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## EU GREEN AGRICULTURE INITIATIVE IN ARMENIA (EU-GAIA)

# MARKET AND FEASIBILITY STUDY TO SELECT VALUE CHAINS

## FINAL REPORT



Yerevan, 2020

A Study mandated by the EU-GAIA project on behalf of the European Union, the Austrian Development Agency and United Nations Development Programme

Suggestions and recommendations by EV Consulting CJSC



This publication was produced with the financial support of the European Union and the Austrian Development Cooperation. Its contents are the sole responsibility of the EU-GAIA project and do not necessarily reflect the views of the European Union and the Austrian Development Agency.



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### ABOUT EU-GAIA PROJECT

The **EU Green Agriculture Initiative (EU-GAIA)** is currently **the largest** agricultural assistance program in Armenia funded by the **European Union (EU)** and co-funded by the **Austrian Development Cooperation (ADC)**. The EU-GAIA project is implemented by the **Austrian Development Agency (ADA)** and by the **United Nations Development Programme (UNDP)** in Armenia. The project works in close cooperation with the **Ministry of Economy of the Republic of Armenia**.

### EU-GAIA OBJECTIVE

To contribute to the realization of shared and balanced inclusive growth in the northern regions of Armenia through boosting green agriculture and enhancing local value added. The project promotes sustainable, innovative and market-driven agribusinesses.



#### Specific Objective 1:

The policy, legal and institutional environment encourages green, inclusive and rights-based agriculture development.

#### Specific Objective 2:

Selected agribusinesses have better access to infrastructure, green technologies, good agricultural practices and markets creating also better employment conditions.



#### Specific Objective 3:



Selected agribusinesses are more competitive through access to inputs, equipment, infrastructures and services (to be partially implemented by UNDP).

#### Specific Objective 4:

Selected organic agribusinesses are more competitive through access to inputs, equipment, infrastructures and services.





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## ABOUT THE PUBLICATION:

This publication was produced within the framework of the **EU Green Agriculture Initiative in Armenia (EU-GAIA)** project, which is funded by the **European Union (EU)** and the **Austrian Development Cooperation (ADC)**, and implemented by the **Austrian Development Agency (ADA)** and the **United Nations Development Programme (UNDP)** in Armenia.

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Yerevan, 2020

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## LIST OF ABBREVIATIONS

ASME	Agricultural Small and Medium Enterprises
AMD	Armenian dram
CAGR	Compound Annual Growth Rate
CIS	Commonwealth of Independent States
DRR	Disaster Risk Reduction
EU	European Union
EU-GAIA	EU Green Agriculture Initiative in Armenia
FAO	The Food and Agriculture Organization
GDP	Gross Domestic Product
LSU	Livestock Unit
NACE	Statistical Classification of Economic Activities in the European Community
SC RA	Statistical Committee of the Republic of Armenia
SME	Small and Medium Enterprises
VC	Value Chain
UN	United Nations
USD	United States Dollar

## 1. INTRODUCTION AND BACKGROUND

The purpose of the current study is to prioritize Value Chains in the targeted 3 Marzes (Shirak, Lori, Tavush).

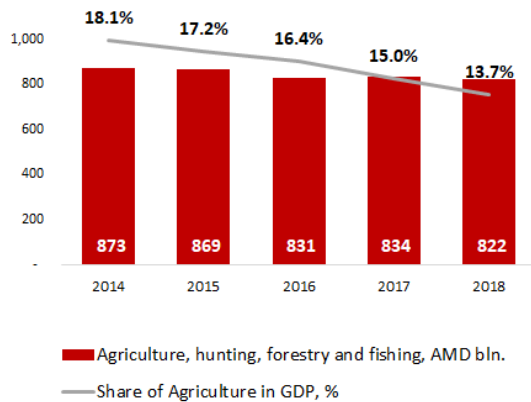
The study covered the identification, defining and mapping of the perspective agricultural value chains and conducting their assessment based on the framework (proposed by Consultant and approved by Client) which is built on the set of prioritization criteria such as the potential for green growth and competitiveness, accessing local, national and international markets, the potential for positive environmental, gender and social impacts, potential for addressing negative impacts/risks and identification of mitigation measures, and identified specific bottlenecks and opportunities in the respective value chains that can be addressed and leveraged through EU-GAIA interventions.

## 2. OVERVIEW OF DEVELOPMENT DYNAMICS OF AGRICULTURE IN ARMENIA AND GOVERNMENT PRIORITIES

Agriculture is one of the largest sectors of Armenia’s economy though the share of its contribution to the value-added of the country has been declining during the last 5 years due to a decrease in the production of agricultural produce and higher growth rate of other sectors.

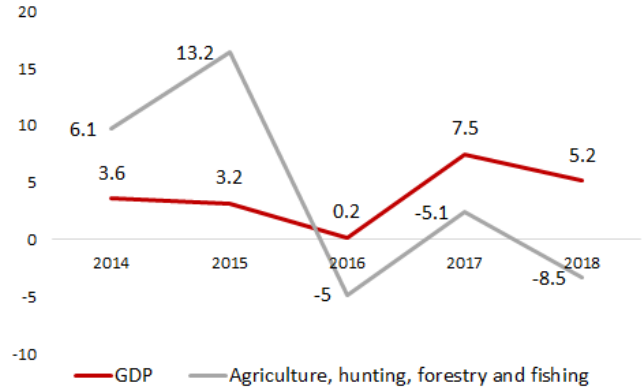
Given the favorable soil and climate conditions, agriculture can become one of the main drivers of economic growth in the coming years. To reverse the declining trend and boost the development of the agricultural sector, the Government provides continuous support to facilitate access to finance, promote wider use of advanced technologies and enhance the productivity of farming, as well as to reduce risks connected to natural disasters through introducing agricultural insurance.

**Chart 2.1. Agricultural Value Added Trends**



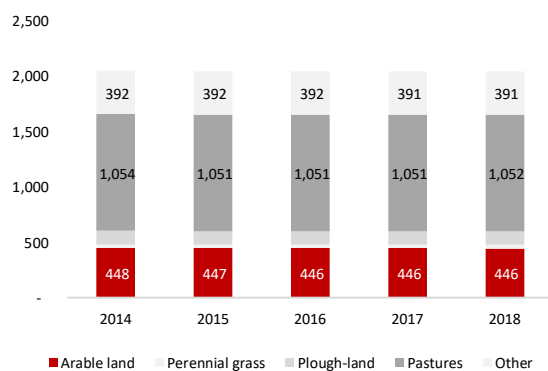
Source: SC RA, Statistical Yearbook of Armenia, 2019

**Chart 2.2. Growth Rates of GDP and Agriculture, in % to the previous year**



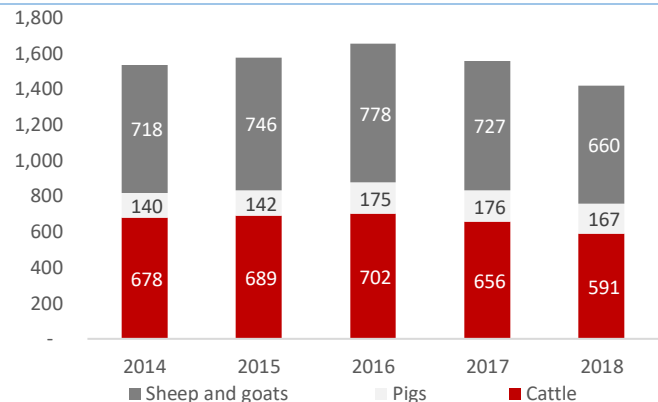
Source: SC RA, Statistical Yearbook of Armenia, 2019

**Chart 2.3. Total Land Area and Agricultural Lands by Types, 1,000 ha**



Source: SC RA, Statistical Yearbook of Armenia, 2017, 2018, 2019

**Chart 2.4. Number of Livestock (horses and poultry excluded), as of 1 January, 1 000 heads**

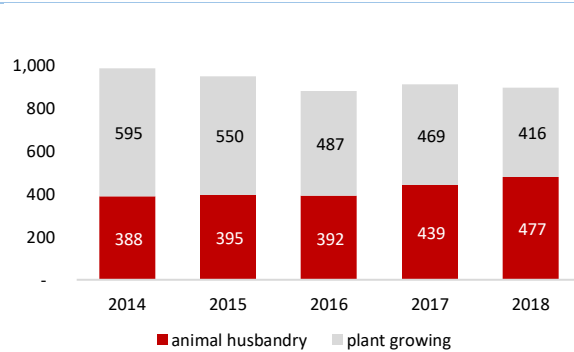


Source: SC RA, Statistical Yearbook of Armenia, 2017, 2018, 2019

Overall, agricultural lands cover about 70% of the total land area. Arable lands and pastures occupy about 50% of total lands and over 70% of agricultural lands.

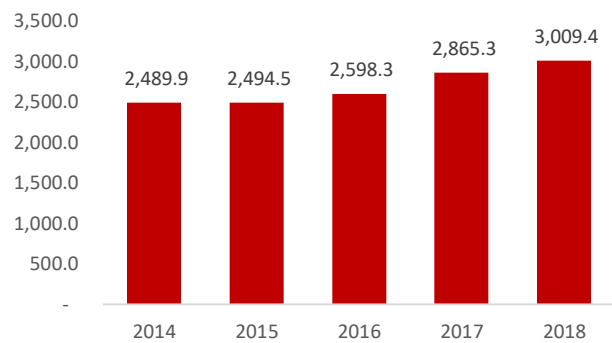
In terms of livestock, since 2016 the number of livestock has been decreasing due to the increasing number of sheep and goat export from Armenia. Particularly, 207.6 tons of sheep and goat (live) exported from Armenia in 2016, while the volumes for 2017 and 2018 were 621 tons and 428 tons, respectively. Qatar, Kuwait, and Lebanon were the major countries of export of sheep and goat. The situation is different in the case of poultry. In 2018 the heads of poultry exceeded the level of 2015 (4.1mln heads) and reached 4.4mln heads.

**Chart 2.5. Gross Agricultural Output, at current prices, bln. AMD**



Source: SC RA, Statistical Yearbook of Armenia, 2017, 2018, 2019

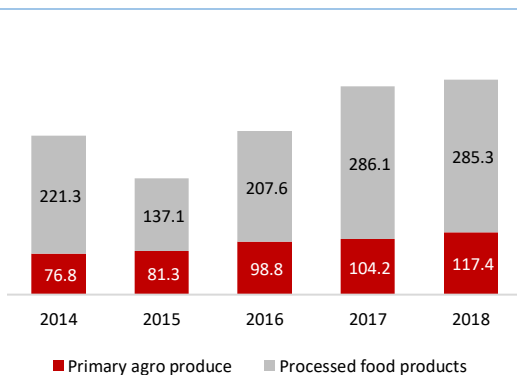
**Chart 2.6. Output per Employed person, thousand AMD**



Source: SC RA, Statistical Yearbook of Armenia, 2017, 2018, 2019

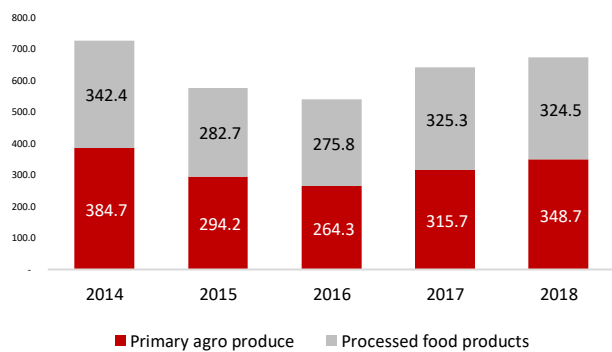
The share of plant growing sector in the gross agricultural output of Armenia decreased slightly in 2014-2018. In 2018 it accounted for 47% of the gross agricultural output of Armenia, compared to 61% in 2014.

**Chart 2.7. Primary Agricultural Produce and Processed Food Export from Armenia, mln. USD**



Source: UN Comtrade Database

**Chart 2.8. Primary Agricultural Produce and Processed Food Import to Armenia, mln. USD**

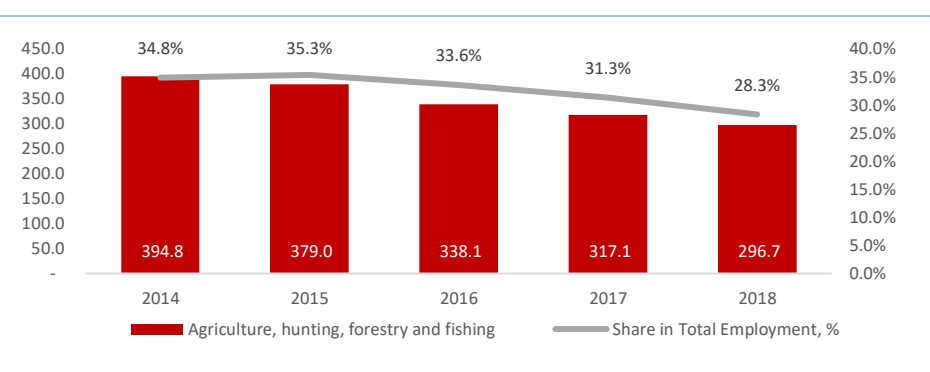


Source: UN Comtrade Database

Overall, agri-food export is dominated by processed food products - around 71% in 2018. The maximum share recorded for the Primary agricultural produce in the period of 2014-2018 was 32%. On the import side, Primary agri-produce covers a larger share in the import of agricultural products, with an average 15% growth rate during 2017-2018.



**Chart 2.9. Employment in Agriculture**



Source: SC RA, Statistical Yearbook of Armenia, 2017, 2018, 2019

Agriculture is also an important source of job creation and employment in rural areas of Armenia. About 30% of the employed population is engaged in the agricultural sector. Overall, the share of employment in agriculture has been declining during the period under review. While about 395000 workers were engaged in agriculture (or about 35% in total employment) in 2014, the indicator has declined to 28% or 297000 in 2018. Note that in 2018 about 62 % (or 481.8 thousand persons) of total agriculture workers (778.5 thousand persons in 2018) were own-use producers (also called the subsistence foodstuff producers)<sup>1</sup>. This resulted in a gradual increase in productivity per employed person. Particularly, output per employed person has been increasing at a 5% rate since 2016.

### **Government Strategic priorities of Agricultural sector development**

The Government of the Republic of Armenia has a vision of sustainably developing, innovative, and added value-creating agriculture in the country level, which takes care of natural resources and is harmonious with the environment, as well as creates an ecologically clean product and ensures the prosperity of people, living in villages<sup>2</sup>. The strategy bases on the seven principles and aims at inclusive growth, gender equality and institutional sustainability:

1. **Consolidation:** support to the small households and separated value chains, etc.
2. **Commercialization:** support to the export and investments to the private sector, etc.
3. **Orientation towards quality:** concentrate the efforts on the quality of agricultural products, etc.
4. **Youth engagement:** involve the Youth in agriculture development activities;
5. **Diversification and risk management:** support to the product and market diversification, implement a risk management system, etc.
6. **Adaptability and resilience to climate change, and sustainability of the environment.**
7. **Modernization of technologies:** invest in digitalization and mapping of the agricultural sector, accelerate post-harvesting infrastructure development, create innovative technological systems, deliver digital agriculture services, etc.

<sup>1</sup> SC RA, Labour Market In Armenia, 2017-2018, Statistical Handbook, Yerevan, 2019

<sup>2</sup> [https://www.e-gov.am/u\\_files/file/decrees/kar/2019/12,1/19\\_1886-1.pdf](https://www.e-gov.am/u_files/file/decrees/kar/2019/12,1/19_1886-1.pdf)

Among the priorities of agriculture development strategy, the Government emphasizes land reform, export diversification, commercialization and value-added, along with technological modernization and innovation, development of human capabilities and skills, rural development and institutional capabilities. In line with the mentioned strategic priorities, strategic directions are defined as follows:

- Increase the competitiveness and efficiency of agriculture,
- Ensure food safety,
- Improve food safety and nutrition,
- Develop local markets and expand the export opportunities,
- Empower human and institutional capabilities in agriculture,
- Support the sustainable development of rural communities,
- Encourage digital agriculture and technological innovations.

The Government intends to deliver a range of activities, which aim at the achievement of the strategic goals. The activities are as follows:

- To invest in the commercialization, modernization and automation of value chains, which suppose investments in new technologies (machines, equipment, etc.), agricultural education, primary agricultural value chains, and farming households related activities. Furthermore, the Government gives high importance to the analysis of gaps in the primary agricultural VCs, grant programs for studying the VCs, increasing the capabilities of the Ministry for assessing the VCs, etc.
- To improve the export logistics system, it is necessary to ensure the same level of capabilities for both production and supply aspects.
- To support entry into new export markets, investment attraction and export promotion.
- Agricultural advisory services are among the central support functions for agriculture development. In line with traditional advisory services, new and advanced service lines should be implemented to support the empowerment of agricultural capabilities and infrastructure improvements.

Below are the key strategic indicators the Government has targeted to achieve by 2029 compared to the level of 2018:

- To increase the areas of perennial crops by 26%, while keeping the area of cultivated lands at the same level and decreasing the non-cultivated areas twice.
- To double the gross agricultural product value, with 116% growth in the plant-growing sector and 89% in the sector of animal husbandry.
- To increase the swine number by 67%, sheep and goat number by 58%, and cattle number by 25%.
- To increase the level of milk productivity by 71% and to double the milk production volumes in Armenia: +113%.

- To increase the annual volumes of poultry meat at about four times and pork volumes by 82%.
- To increase the production capacities of the key sector of plant growing by at least 25%.
- To ensure a 164% increase in agricultural value-added per employee by reaching the target of 7.45mln AMD.
- To encourage the export of agricultural products and increase the volumes by about 70%.

### 3. SOCIO-ECONOMIC PROFILE OF TARGET MARZES AT A GLANCE AND DESCRIPTION OF MAIN AGRICULTURAL VALUE CHAINS

#### Lori Marz

Lori marz is the second largest by the area with 3799 km<sup>2</sup> (12.7% of the total area of Armenia, 7.8% of the population of RA) with 137,784 (58.5%) urban and 97,753 (41.5%) rural population. Lori marz neighbors with Tavush, Shirak, Aragatsotn and Kotayk marzes of Armenia, and with Georgia.

Lori marz has 8 urban communities and 105 rural communities with 122 villages. The population is 234,7 thousand, of which 137,2 thousand (58.46%) live in cities, 97,5 thousand (41.54%) in rural communities.

Agricultural lands are 251,154 ha, of which arable lands are 42075 ha, perennial plantations - 418, grasslands - 35,155.8, pastures - 145714.1, other lands – 27,791.7. Each year almost 8,400 ha arable lands are not cultivated.



#### Shirak

Shirak marz is situated in the north-western part of Armenia and covers an area of 2,680 km<sup>2</sup> (9% of the total area of Armenia, 7.9% of the population of RA), 136,9 thousand urban and 96.4 thousand rural population.

The marz includes 3 urban (Gyumri, Artik, Maralik) and 127 rural communities (enlarged into 42 communities in 2019) and consists of Ashotsq, Amasia, Akhuryan, Artik and Ani regions.

The economy of the region bases mainly on agriculture, including plant growing (49.9% of total agriculture production in the region) and animal husbandry (50.1% of total agriculture production in the region). Arable lands cover 37% (91% cultivated) and pastures cover



53% of total agricultural land in marz. The sown areas under grains, leguminous crops, potatoes, and vegetables have gradually increased during the last 5 years.

### Tavush

Tavush marz is situated in the northeastern part of Armenia (9% of the total area of Armenia, 4.3% of the population of RA), with a population of 128,609 it is the second least populated marz. In the southeast and south, the marz borders with Gegharqunik and Kotayk marzes, in the West it borders with Lori marz, and with Georgia and Azerbaijan.



The marz includes 5 urban and 55 rural communities and consists of Ijevan, Dilijan, Berd, Noyemberyan regions.

Marz has only 4.8% of share in the total annual agricultural product of Armenia. Around 41% (1,108 km<sup>2</sup>) of the total area of the marz are arable lands, out of which 23% (256 km<sup>2</sup>) is cultivated. The population in many rural communities is mainly involved in farming, cattle breeding, and pig farming.

**Table 3.1. Gross Agricultural Product, current prices, AMD bln.**

Marz	2014	2015	2016	2017	2018
<b>Total Output</b>					
Lori	73.8	75.1	69.2	79.0	73.2
Shirak	109.0	109.5	101.7	99.4	97.9
Tavush	45.4	46.0	39.6	39.9	39.3
Armenia	983.0	945.4	878.5	908.6	892.9
<b>Plant Growing</b>					
Lori	32.2	31.5	24.9	29.0	21.6
Shirak	57.5	57.3	50.8	41.4	35.5
Tavush	22.0	21.8	16.0	13.3	11.1
Armenia	595.0	550.0	486.7	469.3	415.8
<b>Animal Husbandry</b>					
Lori	41.6	43.6	44.3	50.0	51.6
Shirak	51.5	52.2	50.9	58.0	62.4
Tavush	23.4	24.2	23.6	26.6	28.2
Armenia	387.8	395.4	391.8	439.3	477.1

For the period under review, the gross agricultural product of Armenia has been fluctuating near the threshold of 921 billion AMD with modest increases and decreases in separate years. Between the key branches of agriculture, the plant growing sector demonstrated higher fluctuations (from -4% to -12%) compared to the animal husbandry branch during this period. Note that historically these three marzes together produce on average about 24% of the gross agricultural product of the country (18% of plant growing sector and 30% of animal husbandry). On the country level, Shirak marz ensures a larger share compared to the volumes of Lori and Tavush marzes.

## DESCRIPTION OF MAIN AGRICULTURAL VCS IN TARGET MARZES

### Vegetables

Table 4.1. Vegetable

	2014	2015	2016	2017	2018	Share in Armenia, %*	Yield, ton per ha*
<b>Cultivated Areas, ha</b>							
Lori	1,489	1,605	1,800	1,602	1,338	5.9%	15.41
Shirak	1,698	1,727	1,896	1,757	1,450	6.4%	24.83
Tavush	986	1,144	1,156	815	708	3.0%	10.36
<b>Armenia</b>	<b>26,412</b>	<b>28,428</b>	<b>30,232</b>	<b>28,280</b>	<b>21,658</b>	<b>100%</b>	<b>29.73</b>

**Gross harvest, 1000 tons**

Lori	27.0	30.5	33.6	27.7	18.1	3.1%
Shirak	53.0	55.2	56.6	49.1	31.5	5.6%
Tavush	12.0	13.5	11.7	8.6	7.2	1.2%
<b>Armenia</b>	<b>954.6</b>	<b>1,007.6</b>	<b>968.6</b>	<b>861.0</b>	<b>628.2</b>	<b>100%</b>

\* Note: The shares are calculated for the average of the 2017-2018 period.

