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Apples Value Chain “Economic Impact Analysis”

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LIVCD - LEBANON INDUSTRY
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List of Abbreviations

AVC	Apples Value Chain
DAI	Development Alternatives Inc.
DEI	Direct Economic Impact
GACA	Global Agricultural Cooperative in Ainata
IDEI	Indirect Economic Impact
IEI	Induced Economic Impact
LIVCD	Lebanon Industry Value Chain Development
MSAC	Mar Semaan Agricultural Cooperative
SCSA	Sannine Cooperative for Sustainable Agriculture
TEI	Total Economic Impact
USAID	United States Agency for International Development
VC	Value Chain

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Executive summary

This report assesses the economic impact of the USAID-funded Lebanon Industry Value Chain Development (LIVCD) project on the Lebanese Apples Value Chain (AVC). The LIVCD project provided technical assistance to the AVC operators and grants to key stakeholders with the aim of improving the competitiveness of Lebanese apples on the local and export markets through the creation of specialized agricultural service centers and demonstration orchards introducing new cultivation techniques (trellis system) and agricultural practices.

The economic impact assessment covers the period (2016-2025) with real data collected for the period 2016-2017 and assumption projected for the period 2018-2025. The 10-year period (2016-2025) is the minimum timeframe that could be applied to fruits value chains financial assessments and business planning, especially in the case of new plantations, where the production maturity and peak are reached between year 5 and 7. The assessment is a quantitative study that tracks the changes in the economic performance of the AVC on the project beneficiaries' level and documents their nature, context and extent, by evaluating a set of indicators including: the increase in production quantity and value; sales on the local and export market; profit margins and income for farmers and traders; performance of the agricultural service centers; and new investments in the value chain.

The study estimated the Direct Economic Impact on the farm and service center level taking into consideration the grants and the direct technical support provided by LIVCD, and the Induced Economic Impact related to leveraged private sector investments in the value chain. Whereas, the Indirect Economic Impact for the wider value chain with stakeholders' forward and backward linkages could not be estimated due to the large scale of the Apples Value Chain compared to the LIVCD intervention which did not aim at increasing the apples' cultivated area and focused on quality improvement, as well as to the complex market dynamics of the apples' market in Lebanon that is affected by internal and external factors. To assess the efficiency of LIVCD investments, a cost-benefit ratio was calculated for the direct and induced economic impacts:

- The direct economic impact ratio was estimated at 3.36
(For each \$1 invested by LIVCD \$3.36 are generated by the direct beneficiaries for the period 2016-2025)
- The induced economic impact ratio was estimated at \$1.34
(For each \$1 invested by LIVCD \$1.34 were invested by the private sector by the end of 2017)

Adding the two economic impact levels (direct + induced) results in a ratio of 4.7, meaning that for every \$1 invested by LIVCD \$4.7 will be generated in the apple value chain.

I. Background and Methodology

Despite the challenges and obstacles hindering the development of the Lebanese agriculture, the sector still plays an important role at the socio-economic and environmental levels. Many Lebanese agricultural products have the potential to provide economic opportunities, contribute to rural development, and compete on regional and international markets. However, most of Lebanon's agricultural Value Chains (VC) are facing an array of institutional, technical, environmental, economic and financial constraints, resulting in their low competitiveness, especially in export markets. Therefore, agricultural production needs to be upgraded in order to improve the quality and consistency of Lebanese produce to meet both local and international market expectations and requirements.

Within this context, the Lebanon Industry Value Chain Development (LIVCD), a 6 year and four-months project launched in 2012 and funded by the United States Agency for International Development (USAID) with a budget of \$46.2 million, aimed at providing income-generating opportunities in rural areas by improving the competitiveness of selected agricultural value chains as a result of increasing their quality, quantity, and consistency. The LIVCD project identified seven rural value chains for project intervention, including: Olive Oil; Grapes; Pome fruits: Apples and Pears; Stone fruits: Cherries and Avocados; Processed Foods; Rural Basket which includes honey, thyme, and free range eggs; and rural tourism.

Apples represent an important sector in the Lebanese agricultural economy. However, this value chain is facing many challenges and constraints hindering its development and reducing its competitiveness in both local and export markets. The apples value chain is relatively fragmented with little integration between its stakeholders. Competiveness is constrained by high production costs, inefficient harvesting techniques, insufficient and inefficient post-harvesting facilities, small farm size, land degradation and lack of quality control. Moreover, since 2012, the sector faced additional challenges and constraints, especially with regards to export, following the Syrian crisis and the devaluation of the Egyptian pound.

Based on the initial VC assessments and the LIVCD work plan prepared in 2013, the project's main objective focused on improving and upgrading apples' production and post harvesting practices through different interventions in the AVC including:

- Creation of specialized service centers through lead partners such as cooperatives, post-harvest facilities, traders or exporters;
- Provision of training programs, extension services and technical assistance;
- Establishment of demonstration plots using new cultivation techniques and new varieties;
- Facilitation of new investments and support for business planning;
- Support processing operations to improve margins and diversify market channels;
- Development of market analysis capacity and creation of linkages between farmers and traders focusing on domestic and export markets.

Through these interventions in the AVC, LIVCD aimed to:

- I. Improve vertical and horizontal linkages across the value chain

2. Improve quality of production and competitiveness to guarantee higher selling prices for the farmers as well as exporters
3. Facilitate access to new export markets.

In measuring the economic impact of agricultural development projects targeting specific VCs it is important to demonstrate the effectiveness and efficiency of this approach. The underlying purpose of this report is to analyze the economic impact of LIVCD interventions in the apple value chain and the resulting changes. It documents the nature, context and extent of the economic impact realized by estimating:

- The increase in production quality and quantity
- The increase in production value and selling price
- Reduced cost for the VC operators
- Profit margins and income for the VC operators
- Investments by the private sector

The economic impact assessment is a quantitative study that tracks the changes in the economic performance of the value chain using selected indicators to estimate the economic impact on three levels:

- Direct Economic Impact (DEI) applying for each grant. The impact is calculated using the business plan model adopted by LIVCD for all its grants. It covers a ten-years period 2016-2025¹ (two years during the project implementation 2016-2017 with real data collected from the field, and financial projections for the remaining period 2018-2025)
- Indirect Economic Impact (IDEI) for the wider value chain with stakeholders' forward and backward linkages (from inputs to output) with the determination of the value-added, profit margins, and total economic value of the AVC;
- Induced Economic Impact (IEI): leveraged private sector investments, mainly through loans.

