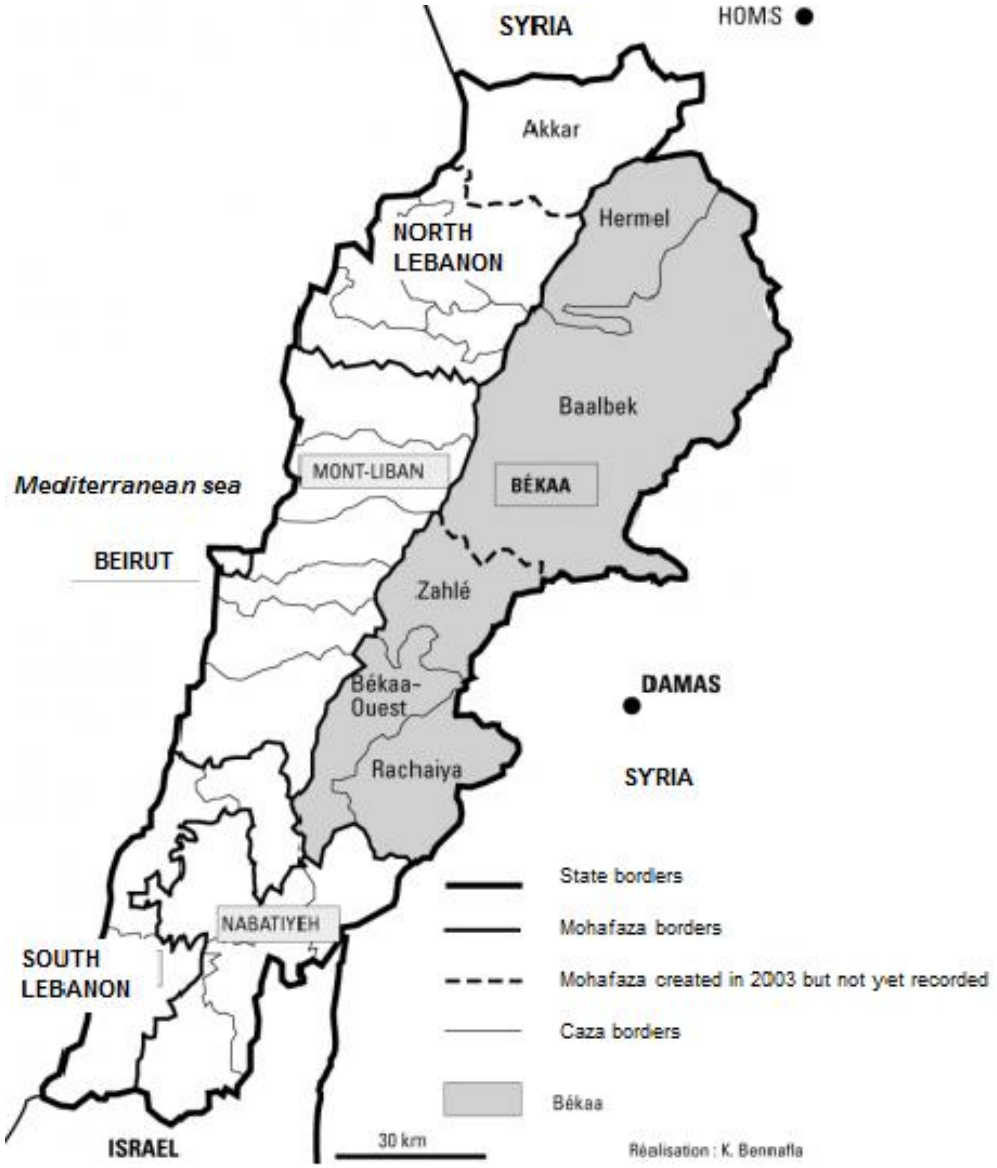
ALI	Association of Lebanese Industrialists
PDO	Protected Designation of Origin
AREC	Agricultural Research and Education Centre
CCIAZ	Chamber of Commerce, Industry and Agriculture of Zahle and Bekaa
CDR	Council for Development and Reconstruction
ESIAM	Engineering School for Mediterranean Agronomy
FAO	Food and Agriculture Organisation of the United Nations
IFAD	International Fund for Agricultural Development
IDAL	Investment Development Authority of Lebanon
IRAL	Lebanese Agricultural Research Institute
IRI	Institute of Industrial Research
ISO	International Standardisation Organisation
LIBNOR	Lebanese Standards Institution
LL	Lebanese Pound
NGO	Non-Governmental Organisation
UNIDO	United Nations Industrial Development Organisation
OPEC	Organisation of the Petroleum Exporting Countries
GDP	Gross Domestic Product
SME	Small and Medium Enterprise
UNDP	United Nations Development Programme
R&D	Research and Development
SWOT	Strengths Weaknesses Opportunities Threats
EU	European Union
UHT	Ultra-High Temperature
USAID	United States Agency for International Development

CONTENTS

1. The dairy chain in Lebanon

Lebanon is a country with rugged terrain. It is located on the Eastern shore of the Mediterranean and covers an area of 10,452 m². It is divided into eight governorates (mohafazats): Beirut, North Lebanon, Akkar, Mount Lebanon, Bekaa, Baalbek-Hermel, South Lebanon and Nabatieh (see Map 1). It consists of two mountain ranges: Mount Lebanon and Anti-Lebanon (bordering Syria). Two plains are the main breeding areas: the Bekaa Valley (between the two mountain ranges) and the Akkar Valley (in the North along the Syrian border). Despite its geographical environment, Lebanon enjoys relatively high rainfall in winter, concentrated between November and March, while summer is very dry, especially in Baalbeck-Hermel.

Map 1: Administrative map of Lebanon



Source: Karine Bennafla. Development at the risk of the geopolitics: example of the Bekaa Valley (Lebanon), Géocarrefour [online], vol. 81/4, 2006, posted April 1, 2010, accessed December 13, 2013.

URL: http://geocarrefour.revues.org/1644

Lebanon is characterised by its rich soils. Despite its small surface area, agriculture is an important part of the economic and social activity of the country. In 2010, it contributed to about 4.7% of GDP and 16% of export (in terms of growth). However, the agricultural sector does not nearly meet the food needs of the population. The agricultural and food trade balance is heavily in deficit. Lebanon's population is estimated at 4.2 million with about 13% living in rural areas. 12.5% of the population lives in the Bekaa and Baalbeck-Hermel governorates.

The Lebanese agricultural sector could be one of the most productive in the region, but it is underdeveloped (less than 1% of the national budget is allocated to the Ministry of Agriculture) and poorly managed. Private sector funding and bank loans to the agricultural sector are limited. This results in a lack of investment, which is detrimental to performance and competitiveness. The main crops are vegetables (tomatoes, potatoes), fruits (citrus, bananas, grapes and apples), olives, tobacco and cereals (mainly wheat). Major agricultural sub-sectors are wine, olive oil and table olives, dairy products and processed products.

The dairy chain has grown in recent years due, firstly, to support from the Ministry of Agriculture and, secondly, to private investment, particularly for processing activities. However, much remains to be done, particularly in terms of organisation and control of the chain.

1.1. Dairy industry stakeholders

1.1.1. Cattle farmers and their herds

FARM SIZE AND EDUCATION LEVEL OF LIVESTOCK FARMERS

The number of livestock farms in Lebanon evolved from 28,060 in 1999 to 27,497 in 2009. The figures for different herds (cattle, sheep and goats) are described in the following table:

Table 1: Evolution of the number of livestock farms in Lebanon between 1999 and 2009

Number of livestock farms	1999	2009	Change (in %)
Cattle	15,600	14,980	- 3.97%
Sheep	5,260	6,000	14%
Goat	7,200	6,517	- 9.48%

Source: Ministry of Agriculture, 2000 and 2010.

In 2010, the number of livestock farmers fell significantly due to the economic crisis in Lebanon since 2006, as well as specific challenges in the livestock sector. The number of cattle farmers fell to 10,400, sheep farmers to 4,094 and goat farmers to 5847. However, these numbers should have risen in 2011 and 2012 due to government support of the dairy chain.

Small-scale milk production is the dominant activity in Lebanese farms: in 2010, 90% of cattle farmers had between 1 and 15 head of cattle and 70% of sheep and goat farmers had under 50 heads.

Also in 2010, the average age of farmers (including livestock farmers) was 52 years. Only 12% of cattle farmers were under 35 years. This shows that young people are moving to other sectors (Ministry of Agriculture, 2012).

Most manufacturers believe that the low level of education of livestock farmers weigh on farm management, on the health status of the herd and the health and safety quality of milk (our interviews, 2013; Haddad, 1996). In fact, according to studies conducted as part of the development of animal production for the International Fund for Agricultural Development (IFAD) in 1995, 25% of livestock farmers were found to be illiterate and 65% literate (Haddad 1996).

BREEDS AND PRODUCTIVITY

The study of three breeds of livestock shows that:

- Bovine herds are composed mostly of Holstein cows, as well as local breeds (especially in northern Lebanon where pastures are scarce), and Friesian and mixed breeds; the average annual milk production per cow over 305 days is 2,000 to 2,500 litres for local and mixed breeds, respectively, 4,000 litres for Friesians and 6,000 to 6,500 for Holsteins (Saade, 1992; Asmar, 2011; our interviews, 2013);
- Sheep herds are composed solely of Awassi sheep, a breed that produces an average of 100 to 200 litres of milk per year over 150 days, depending on whether it is selected for milk production or for feeding its young (National Livestock Institute, 2003; our interviews, 2013);
- Goat herds are composed primarily of hybrid-breed goats (local and Chami, with varying hybridisation rates from one farm to another), which produce 120 to 140 litres of milk per year over 180 days (our interviews, 2013; Kharrat, 2005).

PRODUCTION SYSTEMS

In a 2003 study, the National Institute of Livestock identified four dairy cattle systems:

- "Subsistence systems" (one to three cows): milk is first used to feed the young and the surplus is sold fresh or processed milk by rural women;
- "Diverse systems" (four to six cows): milking is no longer done just by hand and most of the milk is sold;
- "Specialised dairy cattle systems" (seven or more cows): milking is done in a trap pail except in large farms, which have full milking sheds;
- "Integrated industrial dairy farms": this system meets all or part of the raw material requirements according to the standards, and has created a market for fresh, fluid milk (pasteurised or UHT), which did not exist before the 2000s.

The National Institute of Livestock also includes small ruminant farms in three categories:

- "Sedentary farming" (200 to 300 heads): farmers have fields of cereal and vegetable crops; animals graze on common or public land and are also fed concentrates; the portion of auto-consumption is significant;
- "Semi-nomadic farming" (300 to 500 heads): farmers have no land; herds move up into the mountains from May to November, and in winter, the diet is based on grazing on leased land around the villages and on feed concentrates;
- "Transhumant farming" (intermediate systems): the size of the area cultivated by the farmer determines the magnitude of residues and pastures provided to the animals and therefore, the farmer's use of natural land.

FODDER PRODUCTION

In general, 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 crops by-products (National Institute of Livestock, 2003). Small ruminants are mainly fed of stubble and a mixture of barley and vetch from late June to mid-November in sedentary or semi-nomadic farming (Ministry of Agriculture, 2012).

According to the census of the Ministry of Agriculture in 2010[1], barley[2] 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 2003 and 2011 is detailed in the following table:

Table 2: Area of different fodder crops in Lebanon between 2003 and 2011 (in hectares)

Year	2003	2004	2005	2006	2007	2008	2009	2010	2011
Vetch acreage	4,350	3,800	3,500	3,100	2,700	1,900	1,000	583	481
Corn acreage	930	550	900	1,050	900	900	1,928	1 645	1 650
Barley acreage	13,911	12,590	14,500	15,900	15,750	14,500	14,400	10 685	11 000
Sorghum acreage	600	591	520	480	410	370	290	228	230
Alfalfa acreage	750	750	750	750	750	750	750	750	750
Oats acreage	272	190	150	215	180	185	190	188	190

Source: FAO, 2011.

Based on analyses of the FAO (2011), between 2003 and 2011, cultivated vetch and sorghum acreage is in continual decline, maize, barley and oats acreage fluctuate and alfalfa acreage is stable.

However, these statistics are approximate. The evolution of the cultivated acreage is probably due to:

- Evolution of world diesel prices (used for crop irrigation), as well as livestock and fodder;
- Climatic factors that impact directly on the production and yield surfaces in non-irrigated regions;
- Crop rotation (bi, tri, quad or annual) practiced by farmers.

[1] The Ministry of Agriculture's figures and those on which we calculated the percentages do not correspond to the FAO statistics presented in Table 2.
[2] It should be noted that barley and oats associated with vetch supply hay, which is valued by different types of livestock given its nutrient content.

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.

An incentive to barley production was recently introduced: the Ministry of Agriculture provides barley seeds after multiplication at subsidised prices. A grant programme for vetch and alfalfa crops has also been established (Ministry of Agriculture, 2012).

1.1.2. Collectors, processors and related industries

COLLECTION CENTRES

In the 1960s, the Department of Animal Production of the Ministry of Agriculture set up three milk collection centres in Baalbeck-Hermel (Hermel), in the South (Tyr) and in the North (Abdeh) to organise 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 centres were closed down. Subsequently, milk was collected chaotically by out-of-control peddlers, causing major health issues for consumers.

In 2000, the "Small livestock farms rehabilitation project", co-financed by the IFAD and the OPEC, built 12 collection centres with a budget of $ 5.5 million, including four in the Bekaa and Baalbeck-Hermel (Ministry of Agriculture, 2005). During this period, the collection system changed considerably: milk quality improved and its price increased. After the project terminated in 2007, the collection centres 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 authorised the Ministry of Agriculture to lease the collection centres established under the IFAD-OPEC project to the private sector, municipalities or international organisations, where the tenants ensured maintenance of the premises and the milk quality standards (Le Commerce du Levant, 2011). 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 Ministry of Agriculture, leases certain equipment of the centres to cooperatives and cooperative groups created under the project in the Bekaa and Baalbeck-Hermel. Launched in 2009, this project was funded by the reconstruction funds of the Stockholm Conference for the Reconstruction of Lebanon.

Contrarily, some private companies built their own collection centres in the Bekaa with their processing plants located in Beirut and Mount Lebanon. This is particularly the case of Taanayel Les Fermes and Dairy Khoury.

IMPORTANCE OF THE AGRI-FOOD INDUSTRY

Agri-food production occupies a significant place in national industrial production, both in terms of the number of establishments and permanent employees, and the value produced. In addition, the development of the agri-food sector has a ripple effect on the agricultural, packaging and services sectors.

Table 3: Percentage of agri-food production in industrial production

Year	2003	2004	2005	2006	2007	2008	2009
Percentage	37.81%	36.60%	33.51%	35.16%	27.21%	31.85%	32.56%

Source: Our calculations based on the Economic Accounts Mission, 2008; Kasparian, 2009 and 2010.

In 2007, the agri-food industry employed more than 25% of the industrial workforce (Ministry of Industry, AIL and UNIDO, 2010).

MILK PROCESSING

Since the 1980s, the number of dairy farms has increased. According to official figures, they increased from 64 units in 1985 to 228 in 1994 and to 280 in 1998. In the late 1990s, industry actors estimated the number of units as 350 or even 500 if informal units are counted. The majority were individual and small-scale units (Haddad, 2001).

In July 2013, the number of dairy companies registered with the Ministry of Industry was 115. During the same period, 202 units also filed an application for health and safety approval from the Health Ministry of Agriculture (our interviews, 2013).

However, many processing units work without a license, a widespread phenomenon in all branches of the Lebanese industry. It is therefore difficult to accurately estimate the total number in the country, but it must exceed 500.