Vegetables in selected three target marzes together cover less than 16% of the total area of vegetable cultivation in Armenia.

Nearly every household in rural communities of Shirak marz grows vegetables in the backyard. However, there are few big farmers, who took it to a commercial level, producing in bigger areas. Main vegetables are cabbage, carrot, cauliflower, onion, garlic, etc. Tavush and Lori marzes are not “significant” suppliers on the country level, each ensuring less than 5% of the total harvest of vegetables on average.

In Lori marz almost every household has vegetables growing in the backyard. In recent years, the cultivation of non-traditional and high-value vegetables became very popular in marz, especially in Stepanavan and Spitak regions, which led to the establishment of greenhouses and cold storages for high-value vegetables.

### Potatoes

Table 4.2. Potatoes

	2014	2015	2016	2017	2018	Share in Armenia, %*	Yield, ton per ha
<b>Cultivated Areas, ha</b>							
Lori	4,016	4,278	4,613	4,190	3,596	16.4%	16.1
Shirak	4,268	4,383	4,556	3,715	3,221	14.6%	23.4
Tavush	1,914	1,996	2,026	1,287	1,051	4.9%	10.0
<b>Armenia</b>	<b>30,042</b>	<b>27,806</b>	<b>28,872</b>	<b>25,337</b>	<b>22,062</b>	<b>100%</b>	<b>20.2</b>

**Gross harvest, 1000 tons**

Lori	73.3	75.9	74.3	73.7	52.4	13.1%
Shirak	107.5	114.0	118.0	93.3	69.6	16.9%
Tavush	23.7	25.2	22.2	13.6	9.9	2.4%
<b>Armenia</b>	<b>696.1</b>	<b>607.7</b>	<b>606.3</b>	<b>547.4</b>	<b>415.1</b>	<b>100%</b>

\* Note: The shares are calculated for the average of the 2017-2018 period.

The situation is different in the case of the potato growing sector. About 36% of total areas for the cultivation of potatoes are ensured by three marzes, while Lori and Shirak have approximately the same share.

Shirak marz is one of the main producers of potatoes in the country, providing about 17% of the total volume. Together with Lori, Shirak marz ensures about 30% of the total gross harvest of potatoes. Tavush marz is not an active participant in VC.

The main regions of potato cultivation in Lori marz are Stepanavan, Spitak and Gugarq regions. Stepanavan region has a centralized entity to provide agricultural service with advanced equipment for cultivation and harvesting.

## Grains

**Table 4.3. Grains**

	2014	2015	2016	2017	2018	Share in Armenia, %*	Yield, ton per ha
<b>Cultivated Areas, ha</b>							
Lori	12,238	14,245	14,506	11,887	11,540	7.5%	3.0
Shirak	43,875	46,663	48,435	41,888	35,613	25.3%	2.4
Tavush	8,920	9,976	9,382	4,438	4,372	4.3%	2.6
<b>Armenia</b>	<b>183,559</b>	<b>193,048</b>	<b>195,937</b>	<b>153,156</b>	<b>130,163</b>	<b>100%</b>	<b>2.3</b>
<b>Gross harvest, 1000 tons</b>							
Lori	41.0	46.7	47.4	33.2	36.3	10.9%	
Shirak	121.0	150.9	157.1	77.4	108.6	29.2%	
Tavush	34.0	36.7	32.4	12.5	10.6	3.6%	
<b>Armenia</b>	<b>575.0</b>	<b>595.8</b>	<b>599.0</b>	<b>298.0</b>	<b>337.6</b>	<b>100%</b>	

\* Note: The shares are calculated for the average of the 2017-2018 period.

Shirak marz holds a leading position in grains cultivation, by occupying over 25% of the total area cultivated for grains on the country level. Note that the other two marzes together cover less than 12%.

Historically Shirak Marz considered the granary of Armenia. Lori and Tavush marzes together ensure comparatively modest volumes of grains gross harvest (about 14%).

## Legumes

**Table 4.4. Legumes**

	2014	2015	2016	2017	2018	Share in Armenia, %*	Yield, ton per ha
<b>Cultivated Areas, ha</b>							
Lori	196.0	207.0	240.0	287.0	291.0	25.9%	1.7
Shirak	38.0	71.0	59.0	110.0	137.0	11.1%	1.8
Tavush	651.0	680.0	701.0	424.0	309.0	32.9%	1.4
<b>Armenia</b>	<b>1,936.0</b>	<b>2,108.0</b>	<b>2,211.0</b>	<b>2,091.0</b>	<b>1848.0</b>	<b>100.0%</b>	<b>13.2</b>
<b>Gross harvest, 1000 tons</b>							
Lori	0.4	0.5	0.5	0.6	0.4	12.8%	
Shirak	0.4	0.3	0.4	0.2	0.2	5.8%	
Tavush	1.1	1.3	0.9	0.6	0.4	13.3%	
<b>Armenia</b>	<b>5.5</b>	<b>5.7</b>	<b>5.2</b>	<b>4.4</b>	<b>3.3</b>	<b>100%</b>	

\* Note: The shares are calculated for the average of the 2017-2018 period.

Among the target marzes, Tavush and Lori ensure approximately the same annual volumes of legumes, i.e. about 0.5 tons during 2017-2018, which is about 13% of produced legumes by each marz in the total gross harvest of legumes in Armenia. Lands cultivated for legumes are larger in Tavush marz compared to the other two marzes. Shirak and Lori marzes started the cultivation of legumes in the scope of ENPARD project, which provided high-quality seeds during 2016 to boost the legumes production in those regions.

## Forage

**Table 4.5. Forage**

	2014	2015	2016	2017	2018	Share in Armenia, %*	Yield, ton per ha
<b>Cultivated Areas, ha</b>							
Lori	9,685	8,900	10,607	8,235	6,795	11.1%	2.9
Shirak	13,485	13,740	15,430	13,613	11,610	18.5%	2.3
Tavush	1,920	3,700	2,201	938	849	1.3%	4.0
<b>Armenia</b>	<b>72,066</b>	<b>76,518</b>	<b>84,497</b>	<b>75,060</b>	<b>60,952</b>	<b>100%</b>	<b>5.2</b>
<b>Gross harvest, 1000 tons</b>							
Lori	32.4	30.9	33.4	23.2	19.7	6.0%	
Shirak	27.1	36.4	41.1	22.7	33.5	7.9%	
Tavush	12.0	10.9	9.8	3.9	3.2	1.0%	
<b>Armenia</b>	<b>465.0</b>	<b>542.0</b>	<b>508.6</b>	<b>388.9</b>	<b>321.3</b>	<b>100%</b>	

\* Note: The shares are calculated for the average of the 2017-2018 period.

Forage growing (includes fodder root crops, maize (corn), silage crops, perennial and annual crops such as sainfoin, alfalfa) sector is “concentrated” in Shirak and Lori marzes, which cover over 30% of the area, but account only for 13.5% of the gross harvest. Tavush has a very modest share compared to Lori and Shirak.

The biggest share of forage production in Shirak marz belongs to Amasia and Ashotsq regions, which are popular for cattle breeding. Tavush has a minor share in the said volumes. Lori holds a middle position.

In Lori marz, forage is cultivated almost in all regions, with the main concentration in the Tashir region, which is leading in terms of animal husbandry. Forage grown in the Tashir region usually is exported to other regions or marzes of Armenia.

## Fruits

**Table 4.6. Fruits**

	2014	2015	2016	2017	2018	Share in Armenia, %*	Yield, ton per ha
<b>Orchards, ha</b>							
Lori	2,402	2,414	2,249	2,267	2,265	4.1%	3.1
Shirak	504	525	525	636	610	1.0%	8.8
Tavush	3,764	3,773	3,767	3,803	3,932	6.8%	5.1
<b>Armenia</b>	<b>54,936</b>	<b>55,429</b>	<b>55,371</b>	<b>56,392</b>	<b>57,364</b>	<b>100.0%</b>	<b>9.4</b>
<b>Gross harvest, 1000 tons</b>							
Lori	3.0	2.4	1.5	7.9	6.2	1.3%	
Shirak	9.0	9.6	8.0	5.9	5.1	1.0%	
Tavush	24.1	31.1	17.1	20.8	18.3	3.7%	
<b>Armenia</b>	<b>540.5</b>	<b>673.1</b>	<b>409.9</b>	<b>555.3</b>	<b>511.1</b>	<b>100.0%</b>	

Note: Grapes are included within the Fruits VC.

\* Note: The shares are calculated for the average of the 2017-2018 period.

The yield ton per hectare is taken as the average of 2017-2018, since the data on these years are more accurate, while data from 2014 to 2016 is exaggerated and yield in Shirak marz is considered the highest in Armenia.

Among the targeted marzes Tavush is leading with the lands cultivated for fruits. The most common varieties of fruits are peach, apple, pear, plum, persimmon, grape, etc.

Although Shirak Marz is not popular with fruit production, the yield is higher compared to other target marzes. Fruits with good potential are apple, pear, and cherry.

In Lori marz fruit growing is popular, especially in Tumanyan, Gugark and Spitak regions. In recent years, the number of intensive orchards established in the mentioned regions is growing. The main fruits growing in Lori marz are plum, cherry, and peach. Stepanavan and Tumanyan regions are popular with wild pear and apple.

## Berries

**Table 4.7. Berries**

	2014	2015	2016	2017	2018	Share in Armenia, %*	Yield, ton per ha
<b>Berry plantations, ha</b>							
Lori	150	141	111	114	112	6.5%	2.6
Shirak	14	9	9	19	17	1.0%	3.5
Tavush	157	160	162	164	164	9.5%	5.2
<b>Armenia</b>	<b>2,408</b>	<b>2,149</b>	<b>2,198</b>	<b>1,691</b>	<b>1,770</b>	100%	8.2
<b>Gross harvest, 1000 tons</b>							
Lori	0.2	0.2	0.2	0.3	0.3	2.0%	
Shirak	0.0	0.1	0.1	0.1	0.0	0.5%	
Tavush	0.8	1.1	0.8	0.9	0.8	6.0%	
<b>Armenia</b>	<b>11.8</b>	<b>13.3</b>	<b>11.5</b>	<b>16.3</b>	<b>12.1</b>	100%	

\* Note: The shares are calculated for the average of the 2017-2018 period.

Tavush and Lori have the highest share in the berries growing sector among the target marzes, covering over 13% of total areas cultivated in Armenia, while the share of Shirak marz is less than 1%.

In Shirak marz, berries are becoming popular year by year due to projects implemented by different NGOs like Green Lane. There are several big producers with a total area of above 1,000 sq. m. Marz has big potential to enlarge the area of cultivation.

In general, the strawberries are produced in greenhouses. For instance, in Artik, Shirak marz, there is a three ha greenhouse and another three ha is under construction for expanding the production volumes of strawberry in that marz.

Tavush is also famous for the berries growing, including the wild collection, and ensures on average 6-7% of total gross output of berries in Armenia.

In Lori marz all the regions cultivate berries, but the highest concentration is in Tumanyan, Gugark and Stepanavan regions, which are also popular with wild berries like raspberries, rosehip, cornelian cherry. NGOs like Armenia tree project and COAF Armenia are actively involved in the development of berries VC in the marz, by providing training and seedlings for the farmers.



Overall, it should be noted that there is untapped demand for berries expressed by local processors, which are always ready to procure large volumes of berries produced by local farmers.

## Cattle

### Number of Livestock (horses excluded), as of 1 January, 1,000 heads

Table 4.7. Cattle

	2014	2015	2016	2017	2018	Share in Armenia, %*
<b>Total, 1 000 heads</b>						
Lori	81.8	81	81.8	81	69.3	12.1%
Shirak	107.1	107.9	107.9	101	91.1	15.4%
Tavush	37.1	37.1	37.8	31.7	29.7	4.9%
<b>Armenia</b>	<b>677.6</b>	<b>688.6</b>	<b>701.5</b>	<b>655.8</b>	590.6	100%
out of which Cows, 1000 heads						
Lori	39.2	39.7	40.9	39.8	34.6	13.2%
Shirak	50.6	50.6	49.7	47.4	44.3	16.3%
Tavush	17.5	17.6	17.7	14.2	13.5	4.9%
<b>Armenia</b>	<b>309.6</b>	<b>313.9</b>	<b>318.6</b>	<b>296</b>	<b>266.8</b>	<b>100%</b>

\* Note: The shares are calculated for the average of the 2017-2018 period.

Targeted marzes breed around 33% of total cattle in Armenia. The leader, from selected marzes, is Shirak, then Lori and finally Tavush marz.

## Swine

Table 4.8. Number of swine, as of 1 January, 1 000 heads

	2014	2015	2016	2017	2018	Share in Armenia, %*
Lori	12.3	10.9	15.4	15.8	12.5	8.3%
Shirak	13.8	12.9	14.8	18.7	14.7	9.8%
Tavush	16.9	16.7	20.1	16.4	16.6	9.6%
<b>Armenia</b>	<b>139.8</b>	<b>142.4</b>	<b>174.8</b>	<b>175.5</b>	<b>166.8</b>	<b>100%</b>

\* Note: The shares are calculated for the average of the 2017-2018 period.

Swine breeding is traditionally a developed VC in Tavush marz, with around 11% of the country's share. Shirak and Lori marz share 9.5% and 8.5% of countries' production respectively.

## Sheep and Goats

Table 4.9. Number of Sheep and Goats, as of 1 January, 1 000 heads

	2014	2015	2016	2017	2018	Share in Armenia, %*
Lori	37.8	38.3	37.9	37.4	27.2	4.7%
Shirak	90.4	90.5	93.5	83.4	71.8	11.2%
Tavush	16.2	17	17.6	16.9	15	2.3%
<b>Armenia</b>	<b>717.6</b>	<b>745.8</b>	<b>778.1</b>	<b>727.1</b>	<b>660.1</b>	<b>100.0%</b>

\* Note: The shares are calculated for the average of the 2017-2018 period.

Sheep breeding is popular in targeted marzes, with the leading position of Shirak marz. Shirak marz breeds around 12% of the total number in Armenia, while the other two marzes have less than 5% share each.

## Poultry

**Table 4.10. Number of Poultry, as of 1 January, 1 000 heads**

	2017	2018	2019	Share in Armenia, %*
Lori	287	331	325	7.5%
Shirak	222	270	244	6.0%
Tavush	197	195	186	4.8%
<b>Armenia</b>	<b>3,814</b>	<b>4,406</b>	<b>4,152</b>	<b>100.0%</b>

\* Note: The shares are calculated for the average of the 2017-2018 period.

Nearly every rural household in target marzes owns 1-20 chicken for own egg consumption, which can't be commercialized due to lack of food safety standards, quantity, etc. In this VC only big farmers are considered with over two thousand chickens, and there are only 2-3 big farmers in each of target marz.

## Beekeeping

**Table 4.11. Beekeeping**

	Number of farmers	Total production tones	Share in Armenia, %*
Lori	1800	218	10.5%
Shirak	880	169	8.2%
Tavush	1974	197	9.5%

\* Note: Data is taken from the 2014 Agricultural Census, no updated data is available.

There is no available statistical data on honey production. Most honey producers don't view it as a business. On average, farmers have 14 beehives. In Lori and Tavush marzes beekeeping is very popular compared to Shirak marz. Shirak marz has very good conditions for getting high-quality honey in Amasia and Ashotsq regions. The average yield per hive is 20 kg in case of moving hives from low altitude regions to high altitude regions for catching up with blossom of flowers. If beehives are not transported and only one location is used, then the yield is low, around 10-15 kg. 7kg of honey should be left as feed for bees during the winter season, the rest can go for sale. In the case of Armenia, consumers prefer to purchase honey directly from the producer (3500-4500 AMD kg) than from supermarkets/shops.

## Food processing

**Table 4.12. Output of agriculture**

	2014	2015	2016	2017	2018	2017-2018 average in Armenia, %
<b>Meat (slaughter weight), 1000 tons</b>						
Lori	17.3	19.7	21.7	22.5	20.8	11.3%
Shirak	22.0	23.8	24.7	25.7	24.9	13.2%
Tavush	9.3	10.2	10.5	10.8	10.4	5.5%
<b>Armenia</b>	<b>163.3</b>	<b>176.1</b>	<b>187.1</b>	<b>192.5</b>	<b>190.3</b>	<b>100%</b>
<b>Milk production, thousand tons</b>						
Lori	86.0	90.3	94.6	95.0	84.9	12.4%

Shirak	110.5	112.2	115.7	116.4	110.7	15.6%
Tavush	41.0	42.1	43.3	43.5	40.1	5.7%
Armenia	700.4	728.6	754.2	758.2	697.7	100%
<b>Wool (physical weight), tons</b>						
Lori	72.1	76.5	76.2	69.6	43.5	4.7%
Shirak	185.7	193.1	200.1	160.8	104.6	11.0%
Tavush	35.0	34.0	34.9	30.4	21.0	2.1%
Armenia	1,477.0	1,571.0	1,641.0	1,385.0	1,032.0	100%
<b>Eggs productions, mln. pieces</b>						
Lori	45.8	47.8	49.5	50.4	51.0	7.2%
Shirak	39.9	43.0	45.7	45.4	45.5	6.4%
Tavush	46.3	49.4	50.6	50.8	50.8	7.2%
Armenia	641.8	659.8	694.6	683.0	726.8	100%

Within the target marzes, Shirak and Lori are more specialized in meat production by ensuring together about 25% of the country's meat production volumes. As a result, of the implementation of the government program of mandatory utilization of slaughterhouse services, the market quality will be improved, as the centralized, controlled quality services will substitute the current slaughtering processes, which are mostly done separately and individually by farmers and/or butchers.

Shirak marz is a leader in the sector of milk production and ensures over 15% of the country's volumes. Note that there are several milk processing companies: "Bandivan kat" Ltd, "Igit" Ltd, "Aleqpol" LLC, "Ashotsk Cheese Factory" LLC, "Amasia Chief Cheese Factory" LLC, "Voske Ser" LLC. Some large producers are also exporting.

In terms of wool production, again the leader is Shirak marz by producing about 12% of the total wool. The other two marzes have very small volumes in wool production.

The picture is comparatively smooth in the case of egg production with equal volumes.

**Table 4.13. Marketability rate, in %**

	Lori	Shirak	Tavush	*Total in Armenia
<b>Vegetables</b>	36.0	68.8	12.8	81.2
<b>Potato</b>	23.1	46.3	6.0	6.0
<b>Grains and Legumes</b>	21.3	27.0	13.8	33.3
<b>Fruits and Berries</b>	33.7	13.7	39.8	67.6
<b>Meat</b>	72.3	85.6	75.7	81.6
<b>Milk</b>	59.4	53.9	39.2	59.4
<b>Eggs</b>	26.3	42.8	23.9	40.8
<b>Beekeeping</b>	46.0	41.8	46.0	56.2

Note: Marketability rate or marketable surplus is the portion of a harvest that a farmer can sell/barter on the market to earn a profit.

\*Total in Armenia shows what percent of total produce in Armenia is sold/bartered of the VC.

A large portion of vegetables produced in Shirak and Lori marzes are for commercial purposes. Around 70% of the vegetable harvest in Shirak and 36% in Lori are sold or bartered, while in Tavush vegetable is produced mostly for own consumption.

Potato growing is specific for Shirak marz, which is one of the leaders in Armenia. About half of the produce is marketed compared to the 6% marketability rate in Armenia.

Grains and Legumes have a higher marketability rate in Shirak and Lori than in Tavush. Fruit marketable surplus is the highest in Tavush among three target marzes with around 40% of produce being sold. Shirak marz with 600 ha orchards is mostly producing for personal consumption. Cherries have a relatively higher marketability rate among fruits in Shirak, which is considered as the main supplier of cherries for processing.

Meat is the distinct leader as marketed agricultural produce in all target marzes and overall Armenia with a share of marketable surplus above 70% in Tavush and Lori and over 85% in Shirak. In the case of milk, the share of products sold or bartered is lower than meat, but compared with other agro products is relatively high. Beekeeping is also commercialized activity with above 40% of produce sold.

**Table 4.14: Production of food products in 2018, bln AMD**

NACE rev 2 Code	Subsector	Lori	Shirak	Tavush
10.3	Processing and preserving of fruit and vegetables	-	-	0.5
10.5	Manufacture of dairy products	5.6	6.6	1.3
10.6	Manufacture of grain mill products, starches, and starch products	-	0.1	-
10.7	Manufacture of bakery and farinaceous products	9.2	8.1	2.1
10.8	Manufacture of other food products	0.01	13.3*	-
	<b>Total: Manufacture of food products</b>	<b>34.7</b>	<b>53.7</b>	<b>16.7</b>

\*Production of sugar.

Source: SC RA

The fruit and vegetable processing is underdeveloped in the target marzes. There are only a few small-scale producers of canned food in Tavush.

Dairy production is comparatively well developed in Shirak and Lori marzes, with established and well-known large companies such as Igit, Bandivan Kat and Duster Melania. The production of the dairy products amounted to AMD 6.6 bln. and AMD 5.6 bln. in 2018. The leading producer of dairy products in Tavush is Dili, which is currently expanding its production capacities.

## 4. METHODOLOGICAL APPROACH IN BRIEF

The study was carried out in the following three phases:

	<b>Phase 1: Identification, mapping, and assessment of potential</b>	<b>Phase 2: Selection of target VCs</b>	<b>Phase 3: Analysis and description of selected value chains</b>
<b>Actions</b>	<p>Conducted mapping and prioritization of value chains based on high-level assessment by following dimensions:</p> <ul style="list-style-type: none"> <li>• Economic scale</li> <li>• Growth perspectives</li> <li>• Social impact and inclusiveness</li> <li>• Environmental sustainability (Green potential)</li> </ul> <p>Prioritization of up to 5 value chains per marz</p>	<p>Based on assessment results of potential VCs EU GAIA team has selected the VC for Phase 3 detailed analysis</p>	<p>Deeper analysis and description of selected VCs which covered:</p> <ul style="list-style-type: none"> <li>• Description of main products</li> <li>• Key players</li> <li>• Availability and access to inputs and extension services</li> <li>• Cultivation, harvesting and post-harvesting practices</li> <li>• Productivity</li> <li>• Markets and growth potential</li> <li>• Distribution channels and marketing</li> <li>• Recommendations on: <ul style="list-style-type: none"> <li>- activities to support the development along the selected value chains and the priority areas for these,</li> <li>- investment themes for removing and mitigating the key constraints and bottlenecks hurdling the growth as well as promoting green development.</li> </ul> </li> </ul>
<b>Sources of information</b>	<p>Meetings and interviews of key stakeholders, review of available reports, statistical data</p>	<p>Phase 1 Report</p>	<p>Meetings and interviews of key stakeholders, FG discussions in target marzes, available reports, statistical data</p>
<b>Outcomes</b>	<ul style="list-style-type: none"> <li>• VC assessment framework</li> <li>• Assessment of the potential VCs by prioritization criteria</li> </ul>	<p>Selected VCs (with focus on specific products) for further analysis</p>	<p>Final report including VC assessment results, analysis</p>

## MAPPING AND PRIORITIZATION OF VALUE CHAINS IN TARGET MARZES

Based on the results of desk research and statistical data analysis the research team has compiled a list of 13 potential value chains, which are present in the target 3 marzes. In the frame of the current study, we define the "agricultural value chain" as a range of activities and set of actors that bring the agricultural product from production in the field to final consumption, wherein at each stage value is added to the product. In the first stage of the assessment, the research team in consultation with the EU GAIA project team has defined the value chain broadly to capture all possible sub value chains.