An Economic Impact Ratio (EIR) is calculated for each level to assess the efficiency of LIVCD investments:

$$\text{EIR} = \text{Economic impact value} \div \text{Allocated investment}$$

A ratio greater than 1 means the investment is efficient and rewarding.

The following approach and tools were used to conduct the economic impact assessment and to meet the key objective of the study:

1. Review of secondary data including the LIVCD baseline study and progress reports;
2. Field visits to selected farms and partners supported by LIVCD;
3. Interviews with key stakeholders of the AVC;
4. Selection of the economic indicators to estimate the economic direct economic impact;
5. Calculation of the economic impact ratios.

¹The 10-year period (2016-2025) is the minimum timeframe that could be applied to fruits value chains, especially in the case of new plantations, where the production maturity and peak are reached between year 5 and 7.

II. Economic Impact Assessment

The economic and social importance of Apples production demonstrated in the baseline assessment of the LIVCD project conducted in 2013 justifies the need to carry out a post-project Economic Impact Assessment and to evaluate the changes affecting the economic performance of the VC and the level of impact on its different stakeholders.

II.1. LIVCD support to the Apples Value Chain

LIVCD intervention in the AVC focused on three main axes:

Axis 1: Work with lead partners to lead focused regionally specific programs of improved production and post-harvest handling

Axis 2: Business development support to address critical needs in the value chain

Axis 3: Respond to the growing regional markets by supporting Lebanese exporters to develop needed contacts, linkages, trade and analytical capacity to react to export market opportunities

Axis 4: Support and promote processing operations to improve margins and diversify market channels for producers

The Economic Impact Assessment covers seven grants completed between 2014 and 2017 (5 in the fresh apples VC and 2 in the processed apples VC), in addition to the project management technical support². The value of money invested in the AVC until the end of 2017 was \$2,950,867 distributed as follow (**Figure.1**):

- Project management and technical support cost: \$477,768
 - Technical assistance for the establishment of intensive production systems (demonstration plots on trellis): \$1,166,131
 - Grants for the establishment of Agricultural service centers: \$1,306,968
- Grants value include the grantee cost share

² The three active grants awarded in 2017 and planned to be completed in July 2018 are not included in this assessment.

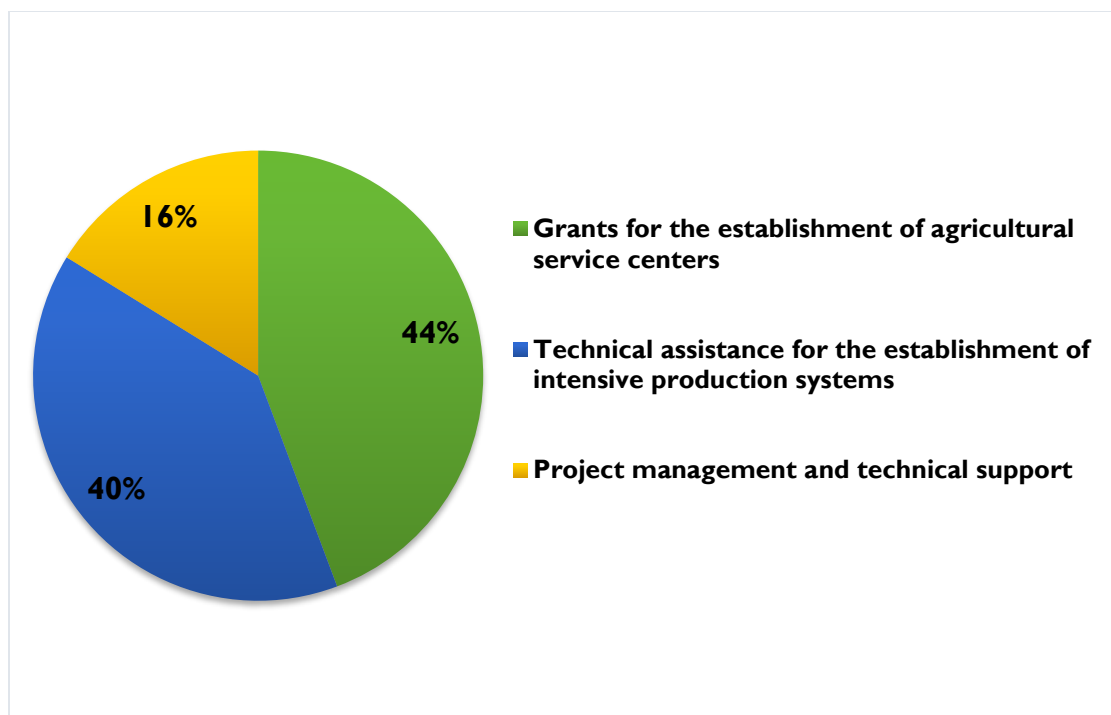


Figure.1. Investment value distribution in the Apples VC between 2014 and 2017

By the end of 2017 LIVCD intervention in the AVC targeted 1,630 farmers (7.5% of the total number of apple farmers in Lebanon) cultivating 1,468.9 ha (10.8% of the total cultivated area of apples in Lebanon) in the major production clusters³: Ainata (Baalbeck), Zahle, Bcharreh, Akoura (Jbeil), Kesrouane, Baskinta (Maten), and Shouf. The average land size of the targeted farmers is 0.9 ha per farmer compared to 0.6 ha per farmer on the national level, which means that LIVCD focused in its intervention on medium and large farmers who could make a real change in the apple value chain, The following tables summarize the geographical distribution of beneficiaries, and the list of grants awarded by the LIVCD project to support the AVC. (**Table.1, Tables.2, Table.3**)

Table.1. Geographical distribution of apples value chain beneficiaries

District	Number of farmers	Farmers (%)	Area covered (ha)	Area covered (%)
Baalbeck	190	11.7%	316.8	21.6%
Jbeil	160	9.8%	234.7	16.0%
Kesrouane	229	14.0%	211.3	14.4%
Zahle	65	4.0%	197.7	13.5%
Bcharreh	188	11.5%	144.5	9.8%
Maten	153	9.4%	102.3	7.0%
Akkar	157	9.6%	92	6.3%
Shouf, Aley&Baabda	268	16.4%	70.7	4.8%
West Beqaa&Rachaya	115	7.1%	61	4.2%
South Lebanon (Jezzine, Nabatieh, Hasbaya, Sour, Saida)	63	3.9%	22.4	1.5%

³This report covers LIVCD intervention until the end of 2017, the project has ongoing grants and activities in 2018 and the total number of farmers and the cultivated area reached will increase by the end of the project in September 2018.