Lebanese processing units can be divided into three categories:

- Modern dairies: the production process is mechanised with minimal labour intervention, as in Liban Lait (Haouch-Sneid in the Bekaa), Taanayel Les Fermes (Fanar, Mont-Liban), Ghandour's the Dairy (Kfarchima near Beirut) and Skaff Farm (Zahle, Bekaa);
- Semi-modern dairies: production is partially mechanised, as in Centre Jdita (Jdita, Bekaa), Jarjoura (Chtaura, Bekaa), Massabki (Chtaura, Bekaa), Couvent de Tanaël (Tanaël, Bekaa) and Jaber (Mrayjat, Bekaa);
- Traditional dairies: production is traditional and the level of hygiene is generally unreliable.

According Dib, Hajj Semaan and Noureddine (2008), daily production is less than five tonnes for most dairy processing companies.

RELATED INDUSTRIES

- **Packaging suppliers**

Packaging adopted by dairies is generally conducted as follows:

- Labneh and yogurt are sold in different sized plastic pots: 400 g, 500 g, 900 g, 1kg, 2kg and 5 kg;
- Cheeses are packaged in nylon bags, most under vacuum, between 200 g and 1 kg;
- Pasteurised and Ayran milk are packaged in plastic bottles of 200 ml and 1 l;
- UHT milk is packaged in Tetra-pack cardboard.

Note that many factories sell their products in bulk to distributors, cafes, hotels and restaurants (CHR) as well as households.

Plastic and nylon packaging is manufactured locally. Two types of packaging exist:

- With separate labels printed on paper or nylon;
- With printing directly on the pots or on nylon.

- **Additive, chemical and enzyme suppliers**

All plants use enzymes, flavouring, stabilisers, salts and other additives for the production of dairy products.

Sterilisation of Ayran bottles is implemented in plants with special machines, whereas plastic pots are heat sterilised directly before filling.

- **Machinery and equipment suppliers**

Some machinery and equipment are manufactured in Lebanon in mechanical workshops. Parts difficult to make, sophisticated machinery and some equipment are imported (Haddad, 1996; our interviews, 2013).

- **Electricity suppliers**

Electricity is the energy source most used in the dairy industry. It is provided by:

- Electricity of Lebanon (EDL), and for part of the District of Zahle by Electricity of Zahle (EDZ);
- Private generators (constituting an additional charge) due to the inability of the two above mentioned companies to provide continuous electricity as stations and networks have become deteriorated due to the civil war (Haddad, 1996; our interviews, 2013).

1.1.3. Quality of milk and dairy products

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). It should also be noted that milk delivered by peddlers (intermediate collectors) 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.) and perhaps with serious consequences (Touma, 2002).

The physical quality of milk is also variable, in particular concerning the fat content. Indeed, 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 analyse their finished products in an internal or external laboratory.

Powdered milk is used by many dairies:

- Firstly, because it is cheaper than fresh milk;
- Secondly, because 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 (our interviews, 2013).

In addition, fraudulent practices mislead consumers about the origin of the raw material. Some dairies use artificial and already industrialised materials (powdered milk, gelatine and hydrogenated oils) and market their goods as fresh and natural production. Competition between these dairies and those using fresh milk becomes unfair (Haddad, 2001; our interviews 2013).

Indeed, "gelatine cream" (or Labneh Sab), made from powdered milk, sodium or calcium caseinate, animal gelatines, butter and other fats, is sold under the name "Labneh" despite its different preparation and composition from traditional Labneh, thus disrupting the market.

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

1.1.4. Distribution networks

MAIN CIRCUITS AND DISTRIBUTION CHANNELS OF RAW MILK

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, aluminium 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: it is now an upstream vertical integration strategy, which is complete (case of Lebanon milk) or partial (case of dairy Convent of Tanaël);
- Sale to processing units: it is rare that a producer delivers his own milk to the dairy plant or the plant itself collects the required amounts of milk from livestock farms; plants tend to use an intermediate collector (Haddad 1996; our interviews, 2013).

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

- 75% sell their milk to cooperatives of which they are members, to collection centres 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 by dairies;
- 25% sell their milk to dairies and households, or process it themselves into dairy products (our interviews, 2013).

FLOW BETWEEN PROCESSORS AND DISTRIBUTORS

The majority of dairies distribute their products themselves. Therefore, they have their own means of transport, as well as staff specifically assigned to this task.

The percentage of export in the total sales is minimal, if it exists at all (our interviews, 2013).

DAIRY INDUSTRY DISTRIBUTION CHANNELS

The dairy industry distribution channels are:

- 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. Amongst the most important: Spinneys (10 stores), Le Charcutier Aoun (10 stores), Bou Khalil (10 stores), Monoprix (three stores), Carrefour, TSC, BHV, Farm superstores and Caliprix;
- 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;
- AFH consumption consisting mainly of hotels, restaurants and cafes;
- Plant-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 cafes-snack bars.

National trade suffers from a number of problems, the most important being:

- Frequent power cuts, which deteriorate the quality of the fresh produce stored;
- Deterioration of certain road networks and poor maintenance of others.

1.1.5. Public institutions and professional organisations

PUBLIC STAKEHOLDERS

Public stakeholders are responsible for the organisation and support of the dairy chain in Lebanon:

- **The Ministry of Agriculture (MoA)**

The MoA is responsible for the organisation of the dairy chain, from primary production to marketing: recording, control of farms and animal identification, registration, control and approval of health and safety in milk processing units and transporters, labelling authorisation and control.

- **The Ministries of Industry, Agriculture, Health, Public Works and the Environment**

They are jointly responsible for the production licensing of dairy processing units. The committee license is composed of one representative of each of these departments and chaired by the representative of the Ministry of Industry (Decree No. 7945, dated 29/05/2002). The first three ministries support the control of health and safety in milk processing units.

- **The Lebanese Agricultural Research Institute (LARI)**

The IRAL's mission is to conduct scientific research for the development of the agricultural sector in Lebanon. It began as an agricultural training centre in Tal Amara in the Bekaa after the Second World War. In 1957, it became a department of the Ministry of Agriculture, responsible for agricultural research. In 1964, the Institute acquired the status of an independent public institution under the Ministry of Agriculture. It now houses eight experiment stations, including two in the Bekaa (Tal Amara and Tourbol) and one in Baalbeck-Hermel (Kafar dene). It has, in particular, fodder culture testing grounds, a station for the genetic improvement of sheep and goat herds, as well as fodder quality, milk and dairy products analysis laboratories.

- **The Industrial Research Institute (IRI)**

Established in 1953, the IRI is attached to the Ministry of Industry and enjoys administrative and financial autonomy. It conducts studies and industrial research, scientific tests and laboratory analyses. In particular, it provides fodder, milk and dairy product quality analysis.

- **The Lebanese Standards Institution (LIBNOR)**

Established in 1962 under the Ministry of Industry, LIBNOR's missions is firstly, to prepare and publish national standards and, secondly, to allow the use of the "Lebanese brand". The standardisation system applies, amongst other products, to fodder, milk and dairy products.

- **The Department of Consumer Protection**

Under the responsibility of the Ministry of Economy, it aims to "ensure a safe environment and fair and equitable trade to consumers and traders". The law governing consumer protection was ratified in 2004. This service is

mobilised on personal initiative or upon complaint to control the price and quality of processing units and distribution.

SUPPORT SERVICES

- **The Council for Development and Reconstruction (CDR)**

The 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.

- **The Agency for Investment Development in Lebanon (IDAL)**

Founded in 1994, IDAL is responsible for the promotion of investment in all sectors, as well as grants and the promotion of agricultural exports (fruits and vegetables). Its activities, which can benefit to fodder farmers and dairy processing units, consist primarily of providing investors with economic and financial information on the Lebanese environment. The IDAL also offers tax incentives (tax exemption on income for a period of up to 10 years), financial incentives (reduced registration and license fees) and non-financial incentives (facilities for obtaining work permits for employees). The minimum investment amount required to benefit from these advantages is $ 500,000 for agricultural projects and $ 1 million for industrial projects (investment law No. 360).

- **The 4 Chambers of Commerce, Industry and Agriculture (CCIA)**

Covering all of the Lebanese territory, the CCIA provides businesses, including fodder farmers and milk processing units, with the following services: information on national and international quality standards and export market trends, technical assistance by experts in the framework of projects financed by international organisations, vocational training and support in the development of food products and quality control.

- **Technical institutes and universities hosting schools or faculties of agricultural sciences, food and nutrition**

Amongst them are the Lebanese University, Saint Joseph's University, the American University of Beirut and the Holy Spirit University of Kaslik. The universities are teaching and research institutions.

- **Private product quality analysis laboratories**

PROFESSIONAL ORGANISATIONS

- **Farmers' organisations**

The individualistic nature of milk producers (like the whole Lebanese people) has long been an obstacle to any form of organisation, reinforced by the lack of encouragement from the state. However, many attempts at cooperation have been undertaken. Amongst them, some have remained in draft form, others have been implemented, but quickly declined and terminated; however, some are still active in the market. These cooperatives collect milk from member farms for delivery to processors (Haddad, 1996; our interviews 2013).

A large number of farmers' cooperatives were created within the "Small livestock farms rehabilitation" project, co-financed by the IFAD and the OPEC (1993-2002), and the "Improvement of dairy cattle project in Lebanon - fodder crops" project, funded by the USAID (1997-2004). In the years 2012-2013, the majority of these cooperatives became dissolute by ministerial decisions because they were no longer active.

In the Bekaa and Baalbeck-Hermel, milk producers' cooperatives created under the "Recovery and Rehabilitation of Dairy Sector in Beqaa Valley and Hermel-Akkar Uplands Dairy project", implemented by the FAO since 2009, are listed in the following table (our interviews, 2013):

Table 4: Dairy cooperatives in the Bekaa and Baalbeck-Hermel regions

Headquarters	Region	Date of creation	Number of members
Hermel and Hosh Essayed Ali	Baalbeck -Hermel	2010	70
Qaa	Baalbeck -Hermel	2010	110
Bazzaliah	Baalbeck -Hermel	2010	150
Chlifa	Baalbeck -Hermel	2010	20
Nassrieh and Hoch El Nabi	Baalbeck -Hermel	2010	100
Kfarmechki and Kherbet Rouha	Bekaa	2010	112
Ghazzé	Bekaa	2010	110
Zahlé	Bekaa	2011	110

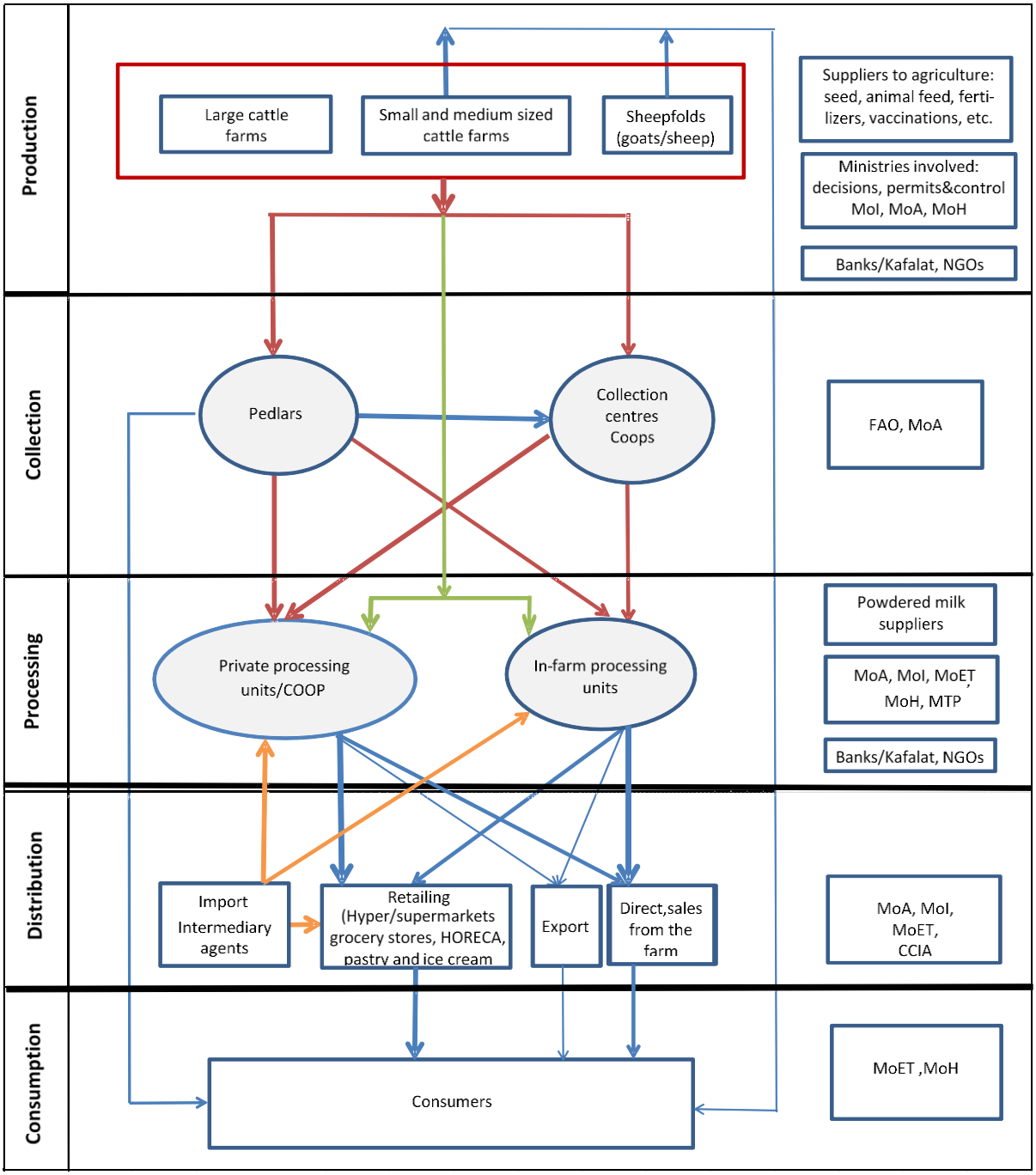
It should be noted that in 2010, 96% of farmers (including livestock farmers) were not part of any agricultural cooperative (Ministry of Agriculture, 2012).

- **Processors' organisations**

In Lebanon, processing organisations are almost non-existent in the dairy chain. This is mainly due to conflicts of interest between large plants, and small and medium-sized plants. Indeed, their strategies, as well as their vision for the future and the structure of the industry, are opposing.

The attempt to organise the dairy chain in the Bekaa has resulted in the creation of a group of dairy processing plants in 1991, gathering in the beginning 15 processors. This number then increased to 30. The main objectives of the group were to improve the quality of milk and stabilise its price. The group has been relatively active for 10 years. Unfortunately, all activities were subsequently suspended for the above-mentioned reasons, which led to its dissolution by the Ministry of Agriculture in 2012 (our interviews, 2013).

Figure 1: Diagram of the dairy chain in Lebanon



MoA: Ministry of Agriculture; MoH: Ministry of Health; DPW: Department of Public Works; MoET: Ministry of Economy and Trade; MoI: Ministry of Interior and Municipalities; CCIA: Chamber of Commerce, Industry and Agriculture

1.2. Flow dynamics and explanatory factors

1.2.1. Evolution of the production and collection of raw milk

EVOLUTION OF LIVESTOCK NUMBERS AND COMPOSITION

The evolution of cattle numbers, described below, can be explained by the following factors:

- Political and security events affecting Lebanon, including the July 2006 war;
- Diseases affecting livestock and limited veterinary services;
- Climatic factors affecting grazing and transhumance;
- Evolution of world prices for livestock and fodder;
- Lower milk prices at certain times.