The list of defined VCs might be adjusted after consultations with the EU GAIA team and key stakeholders. As the primary focus of the EU GAIA Project is the primary agriculture, we have defined the value chains based on primary agricultural produce:

Name of the value chain	Description
<b>1. Vegetables</b>	Includes traditional and non-traditional high-value vegetables such as broccoli, kohlrabi, artichoke, physalis, cherry tomato, leek, green bean, bell pepper, etc.
<b>2. Potato</b>	Potato
<b>3. Legumes</b>	Includes peas, beans, lentils, etc.
<b>4. Grains</b>	Includes wheat, barley, rye, oats, spelt, buckwheat, etc.
<b>5. Fruits</b>	All kinds of fruits, grapes, nuts including wild collection
<b>6. Berries</b>	All kind of berries including wild collection berries
<b>7. Herbs</b>	Includes all kinds of edible and medical herbs either cultivated or wild collected such as thyme, mint, chamomile, and melissa, sorrel, tutsan, polygonatum, and flowers of tilia
<b>8. Forage</b>	Fodder root crops, maize (corn), silage crops, perennial and annual crops (sainfoin, alfalfa)
<b>9. Cattle</b>	Includes all the products gained out of cattle including milk, meat, and other sub-products
<b>10. Sheep</b>	Includes all the products gained out of sheep including milk, meat, wool, and other sub-products
<b>11. Swine</b>	Includes all the products gained out of swine including meat and other sub-products
<b>12. Poultry</b>	Includes all the products gained out of Poultry including eggs and meat
<b>13. Beekeeping</b>	Includes honey and apiculture products

For the selection of target value chains (at least 5 VCs), from the above-mentioned value chains, has been assessed and prioritized from the following aspects: Economic Scale, Demand Growth Perspectives, Value-added Increase Potential, Social Impact, and Environmental Sustainability.

The set of quantitative and qualitative indicators have been used to assess each VC in target marzes. Each factor got a score from one to three where "1" means low, "2" – medium and "3" – high. A high score means that the VC has higher importance for Marz in terms of economic and social impact as well as has positive externalities in terms of environmental sustainability.

Dimensions and measures	Measurement approach
<b>Economic Scale</b>	
- Sector output in monetary terms	The indicator measures the total revenue created by the sector e.g. its power and importance of the VC in revenue generation in the particular marz. The higher the revenue of the VC is the higher a score it gets. The indicator is calculated based on the statistical data provided by SC RA and estimates of EV Consulting.
- Specialization level	This indicator presents the share of the marz output in the total country output. If the share of the marz in total sector output is more than 10%, then the sector gets the highest score, 5-10% - medium, lower than 5% - low.  The base of the estimation is the agricultural output data of SC RA
<b>Demand Growth Perspectives</b>	
- Export orientation	This indicator presents the export orientation of VC and future growth potential through export. To assess the export growth potential and the growth trend of the last 5 years, the export volume in physical and value terms for both primary agricultural produce and processed food products is analyzed.  The data of UN Comtrade foreign trade statistics, statistical data of industrial companies of SC RA is used in the assessment.
- Import substitution potential	This indicator measures the extent of import substitution potential in the particular value chain. The feasibility of the local production of the imported and its price competitiveness is taken into account.  The indicator is estimated based on UN Comtrade foreign trade statistics, interviews with key informants and expert judgment.
- Local consumption	This indicator estimates the trend of the local consumption of agro products in the future. It captures the expected change of consumption pattern of the food considering the future revenue growth of the population.  The indicator is estimated based on food consumption data of FAO and expert judgment.
<b>Value-Added Increase Potential</b>	
- Extension potential of value add capturing (backward and forward expansion of value chain)	The indicator estimates the opportunities for value-adding activities for the sector. The value-adding opportunities include such activities as freezing, drying, canning, or processing as well as producing inputs and provision of extension services. If the opportunities of additional value-adding activities are high, the VC gets the score three. The indicator is estimated based on the insights collected from interviews with key informants and expert judgment as well as statistical data on food processing capacities in the marz.

- Revenue per agricultural unit	Revenue per agricultural asset unit is used to capture the high value capturing of the particular VC. In the case of Plant Growing revenue per ha is the measurement unit. The revenue per livestock unit is used to compare the revenue levels among animal husbandry types. The number of livestock from various species was converted to a unified livestock unit by using conversion coefficients.  Source: <a href="https://ec.europa.eu/eurostat/statistics-explained/index.php/Glossary:Livestock_unit_(LSU)">https://ec.europa.eu/eurostat/statistics-explained/index.php/Glossary:Livestock_unit_(LSU)</a>
<b>Social Impact</b>	
- Engagement of women in VC	This indicator estimates the engagement of women in the particular value chain taking into account the specifics of activities/works as well as current practices and traditions. The higher the level of women engagement and its potential is, the higher a score gets the VC. The indicator is estimated based on interviews with key informants and expert judgment.
- Job creation potential	This indicator estimates the extent of job creation and revenue generation in the VC. The following factors are considered in the assessment: <ul style="list-style-type: none"> <li>● Capital intensity</li> <li>● Level of possible automation</li> <li>● Availability and possible backward and forward linkages</li> <li>● Relative profitability of the VC</li> </ul> The assessment is done based on expert interviews and judgments.
<b>Environmental sustainability</b>	
- Impact of VC on the environment	This indicator presents the extent of the negative impact the VC has on the environment. The assessment of environmental component is carried out from the perspective of their potential impact on the following five areas: air, soil, water, waste, and biodiversity. The assessment will be done through expert judgment based on available secondary data. Assessment is done by an environmental Expert.
- Green opportunities	This indicator presents the potential of the application of environmentally friendly technologies and practices in each VC. Assessment is done by an environmental Expert. The assessment approach is presented below.

### Assessing Green Opportunities in VCs

The following aspects and measures will be considered in assessing the green opportunities in VCs:

- Improved pest management, proper control of herbicides and pesticides usage;
- Control of fertilizer usage: analyze soil and not to overdose with the use of fertilizer;
- Upgrade of agricultural machinery and technology for agricultural work to reduce the fuel usage, oil leakage and consumption of energy;
- Use of new technology in the land cultivation to reduce side effects on land;



- Improved waste management, recycling of pre-cultivation inorganic waste;
- Implementation of drip irrigation and improvement of the water management system;
- Usage of organic fertilizers and substitution of chemicals with organic fighting means;
- Usage of environmentally friendly fertilizers and chemicals that has less harmful effects;
- Cultivation rotation and usage of new cultures to enrich the soil;
- Banning of post-harvest field burning practice that has a negative impact on air, soil, and biodiversity;
- Improvement of agro-technical cultivation methods (training, demos, new machinery, new plants, etc.);
- Improved pasture management: proportional use of pastures and control of timing;
- Control of water reservoirs.

### **Climate change and DRR**

The climate change impact on the value chains has been carried out from two perspectives:

1. description of positive and negative factors which affect each value chain development opportunities,
2. description of disaster risk reduction (DRR) and climate change adaptation methods/ways that can be implemented for each value chain.

The assessment is done by the environmental expert based on their own experience and available secondary data. The climate change and DRR have not been included in the VC assessment framework, but analyzed and described in selected value chains to highlight the risks and mitigation/adoption options.

## 5. ASSESSMENT OF THE VALUE CHAINS

The following dimensions were used for assessment and prioritization of mapped value chains in target marzes: A. Economic Scale, B. Demand Growth, C. Value-Added Increase Potential, D. Social impact, E. Environmental Sustainability.

Each of the above-mentioned dimensions was assessed by 2-3 indicators with the following grades: high=3, medium=2, low=1 grades.

The section below presents the detailed explanation and justification of assessment results by each dimension.

### DIMENSION A: ECONOMIC SCALE

#### Assessment of economic scale and specialization level

The indicator measures the total revenue created by the sector e.g. its power and importance of the VC in revenue generation in the particular marz. The higher the revenue of the VC is the higher a score it gets.

The specialization level indicator presents the share of the marz output in the total country output. If the share of the marz in total sector output is more than 10%, then the sectors get the highest score, 5-10% - medium, lower than 5% - low.

Note: prioritization of high, low and medium is done by scaling all VC to medium (excluded cattle due to big revenue gap with others).

The statistical data on herbs are missing and the assessment is done based on expert judgment.

**Table 6.1. The results of the assessment of the economic scale and marz specialization level in target marzes**

Shirak					
	VCs	VC output (revenue), bln AMD	Sector output, bln AMD	Share of production in the total output of Armenia, (average 2017-2018)	Specialization level
1	Vegetables	5.95	High	5.4%	Medium
2	Potato	7.91	High	16.9%	High
3	Legumes	0.10	Low	5.8%	Medium
4	Grains	10.97	High	29.2%	High
5	Fruits	1.55	Low	1.6%	Low
6	Berries	0.04	Low	0.5%	Low
7	Herbs	n/a	Low	n/a	Low
8	Forage	0.84	Low	7.9%	Medium
9	Cattle	35.57	High	15.0%	High
10	Sheep	2.14	Medium	12.0%	High
11	Swine	3.14	Medium	9.4%	Medium
12	Poultry	3.33	Medium	5.9%	Medium
13	Beekeeping	0.59	Low	8.2%	Medium

**Lori**

	VCs	VC output (revenue), bln AMD	Sector output, bln AMD	Share of production in the total output of Armenia, (average 2017-2018)	Specialization level
1	Vegetables	3.42	Medium	3.1%	Low
2	Potato	6.08	High	13.1%	High
3	Legumes	0.25	Low	12.8%	High
4	Grains	4.13	Medium	10.9%	High
5	Fruits	1.97	Low	2.0%	Low
6	Berries	0.20	Low	2.0%	Low
7	Herbs	n/a	Low	n/a	High
8	Forage	0.63	Low	6.0%	Medium
9	Cattle	27.57	High	12.0%	High
10	Sheep	0.88	Low	4.9%	Medium
11	Swine	2.63	Medium	8.4%	Medium
12	Poultry	3.88	Medium	7.8%	Medium
13	Beekeeping	0.76	Low	10.5%	High

**Tavush**

	VCs	VC output (revenue), bln AMD	Sector output, bln AMD	Share of production in the total output of Armenia, (average 2017-2018)	Specialization level
1	Vegetables	1.19	Medium	1.1%	Low
2	Potato	1.16	Medium	2.4%	Low
3	Legumes	0.25	Low	13.3%	High
4	Grains	1.42	Medium	3.6%	Low
5	Fruits	9.25	High	2.9%	Low
6	Berries	0.60	Low	6.0%	Medium
7	Herbs	n/a	Low	n/a	High
8	Forage	0.11	Low	1.0%	Low
9	Cattle	12.13	High	5.0%	Medium
10	Sheep	0.44	Low	2.3%	Low
11	Swine	3.20	High	10.8%	High
12	Poultry	3.43	High	4.5%	Low
13	Beekeeping	0.69	Low	9.5%	Medium

The results of the assessment of the economic scale have shown, that the cattle value chain has great power and importance in revenue generation in all three target marzes. While the potato VC's output is high in Shirak and Lori. There are also other VCs with high sector output in the target marzes: vegetables and grains in Shirak, fruits, swine and poultry in Tavush. Besides the high output level, Tavush marz has a high specialization level in the swine VC.

It is important to highlight that Shirak and Lori marzes have a high level of specialization in potato, grains and cattle sectors. On the other hand, Tavush and again Lori marzes are specialized in legumes and herbs sectors. Besides the mentioned VCs, the Shirak marz is also specialized in sheep's VC, Lori – in beekeeping.

Shirak marz has the lowest specialization levels in the fruits, berries and herbs sectors, where the output level is the lowest, too. Lori is the least specialized in vegetables, fruits and berries VCs, while the least revenue-generating sectors for this marz are legumes and herbs (in which the marz has a high level of specialization), fruits, berries, forage, sheep and beekeeping. In Shirak marz the VCs with the lowest level of specialization are as follows: vegetables, potato, grains, fruits and poultry (where the sector output is high), forage, sheep. The sectors with the lowest indicators of sector output are as follows: legumes and herbs (in which the marz has a high level of specialization), berries, forage, sheep and beekeeping.

The table below pictures the number of agricultural SME farms (ASMEs). ASMEs are the farms, which produce more than own consumption and are able to market their products. As the base for ASME identification is used the area of cultivation (as a threshold is taken from 0.1 ha to 2 ha depending on type of produce e.g. for orchards the threshold was 0.1 ha while for grains - 1ha and for forage - 2ha) per farm or number of livestock at the farm. As a rule, the farmers are engaged in more than one VC.

**Table 6.2. Total Number of farmers engaged in the respective value chain and number of agricultural SME farms\***

		Shirak		Lori		Tavush	
		Total	ASMEs	Total	ASMEs	Total	ASMEs
1	<b>Vegetables</b>	13,811	3,387	14,473	2,597	16,603	1,978
2	<b>Potato</b>	21,611	1,169	28,637	1,618	22,152	235
3	<b>Legumes</b>	404	404	3,454	3,454	10,766	10,766
4	<b>Grains</b>	18,349	12,231	9,566	3,175	12,555	3,206
5	<b>Fruits</b>	11,004	225	20,007	1,027	20,922	1,789
6	<b>Berries</b>	581	581	1,009	1,009	993	993
7	<b>Herbs*</b>	N/A	N/A	N/A	N/A	N/A	N/A
8	<b>Forage</b>	9,499	1,898	6,063	839	1,686	80
9	<b>Cattle</b>	14,727	8,974	13,062	6,235	6,462	2,651
10	<b>Sheep</b>	4,884	3,273	2,098	1,178	1,550	469
11	<b>Swine</b>	3,710	772	5,686	634	6,953	897
12	<b>Poultry</b>	13,272	500	15,878	187	15,657	466
13	<b>Beekeeping</b>	880	880	1,794	1,794	1,974	1,974

\* No statistical data available.

Source: SC RA, Agricultural Census Data from 2014.

These data indicate that the large share of them are subsistence farms in most of VCs. Though almost all farmers engaged in the cultivation of legumes, berries, and beekeeping have a marketable surplus.

## **DIMENSION B: ASSESSMENT OF DEMAND GROWTH**

The demand for agriculture produce is an important indicator of the development of the sector. The export potential, import substitution and consumption growth for the target VCs are analyzed at the country level because of missing statistics at the marz level. However, the specifics of certain products, which are concentrated in specific marz, have been taken into consideration such as the export of fruits from Tavush marz which have higher export potential than the fruits from the other two marzes.

The table below shows the assessment results for all selected value chains. For each factor, it is graded High, Medium Low, e.g.

**Table 6.3. The results of the assessment of demand growth for all selected value chains**

Value chains	Assessment results		
	Export growth potential	Import substitution potential	Consumption
1 Vegetables	High	Low	Medium
2 Potato	Low	Low	Low
3 Legumes	Low	Medium	High
4 Grains	Low	Medium	Low
5 Fruits	Low (for Shirak and Lori) High (Tavush)	Low	Medium
6 Berries	High	Low	High
7 Herbs	Medium	Low	Medium
8 Forage	Low	Low	High
9 Cattle	Medium	Medium	High
10 Sheep	High	Low	Low
11 Swine	Low	High	High
12 Poultry	Low	Medium	Medium
13 Beekeeping	Medium	Low	High

The vegetables, berries, and sheep VCs showed high export potential in all three target marzes, while in the fruits sector the considered indicator is high only in Tavush. The potato, legumes, grains, forage, swine, and poultry have the lowest grades in respect of the export potential.

The situation is different in terms of import substitution potential. In this case, only the sector of swine has a high

potential. Meanwhile, the assessment results showed medium potential for the VCs legumes, grains, cattle and poultry.

Because of major development in the world, income growth, and consumer preference changes, food consumption has been growing at a faster pace than the world population. Because of these developments consumption of high-value products increased in emerging economies. Armenia is a developing country and follows global trends with increasing consumption of high-value products. At the same time, there is some traditional preference for the population in food consumption. Moreover, Armenian consumers are very price sensitive. Considering this and the importance of consumer products, the following assessment result was generated: primary consumption products, not high value, will grow slightly, while the increase of income level and change of diet preference will lead to increasing the consumption of high-value products.

The detailed description of the assessment is provided in Annex 3.

## DIMENSION C: VALUE-ADDED INCREASE POTENTIAL

### C1: Assessment of VC extension potential

The assessment of VC extension potential has great importance for the estimation of the development potential of each sector.

The table below shows the assessment results for all selected value chains. For each factor, it is graded High, Medium and Low.

**Table 6.4. The results of the assessment of the value-added Increase potential of selected value chains**

Value chains		Assessment results
1	Vegetables	High
2	Potato	Medium
3	Legumes	Medium
4	Grains	Medium
5	Fruits	High
6	Berries	High
7	Herbs	Medium
8	Forage	Low
9	Cattle	High
10	Sheep	Medium
11	Swine	Medium
12	Poultry	Medium
13	Beekeeping	Medium

According to the results, the following VCs have high extension potential: Vegetables, Fruits, Berries, and Cattle. Potato is considered as primary consumption product, with low opportunities for adding value. However, potato VC has significant extension potential. The legumes and grains VCs have significant extension potential in terms of packaging and in case of grains also processing.

The assessment showed that the Forage VC has the lowest extension potential, as it has limited opportunity for processing. It mainly goes to animal fodder or combined feed processing.

The detailed description of the assessment is provided in Annex 4.

### C2: Revenue per agricultural unit

Revenue per agricultural asset unit is used to capture the revenue-generating capacity of a particular VC or high value-added potential. In the case of Plant Growing revenue per ha was used as the measurement unit and for animal husbandry the livestock unit (LSU) the calculation methodology of which is provided in the assessment framework description.

**Table 6.5. The results of the assessment of the revenue per agricultural unit of selected value chains**

VCs	Shirak		Lori		Tavush	
	Revenue per ha/ per LSU, mln AMD	Revenue per unit	Revenue per ha/ per LSU, mln AMD	Revenue per unit	Revenue per ha/per LSU, mln AMD	Revenue per unit
1 Vegetables	3.71	High	2.33	High	1.56	Medium
2 Potato	2.28	High	1.56	High	0.99	Medium
3 Legumes	0.81	Medium	0.87	Medium	0.68	Medium
4 Grains	0.28	Low	0.35	Low	0.32	Low
5 Fruits	2.49	High	0.90	Medium	3.68	High
6 Berries	2.49	High	1.80	High	3.63	High
7 Herbs	-	Medium	-	Medium	-	Medium
8 Forage	0.07	Low	0.08	Low	0.12	Low
9 Cattle	0.37	Medium	0.37	Medium	0.39	Medium
10 Sheep	0.27	Low	0.27	Low	0.27	Low
11 Swine	0.47	Medium	0.47	Medium	0.47	Medium
12 Poultry	1.30	High	1.14	High	1.77	High
13 Beekeeping	n/a	n/a	n/a	n/a	n/a	n/a

Note: The following coefficients are used for conversion to livestock unit (LSU) for each animal type: cattle – 1, Sheep - 0.1, Swine – 0.4, Poultry – 0.01.

The revenue per agricultural unit of poultry and berries VCs are high in all three target marzes. In Shirak and Lori marzes the vegetables and potato, as well as in Shirak and Tavush marzes the fruits sectors have a high value of the indicator under review.

On the other hand, the assessment showed that grains, forage and sheep value chains have the lowest levels of revenue per agricultural asset unit in all target marzes.

## DIMENSION D: ASSESSMENT OF SOCIAL IMPACT

The assessment of Social Impact was done in two main directions: women engagement in agricultural activities and job creation potential.

**Table 6.6. The assessment of the social impact**

Value chains	Assessment results	
	Women engagement in agricultural activities	Job creation potential
1 Vegetables	Medium	High
2 Potato	Medium	Medium
3 Legumes	Medium	Low
4 Grains	Low	Low
5 Fruits	Medium	High
6 Berries	High	High
7 Herbs	High	High
8 Forage	Low	Low
9 Cattle	Medium	Medium
10 Sheep	Low	Medium
11 Swine	Low	Low
12 Poultry	Medium	Low
13 Beekeeping	Low	Medium

Women play an essential role in the development and growth of agriculture in the global world. Women account for about 43% of the agricultural labor force according to FAO 2011 report. When it comes to agriculture, women do a variety of jobs, from unpaid housework to farming and entrepreneurship. Based on existing practice agricultural work is divided into pure men job (ex: driving a tractor), where men are dominated by the sphere of work, pure women job (ex: milking a cow), where women are dominated by the sphere of work and unisex job, where both can do the same job equally.

Job creation and income generation opportunities are high in the vegetables, fruits, berries, and herbs VCs. These chains provide a good opportunity to involve vulnerable groups in the process of growing and processing. Moreover, the women engagement in agricultural activities is the highest in the berries and herbs VCs.

Legumes, grains, forage, swine, and poultry VCs are very limited in terms of added value and creation of extra jobs, hence extra income. Whereas among these chains the women engagement in legumes and poultry sectors is estimated as medium.

The detailed description of the assessment is provided in Annex 5.

## DIMENSION E: ASSESSMENT OF ENVIRONMENTAL SUSTAINABILITY

Environmental sustainability is the essential component for agriculture development and, of course, for the project. With the increase of agriculture production, the risk to the environment is increasing respectively. To make agricultural production sustainable it's crucial to have well-developed natural resource management and proper waste management, which will eliminate critical environmental issues, such as the degradation of land, extinction of biodiversity, water, and air pollution.

To apply green technologies and effective agricultural practices it is important to assess the current situation in agriculture. For this reason, each selected VCs were assessed to see how environmentally friendly is the specific value chain and what impact it has on air, soil, water, biodiversity and what waste it leaves. On the other hand, each VC was assessed to see what potential it has to become green and sustainable in case of the application of good agricultural practices and environmental sustainability programs.