Minieh-Dannieh	25	1.5%	9.9	0.7%
Batroun	13	0.8%	4.5	0.3%
Zgharta& Koura	4	0.2%	1.1	0.1%
Total	1,630	100%	1,468.9	100%

Table.2. Distribution of farmers and cultivated area benefiting from LIVCD per type of intervention

	Number/Area	%
Number of apple farmers reached through grants	767	47%
Number of apple farmers reached through technical support	863	53%
Total number of apple farmers	1,630	100%
Apple orchards reached through grants (ha)	621.3	42%
Apple orchards reached through technical support (ha)	847.6	58%
Total area of apple orchards (ha)	1,468.9	100%

In addition to the 1,630 farmers supported through grants and direct technical support, LIVCD cooperated with: 10 input suppliers; 4 cooperatives; 16 market operators; 2 post-harvest facilities; 3 processors; 3 associations; 5 municipalities; 2 research institutions.

Table.3. LIVCD completed grants and technical support for the Apples Value Chain (2014-2017)

Grantee	Main intervention	LIVCD grant	Grantee cost share	Total Budget	Number of beneficiaries and apples area covered
Sannine Cooperative for Sustainable Agriculture -SCSA	Improving Pome fruit competitiveness in Maten high mountains through the creation of a Production Service Center providing agricultural services for orchard management, technical support, compost production, and the establishment of a demonstration orchard	\$ 146,672.36	\$ 109,363.00	\$ 256,035.36	125 farmers (29.6 ha) 1 exporter/trader 1 cooperative 1 municipality
Liban Village cold store S.A.L.	Upgrade Liban Village to a model sorting, packing, and cooling storage to facilitate access of pome fruit farmers to new technology	\$ 217,070.54	\$ 228,736.00	\$ 445,806.54	152 farmers (233.9 ha) 9 exporters/traders 1 packing unit
Mar Semaan Agricultural Cooperative Association in Hadath El Jebbeh	Improving Pome Fruit competitiveness in Hadeth El Jebbeh and surrounding villages through the establishment of a Production Service Center providing agricultural practices services, technical support, orchard management, and the establishment of a demonstration orchard	\$ 112,379.70	\$ 47,300.00	\$ 159,679.00	169 farmers (123.1 ha) 2 exporters/traders 3 municipalities 1 cooperative
The Global Agricultural Cooperative of Ainata	Establishment of Ainata Agricultural Service Center (ASC) providing agricultural practices services, technical support, orchard management, and the establishment of a demonstration orchard	\$ 123,962.98	\$ 52,960.70	\$ 176,923.68	175 farmers (227.0 ha) 1 exporter/trader 1 cooperative 1 municipality
Agricultural Cooperative Association in Brih	Establishment of Brih Agricultural Service Center providing agricultural practices services, technical support, orchard management, and the establishment of a demonstration orchard	\$ 55,025.15	\$ 34,227.05	\$ 89,252.20	134 farmers (40.6 ha) 1 cooperative
Balkis S.A.L.	Upgrade the production capability of Balkis apple juice factory so that fresh apple juice can make a competitive entry into the Lebanese market	\$61,743.05	\$71,886.32	\$ 133,629.37	1 processor
Les Vergers des Cedres	Supporting apple farmers in Bcharreh through upgrading the production capacity and enhancing apple juice quality of Les Vergers des Cedres	\$22,445.00	\$ 23,197.00	\$ 45,642.00	1 processor
Total		\$ 739,298.48	\$ 567,670.07	\$ 1,306,969.25	755 farmers (617.7 ha) 13 exporters/traders 1 post-harvest facility 4 cooperatives 3 municipalities

Project	Main intervention	Project cost	Grantee cost share	Total Budget	Number of beneficiaries
Technical Assistance for the establishment of intensive system on trellis	Implementation of trellis system orchards through provision of equipment and technical follow-up	-	-	\$ 1,166,131.00	12 farmers 3.56 ha
Technical support	Training on best agricultural practices, establishment of demonstration plots and pilot orchards, orchard management, processing, post-harvest techniques, and support in marketing and access to finance	\$ 477,768.00	-	\$ 477,768.00	863 farmers (847.6 ha) 10 input suppliers 3 exporters/traders 1 post-harvest facility 3 processors 3 associations

II.2. Direct impact

To estimate the Direct Economic Impact (DEI) of LIVCD intervention on the AVC, changes in the economic performance of the stakeholders benefiting from each grant were calculated using a set of economic indicators selected according to each intervention. The financial results were integrated in a 10-year business plan model developed by LIVCD at the beginning of the project to evaluate the total cumulative discount benefit per grant and the DEI ratio. Real data for the years 2016-2017 was collected from the field and from LIVCD team, as well as assumptions for the period 2018-2025.

II.2.1. Sannine Cooperative for Sustainable Agriculture - SCSA (G-LIVCD-026/27)

LIVCD-USAID grant	\$ 146,672.36
Grantee cost share	\$ 109,363.00
Total	\$256,035.36
Timeframe	2014-2015
Intervention	Improving Pome fruit competitiveness in Maten high mountains through the creation of a Production Service Center providing agricultural services for orchard management, technical support, and compost production
Number of beneficiaries	125 farmers, 1 cooperative, 1 exporter/trader, 1 municipality
Area planted	29.6 ha

The objective of the cooperation between LIVCD and SCSA was to create a Production Services Center affiliated to the cooperative to support the farmers of Baskinta and the surrounding area in improving their apples' production in order to get better prices on the local market and to respond to the needs of export markets in terms of quality and quantity. The activities and services executed and provided by SCSA Production Services Center and their corresponding indicators for the measurement of the economic impact are summarized in **Table.4**.