Table 5: Evolution of cattle numbers in Lebanon between 2003 and 2010 (in thousands)

Year	2003	2004	2005	2006	2007	2008	2009	2010
Cattle	86.2	80.4	76.9	77.0	77.4	73.7	74.9	68.5
Dairy cattle	47.5	43.85	43.8	43.9	45.3	40.2	40.8	40.1

Source: Ministry of Agriculture, 2005a, 2006, 2010 and 2012.

In general, cattle numbers declined between 2003 and 2010. Very small changes compared to the previous year occurred in 2006, 2007 and 2009. The largest decline was recorded in 2010.

Table 6: Evolution of sheep numbers in Lebanon between 2003 and 2010 (in thousands)

Year	2003	2004	2005	2006	2007	2008	2009	2010
Sheep	302.5	305.3	337.3	370.4	324.4	370.9	372.1	265.3
Dairy sheep	175.6	179.4	182.7	202.4	218.6	227.2	204.7	153.6

Source: Ministry of Agriculture, 2005a, 2006, 2010 and 2012.

Sheep numbers, which increased from 2003 to 2006, experienced a sharp decline in 2007 and resumed growth in 2008 and 2009. A second decline occurred in 2010.

Table 7: Evolution of goat numbers in Lebanon between 2003 and 2010 (in thousands)

Year	2003	2004	2005	2006	2007	2008	2009	2010
Goats	428.0	432.1	494.7	484.4	434.7	399.1	430.1	403.8
Dairy goats	240.4	234.5	246.7	206.6	234.7	212.6	214.8	241.4

Source: Ministry of Agriculture, 2005a, 2006, 2010 and 2012.

Goat numbers increased between 2003 and 2005 and then decreased by 19.35% between 2005 and 2008. They increased in 2009 before declining again in 2010.

EVOLUTION OF MILK PRODUCTION

In 2009, the value of agricultural production[3] amounted to 3,173 billion LL ($ 2.115 billion), animal production[4] to 957.9 billion LL ($ 638.6 million) and milk production to 180.9 billion LL ($ 120.6 million). Thus, milk production represented 18.9% of animal production and 5.7% of agricultural production (Ministry of Agriculture, 2010). The tables below depict the evolution in volume and value from 2003 to 2009.

Table 8: Evolution of cattle, sheep and goat's milk production in Lebanon (in thousands of tonnes)

Year	2003	2004	2005	2006	2007	2008	2009	2010
Cow's milk	194.6	186.5	189.8	166.8	183.6	163.8	168.2	165
Sheep's milk	23.3	21.6	22.8	19.7	24.7	17.4	14.8	13
Goat's milk	36.5	36.1	39.3	26	34	21.2	21.7	32
Total	254.4	244.2	251.9	212.5	242.3	202.4	204.7	210

Source: Kasparian, 2010, Ministry of Agriculture, 2005a, 2006 and 2010, FAO, 2011.

[3] Plant and animal production
[4] Milk, red meat, chicken, eggs, honey and fish

Table 9: Evolution of cattle, sheep and goat's milk production in Lebanon ($ millions)

Year	2003	2004	2005	2006	2007	2008	2009
Cow's milk	67.87	64.60	66.07	78.93	96.67	93.67	99.07
Sheep's milk	8.60	7.93	9.27	8.93	13.33	10.00	8.53
Goat's milk	15.33	14.33	17.07	12.87	18.47	13.07	13.00
Total	91.80	86.87	92.40	100.73	128.47	116.73	120.60
Percentage of the local livestock production[5]	26%	23%	25%	-	24%	19%	19%

Source: Kasparian, 2010, Ministry of Agriculture, 2005a, 2006 and 2010.

Milk production depends on the number of animals in the herd, but also their milk performance.

MILK COLLECTION

In Lebanon, milk distribution is based on three main channels:

- **Collection centres (private or public)**

These centres are usually equipped with refrigerated tanks fitted with analytical tools (quick kits), which assess the milk quality on the spot to avoid problems when mixing different milks and during processing, without definitively excluding the risk of contamination.

- **Independent peddlers**

These are intermediate collectors, called "Hallab" in Lebanese dialect. Some work independently with several processing plants, while others work on behalf of specific plants. The quality of the milk transported by independent peddlers is often questionable. A peddler bills a kilo of milk between 75 and 150 LL ($ 0.05 and $ 0.10), and this, according to the mode and means of transport: trucks loaded with aluminium / plastic containers or cooling tanks. The development of this system has been favoured for a long time because the rules on quality control and safety are not applied. This distribution mode has improved in terms of health following the establishment in 2010 of a new regulation from the Ministry of Agriculture concerning the registration and control of health and safety of the vehicles transporting milk and dairy products.

- **Direct delivery from farms**

Some farms, including medium and large farms, deliver directly to processing units by means of privately owned refrigerated tanks.

Most of the milk transported is used by the plants and the remainder is distributed directly to consumers.

1.2.2. Evolution of the production of dairy products

FERMENTED MILK AND CHEESE PRODUCTION

Industrial, farm and artisanal production of the main dairy products is presented in the following table. In the absence of statistics on the subject, these figures were determined based on our own calculations, estimates of the accounts of the Ministry of Agriculture and the Directorate General of Customs, and the field survey results. These figures are not very precise, but give a fairly clear idea the current situation.

Table 10: Evolution of the local production of dairy products between 2003 and 2009 (in tonnes)

Year	2003	2004	2005	2006	2007	2008	2009
Laban and Ayran	116,731	117,934	118,704	103,982	105,541	91,717	101,746
Labneh	29,628	29,911	30,117	26,367	26,809	23,283	25,795
Halloum	7,426	7,520	7,561	6,635	6,697	5,831	6,497
Other cheeses	15,526	15,718	15,805	13,865	14,007	12,192	13,575
Kechec	3,052.8	2,930.4	3,022.8	2,550	2,907.6	2,428.8	2,456.4

Source: Our calculations based on our estimates, survey / interviews, 2013; Ministry of Agriculture, 2004, 2005a, 2006, 2008, 2010, Directorate General of Customs, 2013.

Between the years 2003 and 2009, the average annual production was 108,050 tonnes of Laban/ Ayran, 27,415 tonnes of Labneh, 21,265 tonnes of other cheeses and 2,764 tonnes of Kechec.

In parallel to artisanal and industrial production, many Lebanese, especially in rural areas, continue to produce at home Laban, Labneh, Kechec (powdered yoghurt and semolina) and even cheese, mainly from fresh milk,

[5] Local animal production includes milk, red meat, chicken, eggs, honey and fish.

but sometimes from powdered milk. Part of artisanal Kechec is consumed and the rest is sold on the market or door to door.

UHT AND PASTEURISED MILK PRODUCTION

The production of UHT and pasteurised milk is new in Lebanon. It began in the early 2000s. The product range includes whole, skimmed, semi-skimmed, lactose-free and flavoured (strawberry, banana, chocolate, apricot) milk.

Based on our interviews we believe that in 2013 the production of UHT and pasteurised milk is nearly 5,000 tonnes. The market leader is now Liban Lait.

1.2.3. Consumption of milk and dairy products

CRITERIAS FOR CONSUMPTION

Consumption of milk and dairy products in Lebanon varies according to several criteria (Arja et al., 2001; our interviews, 2013):

- **Age**: fluid milk consumption decreases with age; it is higher in infants and children under 10 years;
- **Gender**: 46% of women and 24% of men regularly consume fluid milk while 66% of women and 60% of men regularly consume dairy products; women, therefore, consume more milk and dairy products than men;
- **Lifestyle (urban or rural)**: village housewives prepare more dairy products, including Laban and Labneh, than urban households, although they continue to do so;
- **Climate**: the demand for milk and dairy products generally decreases during the months of January, February and March; the consumption of fresh Laban and Ayran increases in summer, while traditional warm-milk Lebanese dishes increase in winter;
- **Taste and preferences**: Lebanese, who before the 1990s preferred the acid taste of Labneh, now prefer neutral tasting Labneh, while fluid milk, which was before the 2000s prepared from imported instant powdered milk (guaranteeing its microbiological quality), is also consumed as UHT milk since 1998.

In addition, five categories of consumers (Beirut capita) can be distinguished (Mouawad, 1999):

- The first mainly consumes imported dairy products for their quality technical control and because of brands and flavour;
- The second agrees with the first and considers imported products better value than local products;
- The third prefers imported products and considers them better quality (on the basis of flavour when buying), and demands control of the supply chain;
- The fourth associates quality with the use of raw milk as the raw material, with geographical origin and artisanal production, and does not consider that imported products are better quality than local products;
- The minority fifth is satisfied with local production and prefers to buy it.

In addition, due to the decline in purchasing power, the majority of consumers look for the best quality / price ratio.

EVOLUTION OF CONSUMPTION BY PRODUCT TYPES

In terms of volume, we believe[6] that national consumption is 650,000 tonnes of milk equivalent per year, or about 189 L / inhabitant / year, which is very close to the neighbouring Mediterranean countries. The distribution of consumption by product is as follows:

Table 11: Evolution of the local consumption of dairy products between 2003 and 2009 (in tonnes)

Year	2003	2004	2005	2006	2007	2008	2009
Laban and Ayran	116 739	117 951	118 703	103 957	105 355	91 724	102 031
Labneh	29 568	29 851	30 063	26 338	26 740	23 171	25 692
Cheese	51 210	55 098	52 324	49 684	49 519	44 604	51 539
Butter	5,517	5,175	4,944	4,376	5,030	2,946	4,620

Source: Our calculations based on our estimates, survey / interviews, 2013; Ministry of Agriculture, 2004, 2005a, 2006, 2008, 2010, Directorate General of Customs, 2013.

[6] According to our interviews with the dairy chain stakeholders and our figures.

In terms of value, domestic consumption of dairy products is presented in the following table:

Table 12: Domestic consumption (current prices) of households ($ millions)

Year	2003	2004	2005	2006	2007	2008	2009
Dairy products	459	467	479	487	590	679	761
Total food consumption	4,298	4,523	4,510	4 629	5 290	6 164	6 717
Total consumption	17,552	19,115	19,256	19,475	21,604	26,338	27,772

Source: Our calculations based on the Economic Accounts Mission, 2008; Kasparian, 2009 and 2010.

In 2009, the consumption of dairy products was, in terms of value, 11.33% of the total food consumption and 2.74% of total consumption.

CONSUMPTION HABITS BY PRODUCT TYPES

The nutritional quality of milk, recognised by the housewife and distributed in households, has made it an important, even vital element of the diet and eating habits in Lebanon (Haddad, 1996). Thus, Lebanese dairy products are at the heart of culinary traditions, which remain pervasively present in Lebanon.

- **Drinking milk**

It is consumed especially in the morning at breakfast by children (with or without chocolate or other accompaniments) and by adults (with or without coffee or chocolate, or other accompaniments). Milk is included in the preparation of various dishes, pastries and ice cream. Milk is used in one of the following three forms: powdered milk, pasteurised fluid milk (especially in rural areas) and UHT milk (especially in urban areas).

- **Laban**

It can be eaten alone or as an accompaniment to some traditional dishes (like Sfiha). It is also used for the preparation of salads (with cucumber and dry mint), and Lebanese and Middle Eastern dishes (Laban Kebbe, Laban hock meat, Laban courgettes, etc.). Consumption increases during the summer.

- **Ayran**

It is consumed as a refreshing drink, especially in summer. It can accompany thyme or minced meat (Sfiha) pita bread or a sandwich.

- **Labneh**

Easy to spread, it is mostly consumed at breakfast and dinner. It is a central element of Lebanese culinary heritage and is included in the preparation of several mezze: Labneh goat balls, Labneh with garlic, etc.

- **Halloum, Akkawi, Double cream, Baladi and Mchallali cheeses**

The cheeses are consumed at any age, especially at breakfast and dinner. They are included in pita bread preparation. Halloum can be eaten fresh or grilled. Akkawi is also used in the preparation of certain traditional desserts including Knafi. Baladi is included in Lebanese mezze.

- **Kechec**

It is prepared as a soup (flavoured with garlic, as an accompaniment to meat cooked and preserved in lard) and mostly consumed at breakfast. It can also fill pita bread.

- **Chanklich**

This is a typical Lebanese cheese. It is consumed mainly by adults at lunch and dinner. It is included in Lebanese mezze and is consumed with chopped tomatoes, onions and olive oil.

- **Anbaris and Darfiyi**

These are sour cheeses, mainly consumed by adults in the Lebanese mountains where they are produced. They are particularly popular with eco-tourists and Lebanese gourmets.

1.2.4. Foreign trade

IMPORT

Lebanon is far from being self-sufficient in milk and dairy products. The figures differ according to sources. According Asmar (2011), import accounts for over 63% of the needs of the population in milk and dairy products, while the FAO (report in preparation) estimate that it contributes to about 78% of products.

Import in terms of volume and value of milk and dairy products are detailed in the tables below; however, informal channels and clandestine imports from Syria exist, and a part is dedicated to re-export.

Table 13: Import of milk and dairy products in Lebanon between 2003 and 2007 (in tonnes)

Year	2003	2004	2005	2006	2007
Milk and non-concentrated milk cream without sugar or sweetener	2,093	2,280	2,216	3,974	6,869
Milk and concentrated milk cream or containing sugar or other sweeteners	19,805	22,631	21,566	20,567	15,178
Buttermilk, curdled milk and cream, yogurt and other fermented or acidified milk or cream	47	54	23	41	2,053
Whey	223	508	663	446	644
Butter, fats and spreads derived from milk	7,614	7,680	7,054	6,297	7,254
Cheeses	30,369	33,036	29,628	29,697	29,749
Total milk and dairy products	60,151	66,189	61,150	61,022	61,747

Source: Ministry of Agriculture, 2004, 2005a, 2006 and 2008.

Table 14: Import of milk and dairy products in Lebanon between 2008 and 20012 (in tonnes)

Year	2008	2009	2010	2011	2012
Milk and non-concentrated milk cream without sugar or sweetener	6,446	8,447	10,626	6,087	5,287
Milk and concentrated milk cream or containing sugar or other sweeteners	15,273	21,212	19,942	18,647	21,512
Buttermilk, curdled milk and cream, yogurt and other fermented or acidified milk or cream	28	312	1,279	1,168	1,561
Whey	419	305	698	393	345
Butter, fats and spreads derived from milk	4,548	7,067	5,880	6,146	5,782
Cheeses	26,661	32,442	32,576	33,492	34,233
Total milk and dairy products	53,375	69,785	71,001	65,933	68,720

Source: Ministry of Agriculture, 2010, Directorate General of Customs, 2013.

Table 15: Import of milk and dairy products in Lebanon between 2003 and 2007 (in thousands of $)

Year	2003	2004	2005	2006	2007
Milk and non-concentrated milk cream without sugar or sweetener	4,132	5,013	5,037	6,532	8,569
Milk and concentrated milk cream or containing sugar or other sweeteners	50,532	63,185	63,854	61,321	73,994
Buttermilk, curdled milk and cream, yogurt and other fermented or acidified milk or cream	192	199	102	117	136
Whey	148	388	616	468	1,063
Butter, fats and spreads derived from milk	17,041	18,777	19,912	17,585	24,989
Cheeses	81,252	91,461	88,717	87,535	103,265
Total milk and dairy products	153,297	179,023	178,239	173,557	212,017

Source: Ministry of Agriculture, 2004, 2005a, 2006 and 2008.

Table 16: Import of milk and dairy products in Lebanon between 2008 and 2012 (in thousands of $)

Year	2008	2009	2010	2011	2012
Milk and non-concentrated milk cream without sugar or sweetener	9,321	12,049	13,924	12,259	11,280
Milk and concentrated milk cream or containing sugar or other sweeteners	788	77,914	77,676	87,675	94,050
Buttermilk, curdled milk and cream, yogurt and other fermented or acidified milk or cream	175	846	2,612	2,442	2,849
Whey	741	342	946	851	630
Butter, fats and spreads derived from milk	24,560	26,569	32,658	38,150	32,208
Cheeses	111,224	134,206	142,588	156,517	154,603
Total milk and dairy products	224,899	251,926	270,404	297,894	295,620

Source: Ministry of Agriculture, 2010, Directorate General of Customs, 2013.