The table below shows the assessment results for all selected value chains. For each factor it is graded High, Medium Low, e.g., cattle and sheep VCs are the least environmentally friendly, while legumes and forage are environmentally friendly and beekeeping is the most environmentally friendly VC.

Vegetables, fruits, and berries VCs have high opportunity to become green, while cattle and sheep VCs have very little opportunity to become green and for beekeeping, the opportunity is low as it's already a green VC, and there is little to do to make it even greener.

The detailed description of the assessment is provided in Annex 6.

**Table 6.7. The assessment results of Environmental Sustainability**

Value chains	Environmentally friendliness					Green opportunities				
	Air	Soil	Water	Waste	Biodiversity	Air	Soil	Water	Waste	Biodiversity
1 Vegetables	Medium	Low	Low	Medium	Medium	High	High	High	High	High
2 Potato	Medium	Low	Low	Medium	Medium	Medium	Medium	Medium	Medium	Medium
3 Legumes	High	High	Medium	High	Medium	Medium	Medium	High	Medium	Medium
4 Grains	Low	Low	Medium	Medium	High	High	High	Low	High	High
5 Fruits	Medium	Medium	Low	Medium	Medium	Medium	High	High	High	High
6 Berries	Medium	Medium	Low	Medium	Medium	Medium	High	High	High	High
7 Herbs	High	Medium	High	Medium	Low	Low	Medium	Low	Low	High
8 Forage	High	Medium	Medium	High	High	Low	Medium	Low	Low	Low
9 Cattle	Low	Low	Medium	Low	Low	Low	Medium	Low	Medium	Low
10 Sheep	Low	Low	Medium	Low	Low	Low	Medium	Low	Medium	Low
11 Swine	Low	High	Medium	Low	Medium	Low	Low	Low	Medium	Low
12 Poultry	Low	High	Medium	Low	Medium	Low	Low	Low	Medium	Low
13 Beekeeping	High	High	High	High	High	Low	Low	Low	Low	Low

The assessment results pinpoint that animal husbandry has the largest adverse impact on the environment and hat the same time has limited room for becoming green. Fruits, berries, grains, and vegetables are the VCs with the highest potential for green opportunities.



## 6. SUMMARY OF ASSESSMENT RESULTS

The tables below summarize the results of the assessment of VCs in target regions across the five dimensions - (i) economic scale (ii) demand growth; (iii) VA increase potential; (iv) social impact; (v) green potential. The total score used for VC prioritization is determined by summing up the weighted final scores of all dimensions. The weights used for calculations were agreed with the EU GAIA team, as follows:

- Economic Scale – 0.1
- Demand Growth – 0.2
- VA increase potential -0.3
- Social Impact – 0.2
- Green potential – 0.3.

Priority is given to sub-sectors that received the highest scores. However, in some instances, specific crops or specific VCs were prioritized within non-prioritized sub-sectors. For instance, grains were given an overall low score concerning the “economic scale” indicator, but some specific crops under grains sub-sector (buckwheat, maize) have high performance.

### Shirak marz

Value Chains	Economic Scale	Demand Growth	VA Increase Potential	Social Impact	Green Potential	Total Score
<b>Plant growing</b>						
Vegetables	2.5	2.0	3.0	2.5	2.3	<b>2.74</b>
Potato	3.0	1.0	2.5	2.0	1.8	<b>2.19</b>
Legumes	1.5	2.0	2.0	2.0	2.4	<b>2.27</b>
Grains	3.0	1.3	1.5	1.0	2.2	<b>1.88</b>
Fruits	1.0	1.0	2.5	2.5	2.3	<b>2.24</b>
Berries	1.0	2.3	3.0	3.0	2.3	<b>2.76</b>
Herbs	1.0	1.7	2.0	3.0	1.9	<b>2.20</b>
Forage	1.5	1.7	1.0	1.0	1.9	<b>1.55</b>
<b>Animal husbandry</b>						
Cattle	3.0	2.3	2.5	2.0	1.3	<b>2.31</b>
Sheep	2.5	1.7	1.5	1.5	1.3	<b>1.72</b>
Swine	2.0	2.3	2.0	1.5	1.5	<b>2.02</b>
Poultry	2.0	2.0	2.5	1.5	1.5	<b>2.10</b>
Beekeeping	1.5	2.0	2.5	1.5	2.0	<b>2.20</b>

## Lori marz

Value Chains	Economic Scale	Demand Growth	VA Increase Potential	Social Impact	Green Potential	Total Score
<b>Plant growing</b>						
Vegetables	1.5	2.0	3.0	2.5	2.3	2.64
Potato	3.0	1.0	2.5	2.0	1.8	2.19
Legumes	2.0	2.0	2.0	2.0	2.4	2.32
Grains	2.5	1.3	1.5	1.0	2.2	1.83
Fruits	1.0	1.0	2.0	2.5	2.3	2.09
Berries	1.0	2.3	3.0	3.0	2.3	2.76
Herbs	2.0	1.7	2.0	3.0	1.9	2.30
Forage	1.5	1.7	1.0	1.0	1.9	1.55
<b>Animal husbandry</b>						
Cattle	3.0	2.3	2.5	2.0	1.3	2.31
Sheep	1.5	1.7	1.5	1.5	1.3	1.62
Swine	2.0	2.3	2.0	1.5	1.5	2.02
Poultry	2.0	2.0	2.5	1.5	1.5	2.10
Beekeeping	2.0	2.0	2.5	1.5	2.0	2.25

## Tavush marz

Value Chains	Economic Scale	Demand Growth	VA Increase Potential	Social Impact	Green Potential	Total Score
<b>Plant growing</b>						
Vegetables	1.5	2.0	2.5	2.5	2.3	2.49
Potato	1.5	1.0	2.0	2.0	1.8	1.89
Legumes	2.0	2.0	2.0	2.0	2.4	2.32
Grains	1.5	1.3	1.5	1.0	2.2	1.73
Fruits	2.0	1.7	3.0	2.5	2.3	2.62
Berries	1.5	2.3	3.0	3.0	2.3	2.81
Herbs	2.0	1.7	2.0	3.0	1.9	2.30
Forage	1.0	1.7	1.0	1.0	1.9	1.50
<b>Animal husbandry</b>						
Cattle	2.5	2.3	2.5	2.0	1.3	2.26
Sheep	1.0	1.7	1.5	1.5	1.3	1.57
Swine	3.0	2.3	2.0	1.5	1.5	2.12
Poultry	2.0	2.0	2.5	1.5	1.5	2.10
Beekeeping	1.5	2.0	2.5	1.5	2.0	2.20

## Economic Scale

The “economic scale” indicator is to reflect the revenue generation potential of a given value chain in the particular marz. High performers under this indicator, among the eight VCs that scored the highest in target marzes, are vegetables, potatoes, and cattle. Grains got an overall low score under this indicator, however, among grains; there are some specific crops with high revenue generation potential. This is

related particularly to such high-value grains as buckwheat and maize or spelt (the latter two crops can be used for feed production for animal husbandry).

### **Demand Growth**

The "demand growth" indicator captured the VC expansion potential through export and increase of local consumption, plus the extent of import substitution. In terms of export growth, vegetables, fruits, and berries have the highest potential. The key export market for Armenian vegetables and fruits is Russia while the Middle East is an emerging export destination with high potential, especially for berries. Among barriers, strawberries lead exports from Armenia, mainly to Russia and UAE. Raspberry, especially organically grown, are highly demanded in export markets. From the target marzes, only Tavush marz has exportable fruits' varieties and volumes, while Shirak and Lori do not have "exportable" fruits (fruit are mainly grown in backyards in comparatively small volumes).

As for the increase of local consumption, legumes, berries, dairy and meat (cattle VC) have the highest potential. Similar to many developing countries, the consumption of high-value products is increasing in Armenia. For instance, with the growth of income in the country, there will be an increase in the consumption of non-primary consumption products such as dairy products. Moreover, changes in dietary preferences will lead to increasing the consumption of high-value products such as berries and legumes.

The import substitution potential for fruits is small as more than 80% of fruits imported to Armenia are tropical fruits.

### **VA Increase Potential**

The VC's Value increase potential is a crucial indicator, which shows the potential of further processing and added value production (e.g. processing, storing, freezing, drying, canning, packaging, etc.), as well as upstream and downstream cooperation and integration opportunities along the value chain. This is important for income generation and job creation. High performers under this indicator are vegetables, fruits, and berries, cattle, and legumes.

Vegetables VC has high extension potential via such value-adding operation as fresh packaging in whole, or packaging as fresh salads, dehydrating, drying, preserving, processing into juice (tomato), pickles, sauces, frozen. Fruit & berries VC have one of the highest potentials for an extension. In addition to direct consumption in fresh form, fruits can be, packaged, peeled and packaged fresh, processed (juice, jam, marmalade, wine, etc.), dried, frozen, preserved, and value-added fruits and berries are used widely in the production of confectionery products.

Cattle VC also has the highest potential for extension, concerning dairy products (pasteurized milk, butter, sour cream, yogurt, cheese varieties, etc.) as well as meat products (sausage, basturma, cooked meat products, smoked meat products). Leather also has a high potential for value addition and can be used in shoemaking, accessories, apparel and other industries.

Legumes VC has significant extension potential in terms of packaging, preserving or using as healthy lifestyle product, which has series of benefits: high protein, high dietary fiber, low fat, gluten-free, high in antioxidants, high in energy, source of micronutrients antidiabetic and anticancer properties, no cholesterol.

## **Social Impact**

To better understand, the social impact of the specific value chain, two main criteria were used for assessing this indicator: (i) women engagement in the cultivation/production of the product, and (ii) the opportunities that the VC provides to create more jobs within the community and marz. Men have traditionally dominated in some value chains, while women dominated in others. There are also value chains that equally involve both men and women. Women dominated value chains are berries and herbs with minimal involvement of men, this gives chance to women to realize their potential in their community.

As for job creation potential, four factors were taken into consideration for assessment: capital intensity, level of possible automation, availability and possible backward and forward linkages, the relative profitability of the value chain. Under this indicator, vegetables, fruits, berries, and herbs received the highest score.

## **Green Potential**

The green potential indicator is to assess the environmental friendliness of the value chain and the opportunities for making the specific value chain greener.

The most environmentally friendly value chains are legumes and cultivated herbs.

Legumes VC is not only environmentally friendly but also leaves a lot of positive impact on the environment. It requires a very little amount of chemical fertilizers and a very low amount of water for growth, sometimes no fertilizer or water is needed for growth. The role of legumes is very important in the development of green agriculture, the application of good crop rotation and soil cultivation practices, increasing yields and reducing water consumption. Legumes stimulate the growth of nitrogen-fixing and phosphorus-mobilizing bacteria, which is a very useful and important factor for crop rotation and a decrease in the use of chemical fertilizers. It is highly effective to cultivate legumes in combination with other crops. This is an example of intensive agriculture where the farmer gets two types for crops from the same field, while legume plays the role of nitrogen generator for the other crop.

Herbs VC also requires a low amount of chemical fertilizers and pesticides and water demand for cultivation, which can be improved with the application of organic fertilizers and organic plant protection methods together with modern irrigation technologies.

Other value chains are less environmentally friendly compared to legumes and herbs but have big potential to become greener. These value chains include vegetables, fruits, berries, potatoes, and grains. With the application of modern technologies, those VC can be greener giving less harm to air, water, soil, and biodiversity.

It is worth mentioning that the cattle VC is one of the least environmentally friendly VC.

In terms of environmental friendliness, a reservation shall be made also regarding the wild collection of berries and herbs. Though the population in the target regions traditionally uses wild herbs and berries in their diet, the commercial collection of wild berries and herbs may damage biodiversity, due to uncontrolled and improper collection practices.

In the regional context, the assessment suggests the following regional distribution of priority VCs:

Plant growing: berries, vegetables, and legumes are top three high-scored leaders in Shirak and Lori while fruits, berries, and vegetables top the list for Tavush.

Animal husbandry: Cattle is the leader in all marzes followed by beekeeping.

Shirak		Lori		Tavush	
Value Chains	Total Score	Value Chains	Total Score	Value Chains	Total Score
<b>Plant growing</b>		<b>Plant growing</b>		<b>Plant growing</b>	
1 Berries	2.76	1 Berries	2.76	1 Berries	2.81
2 Vegetables	2.74	2 Vegetables	2.64	2 Fruits	2.62
3 Legumes	2.27	3 Legumes	2.32	3 Vegetables	2.49
4 Fruits	2.24	4 Herbs	2.30	4 Legumes	2.32
5 Herbs	2.20	5 Potato	2.19	5 Herbs	2.30
6 Potato	2.19	6 Fruits	2.09	6 Potato	1.89
7 Grains	1.88	7 Grains	1.83	7 Grains	1.73
8 Forage	1.55	8 Forage	1.55	8 Forage	1.50
<b>Animal husbandry</b>		<b>Animal husbandry</b>		<b>Animal husbandry</b>	
1 Cattle	2.31	1 Cattle	2.31	1 Cattle	2.26
2 Beekeeping	2.20	2 Beekeeping	2.25	2 Beekeeping	2.20
3 Poultry	2.10	3 Poultry	2.10	3 Swine	2.12
4 Swine	2.02	4 Swine	2.02	4 Poultry	2.10
5 Sheep	1.72	5 Sheep	1.62	5 Sheep	1.57

## SELECTION OF VALUE CHAINS

The final selection of target VCs was conducted by the EU GAIA team based on the assessment results and taking into consideration of the scope aspects of the project duration and coverage and the fact that other donors already implement livestock projects in the northern Marzes.

Based on these considerations, the following value chains and sub-value chains are selected:

Value chains	Sub-value chains
Vegetables	a. Potatoes b. Established/traditional crops, e.g. tomatoes, onion, cabbage c. Higher value/non-traditional crops, e.g. broccoli, kale, leek, asparagus, high-value lettuce varieties
Fruits	a. Grapes b. Subtropical, e.g. kiwi, fig, pomegranate, persimmon c. Fruit trees, e.g. pommies, plums, peach
Legumes	a. Chickpeas b. Lentils c. Beans
Berries	Cultivated berries
Herbs	Cultivated herbs / medicinal and aromatic plants
Sheep	

## 7. ANALYSIS AND DESCRIPTION OF SELECTED VALUS CHAINS

The current section provides a deeper analysis of the selected value chains from the perspectives of structure and key players in the value creation chain, geographic concentration and supply chain linkages, key gaps and constrains for growth, market development perspectives and needs for interventions and support.

The value chains are analyzed by using the following framework:



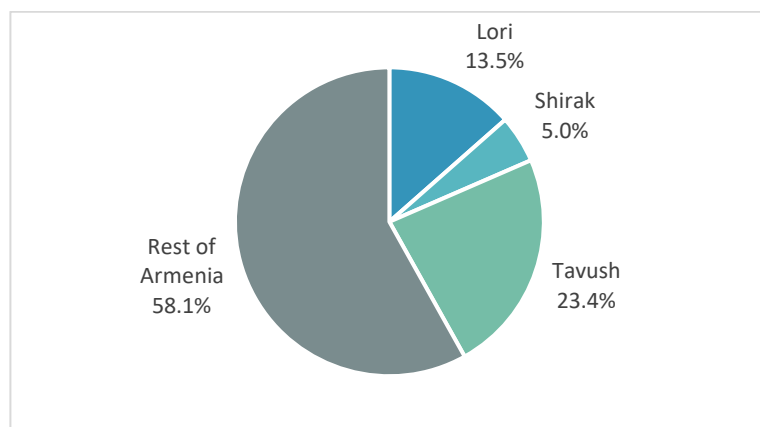
The structure of the analysis is adjusted to the specifics of each value chain.

### ANALYSIS AND DESCRIPTION OF LEGUMES VALUE CHAIN

#### **Local production**

The cultivation of legumes in Armenia is not widespread. The sown area under legumes (average for 2016-2018) was 2,050 ha which comprises only 0.7% of the total sown area in the country. Legumes are cultivated in all target marzes, which together account for 42% of the total sown area and 33% of the harvest of legumes in Armenia (about 1.500 tons from 4,300 tons of total production in Armenia). Legumes are cultivated mostly by farms engaged in grain-growing which is cultivated on non-irrigated land plots in the locations with high altitude.

**Chart 7.1. Distribution of legumes sown area in Armenia, 2016-2018 average**



Main regions, which practice legume production, are Amasia, Ashotsq, Akhuryan, Ani, Artik regions in Shirak marz, Spitak and Stepanavan regions in Lori marz, and Berd and Ijevan (mainly beans production) regions in Tavush marz.

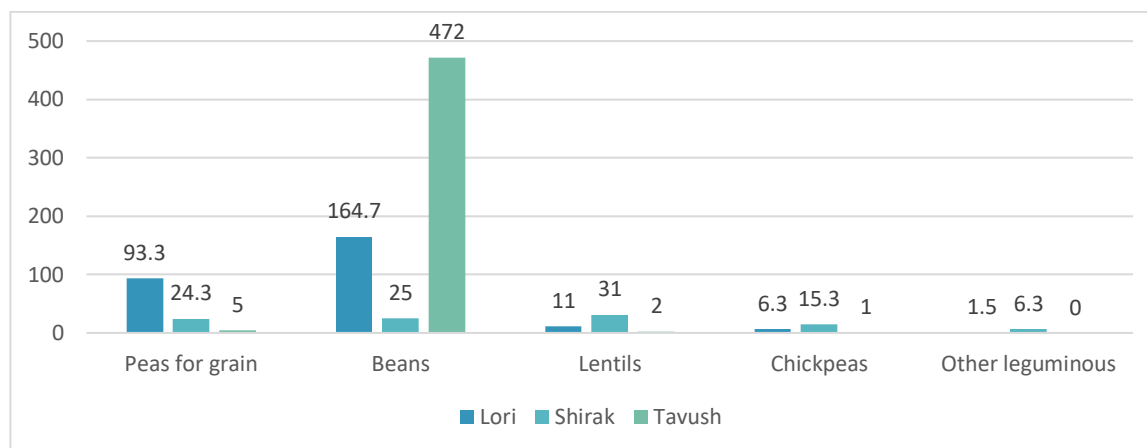
The production of legumes in Shirak and Lori marzes was boosted with the support of the European Union's

Source: SC RA

ENPARD<sup>3</sup> project in 2017-2018. Within the framework of the ENPARD project, farmers from five marzes received high-quality elite legume seeds (imported from Russia) for 1 ha cultivation. In total 126 farmers cultivated 126 ha of lentil, 39 farmers - 39 ha of chickpeas, and 83 farmers - 83 ha of peas for grain, of which:

- Shirak marz cultivated 67 ha lentils, 11 ha chickpeas and 22 ha of peas for grain
- Lori marz cultivated 10 ha lentil and 21 ha of peas for grain.

**Chart 7.2. Distribution of legumes sown area in target marzes by legumes types, 2016-2018 average**



Source: SC RA

**Beans** represent 77 % of legumes sown area and 75.5% of the gross harvest of legumes in target marzes. Tavush marz is the leader in bean production among the target marzes. In 2016-2018, the sown area under beans in Tavush was 472 ha or 28% of Armenia’s total sown area under beans, in Lori - 165 ha or 10%, and about 25 ha in Shirak or 2% of the total.

Lori marz dominates in peas (for grain) production in comparison with Shirak and Tavush. The total cultivated area under peas in Lori was around 94 ha or 42% of total sown area of the country, in Shirak - 24 ha or 11%, and in Tavush only 5 ha of country’s total sown area under peas.

**Lentil** is the third-largest legume crop cultivated both in the country and in target marzes. The largest lentil cultivation area was in Shirak marz (31 ha) accounting for 35% of the country’s sown area under lentil. In Lori and Tavush marzes lentil production is limited with 11 ha and 2 ha respectively.

**Chickpeas** are the least popular cultivated legume. From the target marzes, farmers from Shirak and Lori cultivate this crop with a three-year average of 15 ha area in Shirak and 6 ha in Lori, accounting for 22% and 9 % of the country’s sown area under chickpeas, respectively.

### ***Farming practices and productivity***

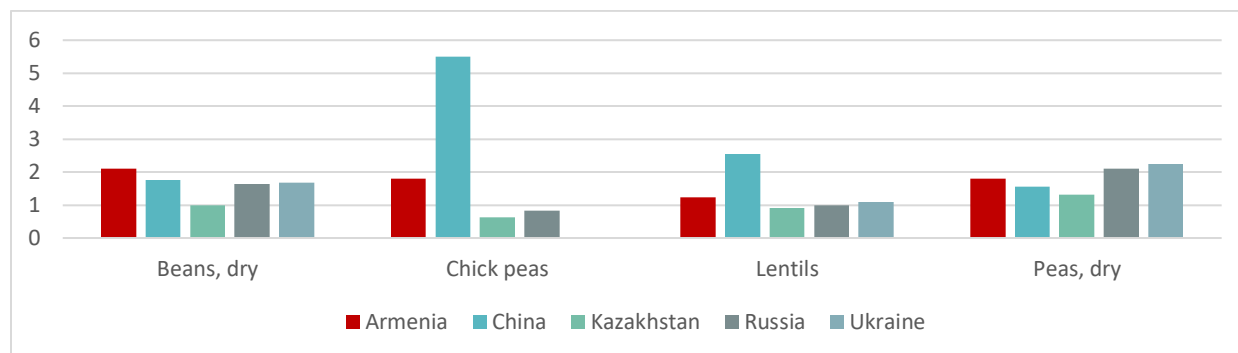
Farmers engaged in grain-growing are also potential legume producers since legumes are often used in grain production for crop rotation purposes to enriching the soil. Moreover, the same cultivation

<sup>3</sup>ENPARD Project stands for European Neighborhood Program for Agriculture and Rural Development Project.

technology and harvesting machinery (with different harvesting implements) can be used for legumes and grains.

The comparison of productivity (yield per ha) levels in Armenia and its import partners – China, Kazakhstan, Russia, and Ukraine - suggest that a significant difference in productivity exists in chickpeas and lentil production, where China leads with a large gap. Concerning other legumes, the productivity differences are not significant. Moreover, Armenia’s productivity is the highest in beans production. China is also the world leader by productivity (yield per ha) for lentils and chickpeas.

**Chart 7.3. Productivity benchmark with main producing countries, yield tons per ha**



Source: FAO Stat, an average of 2017-2018

During the meetings, the farmers reported different figures on yield almost the double of the national average for some species (lentil and peas). Farmers from Shirak marz are happy with the yield of lentil, but raised concerns about the cultivation process and yield of chickpeas. Chickpea cultivation requires an effort that is more intensive, hard work and plant management/care but provides lower yield compared to lentil and peas.