Table.4. SCSA grant activities and economic indicators

Activity/service	Change/improvement in the VC operations	Economic performance indicator
Orchard management and provision of agricultural services (pruning, thinning, spraying, fertilization, irrigation) according to the Integrated Production (IP) manual ⁴ elaborated by SCSA	At least one IP recommendation was adopted by 125 farmers cultivating 29.6 ha of apples for the years 2016 and 2017. By the end of 2025 around 150 farmers cultivating 40 ha of apples will be fully committed to the IP system in Baskinta and its surroundings. The partial adoption of IP is expected to reduce apples production cost in the first five years (2016-2020) by 10%, and 30% between 2021 and 2025 with the full adoption of IP system. It is expected to increase the farm gate selling price by 25% in the period 2016-2020, and 50%(2021-2025) compared to conventional apples price.	Reduced production cost for farmers
		Increased in the selling price of apples for farmers
Production and sales of compost following the upgrading of the SCSA composting unit and the improvement of the packaging	In 2016 SCSA sold 170 T of compost at the price of 215\$/T compared to 400\$/T in the market, and with 40% profit margin. In 2017, 350 T of compost were sold. Considering the same market prices and profit margins, SCSA estimates an increase in the compost sales by 100T on yearly basis between 2018 and 2023 until it reaches the maximum capacity of 1,000 T in 2024 and 2025.	Income generated by SCSA from compost sales
		Money saved by farmers buying compost from SCSA

Based on data collected from the field and the information provided by LIVCD team for the period 2016-2017, and with the estimations for 2018-2025, the economic indicators mentioned in the previous table were calculated and integrated in the business plan model (**Annex.I. Business plan model⁵**). The results showed that SCSA activities and services will generate in a 10-year period (2016-2025) a total cumulative discounted benefit of \$1,145,347. The SCSA grant DEI ratio by the end of 2025 will be:

$$\text{DEI ratio} = 1,145,347 \div 256,035 = 4.47$$

II.2.2. Liban Village S.A.L. (G-LIVCD-079/80)

LIVCD-USAID grant	\$ 217,070.54
Grantee cost share	\$ 228,736.00
Total	\$ 445,806.54
Timeframe	2015-2016
Intervention	Upgrade Liban Village post-harvesting facility to a model sorting, packing, and cooling storage to facilitate access of pome fruit farmers to new technology and find new export markets
Number of beneficiaries	152 farmers, 9 exporters/traders, 1 post-harvest facility
Area planted	233.9 ha

The objective of the cooperation between LIVCD and Liban Village was to upgrade the company's post-harvest facility in order to help the farmers of Kesrouane and Jbeil districts in improving their apples' sorting techniques and storing conditions in order to get better prices on the local market and to respond to the needs of the export market in terms of quality and quantity.

The activities and services executed and provided by Liban Village and their corresponding indicators for the measurement of the economic impact are summarized in **Table.5**

⁴ The IP manual was elaborated in partnership with the municipality of Baskinta. SCSA became a reference stakeholder on the local, regional, and national level in terms of apples production with regards to the IP system established with the support of LIVCD. The IP manual has been promoted in other villages, with other cooperatives and NGOs, as well as through the Ministry of Agriculture in the context of drafting the National Paper for Apples Production in Lebanon.

⁵ The same business model is used to assess the projected direct economic impact for all the following grants.

Table.5. Liban Village grant activities and economic indicators

Activity/service	Change/improvement in the VC operations	Economic performance indicator
Installation of a photovoltaic on-grid solar system	Reduce the energy cost by around 40% for the years 2016 and 2017 (equivalent to 8,000\$/year). Liban Village estimates that the same value will be saved for the period 2018-2020, and it will increase to 10,000\$/year for the period 2021-2025	Reduced energy cost for Liban Village
Installation of an automated sorting line, including washing, drying and waxing units operated through advanced software	Farmers' free access to modified crates to transport their apples to the cold storage and reduction of apples sorting by 15% and cooling services by 25% (equivalent to 50,000\$/year for the period 2016-2020 and 75,000\$/year for the period 2021-2025) Liban Village increased its storing capacity from 2,000T in 2016 to 5,400 T in 2017, where 80% of the apples were exported to Egypt, 10% sold on the local market with 25% higher price than the market, and 10% exported to new markets with 25% higher price than the Egyptian market. Liban Village estimates that starting 2021 the quantity of apples sold for high end market will double. On average, an additional profit of 200\$/container exported was made by Liban village compared to the pre project situation. This is applied to 180 containers exported in 2016 and 2017, and around 2,400 container expected to be exported between 2018 and 2025	Reduced cost of post-harvest services for the farmers
Increase capacity and quality of cooling space through the introduction of a metal structure to allow maximum use of space and increase aeration		Increased income for Liban Village from bigger volume of exported apples and higher prices for high end local market and new export markets
Training small exporters and other cold storage facilities on the best cooling and sorting practices to enhance product life	9 exporters/traders were trained	<i>Not calculated</i> To estimate the economic impact of this intervention a specific study on the performance of the concerned exporters and traders should be done in the future
Provision of technical support and training on orchard management for a group of farmers in Jbeil and Kesrouane area	152 farmers cultivating 233.9 ha were trained. Liban Village estimates that at least half of the farmers and cultivated area will convert into better practices and consequently get better selling prices of their apples by an average of 25% compared to the market price for the next 10 years.	Increase in the selling price of apples for farmers
Linkages to the domestic and export market, and facilitation of apples export	Signature of contracts to provide local market with "ready to eat" apples for a volume of 836 T in 2017 generating an additional profit of 500\$/T compared to the conventional market. This market has great potential in Lebanon according to Liban Village especially in School, however, no projections can be made for its future development	Additional profit from high end market sales