Import of milk and dairy products fluctuated between 2003 and 2012 with a minimum of 53,375 tonnes in 2008 and a maximum of 71,001 tonnes in 2010.

EXPORT

Export of milk and dairy products produced in Lebanon is minimal. The export/ import ratio in 2012 was 7.74%.

Data provided by the Lebanese customs include national export and re-export. Export in terms of volume and value of milk and dairy products are detailed in the following tables:

Table 17: Export of milk and dairy products in Lebanon between 2003 and 2007 (in tonnes)

Year	2003	2004	2005	2006	2007
Milk and non-concentrated milk cream without sugar or sweetener	20	55	50	158.4	9,2
Milk and concentrated milk cream or containing sugar or other sweeteners	145	71	135	130	98
Buttermilk, curdled milk and cream, yogurt and other fermented or acidified milk or cream	99	97	78	52	288
Whey	6	3	32	0,4	30.4
Butter, fats and spreads derived from milk	37	26	80	62	25
Cheeses	2,111	1,176	670	513.2	934.5
Total milk and dairy products	2,418	1,428	1,045	916	1,385.1

Source: Ministry of Agriculture, 2004, 2005a, 2006 and 2008.

Table 18: Export of milk and dairy products in Lebanon between 2008 and 2012 (in tonnes)

Year	2008	2009	2010	2011	2012
Milk and non-concentrated milk cream without sugar or sweetener	15	194	103	32	36
Milk and concentrated milk cream or containing sugar or other sweeteners	136	226	174	217	211
Buttermilk, curdled milk and cream, yogurt and other fermented or acidified milk or cream	133	130	1.093	1.188	1.681
Whey	4	1	824	1.303	2.096
Butter, fats and spreads derived from milk	21	161	80	73	50
Cheeses	80	975	615	1.059	1.245
Total milk and dairy products	1.111	1.687	2.889	3.872	5.319

Source: Ministry of Agriculture, 2010. Directorate General of Customs, 2013.

Table 19: Export of milk and dairy products in Lebanon between 2003 and 2007 (in thousands of $)

Year	2003	2004	2005	2006	2007
Milk and non-concentrated milk cream without sugar or sweetener	23	58	64	424	39
Milk and concentrated milk cream or containing sugar or other sweeteners	342	201	512	372	370
Buttermilk, curdled milk and cream, yogurt and other fermented or acidified milk or cream	163	179	194	208	290
Whey	11	15	29	2	31
Butter, fats and spreads derived from milk	89	77	249	180	83
Cheeses	1,802	2,050	2,186	2,236	2,993
Total milk and dairy products	2,430	2,580	3,234	3,422	3,806

Source: Ministry of Agriculture, 2004, 2005a, 2006 and 2008.

Table 20: Export of milk and dairy products in Lebanon between 2008 and 2012 (in thousands of $)

Year	2008	2009	2010	2011	2012
Milk and non-concentrated milk cream without sugar or sweetener	60	190	139	38	40
Milk and concentrated milk cream or containing sugar or other sweeteners	999	940	769	999	854
Buttermilk, curdled milk and cream, yogurt and other fermented or acidified milk or cream	374	534	1,246	1,522	1,678
Whey	7	6	745	1.131	1.888
Butter, fats and spreads derived from milk	107	356	252	305	207
Cheeses	4,099	3,578	2,556	4,206	4,692
Total milk and dairy products	56,445	5,604	5,707	8,201	9,359

Source: Ministry of Agriculture, 2010. Directorate General of Customs, 2013.

Like import, export of milk and dairy products varied from year to year, between 2003 and 2012, with a minimum of 916 tonnes in 2006 to a maximum of 5,319 tonnes in 2012.

1.2.5. Pricing system

PRICE OF RAW COW'S MILK

In 2013, the cost of producing one litre of cow's milk was estimated at 900 LL ($ 0.60). In a modern farm, this cost is distributed as follows amongst the different components:

Table 21: Breakdown of the cost of production of cow's milk

Component	Percentage
Food	65%
Salaries	10%
Health treatments	9%
Electricity and fuel	9%
Miscellaneous charges	7%

Source: Our interviews, 2013.

The average price of a litre of cow's milk from a plant has been increasing since 2002.

Table 22: Evolution of the price of a kilo of cow's milk between 2002 and 2009 (in $)

Year	2002	2003	2004	2005	2006	2007	2008	2009
Price	0.28	0.35	0.35	0.35	-	-	0.64	0.59

Source: Ministry of Agriculture, 2005, 2006 and 2010.

Until 2012, this price was determined according to the law of supply and demand. In 2012, the Ministry of Agriculture established a committee for the organisation of the dairy chain in Lebanon (decision no.1/684 dated August 9, 2012), whose role was to set the price of raw cow's milk, to track sales contracts between cooperatives and the industry, and define standards for raw milk.

In 2013, the price of a litre of chilled cow's milk was set at 1.050 LL (i.e. $ 0.70) by the Ministry of Agriculture. It is adjusted each year.

On average, the milk producer's profit is 15%. The peddler's profit varies between 7% and 14% depending on the mode of transport and the milk quality (our interviews, 2013).

PRICE OF GOAT'S AND SHEEP'S RAW MILK

Goat and sheep dairy production 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 the milk varies with seasonality, i.e. in terms of the quantity of milk available.

Table 23: Evolution of the price of a kilo of sheep's and goat's raw milk between 2002 and 2009 (in $)

Year	2002	2003	2004	2005	2006	2007	2008	2009
Price of sheep's milk	0.39	0.37	0.37	0.41	-	-	0.57	0.57
Price of goat's milk	0.36	0.42	0.39	0.43	-	-	0.62	0.62

Source: Ministry of Agriculture, 2005a, 2006 and 2010.

The price of sheep and goat's milk is determined by the market.

PRICE OF MILK PRODUCTS

The dairy market is very competitive, given the high number of dairies. The price, even if proposed by the manufacturer and negotiated with the customer, seems to be determined by the market.

The table below shows the evolution of the price of two Lebanese traditional products between 2011 and 2013.

Table 24: Price of two dairy products (in $) according to the distribution channel

Year	Labneh (1 kg)			Akkawi cheese in bulk (1 kg)		
	Local stores	Supermarkets	Medium	Local stores	Supermarkets	Medium
2011(1)	5.15	4.67	4.91	7.23	7.73	7.48
2012	4.68	5.06	4.87	6.55	7.99	7.27
2013(2)	5.00	5.24	5.01	7.16	8.86	8.01

(1) Average of four months: September, October, November, December. / (2) Average of two months: January, February.

Source: Ministry of Economy, 2011, 2012 and 2013.

The prices charged by supermarkets are slightly higher than prices in local stores.

The retailer's profit is between 12% and 20% for packaged, branded dairy products, which depends on the type of product, production method and distribution channel. The possibility of comparing the prices of different brands, and comparing the prices of the same brand in different channels, is a key factor limiting the profit. Profit is substantially higher - up in some cases up to 50% - for dairy products sold in bulk in brine because they thereby acquire an image of traditional product (whether they are or not), and moreover, the comparison effect is cancelled in this case (our interviews, 2013).

1.3. Public policies and development projects

1.3.1. Strategic recommendations of the Ministry of Agriculture

The Ministry of Agriculture is the main government agency responsible for the definition and implementation of agricultural development strategies.

The budget of the Ministry of Agriculture is less than 1% of the overall state budget, which limits its intervention possibilities (FAO, report in preparation). In addition the lax management of the Ministry, which reflects the image of the entire Lebanese public sector.

According to a census of the Ministry of Agriculture in 2010 (published in 2012), 90% of farmers say they do not benefit from any extension service, 9% receive extension from NGOs and private companies, and 1% from public extension.

The Department regulates and monitors the health and safety conditions that dairy processing units must meet (Order No. 1/822 dated 03/12/2010). It is also responsible for monitoring the health and safety conditions of transport vehicles for milk and dairy products (Order No. 1/821 dated 12/03/2010), as well as licensing for organising packing, packaging and the supply of milk and dairy products (order No. 1034 dated 21/11/2011).

The Ministry of Agriculture has adopted a strategy for the development of the agricultural sector for the period 2010-2014, whose main objectives are:

- Implementation and updating of laws and decrees within the prerogatives of the Ministry of Agriculture;
- Coordination with other ministries, NGOs, international organisations and the private sector;
- Development of agricultural infrastructure;
- Optimisation of the exploitation of natural resources (land, forests, biodiversity, pastures, marginal lands, etc.);
- Activation of the agricultural extension;
- Implementation of loan programmes for SMEs;
- Development of the production chain, improvement of quality and promotion of industrialisation, commercialisation and export;
- Encouragement of the application of traceability and labelling.

The development strategy of the dairy chain is part of the development of production sectors and aims to:

- Improve the quality of milk and increase the added value;
- Increase marketing opportunities and industrialisation.

1.3.2. Development projects

FODDER CULTURE AND LIVESTOCK DEVELOPMENT PROJECT IN LEBANON[7]

Following the decision of the Lebanese Council of Ministers, the project was launched in 2012 with funding of 150 billion LL (or $ 100 million). Implemented by the Ministry of Agriculture, 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;

[7] Ministry of Agriculture, 2012.

- 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[8]

Co-financed by $ 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:

- Stabilise milk prices throughout the year taking into account its quality and its fat content;
- Improve and control milk quality;
- 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 subsidised loans;
- Subsidised loans to farmers to purchase local breeds of sheep and goats;
- Provision of subsidised credit to farmers, cooperatives and rural women;
- Installation of 12 milk collection centres, including four in the Bekaa 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 analysed for pH, density, wetting, and fat, protein and dried rates, then cooled before being distributed to dairies.

The project increased the annual milk production (about 3,500 litres per cow to more than 6,000 litres) and thus a 50% increase in the price paid to farmers.

After completion of the project, management of the collection centres was entrusted to the Ministry of Agriculture. In 2005, the state decided to close them.

RECOVERY AND REHABILITATION OF THE DAIRY SECTOR IN THE BEKAA VALLEY AND HERMEL AKKAR PROJECT[9]

Implemented by the FAO in cooperation with the Ministry of Agriculture, 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 results of the project are:

- Creation of 23 dairy farmer associations in 300 villages in Akkar, Baalbeck-Hermel and the Bekaa, and 32 equipped collection centres;
- Distribution of 370 electric milking machines with detergents and disinfectants for cleaning;
- Organisation of training sessions, mainly on milk hygiene, good milking practices and food.

According to the FAO, the project has:

- Improved the bargaining power of farmers through their cooperative organisation, ensuring the collection, cooling and transportation of milk;
- Reduced the rejection rate by milk processing units, thus avoiding unnecessary costs on both sides of the transaction.

[8] Ministry of Agriculture, 2005b; Abou Mrad, 2004; FIDA and OPEP, 2005.
[9] FAO, 2010.

2. The dairy chain in the Bekaa and Baalbeck-Hermel

2.1. Specific features of the dairy chain in the Bekaa and Baalbeck-Hermel

The Bekaa Valley is located east of Lebanon, between the mountain ranges of Mount Lebanon and Anti-Lebanon. The altitude of the valley varies between 650 and 1,000 m. It covers about 4,000 km², more than a third of the surface of Lebanon, and extends over a length of 120 km and a width ranging from 8 to 14 km.

The Bekaa Valley is composed of two governorates (mohafazats): Baalbeck-Hermel and the Bekaa. The Bekaa in turn has two districts (cazas): Zahle (Bekaa Centre) and West Bekaa/ Rashayya.

Baalbeck-Hermel and the Bekaa are home to many institutions that promote the production of milk and dairy products, including:

- The Ministry of Agriculture (Regional Directorates);
- The Lebanese Agricultural Research Institute (LARI), Tal Amara (Bekaa);
- Engineering School for Mediterranean Agronomy (ESIAM) of Saint Joseph's University in Tanaël (Bekaa);
- The American University of Beirut (UAB) with its Research and Agricultural Education Centre (AREC) in Haouch Sneid (Baalbeck-Hermel);
- Technical Institute of Agro-Food in Qab Elias (Bekaa);
- Nassrieh Technical School of Agricultural (Baalbeck-Hermel).

2.1.1. Fodder culture

The Bekaa and Baalbeck-Hermel governorates represent a significant percentage of the total agricultural area of the country: 44% of the total cultivated area[10] and 69% of the total irrigated area (Ministry of Agriculture, 2010). The Bekaa is the most fertile region of Lebanon and the Orontes Valley (Baalbeck-Hermel) contains large areas of pasture (Ministry of Agriculture, 2000).

According to the census of the Ministry of Agriculture in 2010 (published in 2012):

- Distribution of the alfalfa production by governorate ranks the Bekaa 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 Bekaa in the lead with 38% of the cultivated area, followed by Akkar (26%) and Nabatieh (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 Bekaa contributes to 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 Bekaa and Baalbeck-Hermel governorates.

In the Lebanese mountains bounding the Bekaa Valley (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 (Haddad, 1996; Kharrat, 2005).

Cattle, sheep and goats herds are fed in an extensive mode in the fields of the Bekaa with agricultural residues from cereal crops, legumes and vegetables. Finally, animals graze under fruit tree plantations or in permanent or temporary fallow land.

[10] The cultivated area includes areas used for the successive growing seasons in the same year.

2.1.2. Milk production

Under agri-climatic characteristics, the Bekaa could be divided into two distinct areas of farming:

- The Orontes Valley (Baalbeck-Hermel), where rainfall is low (between 200 and 400 mm): sedentary and transhumant herds of small ruminants are particularly developed;
- The Bekaa, where rainfall is higher (between 500 and 800 mm): cattle dominate, followed by small ruminants (Ministry of Agriculture, 2000; National Institute of Livestock, 2003).

The number of livestock in the Bekaa and Baalbeck-Hermel governorates are presented in the following tables:

Table 25: Evolution and significance of cattle in the Bekaa and Baalbeck-Hermel

Year	2003	2004	2005	2006	2007	2008	2009	2010
Cattle numbers (thousands)	30.1	27	27.2	-	-	23.3	23	29.5
Percentage of the national herd	34.9%	33.6%	35.4%	-	-	31.2%	30.7%	43%

Ministry of Agriculture, 2005a, 2006, 2010 and 2012.

Cattle numbers, which declined between 2003 and 2009, increased in 2010. During the 2000s, between 30% and 40% of cattle raised in Lebanon resided in the Bekaa and Baalbeck-Hermel governorates.

Table 26: Evolution and significance of sheep in the Bekaa and Baalbeck-Hermel

Year	2003	2004	2005	2006	2007	2008	2009	2010
Sheep numbers (thousands)	227.2	244.5	264.1	-	-	278.2	278.8	191
Percentage of the national herd	75.1%	80.1%	78.3%	-	-	75%	75%	72%

Ministry of Agriculture, 2005a, 2006, 2010 and 2012.

The evolution of sheep is contrary to that of cattle: it increased between 2003 and 2009 and decreased in 2010. Nearly 75% to 80% of Lebanon's sheep are raised in the Bekaa and Baalbeck-Hermel.

Table 27: Evolution and significance of goats in the Bekaa and Baalbeck-Hermel

Year	2003	2004	2005	2006	2007	2008	2009	2010
Goat numbers (thousands)	214.4	209.9	272.5	-	-	171	204.3	205.9
Percentage of the national herd	50.1	48.57	55.08	-	-	42.85	47.5	51

Ministry of Agriculture, 2005a, 2006, 2010 and 2012.

Goat numbers fluctuated between 2003 and 2010, with a peak in 2005 (the year before the 2006 war). However, throughout the period, 42% to 50% of the national numbers were raised in the Bekaa and Baalbeck-Hermel.