### ***Inputs and extension services***

Legume seeds are mainly imported from Russia or selected and stored by farmers from previous years’ harvest. Besides, as reported by the management of “Gyumri Seed Breeding Station”, located in Akhuryan village, with a long history going back to Soviet times, the station is in process of restoring and enhancing its breeding activities with new technologies and intends to supply farmers with legume seeds.

Agricultural inputs are mainly sold in urban communities at specialized shops in each marz, as well as by individual resellers in the villages. There is no structured distribution chain/channel for main inputs on the regional and national levels.

Fertilizers and other chemicals (pesticides, herbicides, etc.) also are imported. The leaders among fertilizer suppliers are “Catherine Group”, “Agrimat Co”, and “Masis Berriutyun” which together cover three fourth of the market. The biggest share of the market of chemicals (pesticides, etc.) supply belongs to “Natali Agro”. They do not have own retail network in the regions and are cooperating with local distributors and specialized shops.



Also, many other small companies and individuals are engaged in importing chemicals and fertilizers in the market. The market became more liberal and competitive with easier market entry, especially after political changes in 2018.

Farmer Service Centers established by CARD in Marzes (in total six – two FSC in each target) also supply fertilizers, chemicals to farmers, and provide extension services to farmers on a commercial basis. Although five of them are specialized in animal husbandry, they also supply other agricultural imputes for horticulture based on the local demand.

Marz branches of the Department of Agricultural Extension, Innovation and Monitoring of the Ministry of Economy (former Agricultural Support Regional Centers - GAMKs) are the key institutions for providing specialized extension services to farmers.

### ***Production technologies, costs, and farm-gate prices***

The cultivation of legumes does not require a significant upfront investment. The initial investment, which amounts to about 290,000-320,000 AMD per ha depending on crop type, includes expenses for seeds, chemicals and land preparation, irrigation, labor, and harvesting.

Cultivation technology is similar to grains cultivation, which has been practiced in Armenia for many years. The machinery required for the cultivation of legumes includes the tractor for plowing, seeding, flattening, fertilization, spraying, and the combine for harvesting. In most rural communities, there is a private agricultural service provider with agricultural machinery, which provides paid services to individual farmers. Most of the available machinery in communities are old outdated machines from Soviet times. Old machines are ineffective in terms of fuel usage and cultivation quality. More than 20% of the harvest is lost during harvesting due to old harvesters.

The table below depicts the average production costs for main legume crops cultivated in Armenia; calculations are made based on discussions with farmers from target marzes. The costs in the table are the average for the region. Costs may slightly vary depending on the region/location of cultivation, the year and input cost fluctuations. For instance, in some locations, farmers do not need to use pesticides to fight weeds due to cold climatic conditions, and there may be differences in transportation costs due to the geographical position of the fields.

**Table 7.1. Calculation of costs for growing legumes**

N	Works	Unit	Lentil		Chickpeas		Peas for grain	
			Q-ty	Amount, AMD	Q-ty	Amount, AMD	Q-ty	Amount, AMD
1.	Land plowing	ha	1	30,000	1	30,000	1	30,000
2.	“Chizel”	ha	1	15,000	1	15,000	1	15,000
3.	Land flattening	ha	1	15,000	1	15,000	1	15,000
4.	Seeds	kg	100	100,000	150	135,000	250	75,000
5.	Sowing	ha	1	15,000	1	15,000	1	15,000
6.	Fighting weeds	ha	1	35,000	1	25,000	1	30,000
7.	Harvesting	ha	1	35,000	1	35,000	1	35,000
8.	Transportation	AMD	1	15,000	1	15,000	1	15,000
9.	Land tax	AMD		3,500		3,500		4,000

10.	Other (5-10%)		10%	26,350	10%	28,850	10%	23,350
Total costs (TC)		AMD	-	289,850	-	317,350	-	256,850
Average yield (AY)		Kg/ha	1,280	-	1,810	-	1,950	-
Cost, kg = TC/AY		AMD	-	226	-	175	-	132

Source: The calculations are made based on farmer interviews for Shirak, Tavush and Lori marzes

About 30-40% of the investment is the cost of seeds. Other major expenses are related to the use of agricultural machinery for the following operations: plowing, land flattening, sowing, harvesting, and transportation. These costs are strongly correlated with the scale of the economy, i.e. the larger the size of the farm the lower the machinery costs per unit of production.

Price competitiveness is critical for legumes since legumes are commodity products. Thus, local producers need to achieve lower prices compared to the prices of imported products. To estimate price competitiveness, the team has compared the production costs of legumes in Armenia with the import prices. Note that farmer and intermediary profit margins are not included in the cost of local produce.

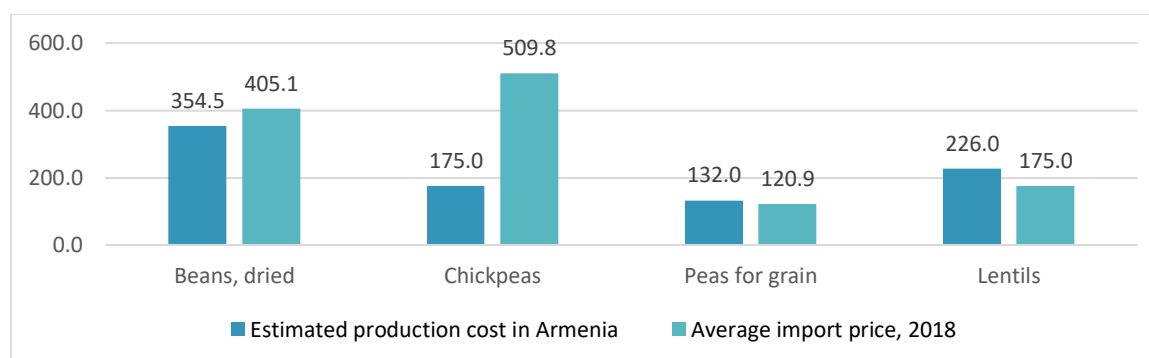
**Table 7.2. Import price per USD kg (CIF price) from the main source countries**

	2014	2015	2016	2017	2018
<b>Lentils</b>					
Russian Federation	0.78	0.71	0.69	0.54	0.36
<b>Chickpeas (garbanzos)</b>					
India	0.94	1.05	0.96	0.91	1.04
Russian Federation	0.96	0.68	1.12	1.43	1.07
<b>Kidney beans, including white pea beans (phaseolus vulgaris)</b>					
Argentina	n/a	n/a	n/a	0.83	0.83
Kyrgyzstan	n/a	1.30	1.02	0.84	0.91
Uzbekistan	1.28	1.28	0.96	0.97	0.78
<b>Peas (pisum sativum)</b>					
Russian Federation	0.60	0.29	0.38	0.37	0.25

Source: UN Comtrade Database

The five-year dynamics of import prices indicate a clear decreasing trend of legume prices. The price of legumes and peas in USD has halved during the last 5 years.

**Chart 7.4. Comparison of production costs in Armenia and average import prices, in AMD, 2018**



Source: UN Comtrade database, EV calculations based on farmers' response

The comparison of import prices with local farmer production costs shows that Armenian producers can have large price differential in the case of chickpeas. The gap between import price and production cost is very small in the case of peas (for grain) and beans while the production cost of lentils significantly exceeds the import price.

For achieving price competitiveness Armenian farmers need to either improve the cost structure or increase the yield per ha. To overcome limitations caused by the small scale of production, local farmers would need to invest in and implement advanced technologies and practices. In terms of cost reduction, there are two aspects to be addressed: (i) reduce the costs of inputs, especially, seeds and machinery as they are the largest cost items; and (ii) apply smart cost management practices.

For enhancing the competitiveness of local produce in domestic as well as foreign markets, there is a need to ensure compliance with food safety and quality requirements in markets. Local producers claim that their product is very tasty and unique due to natural conditions (sun, water, soil). However, this needs to be verified through special laboratory testing as well as testing with professionals and consumers in the market. Safety and quality enhancement require and provide close cooperation among interested farmer groups in terms of establishing and implementing appropriate standards.

### *Post-harvesting activities and processing*

After harvesting, the crop goes to processing, packaging, and distribution. Processing supposes dehulling, cleaning. Farmers mostly do it manually.

Two buckwheat hulling factories constructed with the EU support in Bavra (Shirak Marz) and in Tsovaghyugh village (Gegharkunik marz) have sufficient capacities for cleaning and packaging of legumes in target marzes. The factory in Bavra can serve Shirak and Lori marzes while the second is closer for farmers from Tavush. The remote location of processing facilities limits accessibility for many small-scale farmers. Both factories are selling their products under their brands (“Nor Hatik”, “Tsov Hatik”)

The post-harvest activities include storing the produce in sacks in the storages and selling in bulk to middlemen or retailers. They also participate in the public tenders announced by national and local authorities or international organizations.

The main wholesale trade is being conducted by large importers, which dominate the market. They import, package and distribute imported legumes (packaged or in bulk) throughout the country.

Roz-food LLC (focusing on food export) operating in Vanadzor is currently sourcing legumes from local farmers and is exploring opportunities to export legumes.

### *Consumption*

The legumes are marketed mostly in dried (bulk or packaged/branded) or canned form. Canned peas dominate among canned legumes, which are used mostly for preparing salads by households and HORECA.

Based on production and foreign trade data the consumption of legumes (dried) is estimated at around 11-8.5 thousand tons per annum 60% of which is imported. Legumes are mainly imported from Russia, Ukraine, Canada, Belgium, India, China, etc. Canned peas import volumes were fluctuating between 1.4-2.7 thousand tons during the last 5 years.

**Table 7.3. Consumption estimate of Legumes in Armenia, 1000 tons**

	2016	2017	2018
<b>Lentils</b>			
Import	1.86	2.22	2.82
Local production	0.03	0.10	0.22
<b>Consumption</b>	<b>1.89</b>	<b>2.32</b>	<b>3.04</b>
<b>Chickpeas</b>			
Import	0.20	0.31	0.48
Local production	0.07	0.18	0.13
<b>Consumption</b>	<b>0.26</b>	<b>0.48</b>	<b>0.61</b>
<b>Beans</b>			
Import	0.17	0.48	0.54
Local production	4.66	3.67	2.53
<b>Consumption</b>	<b>4.83</b>	<b>4.15</b>	<b>3.07</b>
<b>Peas for grain</b>			
Import	1.11	1.37	1.44
Local production	0.41	0.48	0.43
<b>Consumption</b>	<b>1.52</b>	<b>1.85</b>	<b>1.87</b>
<b>Total consumption of legumes, dried or produced for grain</b>	<b>8.50</b>	<b>8.80</b>	<b>8.59</b>

Source: UN Comtrade database and SC RA

**Table 7.4. Retail prices of legumes in Yerevan, prices per kg\*, AMD**

	Bulk**	Packaged/branded**
Lentil	350 - 440	1,700 - 1,790 Maranik (1 kg)
		1740-1780 Maranik (0.5 kg)
		770 Barekendan ( 0.45 kg)
		1420 Rio Grande (0.5 kg)
		840 Anush Lini (0.5 kg)
		1200-1480 Voske jraghac
		1960-2330 <b>Mistral (0.45 kg)</b>
		1240 <b>Yarmarka (0.8 kg)</b>
		700 <b>Kuban Premium (0.8 kg)</b>
		Beans
2300 Maranik (0.5 kg)		
1760 Barekendan ( 0.45 kg)		
3400 <b>Passito (0.45 kg)</b>		
1270 <b>Pokos White Beans (0.5kg)</b>		
Peas	320	1,320 - 1,420 Maranik (0.5 kg)
		1320 Barekendan
		750 Barekendan ( 0.5 kg)
		2580 <b>Mistral (0.5 kg)</b>
		390 <b>Kuban Premium (0.9 kg)</b>
		490 <b>Pokos (0.7 kg)</b>
Chickpeas	880 - 1,350	2,520-2,980 Maranik (0.5 kg)
		1980-2,160 Barekendan (450 g)

\* Packages of different volumes are converted to one 1 kg.

\*\* Bulk prices in NorZovq, Carrefour, packaged – Carrefour, SAS supermarkets.

\*\*Red color indicates the imported products with packages, not repacked in Armenia.

Source: UN Comtrade database and SC RA

Peas for grains and chickpeas import share about 3 times higher than local production, while the volume of imported lentils is 20 times more than local production. Though there is a big opportunity for farmers to substitute the imported product, it largely depends on production costs and the price competitiveness of local produce.

In the case of beans, the picture is the opposite as the local production significantly exceeds the imports. However, the trend for the last 3 years is not in favor of local production. The local production dropped by 46% in 2018 compared to 2016 while the imports more than doubled.

There is a big price differential between the bulk and packaged

products which reaches up to three times in case of lentils and peas. The retail price level depends on the brand and species of the legume. The high-end segment is occupied by imported brands (e.g. «Мистраль») and local brand Maranik.

### ***Major constraints and proposed solutions***

Analysis of legumes VC identified the following development constraints in the stages of primary production and packaging:

**Low use of high-quality seeds.** Primary producers usually do not procure elite seeds (i.e. from seed producers and/or other qualified suppliers). They usually use seeds selected and stored from their own harvest of previous years, which cannot ensure high productivity. Besides, farmers who purchase seeds in the market, note that seeds offered at the local market are not of sufficient quality. Russia is a big producer and supplier of high-quality elite seeds but the latter are not widely available and accessible locally. This can be explained also with the small demand for seeds, as the cultivation is still limited in the country.

**The use of old and ineffective machinery.** Agricultural machinery used by farmers is mostly old and obsolete. It requires high efforts and costs for maintenance and more fuel for the operation that leads to low efficiency and effectiveness. This especially refers to harvesters, but problems with plowing, cultivation and other operations also remain actual. Old harvesters cause significant loss of harvest, while the low quality of plowing and cultivation lead to low crop productivity, as well as environmental problems (soil degradation).

**Weak post-harvest and primary processing practices.** Farmers usually do not clean/disinfect their primary products, due to which products (both in bulk and packaged) becomes more perishable with shorter product life. The same refers to the cleaning of in-bulk products from stones, soil, and other objects/particles. In this regard, Bavra and Tsovagyugh buckwheat hulling factories can be used for processing, cleaning, and packaging of legumes, as both are operational and have enough capacity to process the current production of the country.

**Price competitiveness challenge.** In some instances, the costs of locally produced legumes are considerably higher than the value of imported products. There are several underlying factors for this, including (i) low productivity, due to poor farming practices, old technology, and machinery used during production, (ii) ineffective marketing and distribution techniques, (iii) weak cost management i.e. improper recording and cost calculation, (iv) inefficiencies related to the low scale of production.

**Logistics and other inefficiencies related to small scale.** Large packagers/importers/wholesalers report that, in general, they would prefer purchasing locally produced legumes to reduce working capital requirements, lower the risks related to working internationally, avoid from freezing their funds (that are often attracted at market terms from external sources), save time and transportation costs, etc. However, local small producers are often unable to meet product quality requirements and ensure availability and regular supply of sufficiently large quantities at a competitive price.

## ANALYSIS AND DESCRIPTION OF FRUITS & BERRIES VALUE CHAINS

### **Product and farming**

The reason that fruits & berries VCs are viewed together is the high degree of similarity of the value chains in general. This relates to the similarity in such aspects of VCs as the business environment, business processes, raw materials/inputs used for production, suppliers, storage, transportation and processing infrastructure, and export logistics.

The following fruits and berries were selected for the analysis of VCs in target marzes: grapes, kiwi, fig, pomegranate, persimmon, apple, plums, peach, pear, cherry, quince, cornel, nectarine, walnut and raspberry, blueberry, blackberry, strawberry, currant. These fruits were selected based on the marketability and production volumes.

Marketable/exportable fruit production is concentrated in Tavush marz and part of Lori marz, while berries are cultivated in all the three marzes. The table below shows the areas under fruits and berries and the shares of target marzes in total production in Armenia. The table is divided into pomaceous fruits (apple, pear, and quince), stone fruits (peaches, plums, nectarines, apricots, cherries, and cornel), subtropical fruits (kiwi, fig, persimmon, and pomegranate), grapes, walnuts and berries (raspberry, blueberry, blackberry, strawberry, and currant). The figures in the table are average figures for 2016-2018.

Tavush marz is the leader in fruits production, followed by Lori marz, and Shirak with very little fruit production. Only in recent years, several farmers started planting peach, apricot, and plums in Shirak, where total orchard area is around 5-10 ha all together.

Moreover, farmers regularly try new varieties of growing options locally. Particularly, there are some cases of kiwi growing orchards establishment in the Ijevan community of Tavush marz, raspberry growing gardens in Berd and Noyemberyan and Ijevan communities. Another interesting case demonstrates Gardenia Lebanese Farms Armenia, which is a farm of pekan growing, located in the Bagratashen community. Due to high demand in export markets, fig growing is expanding in Ijevan, Aygehovit, Bagratashen and some other communities of Tavush marz.

**Table 7.5. Orchard area in target marzes, ha, 2016-2018 average**

	Lori	Shirak	Tavush	Share of three marzes in Armenia	Armenia
Pomaceous fruits	1,329	401	865	6%	14,381
Stone fruits	618	169	1,052	5%	22,507
Walnuts	200	20	190	8%	2,283
Subtropicals	46	-	319	40%	806
Berries*	112	15	163	9%	1,886
Areas of vineyards	67	-	1,353	8%	16,324
<b>Total</b>	<b>2,372.7</b>	<b>605.3</b>	<b>3,942.0</b>	<b>6.8%</b>	<b>58,187.3</b>

Source: SC RA

\*Including those planted in greenhouses, hothouses, and inter-row areas of fruit-bearing plantations.

**Table 7.6. Gross harvest in target marzes for selected fruits and berries, tons, 2016-2018 average**

	Lori	Shirak	Tavush	Share of three marzes in Armenia	Armenia
Pomaceous fruits	3,624	4,637	1,978	9.0%	113,284
Stone fruits	928	1,590	5,098	4.2%	179,689
Walnuts	212	97	301	13.2%	4,614
Subtropicals	278	0	2,351	52.7%	4,993
Berries	259	69	826	8.7%	13,288
Grapes	200	0	8,974	4.8%	189,458
<b>Total</b>	<b>5,501</b>	<b>6,394</b>	<b>19,528</b>	<b>6.2%</b>	<b>505,326</b>

Source: SC RA

Among the targeted marzes, Tavush is the leader in growing stone fruits, subtropical fruits, and grapes. Lori marz has an advantage in pomaceous fruit production, and more orchards under pomaceous fruits compared to Tavush marz.

Walnut production in the three target marzes makes 610 tons or around 14 % of the total volume of the country's walnut production. Note that the biggest share of walnut production in Armenia belongs to Vayots Dzor and Armavir marzes. In Tavush marz, walnut is considered a strategic agricultural product by marz authorities. Based on discussions with stakeholders in Lori marz, farmers are interested in walnut growing. Recently, one of the farmers established a walnut orchard on 1.5 ha of land.

Subtropical fruits are a brand for Tavush marz. Tavush produces over 2350 tons or around 47% of the country's total subtropical production volume. In Lori marz, subtropical fruit growing (mainly figs and persimmons) is concentrated in regions adjacent to Tavush marz with a total harvest volume of 280 tons.

The berries value chain has one of the highest growth potentials in Armenia. The land area under berries has been increasing steadily due to high demand, high-profit margins, and revenue and proper conditions for growing. The three marzes together cultivate around 200 ha of berries, Tavush being the leader (with about 165 ha), followed by Lori (over 11 ha), and Shirak (15 ha). Despite the small size of production, Shirak marz has high potential and better climatic conditions to grow high-quality marketable berries. There are many successful cases of berry farming in Shirak, including a farmer from Marmashen village who has a contract with "Tamara fruit" LLC to supply berries (raspberry). Another berry farm in Vogji village was established with the support of Green Lane NGO. According to farmers, farm gate price for berries ranges from 700-2000 AMD. The big price range is due to differences in the quantities sold.

For grape production, only Tavush marz has potential with an existing vineyard area of 1350 ha, which makes 8% of the total in Armenia. In Lori marz grape production exists in some regions closer to Tavush, around 67 ha of vineyards. In Shirak marz, climate conditions do not allow to grow grapes.

### ***Value chain structure***

The value chains of analyzed fruits and berries have both complex and simple structure. In Armenia, fruits and berries can have a short value chain – fresh produce from farmer/field directly to the final consumer, and more complex structure, which starts from the farmer, then continues with retailers or processors, packaging companies, distributors and finally local or international market/consumers.

### **Inputs and extension services**

There are no specialized professional fruit and berries plant nurseries in the target marzes. The same is true also for other marzes. The suppliers of fruit/berry saplings are local farmers. Only a small quantity of saplings is imported and mostly in the frame of large investment projects. Among target marzes, the sapling production exists only in Tavush marz (Ayrum and Aygedzor communities). Domestic saplings have an advantage over imported ones, as those are already adapted to local climate conditions.

The situation is different in the subsector of berries. It is one of the fastest-growing segments driven by high demand for fresh and canned products both in local and export markets. In the frame of large investments, the seedlings are imported from Poland and Russia by the investor. The large farms also sell berry plants to small farms. The same model works for walnuts.

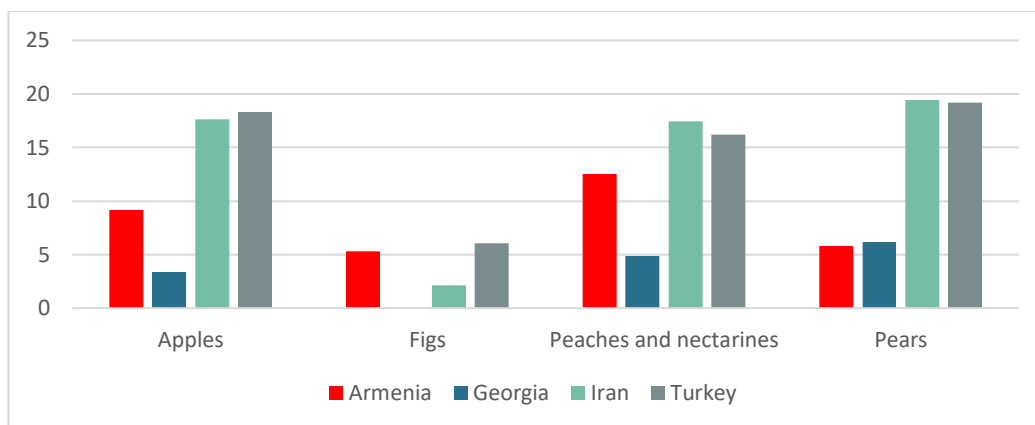
CARD Farmer Service Centers in Achajur and Aygehovit (Tavush marz) are specialized in horticulture, wine, and viticulture. A Winemaking Pilot Facility was established adjacent to Aygehovit FSC, which supports winemakers through consulting on modern winemaking technologies and sales of equipment.