Based on data collected from the field and the information provided by LIVCD team for the period 2016-2017, and with the estimations for 2018-2025, the economic indicators mentioned in the previous table were calculated and integrated in the business plan model. The results showed that Liban Village activities and services will generate in a 10-year period (2016-2025) a total cumulative discounted benefit of \$ 1,256,656. The Liban Village grant DEI ratio by the end of 2025 will be:

$$\text{DEI ratio} = 1,256,656 \div 445,806 = 2.81$$

II.2.3. Mar Semaan Agricultural Cooperative, Hadath El Jebbeh (G-LIVCD-I41/I45)

LIVCD-USAID grant	\$ 112,379.70
Grantee cost share	\$ 47,300.00
Total	\$ 159,679.70
Timeframe	2016-2017
Intervention	Improving Pome Fruit competitiveness in Hadath El Jebbeh and surrounding villages through the establishment of a Production Service Center providing agricultural practices services, technical support, orchard management, and the establishment of a demonstration orchard
Number & distribution of beneficiaries	169 farmers, 2 exporters/traders, 3 municipalities, 1 cooperative
Area planted & distribution	123.1 ha

The objective of the cooperation between LIVCD and Mar Semaan Agricultural Cooperative in Hadath El Jebbeh (MSAC) was to improve pome fruit production in Hadath El Jebbeh through the creation of a Production Services Center providing agricultural services, technical support, orchard management, and the establishment of a demonstration plot. The activities and the services executed and provided by MSAC and their corresponding indicators for the measurement of the economic impact are summarized in **Table.6**

Table.6. Mar Semaan Agricultural Cooperative grant activities and economic indicators

Activity/service	Change/improvement in the VC operations	Economic performance indicator
Orchard management and provision of agricultural services (pruning, thinning, spraying, fertilization, weeding, irrigation)	169 farmers cultivating 123.1 ha used at least two services provided by MSAC. It is estimated that at least half of the farmers and cultivated area improved their agricultural practices and consequently reduced their production cost by 20% and got better selling prices for half of their produced apples' by an average of 25% compared to the market price (applied for the period 2016-2025). Moreover, MSAC will generate profits from the provided services.	Reduced production cost for farmers
		Increase in the selling price of apples for farmers
		Profit generated by MSAC from services provision
Establishment of a pilot orchard with Trellis system	The Trellis system started to show promising results, there are around 10 farmers who showed interest in adopting it, but none has yet invested to convert existing orchard or to plant a new one	<i>Not calculated</i> The pilot orchard is not productive yet
Linkages to the domestic and export market	In 2016, the cooperative was able to sell 50 T of apples on the local market and make a profit of 33 \$ per T. In 2017 the farmers working with the cooperative sold their apples through other traders due to better prices on the market in general. Depending on market dynamic the cooperative will decide if they will repeat the sales of apples or not in the following years.	Profit margin for apple sales

Based on data collected from the field and the information provided by LIVCD team for the period 2016-2017, and with the estimations for 2018-2025, the economic indicators mentioned in the previous table were calculated and integrated in the business plan model. The results showed that MSAC activities and services will generate in a 10-year period (2016-2025) a total cumulative discounted benefit of \$ 697,103. The MSAC grant DEI ratio by the end of 2025 will be:

$$\text{DEI ratio} = 697,103 \div 159,679 = 4.36$$

II.2.4. The Global Agricultural Cooperative of Ainata(G-LIVCD-I88/I89)

LIVCD-USAID grant	\$ 123,962.98
Grantee cost share	\$ 52,960.70
Total	\$176,923.68
Timeframe	2016-2017
Intervention	Establishment of Ainata Agricultural Service Center (ASC) providing agricultural practices services, technical support, orchard management, and the establishment of a demonstration orchard
Number of beneficiaries	175 farmers, 1 exporter/trader, 1 municipality, 1 cooperative
Area planted	227 ha

The objective of the cooperation between LIVCD and the Global Agricultural Cooperative of Ainata (GACA) was to improve pome fruit production in Ainata region through the creation of a Production Services Center providing agricultural services, technical support, orchard management, and the establishment of a demonstration plot. The activities and the services

executed and provided by GACA and their corresponding indicators for the measurement of the economic impact are summarized in **Table.7**

Table.7. Global Agricultural Cooperative of Ainata grant activities and economic indicators

Activity/service	Change/improvement in the VC operations	Economic performance indicator
Orchard management and provision of agricultural services (pruning, thinning, spraying, fertilization, weeding, irrigation)	175 farmers cultivating 227 ha used at least two services provided by GACA. It is estimated that at least half of the farmers and cultivated area improved their agricultural practices and consequently reduced their production cost by 20% and got better selling prices for half of their produced apples by an average of 25% compared to the market price for or (applied for the period 2016-2025). Moreover, GACA will generate profits from the provided services.	Reduced production cost for farmers
		Increase in the selling price of apples for farmers
		Profit generated by GACA from services provision
Establishment of a pilot orchard with Trellis system	The Trellis system started to show promising results, there are around 5 farmers who showed interest in adopting it, but none has yet invested to convert existing orchard or to plant a new one	<i>Not calculated</i> The pilot orchard is not productive yet
Linkages to the domestic and export market	GACA is built and equipped a cooling facility in 2015 with funding from another USAID project. This facility is planned to start its operations in 2018 and will facilitate the marketing activities	Figure not available yet

Based on data collected from the field and the information provided by LIVCD team for the period 2016-2017, and with the estimations for 2018-2025, the economic indicators mentioned in the previous table were calculated and integrated in the business plan model. The results showed that GACA activities and services will generate in a 10-year period (2016-2025) a total cumulative discounted benefit of \$1,076,230. The GACA grant DEI ratio by the end of 2025 will be:

$$\text{DEI ratio} = 1,076,230 \div 176,923 = 6.08$$

II.2.5. Agricultural Cooperative Association in Brih (G-LIVCD-196)

LIVCD-USAID grant	\$ 55,025.15
Grantee cost share	\$ 34,227.05
Total	\$ 89,252.20
Timeframe	2016-2017
Intervention	Establishment of Brih Agricultural Service Center providing agricultural practices services, technical support, orchard management, and the establishment of a demonstration orchard
Number of beneficiaries	134 farmers, 1 cooperative
Area planted	40.6 ha