These evolutions can be explained[11] by three main reasons:

- Political instability, which slows down investments at certain times;
- Factors specific to the dairy industry, such as the illegal trade of milk and dairy products from Syria, or technical difficulties related to livestock farming;
- Lack of rigor of Lebanese statistics (the observed evolutions should be regarded as a general indication as they are not verified or accurate).

According to the agricultural census of 2010, published in 2012 by the Ministry of Agriculture:

- The average number of cattle per farm is 21 heads of cattle[12] in the Bekaa, against seven at national level, which shows that large cattle farms are located in this region;
- In the Bekaa and Baalbeck-Hermel governorates, nearly two-thirds of cattle are raised in farms of less than 50 heads and a third in farms of more than 50 heads;
- 30% of dairy cows are registered in the Bekaa and 17% in Baalbeck-Hermel;
- The average number of sheep per farm is 109 heads in the Bekaa and 83[13] in Baalbeck-Hermel, against 65 at national level;
- 70% of sheep in the Bekaa and Baalbeck-Hermel are raised in farms with more than 100 heads;

[11] See also the section "Evolution of livestock numbers and composition" in section 1.2.1.
[12] This is the highest average number in Lebanon.
[13] Both rates are the highest in Lebanon.

- The average number of goats per farm is 121 heads[14] and 64 in Baalbeck-Hermel, against 69 at national level;
- 50% of dairy goats are registered in the Bekaa and Baalbeck-Hermel.

According to a FAO study (Kayouli, 2010), the Bekaa and Baalbeck-Hermel governorates have 1,553 dairy farmers owning a total of 18,138 animals. The total milk production is estimated at 188 tonnes per day.

Table 28: Results of the FAO study on dairy cattle in the Bekaa and Baalbeck-Hermel (2010)

District (Casa)	Number of villages	Number of farmers	Number of poor farmers	Number of dairy cows	Total quantity of milk (tons / day)
Rachaya	18	145	107	801	9
Bekaa West	28	314	166	6,026	60
Zahle	27	235	74	6,585	62
Baalbeck	70	676	541	3,943	47
Hermel	24	183	160	783	10
Total	**167**	**1,553**	**1,048**	**18,138**	**188**

Sources: Kayouli, 2010.

Production of milk and dairy products are the sole source of income for 60% of dairy farmers[15], 20% live off of livestock products and other agricultural activities and the remaining 20% live off of livestock products and other non-agricultural activities, such as employee wages, the civil service, trade, retirement allowance, etc.

The majority of farmers (67.5%) are classified as poor or very poor. The highest percentage of poor farmers is observed in the Hermel District (87.5%), followed by Baalbeck (80%) and Rashaya (74%) (Kayouli, 2010).

Thus, the Bekaa Valley appears to be the main area of milk production in Lebanon. However, the inability of many farmers to meet the health and safety conditions for the production of good quality milk is a major issue (our surveys, 2013).

2.1.3. Dairy processing

The oldest dairy in the Bekaa, Convent de Tanaël, was established in Tanaël before the First World War, followed by Laiteries Jarjoura in Chtaura in 1922 and Hedouan in Mrayjat in 1928. Thus, the Bekaa has become an attractive area for dairies.

In addition, dairy products manufactured in this area, particularly in the villages of Jdita, Chtaura, Tanaël and Mrayjat, have acquired a nationwide image of traditional fresh products.

This has been encouraged by the events of the war of 1975-1990: following the closure of roads, collectors of the Bekaa raw milk, who supplied raw milk to the Beirut processing units, had to bring back the milk and thus the idea of on-site processing was born. This type of production then became a model (Haddad, 2001). The dairy industry, which began in this area of the Bekaa, then spread across the valley.

It is difficult to precisely determine the number of dairies operating in the Bekaa and Baalbeck-Hermel. In the mid-2013, national institutions provided the following data (our interviews, 2013):

- 42 dairies were registered with the Ministry of Industry in the Bekaa and Baalbeck-Hermel, constituting 36.5% of the registered dairies in Lebanon;
- 102 dairies were registered with the Ministry of Agriculture (for the purpose of health and safety approval) in the Bekaa and Baalbeck-Hermel constituting 50% of registered dairies in Lebanon.

We estimate that in 2013, the number of dairies operating in the Bekaa and Baalbeck-Hermel exceeded 150, most of them being traditional dairies.

Dairies in the Bekaa and Baalbeck-Hermel are divided into modern, semi-modern and traditional dairies. The latter are the most numerous. Some dairies integrate upstream (livestock and milk production) or downstream (own distribution unit) activities. Few companies export, and on an irregularly basis and in small quantities. Production is sold to dairies throughout the country, although some dairies limit their market to a specific region.

Milk is delivered to dairies by peddlers (intermediate collectors), who may or may not work with collection centres, as well as by farmers. According to Kayouli (2010), about 80% of milk is delivered by peddlers in the district of Zahle and West Bekaa, against only 53% in the districts of Baalbeck, Hermel and Rashaya.

[14] This is the highest rate in Lebanon.
[15] Some of them process milk into dairy products in their farms.

According to the dairy industrial groups surveyed, the quality of dairy products is affected by the unstable and uncertain quality of milk from farms. Georges Feghaly's 2005 study of 60 samples on industrial dairy products collected in the Bekaa and Baalbeck-Hermel (17 villages, towns and cities) showed that:

- 80% of processing units offer products in accordance with physico-chemical quality standards;
- 30% of processing units offer products in accordance with microbiological quality standards.

The company Liban Lait, located in the governorate of Baalbeck-Hermel, is considered the second leading dairy company in the country after Taanyael Les Fermes (Mount Lebanon). It processes 20,000 tonnes of milk per year, of which 42% comes from its own farm. Liban Lait has indeed the largest cattle farm in Lebanon with 2,400 heads of cattle. By the way it also prepares the introduction of 360 additional heads. This is a very innovative company (our interviews, 2013).

2.2. Results of the field survey

2.2.1. Survey methodology

The sample is composed of 22 traditional, semi-modern and modern dairies located in the Bekaa and Baalbeck-Hermel governorates.

In these two governorates, the dairies surveyed represent:

- 52% of dairies registered with the Ministry of Industry;
- 33% of dairies registered by the Ministry of Agriculture (for the purpose of health and safety approval);
- Nearly 15% of the estimated total number of dairies (with or without a production license).

The Chamber of Commerce, Industry and Agriculture of Zahle and Bekaa (CCIAZ) was responsible for selecting and meeting with the dairies surveyed. All adhere to the CCIAZ.

It should be noted that the managers of some dairies avoided the survey. Some fixed appointment with the investigators and were absent at the agreed time. Others found the questionnaire too long and asked to skip the questions they considered less important.

The survey was prepared by the Mediterranean Agronomic Institute of Montpellier (CIHEAM-MAIM). It was composed of 56 sets of questions, organised in two parts: "structure and operation" and "vision of the dairy cluster". The presentation of the survey results (below) was built around these two dimensions.

Besides the survey, interviews were conducted with farmers, industrialists and heads of public and private institutions involved in the dairy chain (list in Annex 2).

2.2.2. Structure and operation of dairies in the Bekaa and Baalbek-Hermel

DAIRY STRUCTURE AND SIZE

Of the 22 dairies surveyed, most were created after the 2000s (12 of 22), three in the 1960s, one in 1970 and three between 1980 and 1995. One company was created in 1922 and another in 1940. All dairies were family businesses. The owner is the founder (68% of dairies visited), or the son or grand-son of the founder (27%). Only one dairy, Couvent de Tanaël, is not owned by the director of the institution. The majority of respondents have a level of education equal to or higher than the baccalaureate. Four are agronomists and another holds a cheese-making certificate.

Twenty of the 22 dairies specialised in the production of milk and dairy products. The other two were companies diversified in other sub-sectors of the food industry.

Table 29: Composition of the sample of dairies by size (number of employees)

Dairy size	Micro-enterprise	Small business	Medium business	Total
Number of dairies	5	16	1	**22**
Permanent salaried employees (1)	6	13	190	**11(*)**
Family employment (average) (2)	1-2	3	-	**3(*)**
Share of family employment in the total permanent workforce (2)/ (1+2)	20%	18.7%		**21.4%**
Seasonal employees (average)	3	6		

Microenterprise: workforce of less than 10 permanent employees
Small business: effective between 10-50 permanent employees
(*) The dairy with 190 permanent employees is not taken into account in calculating the average.

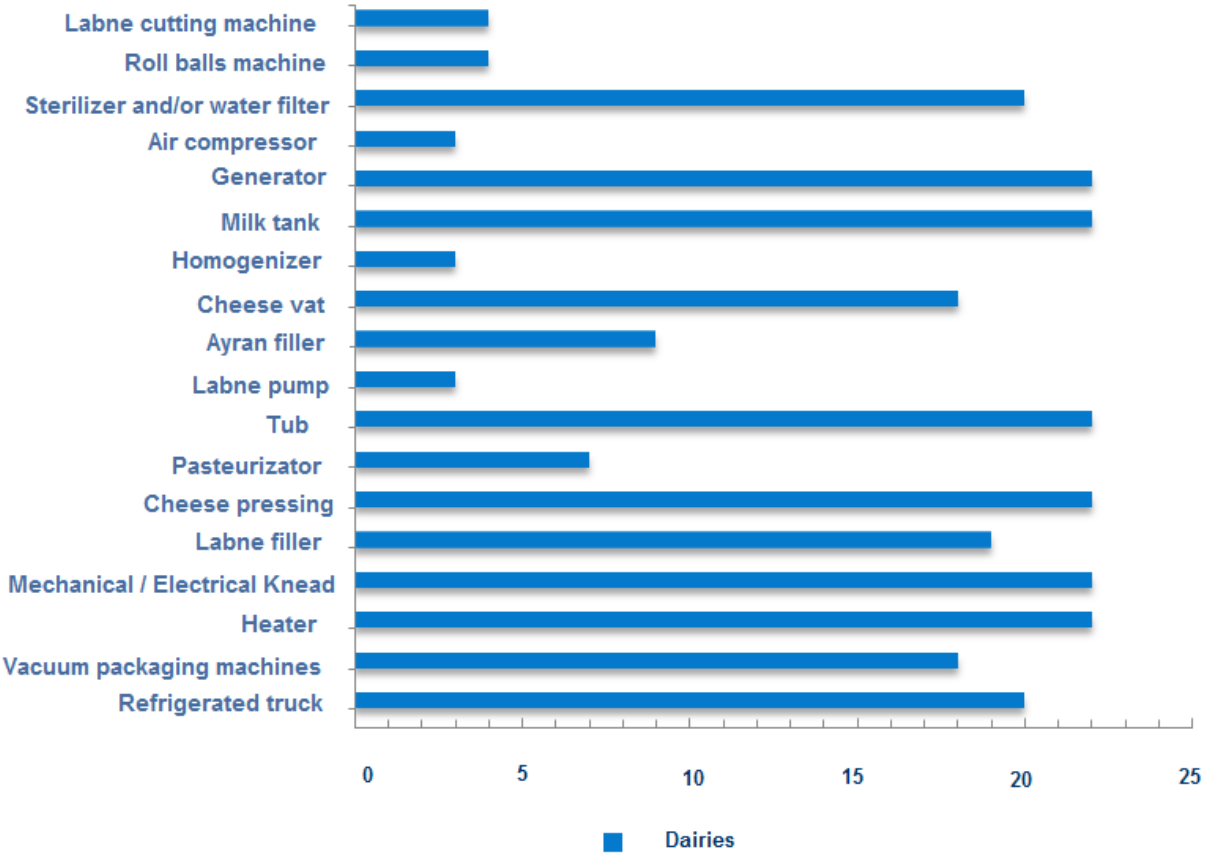
Nearly three quarters of respondent dairies are small businesses with the number of permanent employees between 10 and 26. They also employ family members as well as seasonal employees during the high lactation season (see Table 29). Of the 22 dairies surveyed, five others are microenterprises and only one can be considered medium-sized or large with 190 permanent employees.

THEIR EQUIPMENT AND FUNDING

All dairies surveyed have generators, boilers, cheese presses, kneading machines, milk cooling tanks and refrigerators for storing milk and dairy products, but storage capacities vary from one dairy to another.

Given the results of the investigation, dairies seem rather well equipped for the logistics and marketing of their products (see Figure 1): 20 of 22 have refrigerated trucks. The largest owns 53 while 12 of the 16 small dairies and three of the five micro-dairies have more than two. In addition, 18 dairies have one or more vacuum packaging machines and four dairies have a Labneh cutting machine.

Figure 1: Equipment owned by the surveyed dairies



Again on the preparation and packaging of finished products, some dairies have Labneh fillers (19), Ayran fillers (9) and ball rolling machines (4). In addition, five small dairies, one micro-dairy and the medium company own pasteurisers. Others pasteurise milk in tanks. Three dairies have homogenisers and 20 dairies have a steriliser and / or water filters. Finally, some dairies are equipped with pumps (3) and cheese vats (18).

Table 30: Distribution of investments by dairies surveyed during the 2000s divided by funding sources and types of loans obtained

Funding sources and types of loans	Medium dairies	Small dairies	Micro-dairies	Total
100% self-financing	1	11	3	**15**
85% self-financing / 15% Kafalat loan		1		**1**
75% self-financing / 25% Kafalat loan		1		**1**
50% self-financing / 50% borrowed (Kafalat + Central Bank)			1	**1**
Kafalat Loan		3		**3**
No response			1	**1**
Total	**1**	**16**	**5**	**22**

The majority of dairies surveyed opted for 100% self-financing (15 of 22) (Table 30). Those borrowing through the Kafalat loan[16] finance more than 50% of the investments on their own. Only three small dairies took out a Kafalat loan to finance their investments.

RELATIONS WITH UPSTREAM ACTORS

The majority of dairies in the sample (10 of 22) use sheep, goat and cow's milk for the development of their products. Seven use goat and cow's milk, two sheep and cow's milk and three others (including the largest in the country) use only cow's milk.

Table 31: Raw milk supply conditions of the dairies surveyed

Features	Sheep's milk	Goat's milk	Cow's milk
Number of dairies	12	17	22
Quantity collected (tons / year)	1,296	1,532	34,720
Price paid per litre of raw milk (average)	0.55-0.60€/L	0.60-0.65€/L	0.55-0.60€/L
Number of dairies offering premium quality	3	7	4
Transportation charges paid to farmers	Factory gate price (*)		
Collection period	5 months (April-August)	5 months (April-August)	All year
Number of dairies paying advances to farmers	8	6	8
Period of final payment	End of week		

(*) One small dairy uses its own transport to collect raw milk.

By the continuity of production throughout the year, as well as its high yield per animal, cow's milk is used by all dairies. Of course, the quantities processed by dairies of different sizes are incomparable: the largest collects about 20,000 tonnes of raw milk per year while the total collection from the five micro-dairies surveyed did not exceed 1,200 tonnes (Table 31). Prices paid to farmers vary little, between the different dairies as well as between different types of milk. Indeed, the price of cow's milk is determined by the Ministry of Agriculture; the price of sheep and goat's milk is determined by the market. Dairies that purchase goat's milk are more likely to pay a quality premium (seven of 17), even the smaller and micro-dairies. Transport is organised by farmers (or village collectors) and the prices are fixed by the "factory gate" principle. Only one small dairy transports raw milk by its own means. Nine of the 22 dairies surveyed reported paying an advance to farmers: some do it for only one type of milk, others for two types and others for three types. Payments are generally made at the end of the week of the transaction.