For fertilizers and chemicals, the situation is similar as described in the section for Legumes.

### **Productivity**

The graph below compares productivity (in terms of yield per hectare) of fruit production of Armenia with the productivities of main import partners - Georgia, Iran, and Turkey. Despite favorable climatic conditions, Armenia lags behind many peer countries in terms of yield per hectare, due to weak production technologies and farming practices. Armenia's performance is relatively high in comparison with Georgia in the field of apples and pears production. The data suggests that there is a significant difference in the productivity of pears, where Iran and Turkey lead with a large gap.

**Chart 7.5 Productivity benchmark with main producing countries, yield per ha, tons/ha**



Source: FAO Stat, an average of 2016-2018



**Chart 7.6. Productivity benchmark with main producing countries, yield per ha, tons/ha**

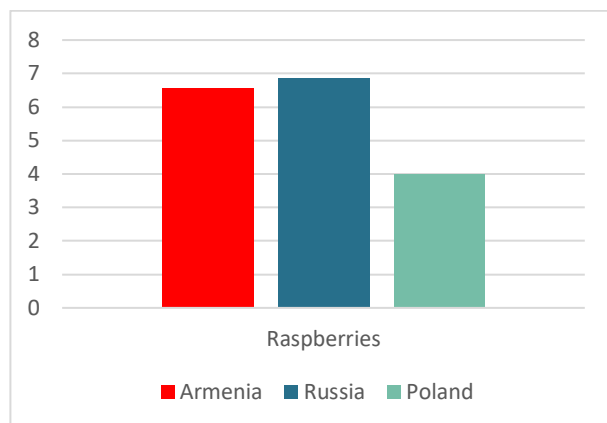


Chart 7.6 compares the productivity of berries production in Armenia with the productivities of main producers of raspberries – Russia and Poland. As the data shows, Armenia's performance in berries production is slightly lower compared with Russia, but significantly higher in comparison with Poland.

Source: FAO Stat, average of 2016-2018

\*Note: Armenia's national statistics gives data for overall berries group

### ***Harvesting and post-harvesting infrastructure***

Harvesting practices and post-harvest activities are crucial to its subsequent storage and marketable life and quality. Harvesting, sorting, preparation for storage and storage is done in the traditional way. Based on farmers' response nearly 30% of the product should be sold after harvesting due to non-storable quality.

As described above, distribution channels vary from simple, direct sale in farmer markets to final consumers to complex value chains including cold storage, sale to intermediaries and processors. Farmers often sell their products to individual entrepreneurs and/or large transportation and/or exporting companies, like Spayka, which accumulates fruits and vegetables for exporting to foreign markets.

Some farmers own small to medium size cold-storage facilities. Cold storage of fruits and vegetables allows farmers to sell the product at high prices off-the-season. The majority of farmers, who do not have cold storages, sell the product to middlemen straight after harvest with lower prices, than those who store fruits and berries for later sell. Storage is a value-addition to the product, which provides an opportunity to sell fruits and berries at a higher price during winter or spring. Those farmers who do not have cold-storages either sell the product during fall, rent a space in someone's cold-storage or build traditional underground basement cold-storages. With the increasing demand for fruits and increase production volumes, the need for cold-storages becomes crucial. The lack of properly equipped cold-storage facilities negatively affects the competitiveness of fruits and berries and reduces possibilities to earn a higher income by marketing products off-the-season. There is no proper information on the total capacity of cold-storages across the regions in Armenia. Many cold-storages were constructed in the scope of donor-supported projects such as USDA, USAID, UNDP, WORLD Vision and many are built by individual farmers/entrepreneurs, who either use for their own production or rent out space to other farmers. There are no specialized storage facilities and logistic center in the target marzes.

In Tavush marz, the cold-storages are concentrated mainly in Noyemberyan, Berd, Ayrum, Ijevan, and surrounding villages. The relatively large facilities are listed below:

Location	Total capacity, tons
Achajur community (Ijevan)	30
Aknaghbyur community (Ijevan)	15-20
Lusadzor community (Ijevan)	20
Lchkadzor community (Noyemberyan)	15
Chinari community (Berd)	30
Sevqar community (Ijevan)	100
Aygehovit community (Ijevan)	20
Ayrum community (Ayrum) operated Spayka company.	Over 100

New storages are under construction and face some delays due to the current situation connected with the Coronavirus outbreak. A large 100-tons storage facility is constructed in Berdavan (Noyemberyan) in the frame of the EU PRDP project which is close to being finished.

Besides, there are 25 smaller cold-storage operators with 1-5 tons of capacity, who mainly utilize them as a part of their retail businesses. For instance, they store the crops in their smaller storages and then re-sell them via their small shops.

During harvest, farmers sort their product by its quality: low quality is sold to processors, damaged products, that can't be stored for a longer time, are sold in the market during fall and high-quality products are stored in cold-storages for winter or spring sells with a higher price.

**Local processors**

The fruit and berry-processing sector in Armenia can be divided into two sectors:

1. Homemade processing of fruits and berries
2. Commercial processing of fruits and berries

There is a long tradition of homemade processing of fruits and berries (producing jams, marmalades, juices, kompot, dried fruits, etc.). In some market segments, homemade products, especially juice (kompot) and jam may be valued more than factory-processed products. For instance, homemade products are in high demand among HORECA.

Currently, there are more than 50 small-, medium- and large-scale processing entities of fruits and berries, some are specialized in making juice and jam, and others are specialized in dry fruits production. They are largely concentrated in Tavush marz. There are few small-scale processors in Lori, none in Shirak. There are statistical records on fruit and berry processing only for Tavush. This lets us assume that the production capacity in Lori is very small.

**Table 7.7. Fruit processing volume in Tavush marz, 2016-2018 average**

	2014	2018
Jam, marmalade, puree, jelly, confit, povidlo, subjected to heat treatment other than homogeneous products, tons	0	32.3
Canned fruit, tons	95.2	318.9
Fruit, other than prepared or preserved, tons	0	313.4
Fruit juice, with sugar additives, without mixtures, liters	153.5	38.2

Source: SC RA

The canned fruit production in Tavush (excluding juice) increased significantly since 2014. The volume of canned fruit production in 2018 comprised about 700 tons, which is about 10% of total canned fruit production in Armenia. The production of fruit juices in Tavush (mostly compotes) reduced by 2.5 times.

**Table 7.8. Fruit processing volume in Armenia, 2016-2018 average**

	2014	2018	Change 2014-2018
Canned fruits, tons	5,471	7,677	40.3%
Dried fruits, tons	56	194	246.4%
Fruit juice, liters	11,611	11,755	1.2%

Source: SC RA

This sub-segment performed flat also in overall Armenia. The dried fruit production was on the rise, though the official statistics do not capture the whole volume of the dried fruit production as it is mostly done by farmers.

#### ***Main players in the fruit/berry processing***

There are other relatively small players in the market engaged in fruit processing, wineries, and canneries. Dry fruits producers are mainly small agribusinesses across the country. There are four processing factories in Tavush marz, which are "Ijevan winery" (one of the biggest wine producers in Armenia which is also engaged in the production of canned food), "Eko Garden Industrial Corporation" (Aygedzor community, "VITAL" brand), Berdavan Wine Factory, which also has cannery production (Berdavan community), Cannery of Jujevan (Arthur and Edita LLC, Jujevan community), and "Ayrum Cannery" (Ayrum community). The latter was established in 2014 with the support of Oxfam Armenia and other donors as a social enterprise. It was planned to process up to 500 tons of fruits and berries making jams, marmalades, fruit drinks. Another social enterprise initiative is implemented by Tavush Dioses of the Armenian Apostolic Church, which is processing and marketing preserved fruits under the brand "Vanqi Anush". There are also other canneries, which are either in the stage of establishment or are not operating currently.

Fama Food LLC (Vanzdor), Van Food LLC (v. Darpas) and Roz-Food LLC (Vanadzor) are local processors operating in Lori Marz. Ararat Food Factory Ltd (brands: Ararat juice, Arega, Armenium) has a food processing facility in Shahumyan village.

From large fruit processing companies Tamara Fruit CJSC (production facility is located in Karbi village, Aragatsoth marz) is actively working in target marzes sourcing berries from Vanadzor and Tavush, and cherries from Shirak.

## Export opportunities

Main export markets for Armenian products are Russia (historically), Georgia, US (mainly for big Armenian diaspora), Europe and with joining of Armenia into Eurasian Economic Union new markets are also available like Kazakhstan, Belarus, and Kyrgyzstan.

The biggest share of fruits' export goes to the Russian market and for certain types of fruits, Russia is the only export country, covering 98% and above of the Armenian export.

**Table 7.9. Export of selected fruits and berries from Armenia**

<b>Fruit, edible; apples, fresh</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>
Net weight, tons	570.1	1,986.3	2,682.9
Trade Value, USD'mln	0.1	1.5	1.5
Average price, \$/kg	0.22	0.76	0.58
Share of Russian Federation in total export	99.9%	98.1%	99.9%
<b>Fruit, edible; apricots, fresh</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>
Net weight, tons	3,153.1	3,904.8	7,214.9
Trade Value, USD'mln	1.9	1.6	5.0
Average price, \$/kg	0.61	0.40	0.70
Share of Russian Federation in total export	100.0%	96.7%	97.3%
<b>Fruit, edible; peaches, including nectarines, fresh</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>
Net weight, tons	5,910.6	2,868.0	5,443.6
Trade Value, USD'mln	2.4	1.0	3.3
Average price, \$/kg	0.40	0.34	0.61
Share of Russian Federation in total export	100.0%	99.9%	100.0%
<b>Fruit, edible; pears, fresh</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>
Net weight, tons	1,912.2	759.6	3,985.1
Trade Value, USD'mln	1.5	0.6	2.7
Average price, \$/kg	0.80	0.82	0.68
Share of Russian Federation in total export	100.0%	100.0%	100.0%
<b>Fruit, edible; plums and sloes, fresh</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>
Netweight, tons	699.3	1,378.5	1,558.3
Trade Value, USD'mln	0.5	1.1	0.8
Average price, \$/kg	0.72	0.79	0.52
Share of Russian Federation in total export	97.2%	98.8%	97.7%
<b>Fruit, edible; strawberries, fresh</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>
Netweight, tons	1,495.0	2,458.3	99.7
Trade Value, USD'mln	1.0	1.2	0.5
Average price, \$/kg	0.67	0.49	4.76
Russian Federation, share in total export	99.5%	99.9%	97.8%
Share of United Arab Emirates in total export	0.5%	0.1%	2.2%
<b>Fruit, edible; figs, fresh or dried</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>
Netweight, tons	2.0	2.0	2.0
Trade Value, USD'mln	0.01	0.10	0.38
Average price, \$/kg	0.95	0.32	0.62

Share of Russian Federation in total export	97.0%	99.8%	99.9%
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Source: UN Comtrade database

The share of Armenia in Russian fruit and berry market is small. Russia imports over 220 thousand tons of peach annually, of which 60% from Belarus, China, and Turkey, while Armenia has only 2% share. A similar situation is also in the case of fig and strawberry.

These trends indicate that there is a huge export potential for Armenian fruits in the Russian market. To justify the mentioned hypothesis, the average importing prices and import volumes were analyzed in the following table.

**Table 7.10. Import of peaches\* in Russia**

Source country	Average prices, \$/kg			Share in Russian Import, %		
	2016	2017	2018	2016	2017	2018
<b>Total import</b>	<b>0.60</b>	<b>0.85</b>	<b>0.91</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>
Armenia	0.38	0.32	0.57	3.3%	1.0%	2.4%
Belarus	0.14	0.17	0.25	50.3%	29.7%	19.6%
China	1.34	1.32	1.34	12.5%	10.5%	8.6%
Turkey	n/a	1.24	1.18	0.0%	22.3%	30.4%
Uzbekistan	0.68	0.57	0.66	6.8%	7.2%	11.3%

Notes:

\* Includes nectarine

HS code: 080930-Fruit, edible; peaches, including nectarines, fresh

Source: UN Comtrade database

During 2016-2018 Armenia could achieve a maximum of 3.3% in the volumes of peach export to Russia, the average price per kg was about USD 0.4 (200 AMD), which is lower than the prices offered by the major players in the Russian market, including Turkey, China, and Uzbekistan. Only Belarus supplies at lower prices and takes a larger share of the Russian fruits market.

**Table 7.11. Import of figs\* in Russia**

Source country	Average prices, \$/kg			Share in Russian Import, %		
	2016	2017	2018	2016	2017	2018
<b>Total import</b>	<b>1.66</b>	<b>1.80</b>	<b>1.57</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>
Armenia	0.78	5.06	2.72	0.3%	0.0%	0.3%
Belarus	0.80	0.81	0.71	35.6%	30.6%	47.7%
Georgia	1.38	1.38	1.38	2.2%	4.3%	2.3%
Turkey	2.16	2.29	2.40	60.9%	64.0%	48.0%

Notes: HS code: 080420-Fruit, edible; figs, fresh or dried

Source: UN Comtrade database

Armenia has a minor share in the export volumes of figs into the Russian market, while Belarus and Turkey jointly cover over 90% of market volumes. The prices offered by Armenia are higher, compared to the average prices applied by the competitor countries.

### **Berries export to Arabic countries**

Arabic countries are an attractive market for Armenia for berries export. For instance, the annual export of strawberries to the United Arab Emirates is about 10 thousand tons, with a value of over USD 35mln.

**Table 7.12. Import of berries to UAE and Qatar**

Item	Net weight, tons			Trade Value, USD'mln		
	2016	2017	2018	2016	2017	2018
United Arab Emirates						
Strawberries*	10,326	10,165	9,329	39.9	37.1	36.1
Other berries**	2,202	2,245	2,450	21.8	21.7	24.8
Qatar						
Fruit, edible; strawberries, fresh*	1,508	1,692	1,634	8.2	11.6	10.3
Other berries **	386	514	507	3.7	5.3	6.1

Notes:

\* HS code: 081010 -Fruit, edible; figs, fresh or dried

\*\* HS code: 081020 -Fruit, edible; raspberries, blackberries, mulberries, and loganberries, fresh

Source: UN Comtrade database

### Opportunity for organic horticulture

Organic horticulture offers wide opportunities for farmers to enter lucrative markets of high-end fruits and berries. As a rule, prices of organic fruits and berries are significantly higher than the prices of conventional products. Similarly, the target three marzes also may benefit from organic horticulture. However, for this, there would be a need for sufficient investment to establish organic orchards, apply organic production practices and undertaking procedures of organic certification.

In Armenia, there is around 1,400 ha land under organic farming, including over 700 ha under certified organic production.<sup>4</sup> There are around 60 certified crop producers and 7 beekeeping entities.<sup>5</sup> Key organic products are fresh and canned fruits (apricots, peaches, plums, cherries), juices berries, fresh, canned and frozen vegetables (eggplant, pepper, tomatoes), alfalfa, wheat, mushroom, honey. The main export markets for Armenian organic exports are EU countries (Germany, France, Hungary, and the Netherlands).

Organic horticulture is more demanding in terms of (i) certification and quality management requirements; (ii) knowledge and skill requirements; (iii) more sophisticated production management practices.

### Main constraints and proposed solutions

**Improper use of chemicals (pesticides, fungicides, etc.) and fertilizers** which: (i) lowers the productivity (yield) of trees and orchards; (ii) negatively affects the health of trees; (iii) deteriorates food safety and quality characteristics of fruits and berries, and thus lowers their export, (iv) pollutes the soil and water. Due to the improper application of these chemical fruits and berries lose competitiveness since they do not meet food safety and quality requirements in international markets.

**Poor irrigation practices and access to water challenges.** The poor operation of primary, secondary, and tertiary irrigation infrastructures, and, thus, the irregularities and difficulties in water access remain among the biggest problems of agriculture in rural areas of Armenia and, particularly, in the target marzes. At the same time, there is very low or no use of efficient irrigation technologies and practices. This may endanger future agricultural practice and sustainability

<sup>4</sup>Source: FAOSTAT, <http://www.fao.org/faostat/en/#data/GV>

<sup>5</sup> Source: Operators register, Ecoglobe, [http://ecoglobe.com/wp-content/uploads/2013/12/List\\_of\\_Operators\\_ENG.pdf](http://ecoglobe.com/wp-content/uploads/2013/12/List_of_Operators_ENG.pdf)

**High risk of production loss due to natural disasters.** The main natural disasters affecting horticulture in the target regions are hail, frost, and drought. Most of the farmers do not use anti-hail nets or other technologies for protecting their orchards against those natural disasters. Similarly, there are no effective technologies and/or practices used for lowering the damages from droughts (irrigation, plant, orchard and soil management, etc.).

**Water and soil pollution due to inappropriate wastewater management.** As indicated in stakeholder meetings, wastewater and sewerage water often are dumped into nature (rivers and irrigation systems). The contaminated water dumped into natural basins is often used for irrigation purposes in primary agricultural production. This, of course, worsens the safety and quality characteristics of fruits and berries.

**Poor orchard management practices.** The integrated management of the soil, irrigation, and nutrition, as well as hail and droughts, determines orchard yield and quality, which are natural causes that can be mitigated to some extent. A lot of the farmers use traditional soil cultivation technologies (found out during stakeholder meeting) instead of practicing modern technologies, that increases the productivity and fertility of the soil. There is no proper knowledge and control of soil composition, pest control, effective irrigation approaches, like drip and rain irrigation.

**Marketing and logistics.** During stakeholder meetings in Shirak, Lori, and Tavush marz, one of the challenges that farmers mentioned is the lack of cold-storages around. The other challenges and problems they face is the lack of market information, especially about the export market, playing as individual farmers, which can't contract with big processors due to small quantities, lack of transportation equipped with cold storages, natural disasters, which decreases the quality of the product, etc.

Absence of specialized and certified **Plant Nurseries in the target marzes and in the country.**

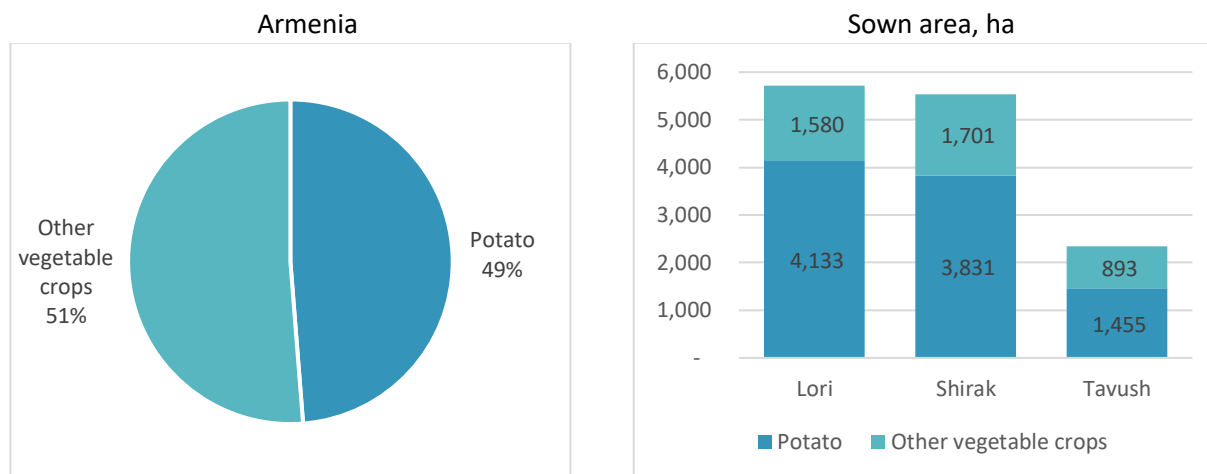
Lack of **Extension service providers** in the field of horticulture in Shirak and Lori.

## ANALYSIS AND DESCRIPTION OF VEGETABLES VALUE CHAIN

### Local production

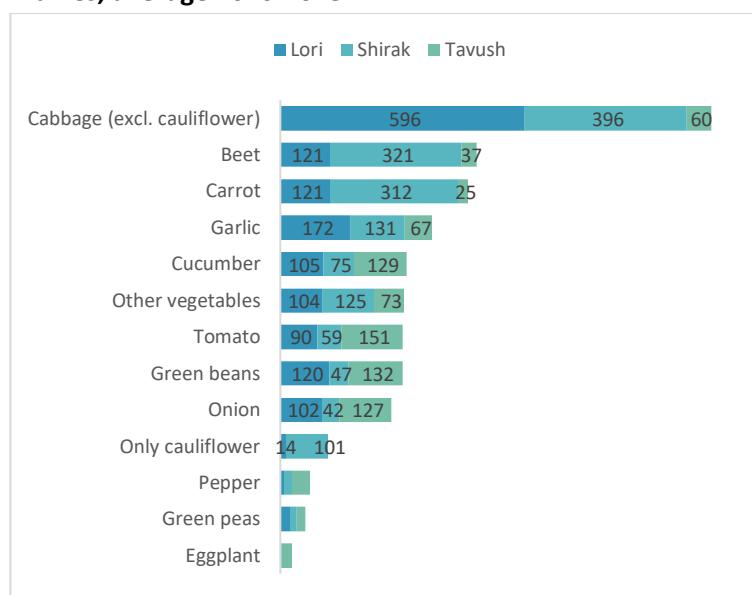
The cultivation of vegetables is a key subsector in the agriculture of Armenia. The total sown area under vegetables in Armenia is 51,600 ha (2018), which is 22% of the total sown area. The availability of irrigation is critical for vegetable cultivation. Thus, the future expansion of this subsector requires significant improvement of the irrigation system.

**Chart 7.7. Structure of vegetable sown area in Armenia and in target marzes, average 2016-2018**



Source: SC RA

**Chart 7.8. Structure of other vegetable sown area in target marzes, average 2016-2018**



Source: SC RA

Shirak provides higher productivity compared to the country average.

Among the target marzes, Lori and Shirak are the leaders in vegetable production, each accounting for about 6% of the total vegetable cultivation area, and about 10% of total vegetable production volume in Armenia. Tavush marz is not active in vegetable production. It accounts for 3% of the total vegetable area and 1% of total vegetable production. It is important to note that Shirak marz is the leader in terms of vegetable productivity compared to the other two marzes, i.e. yield per hectare. For many vegetable crops, Shirak has a significantly higher share of production volume compared to its share in the cultivated area. Moreover, for many vegetable crops,



**Potato** is the major vegetable crop cultivated in all three marzes the sown area of which is more than double of the total sown area of other vegetables all together. Shirak and Lori contribute to more than 30 % of Armenia’s total production of potato in Armenia. Potato cultivation is less popular in Tavush.