The objective of the cooperation between LIVCD and the Agricultural Cooperative Association in Brih was to improve pome fruit production in the village through the creation of a Production Services Center providing agricultural services, technical support, orchard management, and the establishment of a demonstration plot. The activities and the services executed and provided by the cooperative of Brih and their corresponding indicators for the measurement of the economic impact are summarized in **Table.8**

Table.8. Agricultural Cooperative Association of Brihgrant activities and economic indicators

Activity/service	Change/improvement in the VC operations	Economic performance indicator
Orchard management and provision of agricultural services (pruning, thinning, spraying, fertilization, weeding, irrigation)	134 farmers cultivating 40.6ha used at least two services provided by the cooperative. It is estimated that at least half of the farmers and cultivated area improved their agricultural practices and consequently reduced their production cost by 20% and got better selling prices for half of their produced apples by an average of 25% compared to the market price for or (applied for the period 2016-2025). Moreover, Brih cooperative will generate profits from the provided services.	Reduced production cost for farmers
		Increase in the selling price of apples for farmers
		Profit generated by Brih Cooperative from services provision
Establishment of a pilot orchard with Trellis system	The Trellis system started to show promising results, one farmer replicated the model in Baaqline village in 2018	<i>Not calculated</i> The pilot orchard is not productive yet

Based on data collected from the field and the information provided by LIVCD team for the period 2016-2017, and with the estimations for 2018-2025, the economic indicators mentioned in the previous table were calculated and integrated in the business plan model. The results showed that Brih Cooperative activities and services will generate in a 10-year period (2016-2025) a total cumulative discounted benefit of \$ 211,734. The grant DEI ratio by the end of 2025 will be:

$$\text{DEI ratio} = 211,734 \div 89,252 = 2.37$$

II.2.6. Balkis S.A.L. (G-LIVCD-186)

LIVCD-USAID grant	\$ 61,743.05
Grantee cost share	\$ 71,886.32
Total	\$ 133,629.37
Timeframe	2016-2017
Intervention	Upgrade the production capability of Balkis apple juice factory so that fresh apple juice can make a competitive entry into the Lebanese market
Number of beneficiaries	1 processor
Area planted	N/A

The objective of the cooperation between LIVCD and Balkis was to upgrade the production capability and apple juice quality of Balkis and to increase apple farmers' income through purchasing additional low grade apples from them. The activities and the services executed and provided by Balkis and their corresponding indicators for the measurement of the economic impact are summarized in **Table.9**

Table.9. Balkis grant activities and economic indicators

Activity/service	Change/improvement in the VC operations	Economic performance indicator
Apple Juice factory upgraded with a new decanter centrifuge that will help the final product to reach a stable 30-days shelf life	After the project intervention Blakis increased its value of apple juice sales by an average of 55% per year (equivalent to \$ 50,413) for 2016 and 2017. It is estimated that in 2018 the value of sales will increase by 20%, in 2019 it will increase by 15%, and by 10% per year for the period 2020-2025	Increase in apple juice sales
Marketing support and awareness raising within the Lebanese market through an advertising campaign along with below the line in-store activation		

Establishment of a partnership between Balkis and 25 farmers and traders to purchase apples from them for juice making	After the project intervention Balkis increased the volume of purchased apples by 158 T in 2017 compared to 2016 (equivalent to \$ 18,961). This value is estimated to increase by 20% in 2018, 15% in 2019, and 10% per year for the period 2020-2025	Increase in farmers' income from the sales of low grade apples for juice
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Based on data collected from the field and the information provided by LIVCD team for the period 2016-2017, and with the estimations for 2018-2025, the economic indicators mentioned in the previous table were calculated and integrated in the business plan model. The results showed that Balkis activities and services will generate in a 10-year period (2016-2025) a total cumulative discounted benefit of \$ 556,102. The grant DEI ratio by the end of 2025 will be:

$$\text{DEI ratio} = 556,102 \div 133,629 = 4.16$$

II.2.7. Les Vergers des Cedres (G-LIVCD-246)

LIVCD-USAID grant	\$ 22,445.0
Grantee cost share	\$ 23,197.00
Total	\$ 45,642.00
Timeframe	2016-2017
Intervention	Supporting apple farmers in Bcharreh through upgrading the production capacity and enhancing apple juice quality of Les Vergers des Cedres
Number of beneficiaries	1 processor
Area planted	N/A

The objective of the cooperation between LIVCD and Les Vergers des Cedres was to upgrade the production capability and apple juice quality of the company and to increase apple farmers' income through purchasing additional low grade apples from them. The activities and the services executed and provided by Balkis and their corresponding indicators for the measurement of the economic impact are summarized in **Table.10**

Table.10. Les Vergers des Cedres grant activities and economic indicators

Activity/service	Change/improvement in the VC operations	Economic performance indicator
Apple Juice factory upgraded with new design and equipment	After the project intervention Les Vergers des Cedres entered the market with a competitive brand "Pomariis". The value of apple juice sold in 2016 was \$ 22,600 and in 2017 \$ it was 89,300 \$. It is estimated that this value will increase by 10% per annum until 2020 and will remain stable from 2021 to 2025. The production cost of apple juice will be reduced by 20% on average compared to the before project situation.	Increase in apple juice sales and reduction in production cost
New branding and marketing support and awareness raising within the Lebanese market		
Establishment of a partnership between Les Vergers des Cedres and around 20 farmers to purchase apple from them for juice making	In 2016 and 2017, Les Vergers des Cedres purchased around 25 T of apples per year for an average value \$ 6,000. This value is estimated to increase by 10% per year for the period 2018-2021, and will remain stable for the period 2021-2025	Increase in farmers' income from the sales of low grade apples for juice

Based on data collected from the field and the information provided by LIVCD team for the period 2016-2017, and with the estimations for 2018-2025, the economic indicators mentioned in the previous table were calculated and integrated in the business plan model. The results showed that Les Vergers des Cedres activities and services will generate in a 10-year period (2016-2025) a total cumulative discounted benefit of \$ 223,670. The grant DEI ratio by the end of 2025 will be:

$$\text{DEI ratio} = 223,670 \div 45,642 = 4.9$$

II.2.8. Establishment of demonstration pilot apple orchards using trellis system

The objective establishing demonstration pilot orchards using the Trellis system for apples⁶ in different areas around Lebanon was to study the feasibility and efficiency of this cultivation technique in order to promote it and replicate it in the most effective way. LIVCD established between 2014 and 2015, 13 pilot orchards with 12 farmers in Mount Lebanon covering a total area of 3.56 ha. All farmers received extensive technical support and close follow-up from LIVCD team and experts to be able to apply the necessary agricultural practices for the trellis system.