Twenty-one of the 22 dairies surveyed described their raw milk supply modes: the majority use intermediate milk collectors (Hallab). The size of livestock farms does not seem to influence the choice of dairies, since they are supplied from either of the three farm categories. This is certainly due to insufficient raw milk volumes produced in the study area and competition amongst dairies to access this raw material. A small dairy stated that its goat's milk was supplied from 60 farms (herds of 50 to 250 goats) and its cow's milk from 30 farms (herds of 20 to 150 cows) through four collectors (Hallab). Two other small dairies reported buying sheep's milk from 20 farms through two collectors. The other did not give the number of farms from which their raw milk was supplied. For cow's milk, most dairies buy from farms with 20 to 150 cows.

The distances covered to obtain a supply of raw milk vary between 20 km to 50 km on average. However, the largest dairy can only extend its collection perimeter to 400 km, while the five micro-dairies remain in a proximity perimeter between 2 km and 5 km, with the exception of one of them, which obtains its supply from up to 50 km from the place of production. Between these two extremes, small dairies extend their collection perimeter to an average of 50 km: two dairies stated that they travel 100 km to obtain raw milk while another travels only 5 km.

Only 12 of the 22 dairies indicated that they provided services to farmers. One of them said that in principle, it is the village collectors that provide farmers with loans, with technical support and fodder.

[16] Kafalat is a Lebanese company founded in 1999 with a capital of 20 billion LL (€ 13 million) and whose shareholders are for about 75% the National Institute for the Guarantee of Deposits and the rest for about fifty Lebanese banks. It is the only financing tool for the development and the creation of SMEs in Lebanon. http://www.1stmediterranean.com/actufr/archives/resultat.php?id=439

Table 32: Services provided to farmers by the dairies surveyed

Services provided	Number of dairies
Payment in advance, support for the purchase of fodder	1
Loans for the purchase of fodder	1
Loans, advices for fodder, loans for stainless steel cans	1
Loans for stainless steel tanks for milk transport, livestock feeding advice	1
Technical and veterinary advice, livestock feeding advice	3
Delivery of fridges to farmers for milk transport	1
Full cooperation between farms and the dairy	1
Support on the health and safety quality, training and advice	1
Guidance and veterinary technical consulting to improve fodder quality	1
Technical and veterinary advice via the three collectors	1

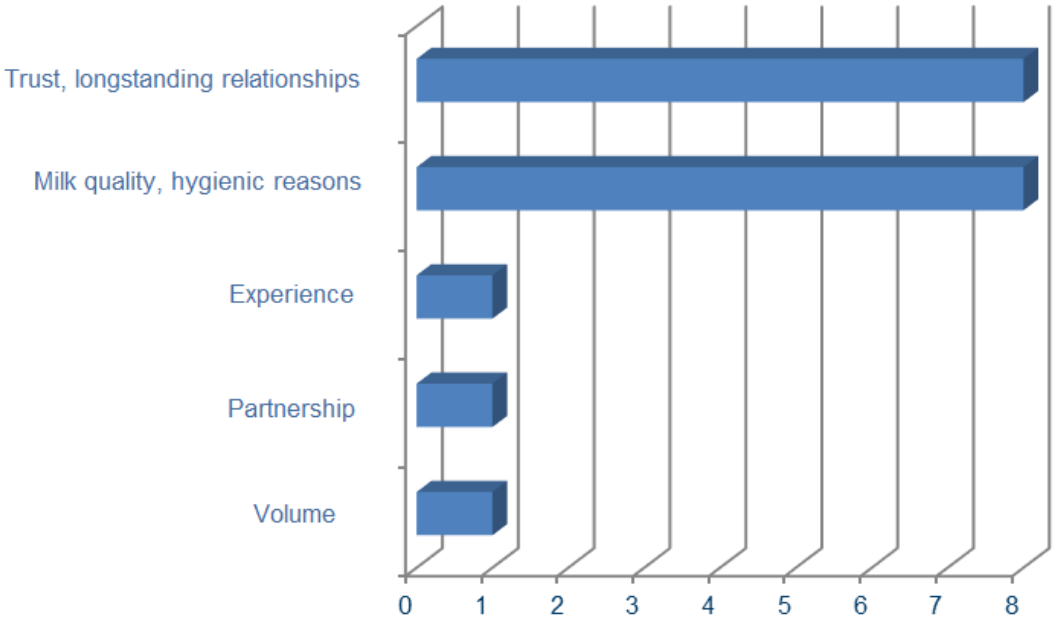
Regarding the collaboration framework with their suppliers, a small dairy and the largest dairy from the sample establish only annual written contracts. Two other dairies (including a micro-dairy) base their transactions on long-term written contracts, while three others use both annual written contracts and oral agreements. The fact that 15 of the 22 dairies surveyed base their transactions with their suppliers only on oral agreements indicates mutual trust between long-established suppliers and dairies. Heavy legal procedures must also be taken into account in the choice of this collaborative framework.

Moreover, regarding the criteria for selecting farmers (suppliers of raw milk), eight of 22 dairies indicated the quality and cleanliness of the milk as the first criterion while eight others retained trust and long-term collaboration.

Table 33: Key selection criteria of farmers (suppliers of raw milk) by dairies

	First criterion	Second criterion
Quality and cleanliness of milk	8	6
Long-term collaboration, experience	5	3
Trust	3	-
Experience	1	-
Partnership	1	-
Quantity, availability	1	1
Cooperative organisation	-	1
Unanswered	3	11
Total	22	22

Figure 2: Selection criteria for farmers from dairies surveyed



As for the backward integration of the chain, among the 22 dairies surveyed, six (one medium, three small and two micro-dairies) have their own farm. One of the three small dairies produces 220 tonnes of raw milk at a cost of 0.4 € per litre of milk, while two others produce between 450 and 500 tons of raw milk per year on their farm.

One of the two micro-dairies mentioned above obtains between 400 and 450 tons of raw milk per year at a cost of € 0.65 per litre, while the other micro-dairy produces 900 tons of raw milk per year on its farm. The medium-sized dairy, located in the Bekaa, produces between 9,900 and 10,000 tonnes of raw milk per year, thus is clearly distinguished from other dairies in sample through scale economies. The coverage needs related to dairy processing are shown in Table 34 below. Only one micro-dairy (in the five sampled) has its own cattle farm and is 100% self-sufficient. It should also be mentioned that the difference between the cost of producing a litre of raw milk by the dairy and the purchase price (factory gate) of a litre of milk by farmers is not very significant except for two small dairies (No. 6 and 18). This observation suggests that upstream integration is more to ensure the quality of the animals' diet and the health and safety of the milk used rather than reducing the cost of the raw material.

Table 34: Comparison of self-sufficiency in raw milk of dairies integrated upstream

Dairy No.	Size	Self-sufficiency quantity (t / year)	Total quantity used (t / year)	Coverage rate	Cost of producing a litre of raw milk
4	Small	500	1,200	40-45%	
6	Small	200	800	25-30%	0.40€/litre
9	Small	450	1,500	30%	
14	Micro	450	450	100%	0.65€/litre
15	Medium	10,000	20,000	50%	0.5€/litre
18	Small	900	900	100%	0.45€/litre

OTHER COMPANY EXPENSES

Concerning third parties services on which dairies rely, 18 to 22 reported that they paid for the microbiological analysis of milk. One dairy mentioned having begun an ISO certification process. Microbiological analysis costs vary from one dairy to another from 100 € to 7,500 € with an average range between 1,300 € and 2,000 €.

All dairies surveyed transport their own products and 18 do so on their own. The annual cost of transportation varies from 6,000 € to 72,000 €, with an average range between 20,000 € and 25,000 € (Table 35).

Table 35: Number of dairies that transport their own products and pay the transport costs

Dairy size	Number	Transport their own products	Average annual cost / dairy
Medium	1	-	-
Small	16	14	28,250€
Micro	5	4	10,250€
Total	**22**	**18**	**24,250€**

DETERMINATION OF RAW MILK PRICES AND PAYMENT MEANS

Table 36: Determination of raw milk prices

Dairy size	Predetermined price			Price set annually according to market (sheep and goat)
	Sheep's milk	Goat's milk	Cow's milk	
Medium			1	
Small	2	2	15	10
Micro			5	3
Total	**2**	**2**	**21**	**13**

All dairies surveyed indicate that the price of cow's milk is predetermined. Only two small dairies predetermine the price of sheep and goat's milk. Other dairies using sheep and goat's milk, and who responded to the question, fix the price annually according to the market (Table 35).

Ten dairies of the 22 respondents pay their raw milk suppliers by cheque while 12 others pay by cash. Micro-dairies (four of five) prefer payment in cash. The medium dairy pays by cheque. Finally, half of the small dairies pay by cheque while the other half pay in cash. Eleven dairies pay within a week, three after 15 days and one within three weeks (Figure 3). Those that pay by cheque pay after an average period of one month.

Figure 3: Payment period to raw milk suppliers of the dairies surveyed

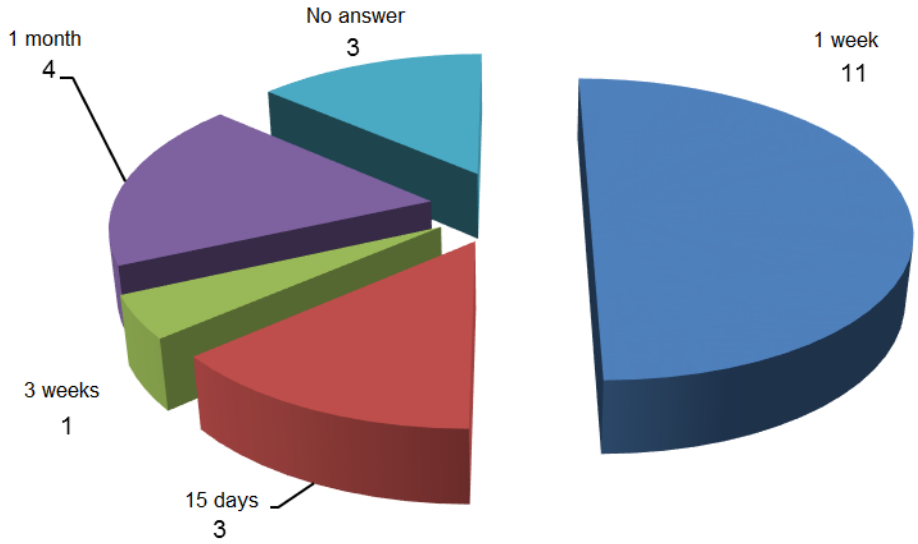


Table 37: Dairy suffering a deficit of milk in their production area

Dairy size	Yes	No	No response	Total
Medium	-	1	-	1
Small	12	3	1	16
Micro	2	3	-	5
Total	**14**	**7**	**1**	**22**

21 of the 22 dairies surveyed responded to the question about a milk deficit in the production basin: 14, including 12 are small dairies and 2 micro-dairies, responded positively, while three micro-dairies of which 1 has its own farm and 3 small dairies consider that there is no deficit. The medium dairy, which owns a large cattle farm, also considers that there is no deficit.

18 dairies of the 22 responded to the question about the major problems with raw materials (Table 38): the quality of the milk is the most important problem (six responses of 18). Additionally, wetting, hygiene and cleanliness of the milk are the main problems (insofar as they have a significant negative impact on the quality of milk), which can be evaluated by the number of dairies (12 of 18 respondents) for which the quality of raw milk is the most important issue. Fat and protein levels are quoted on time as the main problem and four times as the second most important problem. These answers can be related to food intake and milk quality issues.

Table 38: Problems reported by the dairies surveyed by order of importance

Problems reported by the dairies surveyed (by order of importance)	1	2	3
Milk quality	6	1	-
Wetting of milk, other types of fraud by breeders	4	1	-
Hygiene, cleanliness of milk	2	-	1
Unprofessional breeders	1	1	
Lack of raw milk	1	-	1
Energy prices	1	-	-
Fat content and milk protein	1	4	-
Lack of public support	1	-	-
Competition from other products in the supply (ice cream and Kechec)	1	-	-
Fodder	-	1	1
Lack of control, poor regulation of the sector	-	2	
No response	4	12	19
Total	22	22	22

MARKETING AND CUSTOMER RELATIONSHIP

All dairies of the sample have a packaging unit. The materials used are plastic pots and bottles, Tetrapak cartons or vacuum bags. Only 2 of the 22 dairies surveyed do not have logistical services organised internally. Among those who have their own logistics, 6 dairies have their own sales outlets in the area and / or Beirut and one dairy has its own sales force prospecting in shops. One dairy ensures direct marketing of its products by

refrigerated trucks that circulate in neighbourhoods. Another ensures deliveries to its customers by its own means. Two dairies sell their products to wholesalers in bulk and two others have commitments with supermarkets. Five dairies did not answer to the question.

12 of 22 dairies did not answer to the question about payment delays. Among those, three are paid in cash on delivery or within a week, five within 15 days to one month, one within three months and one other within five months. Payments are made either in cash or by cheque for all dairies. Eight dairies reported working on the basis of annual contracts. The rest did not answer to this question.

In total, 10 of the 22 dairies surveyed reported having their own sales outlets. One dairy works with supermarkets, another exclusively with restaurants and two with wholesalers. Four dairies reported working with all types of customers and three others have their own networks and distribution facilities.

All dairies surveyed did not report their annual production volume. However, they all gave their product portfolio, indicating, in an approximate manner, the respective shares of their annual production. A significant concentration of three featured products of the area was noted: Laban, Labneh and Halloum cheese (Table 40). Twenty of the 22 dairies surveyed produce cheeses. Ayran is also one of the products manufactured by nine dairies. Three dairies produce milk desserts and / or drinking milk in addition to the flagship products of the area.

Table 39: Breakdown of the production of the dairies surveyed by dairy products (by volume)

Dairy No.	Laban/ Yoghurt	Milk Labneh	Ayran	Halloum cheese	Other cheeses and Kechec	Milk desserts	Fresh, pasteurized or UHT milk
1	20%	30%	10%	20%	20%		
2	25%	35%		20%	20%		
3	31%	19%	2%	41%	7%		
4	26%	18%	21%	17%	18%		
5	50%	20%		10%	20%		
6	50%	25%		20%	3%		
7	15%	19%		33%	33%		
8	19%	20%		23%	38%		
9	20%	30%		20%	30%		
10	15%	25%	10%	40%	10%		
11	6%	15%		44%	35%		
12	80%	10%		5%	5%		
13	20%	25%	5%	30%	20%		
14	35%	20%		22%	25%		
15	15%	20%		35%	25%		5%
16	61%	15%		8%	16%		
17	30%	30%	20%	-	-	10%	10%
18	10%	30%	20%	-	-	10%	30%
19	33%	33%		17%	17%		
20	28%	28%	16%	15%	13%		
21	7%	6%		55%	33%		
22	15%	30%	5%	35%	15%		

Table 40: Price charged by the dairies surveyed for different dairy products

Product	Average price (€/kg)	Minimum price (€/kg)	Maximum price (€/kg)
Yoghurt	1.40	1.10	1.75
Laban	1.05	0.80	3.50
Labneh	3.00	2.50	6.15
Ayran	0.95	0.50	1.40
Halloum cheese	5.50	4.50	9.70
Other cheeses	4.00	3.50	5.00
Kechek	5.50		
Drinking milk	2.90	1.30	4.50

The prices charged by dairies are quite high (expressed in euros) and vary significantly from one dairy to another, which may be due to lack of control and supervision by public authorities and to the difference in quality (Table 39). Short circuits and direct sales outlets facilitate flexible pricing.

Amongst the reasons for the choice of marketing channels, lack of confidence in the wholesale distributors and retail, the desire to have direct contact with consumers and the difficulty of finding distributors appear most frequently.

EXTERNAL NETWORKS AND ACCESS TO INFORMATION

21 of the 22 dairies surveyed adhere to the CCIAZ, mainly for the product transport permit. In addition, 12 dairies are in contact with research and training institutions, including the IRI and the IRAL. One micro-dairy benefits from training and R&D proposed by the ESIAM (Saint Joseph's University). More than half of the dairies of the sample have benefited from various training provided in the region, mainly focused on the production of new types of cheeses and on the application of health and safety standards. Six of 22 respondents expressed particular interest in training on the production of new varieties of cheese.