**Table 7.13. Gross harvest, in 1000 tons, average 2016-2018**

	Lori	Shirak	Tavush	Share of target marzes in Armenia	Armenia
<b>Potato</b>	<b>66.8</b>	<b>93.7</b>	<b>15.1</b>	<b>34%</b>	<b>520.7</b>
<b>Vegetable crops</b>	<b>26.5</b>	<b>45.7</b>	<b>8.6</b>	<b>11%</b>	<b>731.1</b>
Cabbage	19.8	17.1	1.1	31%	124.1
<i>of which: cauliflower</i>	0.1	3.4	0.0	25%	14.3
Cucumber	0.7	1.8	1.4	6%	61.8
Tomato	0.7	1.4	1.6	2%	218.0
Eggplant	0.0	0.1	0.2	0%	69.8
Pepper	0.1	0.3	0.3	1%	69.9
Beet	1.4	10.0	0.5	66%	18.2
Carrot	1.2	7.6	0.2	46%	19.8
Onion	0.5	1.0	1.1	6%	47.0
Garlic	0.9	2.4	0.4	30%	12.4
Green peas	0.1	0.3	0.1	53%	0.9
Green beans	0.6	0.9	0.9	15%	16.1
Other vegetables	0.6	2.6	0.7	5%	72.8
<b>Total</b>	<b>93.3</b>	<b>139.4</b>	<b>23.7</b>	<b>20%</b>	<b>1,251.7</b>

Source: SC RA

**Cabbage:** Lori marz is the leader in the production of cabbage among the three target marzes. The three-year (2016-2018) average cabbage sown area in Lori marz was 610 ha (16% of the total in Armenia), which provided 16% of Armenia’s cabbage production. Shirak marz is the second with 497 ha (13% of the area) of the sown area and 14% of the production. Cabbage cultivation is not popular among farmers in Tavush.

**Cauliflower:** Despite Lori’s leading position in cabbage production, the leader in cauliflower is Shirak marz, with

a 100 ha cauliflower area (23% of the total area), and 24% of country’s total production. Lori accounts for about 3% of Armenia’s cauliflower production, and Tavush does not cultivate this crop at all.

**Garlic:** Lori marz dominates in terms of area under garlic (170 ha or 17% of total garlic area, but only 7% of garlic production), while Shirak marz produces more garlic with less area (130 ha or 13% of total area, but 20% of total garlic production). Shirak has significantly higher productivity in garlic production. The cultivation of garlic in Tavush lags significantly behind compared to peers.

**Onion:** As in the case of garlic, Shirak has the highest productivity in onion production among three marzes but Tavush and Lori produce twice more than Shirak. All three marzes together contribute only by 6% to the total production of onion in the country.

**Carrot:** Among the targeted marzes, Shirak marz is leading in carrot production in terms of carrot area (312 ha or 36% of total carrot area in Armenia), as well as production volume (7,600 tons or 38% of total production in Armenia).

**Cucumber:** The targeted marzes have approximately equal shares in terms of cucumber sown area, varying in the range of 3%-5%.

**Green peas:** Shirak has higher productivity in green pea’s production compared to the other two marzes. Lori and Tavush have higher shares in terms of areas under green peas (21% and 18% of total green peas

area in Armenia, respectively) compared to shares in production volume (7% and 12%, respectively). In Shirak is comprised 15.7 ha (14% of the total sown area), and 33% of total production volume in Armenia.

**Green beans:** Tavush marz has the largest area under green beans (132 ha or 10% of the total), followed by Lori (120 ha) and Shirak (47 ha). Again, Shirak provides a higher yield per hectare, compared to the other two marzes.

**Asparagus:** Asparagus production is not widespread yet in Armenia. However, asparagus production has been successfully experimented with by many farms in Armenia. Asparagus has a high potential for the domestic market as well as for export (see below for export figures).

The three marzes have a different level of engagement and geographic concentration of vegetable crops.

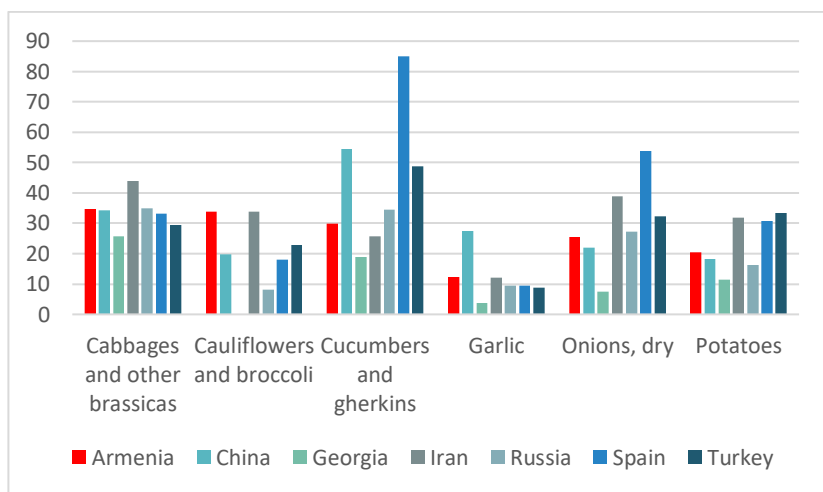
In Lori marz, vegetables are cultivated almost in all sub-regions. Carrot and cabbage are cultivated on a relatively large scale. The usage of greenhouses is practiced in Spitak, Tumanyan, and Gugarq for the cultivation of garlic, onion, cucumber, and greens. In recent years, some farmers started to cultivate non-traditional vegetables and greens, such as artichoke, rucola, broccoli, asparagus, in Spitak and Stepanavan regions.

In Shirak marz, the cultivation of cabbage, cauliflower, and cucumber is concentrated mostly in the Akhuryan region, while garlic and onion production is spread in all parts of the marz.

Tavush marz is not an active producer of vegetables and is known mostly for fruits and berries cultivation. However, within Tavush, Noyemberyan, Ijevan, and Berd regions are the active areas for vegetable growing. Among the targeted vegetable crops, green beans and onion are common crops produced in Tavush.

**Farming practices and yield per ha**

**Chart 7.9. Productivity benchmark with main producing countries, yield tons per ha**



Source: FAO Stat, average of 2016-2018

The graph below compares productivity (in terms of yield per hectare) of vegetable production of Armenia with the productivities of import partners, from where Armenia imports vegetables. Despite favorable climatic conditions, Armenia lags behind many peer countries in terms of yield per hectare, due to weak production technologies and farming practices. Armenia’s performance is relatively high in cabbage and cauliflower production.

### **Inputs and extension services, local processors**

See the section in Fruits and Berries VC.

### **Market and development opportunities**

Armenia has a high level of self-sufficiency in most vegetables. From observed types of vegetables (potato, selected traditional crops and high-value vegetables), only onion is imported in significant volumes (4,500-5,000 tons annually) from Russia, Iran, and Turkey.

Export is also insignificant totaling 250,000 USD in 2018. Export of asparagus, cauliflowers and headed broccoli. Asparagus export has high potential and is dynamically growing. Key export markets are Russia and the United Arab Emirates.

**Table 7.14. Armenia's export of asparagus, cauliflowers and headed broccoli (fresh or chilled)**

	Asparagus, fresh or chilled		Cauliflowers and headed broccoli, fresh or chilled	
	Volume, kg	Value, USD	Volume, kg	Value, USD
2015	4	29	121,540.0	31,676
2016	300	1,938	417,698.0	84,094
2017	1,794	11,096	202,599.0	76,412
2018	1,145	7,594	537,405.0	243,043
2019	5,247	28,885	798,456.0	749,977

Source: UN Comtrade Database

The analysis of the import dynamics in Russia, Qatar and the United Arab Emirates (which are emerging markets for Armenian fresh fruit and vegetables) pinpoint untapped potential for Armenia's exports. The total import value of selected vegetables in these countries reached 1.1 billion USD - the double of 2014 value. The largest share belongs to Russia, which imports a significant volume of onions, garlic, and carrots for more than 800 mln USD.

It is also important to mention the high prices in the Middle East market for recently introduced non-traditional crops for Armenia (such as broccoli, asparagus, Brussels sprouts). This opens interesting avenues to vegetable production and export promotion in targeted regions, especially in Shirak marz.

**Table 7.15. Import dynamics of selected vegetables in Russian Federation, Qatar and UAE, mln USD and import price USD per kg (CIF price), 2016-2018 average**

	2014	2015	2016	2017	2018	Price per kg
<b>Asparagus</b>	8.5	8.0	10.5	11.3	15.3	5.22
Qatar	0.7	0.5	1.0	1.4	1.4	6.50
Russian Federation	1.5	0.9	2.1	2.1	5.9	3.39
United Arab Emirates	6.3	6.6	7.4	7.8	8.1	6.43
<b>Brussels sprouts</b>	6.6	6.0	6.5	4.7	7.4	0.42
Qatar	3.8	3.8	4.2	2.8	4.7	0.34
Russian Federation	0.4	0.1	0.2	0.2	0.4	0.26
United Arab Emirates	2.5	2.2	2.1	1.6	2.4	0.93
<b>Carrots and turnips</b>	183.6	149.7	193.7	223.0	364.7	0.45
Qatar	9.5	9.4	10.8	14.6	12.3	0.72

Russian Federation	116.4	80.4	124.4	152.6	305.5	0.41
United Arab Emirates	57.7	59.9	58.4	55.7	46.9	0.56
<b>Cauliflowers and headed broccoli</b>	54.5	34.1	44.3	55.3	120.4	0.76
Qatar	6.1	6.0	7.4	6.5	6.2	0.56
Russian Federation	29.2	10.0	19.4	30.7	96.7	0.70
United Arab Emirates	19.2	18.1	17.5	18.2	17.5	1.06
<b>Garlic</b>	111.6	147.1	274.7	259.3	307.6	1.40
Qatar	4.4	5.5	9.7	9.6	6.3	1.14
Russian Federation	66.2	71.0	158.2	156.5	268.9	1.44
United Arab Emirates	40.9	70.6	106.8	93.2	32.4	1.24
<b>Onions and shallots</b>	292.5	269.4	225.2	407.1	349.3	0.34
Qatar	20.6	27.9	24.2	28.6	30.9	0.32
Russian Federation	180.9	117.5	112.4	264.4	227.7	0.39
United Arab Emirates	90.9	123.9	88.6	114.0	90.8	0.27
<b>Grand Total</b>	<b>657.3</b>	<b>614.4</b>	<b>754.9</b>	<b>960.6</b>	<b>1,164.8</b>	

Source: UN Comtrade Database

### ***Main constraints and proposed solutions***

**Poor field and plant management practices and improper use chemicals and fertilizers:** Overall, there is significant lack of knowledge and skills among farmers (most of them being non-professional) about good farming practices, good plant growing, and management techniques, use of fertilizers and pesticides, selection of varieties, etc. This leads to low productivity and unsustainable farming. Improper use of chemicals (pesticides, fungicides, etc.) and fertilizers lowers the vegetable productivity (yield); negatively affects the health of plants; deteriorates food safety and quality characteristics of vegetables, and thus lowers their export competitiveness, pollutes the soil and water.

**Poor irrigation practices and access to water challenges.** The poor operation of primary, secondary, and tertiary irrigation infrastructures, and, thus, the irregularities and difficulties in water access remain among the biggest problems of agriculture in rural areas of Armenia and, particularly, in the target marzes. At the same time, there is very low or no use of efficient irrigation technologies and practices (e.g. drip irrigation). This may endanger future agricultural practice and sustainability. Some farmers mentioned also about the high cost of irrigation due to high electricity costs, and imperfections in the irrigation system related to measuring the volume of the supplied water. Farmers feel that they are often charged for more water than they actually receive.

**High risk of production loss due to natural disasters.** The main natural disasters affecting horticulture in the target regions are hail and drought. Most of the farmers do not use anti-hail nets or other technologies for protecting their fields against natural disasters. Similarly, there are no effective technologies and/or practices used for lowering the damages from droughts (irrigation, plant, crop field, and soil management, etc.).

**Negative effects of climate change.** Climate change influences crop farming significantly. Farmers in the region noted the emergence of new diseases in the fields, which are mainly caused by climate change. Besides, crop farming is affected also by the reduction of the level of precipitation. This makes the need for the improvement of irrigation technologies more critical for vegetable production.

**Water and soil pollution due to inappropriate wastewater management.** As indicated in stakeholder meetings, wastewater and sewage water often are dumped into nature (rivers and irrigation systems). The contaminated water dumped into natural basins is often used for irrigation purposes in primary agricultural production. This, of course, worsens the safety and quality characteristics of vegetables.

**Lack of professional agronomic and plant health services, combined with weak extension services.** This is an important shortcoming, having in mind that most of the farmers are non-professional producers with low knowledge about good crop growing, crop management, and farm management.

**Lack of storage capacity and logistic centers.** This is critical for the effective consolidation of the harvest and storage. Effective storage allows selling off-season at a high price, as well as negotiating with wholesalers and processors or buyers for exporting the harvest. Also, farmers would be able to concentrate their efforts on cultivation and harvesting instead of dealing with sales and realization of the harvest.

**Marketing.** Due to the structure of farming (dominance of small size of farms), there are many logistics and marketing inefficiencies, including product consolidation issues, product standardization issues, complex logistics, and high transportation costs, branding issues, etc.

**Air and soil pollution** caused by unsustainable practices of fertilizer and pesticide use, and the use of inefficient and ineffective old agricultural machinery which emits more CO<sub>2</sub> into the atmosphere, etc.

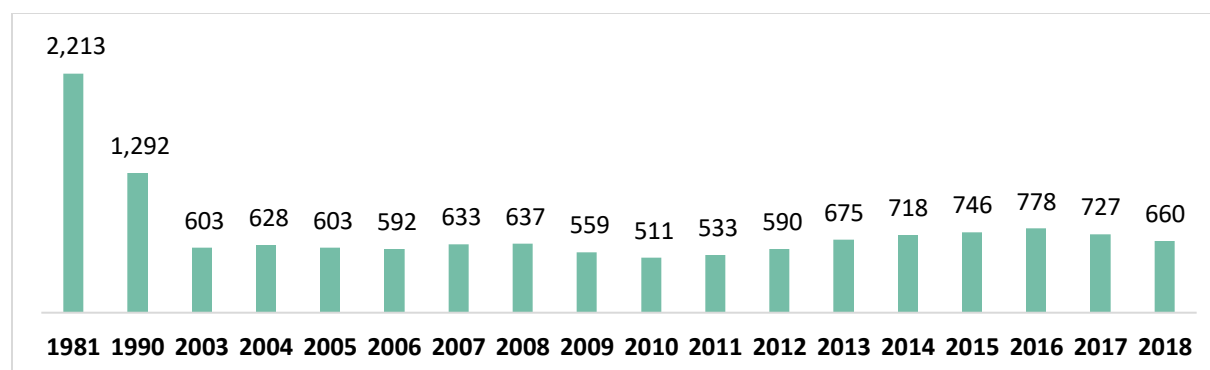
## ANALYSIS AND DESCRIPTION OF SHEEP BREEDING VALUE CHAIN

### *Sheep breeding*

Sheep and goat breeding is considered as low risk and high-income generation sub-sector in animal husbandry. Sheep and goats are farmed for meat, milk and wool production. In some regions of Armenia sheep farming is one of the key agricultural activities and a major source of income for rural households.

During the 1970s, the sheep breeding sub-sector in Armenia involved around 2 million livestock, but after the collapse of the Soviet Union, this number decreased drastically to 1 million in 1991. After privatization, the number of livestock declined further to 520 thousand in 1998. Since then the number of sheep and goats varied in the range of 600 thousand to 800 thousand. The reason for such a drastic decline was the war, political and economic instability, disruption of trade, absence of markets, a decrease of demand, etc.

**Chart 7.10. Dynamics of the livestock of sheep and goats in Armenia, thousand**



Source: SC RA

The sheep husbandry is concentrated in highlands of Armenia with favorable weather and natural conditions for grazing. The sheep farming industry is highly fragmented in Armenia, which is dominated, small-size individual farmers. Sheep farming is widespread also in rural communities of Yazidies, an ethnic minority in Armenia.

For years of sheep breeding history, several endemic species were adapted to the local climatic conditions, as a result of efficient selections done by local specialists. The followings are traditional sheep breeds well-adapted to the natural and climatic conditions of Armenia. They are often referred to as Armenian species:

- Mazekh
- Bozakh
- Gharabaghtsi
- Balbas

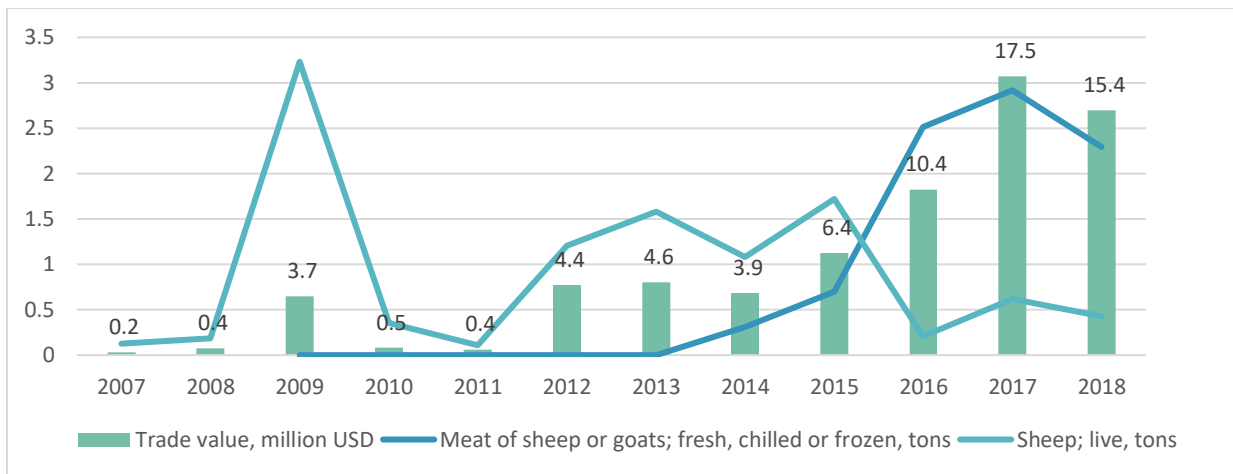
In addition to these breeds, there are several other breeds derived by Armenian breeders. One of such new breeds is Corriedale, which is known for its white semi-harsh wool that is an excellent raw material for carpet manufacturing. To meet the increasing demand for sheepmeat and wool some sheep breeds

were imported to Armenia, including pelt wool breed (Karakul), fertile Romanov breed (2-3 lambs during each birth), and Edilbaev - fat-tailed sheep breed. These breeds successfully adapted to the local climatic conditions.

In 2018, the gross agricultural output of animal husbandry in Armenia was 478 billion AMD, of which 10.5% was accounted for sheep breeding. Sheep milk contributed around 6.5% of the total milk production in the country.

Since 2015, there has been a decreasing trend in the number of sheep (chart 4.1). In 2019, the number of sheep and goats was 638 thousand, compared to 746 thousand in 2015. On the contrary, the volume of sheep meat production and export has increased significantly since 2014. In 2018, the production of sheep meat was 19 thousand tons, almost two times increase from 9.8 thousand tons in 2015. This can be explained by trends in international trade in sheep and sheep meat. The main export market for sheep and sheep meat from Armenia have been Muslim countries (Iran). Until 2014, Armenia exported mostly live sheep (and not sheep meat) to Muslim markets (Iran) due to the lack of HALAL slaughterhouses. HALAL certification is a mandatory requirement for entering markets in Muslim countries. Since 2014, several HALAL certified slaughterhouses were established in Armenia, which allowed exporting sheep meat instead of live animals to Muslim countries. Some of the slaughterhouses involved foreign investment from Iran. However, during 2017-2019 the export of sheep meat from Armenia reduced by two times, one of the reasons being the reduction of the number of animals.

**Chart 7.11. Export volume of sheep, live animals and meat fresh, chilled or frozen, in tons, and trade value in million USD, 2007-2018**



Source: UN Comtrade database

As already mentioned, sheep breeding is more developed in the mountain and sub-mountain regions with favorable natural and climate conditions (availability of grasslands/pastures). The biggest sheep population is recorded in Gegharkunik and Syunik marzes followed by Aragatsotn and Shirak marzes. Among targeted marzes under this task, Shirak marz is the leader in sheep breeding (~72 thousand animals or 11% of the total in Armenia), followed by Lori and Tavush marzes.

**Table 7.16. Number of Sheep and Goats, as of 1 January, 1 000 heads**

	2014	2015	2016	2017	2018	Share in Armenia, %*
Lori	37.8	38.3	37.9	37.4	27.2	4.7%
Shirak	90.4	90.5	93.5	83.4	71.8	11.2%
Tavush	16.2	17	17.6	16.9	15	2.3%
<b>Armenia</b>	<b>717.6</b>	<b>745.8</b>	<b>778.1</b>	<b>727.1</b>	<b>660.1</b>	<b>100.0%</b>

\* Note: The shares are calculated for the average of the 2017-2018 period.

Source: SC RA

### Infrastructure

**Slaughterhouses:** As of January 23, 2020, there were 40 operating slaughterhouses in Armenia, 8 of which are located in target marzes (Lori - 4, Shirak - 2 and 2 in Tavush). The issue is not only the capacity of the slaughterhouses but also the location and accessibility for farmers. According to the head of Meat, Forage Producer and Breeders Association 3-5 slaughterhouses are enough to satisfy the demand for the particular marz.

In general, there is a deficiency of slaughterhouses in Armenia. The largest part of animal slaughter is carried out in villages - house backyards or special locations near meat markets. This causes serious food safety risks and challenges. To address this issue and promote the development of slaughterhouse infrastructure, in 2020, the Government of Armenia introduced a program to subsidize investments in slaughterhouses. The program is still underway, and the results are pending yet.

**Table 7.17. Sheep productivity  
Armenia, meat, 2018**

	Animal/kg
Iran	36
Kyrgyzstan	25.1
Switzerland	22.9
Czech Republic	22.8
Austria	22.6
Ireland	20.8
Portugal	20.7
Cyprus	20.6
Serbia	20.1
Mongolia	19.9
Kazakhstan	19.7
New Zealand	19.6
<b>Armenia</b>	<b>19.1</b>
Russia	17.7
Belarus	17.3
Poland	16.4
Ukraine	16.1
Turkey	16.0

Source: FAO Stat

Since 2014, Armenia established several HALAL certified slaughterhouses, to meet the export market requirements in Muslim countries for sheep meat. There are 6-7 HALAL certified slaughterhouses in Armenia and non of them are located in target marzes.