A comparison study done by LIVCD team and experts on the difference between conventional apple orchards and trellis systems, it was found that the net profitability of the trellis system exceeds the conventional system by 300%. This is due to the higher yield and better quality and price of the produce (1 ha of conventional apples generates on average \$ 20,000 net profit per year, compared to \$ 80,000 per year for the trellis system). Based on this comparison and its validation on the field for the 3.56 ha planted on trellis system, the 13 pilot orchards will generate in a 10-year period (2016-2025) a total cumulative discounted benefit of \$ 2,595,476 (taking into consideration an average yield per ha starting year 3 after plantation). As result, the DEI ratio of the pilot orchards establishment by the end of 2025 will be:

$$\text{DEI ratio} = 2,595,476 \div 1,166,131 = 2.22$$

II.2.9. Direct technical support by the project

Between 2015 and 2017 the AVC team provided direct technical support and training to 862 farmers cultivating 847.6 ha of apples with a total cost of \$477,768. Based on the LIVCD team estimations, at least 25% of these farmers cultivating around 210 ha of apples recorded on average an annual increase in their gross margin of \$ 2,200per hectare (based on initial studies done by LIVCD and interviews with key stakeholders) compared to farmers who are not adopting improved agricultural practices. When projected for a ten year-period (2016-2025) for the same cultivated area, the farmers who attended the different training programs and improved their practices will generate a total cumulative discounted benefit of \$2,162,405 (mainly due to the increase in volume and value of sales and reduced cost of production). The DEI ratio of the direct technical support by the end of 2025 will be:

$$\text{DEI ratio} = 2,162,405 \div 477,768 = 4.52$$

II.2.10. Total Direct Economic Impact

The total DEI ratio for the grants awarded by LIVCD and the direct technical support is

Σ cumulative discounted benefits/ Σ investment value

$$\text{Total DEI} = 9,924,723 \div 2,950,867 = 3.36$$

II.3. Indirect impact

⁶ Trellis systems for apples existed in Lebanon since the late seventies, especially in the Beqaa plain. However, the lack of knowledge and experience in this technique in terms of agricultural practices during the first 3 years of plantation, particularly pruning and irrigation, led to its limited success at that time.

The indirect impact of LIVCD intervention on the Apples Value Chain in general with its stakeholders' forward and backward linkages (from input supply to market dynamics) cannot be calculated for the following reasons:

- Till the end of 2017, LIVCD intervention in the AVC covered 1,630 farmers (7.5% of the total number of apple farmers in Lebanon) and 1,468.9 ha of the existing apples orchards (10.8% of the total apples orchards)⁷;
- The nature of LIVCD intervention in the AVC which focused on improving the quality of apples and increasing their added value on the market instead of increasing the cultivated area;
- The establishment of a relatively small new area of apple orchards cultivated with the trellis system (3.56 ha) that needs time beyond the life of project to be well promoted and replicated in Lebanon due to the resistance of farmers to introduce extensive change in their existing conventional orchards, except for some new investment reported in the induced impact section here-under;
- The large scale of the AVC in Lebanon and its wide coverage of the Lebanese territory.
- The difficulty to capture and measure the changes in the physical and financial flows to determine the total economic value of apple production and sales in Lebanon due to the absence of accurate and up to date agricultural statistics.
- The fluctuating and very uncertain market conditions for apples caused by a wide variety of unforeseen internal and external factors following the Syrian Crisis.

II.4. Induced impact

The Induced Economic Impact is calculated for leveraged private sector investments through private equity and loans. During the LIVCD intervention period (2014-2017), the LIVCD team identified 31 new investments in the Apples VC with a total value of \$ 3,953,305. The 31 investors were encouraged in a direct or indirect way to do their own investment based on successful models they saw on the field at farm level with the trellis pilot plots and at post-harvest and service centers levels. The 31 investments consisted of the establishment of 24 new apple orchards planted using trellis system and other new and innovative agricultural practices (\$ 2,803,305), improvement of 2 packing facilities (\$ 700,000) and technical support and development interventions by 5 municipalities and NGOs (\$ 450,000). The IEI ratio is

$$IDI \text{ ratio} = 3,953,305 \div 2,950,867 = 1.34$$

⁷ The number of targeted farmers will increase by the end of the project and the completion of the remaining on-going grants in 2018 to around 2,400 farmers cultivating 2,000 ha of apples.

For every \$1 invested by LIVCD, \$1.34 were invested by the private sector in the period (2016-2017). This value will increase in the coming years especially with the conversion of existing orchards to trellis systems or with the plantation of new orchards, as well as due to additional investments in new technologies in the sorting and cooling facilities.

III. Conclusion

Due to the scale and nature of the apples value chain and given its complex structure, it was not possible to capture the indirect economic impact of LIVCD intervention, especially with the short period during which real changes were observed (2016-2017). Therefore, it is recommended to update the economic impact assessment at least five years after the end of the project, especially with regards to the increase in the trellis system cultivated area that needs time beyond the life of the project to become a well-known and common agricultural system adopted by farmers.

On the economic level, the results of this report show the successful Value Chain approach intervention adopted by LIVCD for apples. Despite the relatively small size of cultivated area covered by the project (1,468 ha) compared to the total cultivated area of apples in Lebanon (around 13,600 ha), LIVCD intervention had an important economic impact as demonstrated in the economic impact assessment:

- The direct technical support provided by the project and the grants targeting 1,630 farmers resulted in the improvement of the quality of apples, which increased the selling price and reduced the cost of production by an average of 20%. This was reflected in a positive direct economic impact ratio estimated at \$3.36 for each \$1 spent by LIVCD over a 10-years period (2016-2025).
- During the project implementation, 31 farmers and value chain operators invested \$3.95 million in apple production and agricultural services, sorting, cooling, packing, trade and processing on their own without any direct support from LIVCD, resulting in an induced economic impact ratio of \$1.34 in 2017 for each \$1 spent by the project.