Only four respondents said they did not have regular access to information. Those who believe to be informed consider their own experience as their main source of information. Other sources cited are the Internet (six responses), expert advice (four responses) and partners (two responses). One respondent has contacts with Canadian universities.

Nine of the 22 dairies surveyed have used a consulting firm or laboratory. Two respondents have used the services of the Ministry of Health, two others have used the IRAL, one has used the ESIAM (SJU) and three have used have microbiological laboratories. The requested service concerned microbiological analysis and one respondent felt that the cost of this service was too high.

2.2.3. Vision of the dairy cluster

EXPECTATIONS OF THE DAIRIES

19 dairies of the 22 respondents answered the question about their expectations of the dairy cluster in the fields of vocational training, information and business intelligence, R&D and innovation, as well as other services (Table 41).

Table 41: Expectations of the dairies surveyed for a cluster

- Work on milk quality, reducing costs, improving quality (four responses)
- Coordination between industries and farmers to improve milk quality (three responses)
- Good processing practices, HACCP (two responses)
- Availability of an analysis laboratory with fair price (two responses)
- Training on hygiene (one response)
- New production techniques (three responses)
- New varieties of products / cheeses (two responses)
- Innovation on products (two responses)
- Choice of varieties adapted to the desires of the Lebanese customers (one response)
- Use of new technologies for traditional production (one response)
- Learning methods of making foreign cheeses (one response)
- Extension of the expiry date of products (two responses)
- Distribution of products, marketing (two responses)
- Business intelligence (two responses)
- Funding and grants facilities (two responses)
- Problem management, strategic planning (three responses)
- Information on the EEC laws (one response)
- Production of new products from goat and sheep's milk surplus in spring (one response)
- International plant management expertise (one response)
- Increase of tariffs on imported products (one response)
- Improved competitiveness against imported products (one response)
- Exchange of experiences and know-how (one response)
- Exchange of information and solving common problems (one response)
- Council for the construction of a new plant (one response)

These expectations can be divided into three broad categories: improving quality and hygiene, introduction and application of new production technologies and new products, business intelligence, training and information. Even if expressed in different way by respondents, expectations for improving the sanitary quality of raw milk and dairy products converge towards a better coordination between farmers and processors, as well as between processors and control institutions (microbiological analysis laboratories). Some also suggest training farmers on animal health, while others request a reduced rate of laboratories to facilitate access to their services.

Respondents also expect that the cluster support the introduction of new technologies and new varieties of dairy products (cheese). Some consider the production of European cheeses while others wish to adopt new

technologies to improve manufacturing techniques of typical Lebanese dairy. The support expected could take the form of training or technology transfer activities.

The requirements in terms of training and information are quite disparate: from the increase in tariffs on imported dairy products to grant applications, and technical assistance for the construction of a new plant; all these needs cannot be met by trainings offered from a cluster. Therefore, the answers indicate a lack of information on the definition of a cluster, and its scope and limits.

PREREQUISITES

15 dairies also responded to the question about the conditions necessary for the proper operation of the future dairy cluster and use of the proposed products and services (Table 42).

Table 42: Conditions necessary for the proper functioning of the cluster

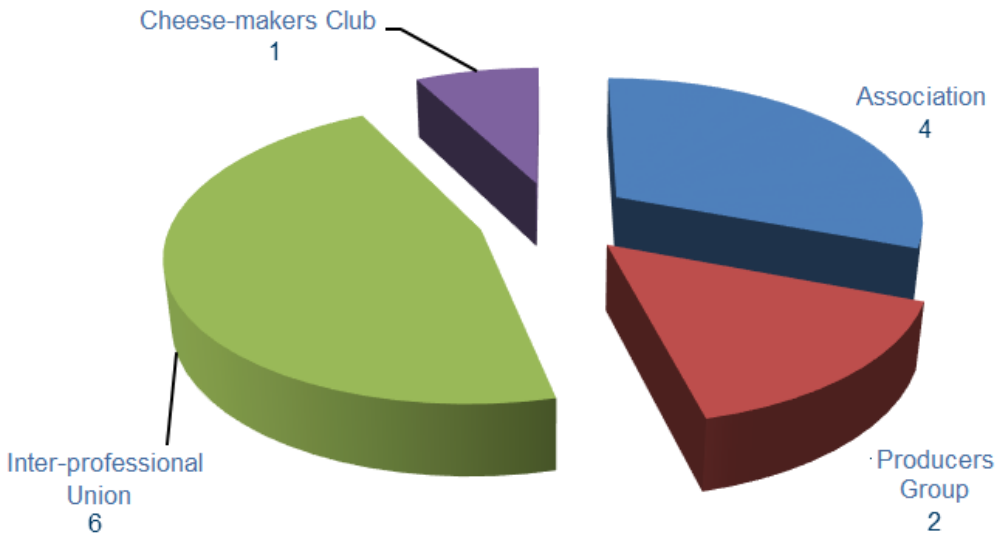
- Serious work (two responses)
- Fair and honest competitive practices and commitment to the cluster (two responses)
- Interviews with active persons (one response)
- Choice of varieties adapted to the wishes of the Lebanese clientele (one response)
- Presence of meticulous foreign experts (one response)
- Conditions that do not require actors to change their working methods (one response)
- Flexibility of entry and exit of the cluster (one response)
- Definition of criteria for the selection of cluster members (one response)
- Lobbying for organising the sector (one response)
- Supervision by foreign experts (one response)
- Organisation of the sector by integrating small farmers and small dairies (one response)
- Good intentions of the participants (one response)
- Stakeholders with solid experience in the field (one responses)

The answers are, for the majority, on behavioural aspects: reliability and hard work, honesty, fairness and good intentions. One of them suggests a flexible organisation of the cluster to facilitate the entry and exit of participants. Recommendations regarding the selection of cluster members and overseeing the work by external agents are also in the sense of establishing strict rules.

FORM OF ORGANISATION

Only 13 of the 22 dairies surveyed responded to the question about the form desired for the dairy cluster organisation (Figure 4). Three of them prefer a horizontal organisation with a cheese club or producer's group; six others prefer an inter-professional union; the last four, an association. This reveals a shared interest of respondents for organisation to coordinate the dairy industry vertically in Baalbeck-Hermel and the Bekaa. Such an organisation would, in fact, improve the flow of raw materials and finished products through quality checks throughout the chain.

Figure 4: Form of organisation desired by respondents for the dairy cluster



For the form of governance of the future cluster, 11 dairies desire a hierarchical mode of governance while six others opt instead for a participatory mode of governance.

Concerning the financing of cluster activities, nine dairies suggest setting up a subscriptions system while six others prefer payment per service. One respondent believes that the funding depends on the shape of the cluster.

Finally, 16 respondents volunteer to take responsibility in the operation of the future dairy cluster: six would be part of the Board of Directors and nine others, members of the steering committee.

2.3. Summary and strategic recommendations

2.3.1. SWOT[17] analysis

SWOT analysis takes into account both the internal (strengths and weaknesses) and external environment (opportunities and threats). For the dairy chain in Baalbeck-Hermel and the Bekaa, the internal environment includes cattle, sheep and goat farms operating in the area; dairy companies operating in the area; distributors of milk and milk-derived products in the area; and consumers of milk and dairy products in the area. The external environment includes the fields of economics, politics, socio-cultural, research and technology.

Strengths

- The dairy chain traditionally well ingrained in the Bekaa Valley, considered as the dairy region of Lebanon;
- Ancestral experience: several dairies have a longstanding history, reflecting the good transmission of the cheese trade from generation to generation and the presence of a well-established local distribution network;
- Presence of natural mountain meadows that surround the Bekaa Valley;
- Important fodder production: 67% of alfalfa and vetch, 88% of barley and 63% of corn feed production are in the Bekaa and Baalbeck-Hermel governorates;
- Presence of large dairy farms: one third of cattle are raised in farms with more than 50 heads of cattle and 70% of sheep in farms with more than 100 heads of sheep while the average number of goats per farm is 121 heads of goats in the Bekaa and 64 in Baalbeck-Hermel against 69 at national level;
- Installation of collection centres and development of a network for milk transport from farms to processing plants;
- A rather well structured dairy industry: half of the dairies registered by the Ministry of Agriculture are located in the Bekaa and Baalbeck-Hermel governorates with the second largest dairy in Lebanon is located in the Bekaa Valley;
- Presence of processors operating in accordance with international quality standards;
- Strengthening of renewal investments and capacity expansion in livestock and dairy farms;
- Creation of new livestock and dairy farms;
- Development of internal trade in dairy products, especially since the entry of supermarkets in the Bekaa and Baalbeck-Hermel governorates;
- Recognition by the Lebanese consumer in general, and the consumer in the Bekaa and Baalbeck-Hermel governorates, in particular of the nutritional qualities of milk and dairy products;
- Significant concentration in the Bekaa and Baalbeck-Hermel governorates of public institutions that promote milk production.

Weaknesses

- Quantitative lack of locally grown fodder: corn and soybean imports greatly increase the cost of raw milk production and the low nutritional quality of diets decreases the milk yield per animal;
- Significant livestock farming instability: 67.5% of farmers are considered poor or very poor, which has a negative effect on the level of investment and renovation operations;
- Lack of farmer training, skilled workers and veterinary controls: this explains the lack of hygiene in many livestock farms, especially in small farms;

[17] SWOT (Strengths, Weaknesses, Opportunities, Threats)

- Increased production costs of livestock farms and processing plants;
- Imperfect coordination between farmers and milk processors in the Bekaa and Baalbeck-Hermel governorates for milk quality standards: processors are often dissatisfied with the quality delivered by farmers;
- Fraudulent practices: false labelling on the origin and form of processed milk (use of powdered milk, but fresh milk indicated in the composition), as well as the techniques used (production techniques: indication of "Sab Labneh", but the legal name is "cream gelatine");
- Unfair competition between dairy companies complying with the rules of hygiene, workers' rights and the duty to acquire a license to produce and those who do not comply;
- Failure of professional associations in the fields of farming and milk processing.

Opportunities

- Establishment of a liberal economic system based on free private enterprise, free trade, free movement of capital, freedom of exchange, etc.;
- Provision of subsidised loans by the Central Bank and Kafalat to farmers and industrialists;
- Availability of fertile land in the Bekaa and Baalbeck-Hermel plains;
- Effective local and national request and / or solvent growth for dairy products in general, and for traditional dairy products in particular;
- Adoption of several ministerial decisions regarding organisation of food systems;
- Interest of international organisations for agriculture and the dairy chain in Lebanon in general, in particular in the Bekaa and Baalbeck-Hermel (UNDP, FAO, USAID, EU, etc.);
- Graduated agronomists and food engineers from Lebanese universities (Lebanese University, Saint Joseph's University, American University of Beirut, Holy Spirit University of Kaslik);
- Development of renewable energies.

Threats

- Negative impact of the political and security instability plaguing Lebanon and neighbouring countries;

Reduced rate of economic growth from 2005 to 2006, in 2010 and in 2011:

Evolution of the growth rate of real GDP[18]								
2003	2004	2005	2006	2007	2008	2009	2010	2011
1.7%	7.5%	0.7%	1.4%	8.4%	8.6%	9%	7%	5.2%

High rate of inflation:

Evolution of the rate of inflation[19]								
2003	2004	2005	2006	2007	2008	2009	2010	2011
3%	1.7%	-2.6%	5.6%	9.3%	5.5%	3.4%	4.6%	3.1%

- Reduced purchasing power due to non-systematic indexation of wages;
- Poor or underdeveloped infrastructure;
- Poor water management due to the limited storage capacity of dams;
- Land pressure: urbanisation leads to the reduction of natural and agricultural areas for breeding and production, and the fragmentation of inherited agricultural land;
- Increase in the cost of input (including fodder), energy sources and land leasing;
- Poor extension services provided by the Ministry of Agriculture;
- Bureaucratic weight: this is a significant barrier to enter into the dairy chain;
- A highly developed informal sector: the presence of informal dairies creates unfair competition for registered dairies;

[18] Ministry of Economy, 2013.
[19] Ministry of Economy, 2013.

- Strong competition of Syrian dairy products;
- Growth in the national demand for imported dairy products (cheese in particular) and the dairies' desire to introduce "globalised" dairy products into their product portfolio.

2.3.2. Strategic recommendations

The dairy chain in the Bekaa and Baalbeck-Hermel governorates, which host the image of the entire Lebanese dairy chain, needs strong public support for its organisation and development.

The strategic guidelines should address as a priority the many structural problems that threaten its survival, and in particular the most urgent:

- A large number of dairy companies produce without a license and compete with legitimate businesses. The government must rapidly stop unlicensed companies or regularise their situation.
- Irregular health and safety controls by the state services favour the marketing of contaminated or questionable products. Recognising the importance of applying good hygiene and manufacturing practices, the Ministry of Agriculture stated the health and safety conditions to be met by milk processing units (Order No. 1/ 822 of 12/03/2010) and set up a programme for inspection and control of these units. However, many companies seem to escape such controls; it is then necessary to activate these measures.
- The current market structure allows illegal practices, particularly in terms of labelling, against which the consumer is helpless. Recognising this problem, the Ministry of Agriculture issued a decree (no.1/1034 of 21/11/2001, modified by Decree 1/539 of 15/6/2012) to organise packing, packaging and shelving milk and dairy products. Despite this, these illegal practices remain heavily applied in a number of dairies, especially small and unregistered ones. The resolution of this problem is, thereafter, urgent.
- Increasing competitiveness requires control of production costs, which are high for reasons related mainly to the economy and to the security situation of the country.

Moreover, a sustainable and defensible competitive advantage could be forged by the creation of a label for specific products, such as a protected designation of origin (PDO). The arguments in favour of such a policy are:

- A traditional anchor of the dairy chain in the Bekaa Valley, which is represented by a specific expertise.
- A physical environment favourable to cattle, sheep and goat farms. Large areas of natural mountain meadows surround the Bekaa Valley and are suitable pastures for sheep and goats. The main villages containing such grazing areas are Arsal, Hermel, Younine, Nahlé, Khreibi, Nabi-Chite, Ham, Maaraboun, Bednayel, Barka, Bechwat, Ainata, Ouyoun Orghoch, Deir El Ahmar and Chlifa in the governorate of Baalbeck-Hermel et Kaa El Rim, Niha, Dahr El Baidar, Kab Elias, Aiha, Rachaya, Manara, Machghara, Aitanit, Maydoun, Helwi, Kemid El lawz, Yanta, Deir El Achayir, Majdel Anjar, Anjar, Ain Kfar Zabed, Deir El Ghazal and Riit in the Bekaa governorate.
- A longstanding history and the transmission from generation to generation of the cheese maker work in a number of dairies.
- The demand for regional, national and global products. Indeed, the Lebanese diaspora is believed to be an important potential market for this type of product.

The implementation of this possibility is conditioned to the presence of an institution which provide better coordination between farmers and milk processors in order to obtain stable dairy quality and consistent standards and which has the practical and legislative framework for the establishment of a PDO. Can the cluster fill this role?

The development strategy of the dairy chain should pay particular attention to breeding sheep and goats for three main reasons:

- Typical Lebanese dairy products (Anbaris, Darfiyi, Chanklich and goat Labneh) are traditionally prepared from sheep and goat's milk;
- Products made from sheep's milk are highly appreciated by the Lebanese consumer;
- Goats and sheep breed with ease in Lebanon thanks to a favourable mountainous environment rich in vegetation (shrubs and wild scrub bushes, and thorny plants) adapted to their food needs.

2.4. Conclusion

The Bekaa and Baalbeck-Hermel governorates are rich in fertile land and have large areas of high-altitude pastures and grasslands. Dairy farming is highly developed: about 75 to 80% of sheep, 45% of goats and 35% of cattle in Lebanon are raised in the Bekaa and Baalbeck-Hermel. In addition, dairy products made in the villages of Jdita, Chtaura, Tanaël and Mrayjat in the Bekaa have a nationwide image of tradition and quality. Moreover, despite a generally unfavourable political, security and economic climate, investment in livestock and in the dairy chain is increasing. Finally, the Bekaa and Baalbeck-Hermel host many organisations that support the dairy industry: the regional directorates of ministries, research institutes, engineering schools and technical schools. They bring their expertise as part of development projects.

The future of the dairy chain in Baalbeck-Hermel and the Bekaa depends greatly on the organisation of the value chain and coordination between the various links. Improved production techniques and strengthening innovation are closely linked to the quality and regularity of the raw milk supply. Indeed, diversification, promotion of typical products and the introduction of new technologies in manufacturing processes require better organisation of the supply.

Fodder deficit is a major problem: national production is insufficient, so it is supplemented by imported products to ensure the supply of livestock feed. The low nutritional quality of the diet, due to the high cost of imported food, is one factor that explains the low yield per animal. Development of the national fodder production and improvement of the diet, therefore, would benefit stakeholders in the dairy chain.

Moreover, even if the creation of large cattle farms soilless and medium-sized processing enterprises has increased in recent years, the Baalbeck-Hermel and Bekaa dairy chain remains characterised by a predominance of small livestock farms, and microenterprise and SME dairies. Better coordination between these stakeholders would allow them to reduce their costs and develop their business.

Many dairy companies own points of sales for the local market and most have their own national distribution network. However, few of them export their products. Non-compliance of some Lebanese dairy products with international health and safety standards is a major obstacle to the entry of Lebanese dairy companies into international markets.

The results of the field survey confirm the need for better coordination between dairy chain stakeholders. The creation of a dairy cluster would encourage the regrouping of milk producers and processors. According to the dairies interviewed, this cluster could take the form of an inter-professional union, vertically coordinated with a hierarchical mode of governance. They seem to volunteer to be part of it as members of the board or the steering committee. For the services provided by the dairy cluster, expectations are focused on business intelligence, information and training to improve the quality of milk and dairy products, and to encourage the adoption of new technologies, innovation and new product development. Dairy companies also see the cluster as a means of influencing the control of the import of foreign dairy products as well as the development of Lebanese dairy product export.

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Appendices

Appendix 1: Typical dairy products of the Bekaa and Baalbeck-Hermel[20]

Production methods of Lebanese dairy products are simple and traditional. Moreover, some products are made by very similar methods.

LABAN

- Appearance: white;
- Texture: soft and homogeneous;
- Packaging: in pots (1 to 5 kg);
- Technology: pasteurization (90°C - 98°C) - cooling - fermentation (inoculation of lactic acid bacteria, stirred and maintained at 45°C until the mixture coagulation);
- Composition (whole milk): more than 3% fat - 8.5% of non-fat solids;
- Composition (skimmed milk): less than 0.5% fat - 8.5% of non-fat solids;
- Species: cow, sheep and goat;
- Production area: the entire Middle East;
- Notes for Lebanon: artisanal or industrial manufacture (also based on imported powdered milk).

AYRAN

- Appearance: white;
- Texture: liquid;
- Packaging: bottle;
- Technology: Laban diluted with 50% water with 2% of salt;
- Composition (whole milk): more than 1.5% fat - 4.2% of non-fat solids;
- Composition (skimmed milk): less than 0.5% fat - 4.2% of non-fat solids;
- Species: cow;
- Production area: Turkey, Lebanon, Iran, Iraq, Greece and other countries;
- Notes for Lebanon: artisanal or industrial production (the latter is dominant).

COW LABNEH

- Appearance: white;
- Texture: soft, easy to spread;
- Packaging: in pots or plastic bags;
- Technology: draining in white muslin bags for 24 to 48 hours - emptying of bags into plastic cups for refrigeration;
- Composition (whole milk) more than 8% fat - 16% of non-fat solids;
- Composition (skimmed milk): less than 1% fat - 20% of non-fat solids;
- Species: cow;
- Production area: from Egypt to Iraq through Lebanon;
- Notes for Lebanon: artisanal or industrial production.

[20] Sources: National Farming Institute, 2003; Haddad, 1996; our interviews with Libnor, 2013.

GOAT LABNEH

- Appearance: white;
- Texture: semi-soft cheese;
- Packaging: in bulk, in plastic bags or glass jars pelletized and immersed in olive oil;
- Technology: rest between 4 and 9 hours at room temperature - dripping in white muslin bags for 48 to 72 h - salting - emptying of bags in plastic containers for refrigeration;
- Composition (whole milk) more than 8% fat - 16% of non-fat solids;
- Composition (skimmed milk): less than 1% fat - 20% of non-fat solids;
- Species: goat;
- Production area: Middle East;
- Notes for Lebanon: artisanal or industrial production.

BALADI CHEESE

- Appearance: whitish;
- Texture: soft and homogeneous, easy to cut without breaking up;
- Packaging: cylindrical block or cube about 10 cm in diameter;
- Technology: pasteurization (milk heated to 60°C for 30min) - cooling (30°C) - renneting (1,000 to 1,200 g of rennet per 500 kg of milk) - riddling - coagulation - draining (separation of the coagulum whey) - moulding - pressing and cooling;
- Composition (whole milk): 60% water - more than 40% fat in the dry matter;
- Composition (skimmed milk): 64% water - less than 10% fat in the dry matter;
- Species: cow, sheep and goat;
- Production area: Lebanon;
- Notes for Lebanon: artisanal or industrial production; Baladi cheese can be brined to be stored and takes on a very strong taste.

AKKAWI

- Appearance: whitish, looks like pressed Baladi
- Texture: semi firm and consistent, easy to cut without breaking up;
- Packaging: sold cut into squares immersed in brine or packed under vacuum;
- Technology: pasteurized (milk heated to 60°C for 30 min) - cool (30°C) - riddling - clotting - drainage (separation of coagulate whey) - placement of coagulate in muslin - mechanical pressing - salting - cooling;
- Composition (whole milk): 56 - 58% water - more than 40% fat in the dry matter;
- Composition (skimmed milk): 63 - 65% water - less than 10% fat in the dry matter;
- Species: mainly cow and also sheep;
- Production area: the entire Middle East;
- Notes for Lebanon: industrial production.

AKKAWI WITH LACTIC FERMENT

- Appearance: light yellow;
- Texture: semi firm and consistent, easy to cut without breaking up;
- Packaging: sold in bulk, cut into squares immersed in brine;
- Technology: pasteurized (milk heated to 60°C for 30 min) - cool (30°C) - rennet - riddling - clotting - drainage (separation of coagulate whey) - placement of coagulate in muslin - mechanical pressing - salting - cooling;
- Composition (whole milk): 56 - 58% water - more than 40% fat in the dry matter;
- Composition (skimmed milk): 63 - 65% water - less than 10% fat in the dry matter;
- Species: cow;
- Production area: the entire Middle East (and other countries);
- Notes for Lebanon: industrial production, but generally imported, Akkawi is also used in Lebanese and Middle Eastern pastries (Knafi, etc.).

HALLOUM

- Appearance: whitish or light yellow
- Texture: semi firm and consistent, easy to cut without breaking up;
- Packaging: rectangle folded in half, sold in a vacuum bag or regular, or can be packaged in brine;
- Technology: fresh or pasteurized milk - clotting - cutting of the curd - separation coagulate whey - moulding - pressing - cutting - baked at 90°C in serum for about 30 min - pressing a second time - folding;
- Composition (whole milk): 50 - 54% water - more than 40% fat in the dry matter;
- Composition (skimmed milk): 63 - 65% water - less than 10%% fat in the dry matter;
- Species: cow, sheep and goat;
- Production area: originating from Cyprus, now occurs everywhere in the Middle East;
- Notes for Lebanon: industrial production.

DOUBLE CREAM

- Appearance: whitish block, it is a whey cheese;
- Texture: soft and homogeneous, easy to cut without breaking up;
- Technology: pasteurization (90°C) - coagulation and flocculation of added whey powder or raw milk, whole or skimmed - purification of the agglomerate - moulding - pressing - cutting;
- Composition (whole milk): 64% water - more than 33% fat in the dry matter;
- Composition (skimmed milk): 66% water - less than 10% fat in the dry matter;
- Species: cow and sheep;
- Production area: the entire Middle East;
- Notes for Lebanon: industrial production.

MCHALLALI

- Appearance: tapered cheese shaped in a braid, whitish or light yellow;
- Texture: semi firm and homogeneous;
- Packaging: vacuum bag sold in bulk or in brine;
- Technology: fresh milk heated to 37°C or pasteurized - rennet (renin or lactic acid bacteria) - curdling - cutting the curd – separation of coagulate whey - kneading the curd in hot water and turning it into a compact elastic mass - braiding during cooling;
- Composition (whole milk): 44% water - more than 40% fat in the dry matter;
- Composition (partly skimmed milk): 45% water - 25 to 40% fat in the dry matter;
- Species: cow, sheep and goat;
- Production area: Middle East;
- Notes for Lebanon: industrial production.

KECHEC

- Appearance: whitish powder;
- Packaging: sold in bulk and filled in ordinary bags;
- Technology: pasteurization of raw milk - milk fermented mixture of crushed durum wheat and salt - sun drying - grinding;
- Composition (whole milk): more than 9.5% fat in the dry matter – less than 10% of water - less than 1% fibre - more than 1.2% lactic acid
- Composition (semi-skimmed milk): less than 5% fat in the dry matter – less than 10% of water - less than 1% fibre - more than 1.2% lactic acid;
- Species: goat, sheep and cow;
- Production area: Middle East;
- Notes for Lebanon: farm and artisanal production.

CHANKLICH

- Appearance: brown or greenish brown exterior coloured balls;
- Texture: firm and even, breaks up when cut;
- Packaging: in vacuum bags or ordinary, or plastic boxes;
- Technology: pasteurization of yoghurt - coagulation - draining - renneting (optional) - mixing to ensure uniformity of the curd - drying for one week - refining the product into balls - coating with thyme, caraway and a spice blend;
- Species: sheep and cow;
- Production area: from Lebanon (Akkar culinary specialty) and Syria, but occurs throughout the Middle East;
- Notes for Lebanon: industrial and farm production.

ANBARIS

- Appearance: raw, sour cheese, whitish;
- Texture: semi firm and smooth dough;
- Packaging: in pots, once dry, the cheese can be preserved in olive oil or cut and sold in bulk;
- Technology: fermentation jars (regularly filled with new milk) - drip on a bench;
- Species: goat essentially;
- Production area: Lebanon (Bekaa, Baalbeck - Hermel and Chouf);
- Notes for Lebanon: farm production in small quantities.

DARFIYI

- Appearance: whitish balls stored in a goatskin;
- Texture: semi firm and homogeneous;
- Technology: matured raw milk, rennet, moulded by hand and put in a goatskin cleaned and salted (called in Arabic, Lebanese dialect, "Darf");
- Composition: 40-50% fat;
- Species: goat;
- Production area: Lebanon (Mount Lebanon);
- Notes for Lebanon: farm production, strong taste.

Note

The production terms and stages of the dairy products presented above comply with traditional methods. There are, nevertheless, some companies that have particular expertise in the manufacture of these products, which is considered a professional secret.

Furthermore, we assist the development of new products such as fruit Laban, which is fruity pasteurized milk, Labneh with herbs, fresh cheese with black seeds (like Halloum, called Nabelsiyi and cut into small squares, and Mchallali).

According to the LIBNOR standards, the amount of liquid present in the vacuum-packaged product shall not exceed 15% of the product weight.

Appendix 2: List of stakeholders and institutions surveyed

INTERVIEWS BY STAKEHOLDER CATEGORIES

Stakeholder categories	Persons interviewed	Nb of interviews
Processors/ dairy companies		**25**
Al Manara dairy	Said Abou Ghnaim	
Produits laitiers et fromages Akel	Zahi and Rami Akl	
Centre Ferzol pour les produits laitiers - Etablissement Nassif Chehade	Tony Chehade	
Chtaura Milky Way	Sassin Tannoury	
Société Al Baraka pour les produits laitiers	Fawaz and Fayez Hamous	
Compagnie Yaourt Taanail	Wassim Akl	
Société Dahrouj Dairy	Mahmoud dahrouj	
Dairy Tannoury	Dany Tannoury	
DMA	Dany Mechaalany	
Fermes Bednayel	Youssef Hassan Akil	
Etablissement Hedwan pour les produits laitiers et fromages	Joseph Hedwan	
Société Ibrahim Salame et Frères	Elie Salame	
Entreprise J-Agri Dairy	Jihad Tanoury	
Etablissement Jarjoura Eid et fils	Boulous Eid	
Laiterie du couvent du travail	Arc en ciel / Elia Ghorra	
Liban Lait	Mohamad Zaidan	
Etablissement de Samir Yammin	Najib Yammin	
Al Serghani for dairy products	Mme Walid and Toufic Serghani	
Skaff Dairy Farm	Kamil Skaff	
Société Moderne pour la fabrication des produits laitiers	Youssef Tannoury and sons	
Tiba foods	Elie Aoun	
Société Libanaise Al-Zawada	Boutrous Tannoury	
Société Les fils Jaber Jaber	Mahmoud Jaber	
Taanayel Les Fermes	Henri Abou Khater	
Centre Jdita	Alexi Chedid	
Livestock farmers		**3**
Mr Jad Darwich/ Mr Samer Darwich		
Mr Nehme Touma		
Mr Abbas		
Institutions		**4**
Ministry of Agriculture	Eng. Ave Khoury	
FAO	Dr Chadly Kayouli	
Ministry of Industry	Eng. Pierre Omran	
Saint Joseph's University / ESIAM	Dr Maya Kharrat	
Cooperatives/ collection centres		**1**
Coopérative Ghazza	Ibrahim Abdel Hadi	
Fodder producters		**1**
Alfacotrade	Eng. Fady Khoury	

Developing the typical dairy products of the Bekaa and Baalbeck-Hermel

Diagnosis and local strategy

January 2014

LACTIMED aims to foster the production and distribution of typical and innovative dairy products in the Mediterranean by organising local value chains, supporting producers in their development projects and creating new markets for their products. The project is implemented under the ENPI CBC MED Programme, and is financed, for an amount of EUR 4.35 million, by the European Union through the European Neighbourhood and Partnership Instrument. From November 2012 to May 2015, ANIMA and its 11 partners will organise a hundred operations targeting the various stakeholders of the dairy chains of Alexandria and Beheira (Egypt), the Bekaa and Baalbeck-Hermel (Lebanon), Bizerte and Beja (Tunisia), Sicily (Italy) and Thessaly (Greece).

So as to encourage integrated development of the dairy chain in the Bekaa and Baalbeck-Hermel, the project will base on a diagnosis of this value chain and study opportunities in the national and international markets, thus helping local authorities and support structures to adopt a strategy for promoting local typical dairy products.

The diagnosis conducted from January to September 2013 involved the following steps:

- Inventory of the dairy chain: literature review, identification of local stakeholders, interviews and working groups with experts and key stakeholders;
- Field survey with 22 dairy enterprises;
- Identification of 12 local typical dairy products and specification of their production methods;
- Summary, definition of strategic priorities to ensure the development of the dairy chain and proposals for the creation of a dairy cluster.

The results of the diagnosis were presented on 9 October 2013 at a regional restitution workshop in Bizerte (Tunisia) and discussed with all the project partners and associates as well as with a panel of Tunisian and international experts. The conclusions of these discussions have been incorporated into the present report.

More information at: www.lactimed.eu

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