The results of the assessment showed that from an economic perspective, the project intervention contributed to the following:

- Creation of five successful models of Agricultural Services Centers (4 for production and 1 for post-harvest) that could be upgraded and replicated in other areas where apple is the main produce.
- Establishment of demonstration plots with intensive system (apple trees on trellis) that encouraged new investors, especially from the young generation, to adopt it. Old and existing farmers need more time to be convinced by this intensive system and to start converting their conventional orchards.
- Positive changes were observed at the level of the local market, especially with the farmers who adopted innovative and good agricultural practices following the technical support of the project and the services provided by the established Agricultural Services Centers. Around 1,000 farmers benefiting from LIVCD intervention were able to increase the quality of their apples and to sell their produce with higher prices compared to the market. In terms of exports, the complex and very dynamic situation of this market in addition to the challenges faced due to the Syrian crisis did not help in making remarkable

changes at this level. Limited experiences were in selling to new export market such as Russia and some African countries.

- The two interventions related to value addition with Balkis and Verges des Cedres showed very positive results with regards to purchasing low quality apples from farmers as well as the increase of the apple juice sales on the local market, and promising potentials for export.

Annex. I. Financial projection model applied to assess the real and projected direct economic impact

Cash flow and ROI statement											
BENEFIT DRIVERS	YEAR										
	0	1	2	3	4	5	6	7	8	9	10
The Project aim to improve Pome fruit competitiveness in Baskinta and surrounding villages through the establishment of a Production Service Center (PSC)											
At coop level											
Revenues from Agricultural Services offered by the coop:											
SCSA revenue from selling compost		\$ 36,550	\$ 75,250	\$ 96,750	\$ 118,250	\$ 139,750	\$ 161,250	\$ 182,750	\$ 204,250	\$ 215,000	\$ 215,000
Less Costs of Agricultural Services											
Compost production cost		\$ (21,930)	\$ (45,150)	\$ (58,050)	\$ (70,950)	\$ (83,850)	\$ (96,750)	\$ (109,650)	\$ (122,550)	\$ (129,000)	\$ (129,000)
Depreciation		\$ (25,604)	\$ (25,604)	\$ (25,604)	\$ (25,604)	\$ (25,604)	\$ (25,604)	\$ (25,604)	\$ (25,604)	\$ (25,604)	\$ (25,604)
At farmer level-Cost saved by farmers											
Decreased cost of production due to IP adoption		\$ 35,520	\$ 35,520	\$ 35,520	\$ 35,520	\$ 35,520	\$ 180,000	\$ 180,000	\$ 180,000	\$ 180,000	\$ 180,000
Increase selling price of apples due to IP adoption		\$ 88,800	\$ 88,800	\$ 88,800	\$ 88,800	\$ 88,800	\$ 300,000	\$ 300,000	\$ 300,000	\$ 300,000	\$ 300,000
Money saved by farmers buying compost from SCSA		\$ 31,450	\$ 64,750	\$ 63,250	\$ 101,750	\$ 120,250	\$ 138,750	\$ 157,250	\$ 175,750	\$ 185,000	\$ 185,000
Less cost of IP application paid to the SCSA											
		\$ (60,000)	\$ (60,000)	\$ (60,000)	\$ (60,000)	\$ (60,000)	\$ (75,000)	\$ (75,000)	\$ (75,000)	\$ (75,000)	\$ (75,000)
Total annual benefits		\$ 84,786	\$ 133,566	\$ 140,666	\$ 187,766	\$ 214,866	\$ 582,646	\$ 609,746	\$ 636,846	\$ 650,396	\$ 650,396
Implementation filter (including costs associated with services and overheads)											
		95%	95%	95%	95%	95%	95%	90%	90%	90%	90%
Total benefits realized		\$80,547	\$126,888	\$133,633	\$178,378	\$204,123	\$553,514	\$548,772	\$573,162	\$585,357	\$585,357
Initial Investment Costs											
	Year 2015	Year 2016	Year 2017	Year 2018	Year 2019	Year 2020	Year 2021	Year 2022	Year 2023	Year 2024	Year 2025
Total	\$256,035	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Benefits											
	Year 2015	Year 2016	Year 2017	Year 2018	Year 2019	Year 2020	Year 2021	Year 2022	Year 2023	Year 2024	Year 2025
Annual benefit flow	(\$256,035)	\$80,547	\$126,888	\$133,633	\$178,378	\$204,123	\$553,514	\$548,772	\$573,162	\$585,357	\$585,357
Cumulative benefit flow	(256,035)	(175,488)	(48,600)	85,033	263,411	467,534	1,021,048	1,569,820	2,142,982	2,728,339	3,313,696
Discounted benefit flow											
	Year 2015	Year 2016	Year 2017	Year 2018	Year 2019	Year 2020	Year 2021	Year 2022	Year 2023	Year 2024	Year 2025
Discounted costs	\$256,035	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Discounted benefits	0	70,041	95,946	87,866	101,988	101,485	239,299	206,304	187,368	166,395	144,691
Total discounted benefit flow	(256,035)	70,041	95,946	87,866	101,988	101,485	239,299	206,304	187,368	166,395	144,691
Total cumulative discounted benefit flow	(256,035)	(185,994)	(90,049)	(2,183)	99,806	201,291	440,590	646,894	834,262	1,000,656	1,145,348
Initial investment											
	Year 2015	Year 2016	Year 2017	Year 2018	Year 2019	Year 2020	Year 2021	Year 2022	Year 2023	Year 2024	Year 2025
INITIAL INVESTMENT-EQUIPMENT	\$256,035	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
LABOR	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
TRAVEL AND PER DIEM	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
OTHER DIRECT COSTS-	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Total costs	\$256,035	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
ROI measures											
Cost of capital	15%										
Net present value	\$1,145,347.71										
Return on investment		27%	65%	99%	139%	179%	272%	353%	426%	491%	547%
Payback (in years)		2.36									