**Pastures and pasture infrastructure.** Sheep and goat farming involves intensive open grazing in pastures. The competitiveness of animal husbandry in Armenia suffers significantly due to the ineffective management of these pastures by community authorities and the lack or insufficiency of investments in pastures (roads to pastures, water infrastructure, electricity, etc.).

It is important to note that sheep husbandry, if not managed properly, may have a negative environmental impact. Unsustainable grazing practices in Armenia causes serious environmental damages such as desertification and soil degradation in pastures.

**Veterinary infrastructure.** After the collapse of the Soviet farming and veterinary system, no effective system was formed to fit the realities of Armenia. The role of the government is



limited to anti-epidemic measures. Private veterinarians provide veterinary services, largely of low quality. The establishment of a dozen private Farmer Service Centers (FSC) supported by CARD in regions was a positive move to address this issue but is still insufficient.

### **Farming structure and productivity**

Smallholders dominate the sheep husbandry in Armenia and the target marzes. The average size depends

**Table 7.18. Sheep productivity  
Armenia, milk, 2017**

	Liter/animal
Switzerland	4510
Austria	4381
France	2572
Spain	2242
Kuwait	2226
Portugal	2090
Malta	2028
Slovenia	1859
Japan	1516
Cyprus	1465
Greece	1347
<b>Armenia</b>	<b>1273</b>
Serbia	1109
Azerbaijan	1010

Source: FAO Stat

on the region, for our targeted regions, where sheep breeding is leading the average size is 100 heads of sheep. For such a region, like Akhuryan, where sheep breeding is not popular and not leading, the average size is 10-15 heads. In general, there is a lack of knowledge among farmers about good farming practices. They apply old traditional practices in poorly equipped farms.

The productivity of sheep husbandry in terms of meat yield per animal was 19 kg per animal in 2018. For comparison, the same indicator in the export market Iran was 36 kg. Armenia ranked 53rd among 190 countries. For achieving higher profitability, the meat yield can be improved through (i) good animal grazing, feeding and management practices, and (ii) selection of effective animal species for farming.

Having in mind the existing situation in the sheep husbandry in Armenia, farmers focus mainly on sheep meat value chain, not on sheep milk, wool or skin. However, the promotion of milk, wool and skin production provide interesting avenues for development. The promotion of such diversified production may require a long time, investments in improving the breeds, and genetic resource and adapting breed to natural and climate conditions in Armenia.

With about 1,270 litter of milk per animal Armenia is 12th among 86 countries. However, is still 3.5 times less than in Switzerland and Austria, which indicates ample room for productivity improvement.

### **Government strategy**

The promotion of sheep breeding is an important item in Government's agenda, having in mind the high export potential of live sheep and sheep meat. In this context, in 2011 the Government adopted a Concept on Sheep Breeding aimed at the development of a high-quality breed, adapted to local conditions, with increased meat and milk productivity, wool quality and less impact on the environment.

The government subsidizes farmers' expenses in sheep and goat breeding and cooperates with breeding centers, etc. ANAU, to breed high-quality breeds.

### **Local market**

The local market for sheep products (meat, milk, wool) is small with limited room for expansion. **Sheep meat** is not part of the everyday diet in Armenia. Unlike, beef, chicken and pork consumed in everyday diet, sheep meat is consumed only on special occasions. The price increase observed during the last years was driven by increased demand in the export market.

**Table 7.19. The sheep meat average prices in Armenia, AMD**

	2014	2015	2016	2017	2018
<b>Sheep meat</b>	3066.1	3011.5	2740	3091.3	3569.6

Source: NS RA

The average annual prices of sheep meat in the domestic market of Armenia have been increasing during the last 3 years reaching 3569.6 AMD in 2018.

**Sheep milk** is highly valued, but due to lack of milking machinery and low milk yield, most of the breeders prefer not to milk the sheep and leave the milk for lamb. During the meetings, farmers pinpointed two problems, which makes them not to milk the sheep. Firstly, sheep are taken to remote pastures, where they lack milking machines, cooling storage facilities, and transportation. Secondly, the milking procedure is generally done manually as there is no sheep milking equipment available in the market, which requires a lot of time and resources and decreases the quality of milk.

The safety and quality of milk and dairy products from sheep/goat milk suffer significantly due to poor animal feeding, and milking and milk processing equipment and practices. Often sheep milk and cheese have a strong and unpleasant smell and taste. This negatively affects the attractiveness and competitiveness of products in local and, especially, foreign markets.

### **Wool production**

According to expert estimates, households use around 25% of the produced wool, 30% is sold, and in most of the cases, the leftover is thrown away as it spoils. The low rates of sales are because of the lack of wool processing infrastructures, low quality of wool which can't be used in carpet or other wool products' processing.

In 2018, with the support of the European Union (EU PRDP project) a wool processing center was established in Amasia (in the North of Shirak), which uses existing wool in the area to process and create more job opportunities for local households. The full-scale operation started in August 2019. The total production capacity is about 30 tons annually. The final product includes washed wool, carded wool, carded ribbon, yarn, colored with natural materials, texture. They have already processed about 5-6 tons, but haven't marketed the products yet. Currently, they are finalizing the brand development including logo design and production of a product catalogue. There are two other wool processing centers in Amasia region, one, felting center, was established by support of World Vision for Aregnadem active women group with brand "Arpi wool", the other was established by a young woman entrepreneur Mery Melikyan, from Amasia, with the brand "Nrane".

The potential of wool output in target marzes (based on 2018 livestock number) will be about 250 tons with a 63 % share of Shirak marz.

On average, one sheep gives on average 2 kg raw wool, which is relatively low. The wool yield varies significantly depending on the type of breed. In the US the average wool production per sheep is 3.2 kg while output from special breeds such as Romney can reach 8 kg. Within the framework of the EU PRDP project, 4 rams were purchased to improve the breeds of sheep. The crossbreeding took place in the fall and this year there will be lambs. All this is done to spread the Corriedale species in the region.

There is an issue concerning the quality of the wool, as the sheep breeders don't pay attention to it. Moreover, the used chemicals to protect sheep from e.g. louses, harm the wool of the sheep.

Last year the price of procurement for 1 kg by Amasia wool factory was 300 AMD. However, the very low quality of the wool increases significantly the cost of raw material.

Initially, they have negotiated with carpet producers, but haven't come to an agreement about the price yet.

The main partner countries of Armenia for wool yarn imports are Germany, Italy, and Turkey as of 2019. During 2015-2018, the import of wool yarn amounted to 37.7 tons. The import volume fluctuates significantly. Since 2016, the unit prices of wool yarn imports have decreased drastically, reaching on average 6 USD per kg. This was due to cheap imports from Turkey, which now accounts for 88.66% of the total imports of this product in Armenia.

**Table 7.20. The wool yarn import prices and structure by country**

	2015		2016		2017		2018		2019	
	Unit price, USD	% in qty	Unit price, USD	% in qty	Unit price, USD	% in qty	Unit price, USD	% in qty	Unit price, USD	% in qty
<b>Germany</b>	40.44	1.50%	38.52	19.09%	X	0.0%	49.46	1.33%	56.85	1.24%
<b>Italy</b>	X	0%	40.97	7.68%	32.84	28.75%	67.02	3.80%	41.37	5.80%
<b>Russia</b>	0.88	96.43%	9	19.71%	6.50	0.74%	X	0%	X	0%
<b>Turkey</b>	X	0%	X	0%	3.08	67.82%	2.97	94.43%	2.90	88.66%
<b>World</b>	1.84	100%	17.71	100%	12.59	100%	6.02	100%	6.00	100%

Source: UN Comtrade

The largest consumer of wool yarn is the carpet industry in Armenia, which once being one of the fast-growing and largest sub-segment in the textile industry currently operates with very low capacities.

The production volumes of carpets were declining in Armenia reaching 18.1 tons in 2016. Since 2017, this industry sector was activated again and showed a steady growth trend reaching 31.5 tons in 2019.

**Table 7.21. The carpet production volumes in Armenia, tons**

	2014	2015	2016	2017	2018	2019
<b>Carpet</b>	44.1	41.1	18.1	19.8	26.3	31.5

Source: NS RA

**Processing of sheepskin** is also possible in Armenia. There are few leather-processing companies located in Yerevan. The cumulative processing capacity of the leather processing companies was estimated at 100 million square decimeters which are more than enough to process the locally produced skin<sup>6</sup>. They are working significantly below their full capacity due to difficulties in the marketing of leather. Moreover, the local demand for processed sheepskin is very limited as the shoe producers use only cattle leather. Thus, the only opportunity exists in export markets.

<sup>6</sup> Shoe Production Sector Development Strategy, approved by the Light Industry sector committee on 14 October 2013, Ministry of Economy of RA

## Export market

Main export locations for Armenian sheep and the meat are:

- Iran
- UAE
- Qatar
- Kuwait
- Georgia

Export figures show that sheep and sheepmeat have high demand in foreign markets. According to the data provided by the Statistical Committee of Armenia, the country is self-sufficient in sheep meat production. The production exceeds consumption by 39%.

Over the past 4 years, on average 21.6 thousand sheep livestock and 2.1 thousand tons of sheep meat were exported from Armenia annually. The export value of sheep (live and meat) was over 10 million USD during 2016-2018 which peaked in 2017 up to 17.5 million USD.

**Table 7.22. Import volume of sheep (live and meat) in major export countries, tons**

	2014	2015	2016	2017	2018
Iran	1,245.9	N/A	3,564.5	19,467.1	N/A
<i>from Armenia</i>	315.4	682.4	2,384.8	2,904.6	2,274.9
Kuwait	63,723.0	75,339.0	58,982.3	63,235.9	43,913.4
<i>from Armenia</i>	58.1	1.4	181.9	51.3	63.7
Qatar	49,625.6	41,554.3	50,453.8	64,880.5	65,332.3
<i>from Armenia</i>	117.7	0	0.5	526.1	339.8
Russian Federation	9,769.4	3,841.2	3,280.7	3,229.2	3,772.6
<i>from Armenia</i>	0	0	0	0	0

Source: UN Comtrade database

Kuwait and Qatar are attractive markets for sheepmeat with about \$500 million annual imports. However, the largest supplier of sheep meat to these countries is Australia with about 65-75% share in total imports. Sheep cheese is highly demanded in the Russian market but exporters face the problem of availability of cheese in proper quantities and quality.

**Table 7.23. The unit prices for live sheep and meat of Armenian exports and imports in the main partner countries, USD**

	2014		2015		2016		2017		2018	
	Meat	Sheep	Meat	Sheep	Meat	Sheep	Meat	Sheep	Meat	Sheep
<b>Armenia</b>	5.17	2.13	4.25	2.00	3.94	2.41	5.48	2.50	6.24	2.59
<b>Iran</b>	6.15	5.33	N/A	N/A	5.02	2.99	6.71	5.71	N/A	N/A
<b>Kuwait</b>	6.05	2.75	5.42	2.16	5.35	2.23	6.31	4.14	6.34	3.63
<b>Qatar</b>	5.94	2.91	5.18	2.80	5.02	2.50	5.58	2.66	6.76	N/A
<b>Russia</b>	6.44	15.32	5.18	8.20	5.17	13.14	5.24	12.37	6.22	16.17

Source: UN Comtrade

Armenia has high price competitiveness in the foreign markets for both live sheep and meat exports. The unit price of Armenian exports of live sheep are 2.59 USD as of 2018, which is lower than the unit prices of imports in Russia by more than 6 times, and in Kuwait by 40%. Concerning the unit prices of meat, it is about similar in all countries under review.

### ***Major constraints and proposed solutions***

**Lack of local professional animal breeding capacity** needed to promote the breed improvement for increasing the productivity

**Poor farming and animal management and feeding practices** leading to low productivity and environmental challenges

**Poor quality of milk and wool:** Lack of milking equipment for sheep and proper milking facilities in remote pastures, which significantly affects the quality of the milk making it less marketable, as well as improper animal health treatment and animal farming practices.

**Lack of good shepherds:** shepherd's job is not attractive and it is challenging for farmers to find good shepherds.

**The threat of animal disease outbreaks** such as brucellosis, which has a much stronger impact than in the case of cows.

**Poor management of pastures** may significantly limit the possibilities of further growth (due to lack of feed). Proper management practices (pasture management, use of remote pastures and establishment of animal watering facilities, setting pasturing norms) can partially mitigate adverse impacts on land.

**The introduction of manure management methods** can organize biomass and biogas production, which may reduce the emission of some gases. Prevention of the outflow of animal and veterinary waste into natural watercourses can minimize their adverse impact on the aquatic ecosystem.

## ANALYSIS AND DESCRIPTION HERBS VALUE CHAIN

Herbs are widely used in many industries: food and beverages, cosmetics and perfumery, healthcare and pharmaceuticals, etc. During years, the increased awareness about healthy lifestyle and nutritional and healthful value of herbs boosted demand for them globally. The herbs industry includes multiple segments by type of herbs and application, including beverage applications (e.g. tea ingredients, soft and alcoholic drinks), healthcare and medical application (medicinal herbs), essential oils, food applications (seasonings and spices), cosmetics and care application (essential oils, extracts, etc.), design and decoration application.

**Table 7.24 Main types of herbs with commercial potential in Armenia**

Herb name	Climatic condition for cultivation and main geographic locations in the target marzes.	Application area
Liquorice / Glycyrrhiza glabra	It is distributed in the natural conditions of the foothill zone in the Ararat Valley, Yerevan, Syunik, and Shirak marzes, as well as in the irrigated arable land. In warm subtropical or tropical climate, growing licorice is possible year-round except peak summer.	Herbal teas, candies, capsules of dried herb, and liquid extract.
Geraniums	Geranium is cultivated in gardens. It is sensitive to cold, with the best growth in hot, dry conditions. Best climatic conditions for cultivation offer Berd and Ayrum regions of Tavush marz.	Tea, essential oil.
Lavender/ Lavandula	Lavender can be grown in gardens on up to 1800 m altitude above sea level. It needs full sun and arid climates and may grow as a perennial. Best climatic conditions for cultivation offer Tumanyan and Gugarq regions of Lori marz, Berd and Ayrum region of Tavush marz.	Medicine, food, cosmetics and perfumes, decorations.
Rosemary/ Salvia rosmarinus	Rosemary is cultivated in gardens in regions of the Mediterranean climate. It is a drought-tolerant plant. Best climatic conditions for the cultivation of Rosemary offers Tavush marz.	Food, medicine, essential oil.
Lemongrass/ Cymbopogon	Lemongrass is a tropical plant that freezes to death where winter temperatures drop below 15F (-9C). It requires similar climatic conditions as Lavender. Best climatic conditions for Lemongrass cultivation offer Berd and Ayrum regions of Tavush marz and Tumayan region of Lori marz.	Herbal tea, oil, detergents, soaps
Basil / sweet basil (or Genovese basil).	Basil is cultivated in vegetable gardens. It is sensitive to cold, with the best growth in hot, dry conditions, in sunny areas. Production areas include countries in the Mediterranean region with subtropical climates. It can be cultivated in all target marzes. Green basil is new to Armenia, and only a few small size farmers cultivate it in their farms.	Medicine, essential oil, food
Sage/ Salvia officinalis	Sage is cultivated in vegetable gardens. It may be killed by a cold wet winter, but can survive 30°C cold under the snow layer. Sage needs a consistent moisture supply until it starts growing quickly. It can be cultivated almost in all subregions of target marzes.	Medicine and food
Stevia/ Stevia rebaudiana	Stevia is a subtropical plant that requires warm temperatures with minimal frost, adequate rainfall, and lots of sunshine. It can be grown in gardens in the Tumanyan region of Lori marz, and Berd and Ayrum regions of Tavush marz.	Food (used as a non-nutritive sweetener and herbal supplement)
Jasmine/ Jasminum	All types of jasmines prefer full sun to partial shade. The ideal planting position should be warm, sunny and sheltered, up to 1600	Food, herbal teas

	m altitude above sea level. Usually is cultivated on large plots. Best climatic conditions for cultivation offers Tavush marz.	
Mint/ Mentha	Mint is grown in the wild and can be cultivated in all target marzes. Mint has a very wide variety of uses.	Herbal teas and other drinks, air fresheners, and herbal medicines, cosmetics food
Thyme/ Thymus vulgaris	Thyme is best cultivated in a hot, sunny location with well-drained soil. In Armenia, Thyme grows in the wild and can be cultivated in all target marzes.	Herbal medicines, food, tea
Lemon balm/ Melissa officinalis	Melissa is a very frost hardy plant. It grows well, especially in Tavush and Lori marzes. In Tavush marz, it grows in the wild, especially in warm locations.	Culinary, oil (to use in perfumery).
Everlasting / Helichrysum orientale	Everlasting is an alpine plant that is native to dry rocky slopes. It can be cultivated well in the Tumanyan region of Lori marz and Shirak marz.	Herbal medicine, herbal teas,
Saffron crocus/ Crocus sativus	Saffron plants need well-draining soil and lots of suns. It requires similar climatic conditions as Lavender.	Food (seasoning and coloring agent in culinary)

Mint and thyme are the most used species in Armenia by herbal tea producers.

**Farmers and farming practices**

Despite the increasing interest in global markets towards herbs and significant donor support to promote herbal business activities, this industry in Armenia remains small in scale with many small-scale processors (with only a few officially registered actors). The donor support provided in this sector is aimed at improving the social environment in rural areas, increasing the engagement of women and disadvantaged groups, and the promotion of non-timber forest product usage.

Armenian herb sector predominantly relies on wild-collected herbs, mostly in rural communities and/or some secondary cities by sole proprietors and individuals (natural persons). It involves mainly small size collection. Women are largely involved in wild collection of herbs and primary processing. The wild collection is not based on good practices such as sorting and grading, sustainable herb collection techniques, proper cleaning (from weeds and other foreign matter) and storage. This results in low quality and competitiveness of the collected herbs. The unsustainable collection has a significant negative impact on the environment and biodiversity. Some environmentally conscious herb processors even refuse to buy herbs from villagers to not damage the biodiversity. Instead, the processors learn to cultivate herbs by themselves.

The cultivation of herbs is not widely practiced in Armenia. It is tested and piloted mostly by processors ("EDNA" Co. Ltd, HAM Ltd, Nairyan LLC, "Tsirane") to ensure the stable supply of the raw materials for own production and reduce the dependence on suppliers. "Tsirane" is piloting the cultivation of various types of herbs (lavender, mellissa, mint, thyme, Stevia, etc.) in Garni and Dilijan. However, the production size is very limited at this moment.

According to processors, the lack of regular, timely supply of a sufficiently large volume of raw materials (herbs) puts a significant constraint on future growth and development. Another constrain for the development of the herb-processing sector is the high price of supplied raw materials (largely due to inefficiencies of wild collection, storage, and transportation operations) and high costs for quality

assurance (laboratory testing of residuals of pesticides). This reduces considerably the price competitiveness of Armenian products.

Thus, the farmer price for mint is 600-800 AMD per kg in bulk (cleaned, not dried), while most of the processors mentioned that 200-300 AMD per kilogram would be the feasible price for them to stay competitive in the market. Another issue, which is related to the wild collection, is related to the application of value-added tax (VAT), as the processors are not able to document the purchase of raw materials and deduct it from revenues hence increasing the tax burden of processors.

Currently, in Armenia herbs are mostly used in the production of herbal teas. Thyme and mint account for 80% of the total volume of herbs purchased by the tea producers in Armenia.

There is a small number of businesses engaged in the production of cosmetics and hygiene and medicine products. The production of herbal spices is very limited.

### **Producers in target marzes**

- H.A.M Ltd (brand "ANCIENT HERBALS") is established in Odzun, Lori marz and is the oldest and leading company in Armenia producing herbal teas. HAM promotes natural rehabilitation of the population of wild herbs and domestic cultivation of high-value herbs. Currently, HAM produces about 15 different herbal teas and tea blends (teas), which are sold under the brand "Ancient Herbs" in the local market and abroad. HAM successfully exports the largest share of its products to the USA, EU, Canada and planning to expand the geography of exports to Russia and Japan.
- "EDNA" Co. Ltd (brand "Darman tea") company specializes in artisan teas, infusions, and other natural products. The manufacturing facilities are located in the Tavush region of Armenia. The company produces herbal tea only from wild-harvested herbs but is very interested in the cultivation of herbs on its plots.
- "Tsirane" is women managed company which is specialized in the production of natural cosmetics means and essential oils. The organization has established own orchards in Garni, Kotayk marz and Dilijan, Tavush marz.

Other producers in Armenia, which can potentially source raw materials from target marzes:

- "ANTARAM" is the leading producer of medical herb and herbal tea mainly from wild herbs.
- Nairian LLC (located in Kotayk) produces essential oils and cosmetics from herbs. The organization procures some raw materials from wild herb collectors, but for environmental reasons, they established their farm for cultivation of some herbs, particularly thyme and mint and oil rose. Current demand for herbs is one ton for Saffron crocus, Thyme, Lavender, Melissa officinalis, Matricaria all together and ten tons for oil rose. Nairian successfully exports its cosmetics and personal hygiene products to foreign markets including the USA, Canada, Russia, Japan, and some European countries. It runs a chain of own stores in Armenia and established stores abroad (Georgia). The organization does not source herbs from Tavush, Lori and Shirak marzes.
- Fidoria LLC is a producer of more than 100 types of medical oils and cosmetic means from fruits, berries, and herb. The company sources its raw materials - wild-harvested herbs - from Gegharquniq and Vayots Dzor marzes.
- Nektar Bonus LLC, producer of essential oils, vegetable oils, and syrups from herbs and berries and fruits. Annually purchases only 20-30 kg mint and thyme.



### **Markets and growth opportunities**

Herbal products are mostly consumed locally. The export value of spices, herbal tea (included under product group of green tea) is negligible (less than \$ 100 thousand), but Armenia's export of products under the category "Plants used in the perfumery, in pharmacy or for insecticidal, fungicidal or similar purposes" increased significantly (table 5.1). The export value of Glycyrrhiza reached 640 thousand USD in 2018. The main item in this group is Glycyrrhiza roots – a high-value product - which is wild harvested. The massive harvesting of Glycyrrhiza raised environmental issues (biodiversity degradation), and Armenian authorities are considering to introduce limitations on the harvest of Glycyrrhiza.

The main markets for export of herbs (particularly of Glycyrrhiza) from Armenia are the markets of Russia, the USA, EU countries (mainly France), Iran. There is no stable trend in terms of the leading export partner. The leadership among the export countries change from year to year. In 2018, France accounted for about 59 percent of Glycyrrhiza exports, and Iran – for 16 percent, while in 2019, leading partners were France and the USA. Most of the herbal tea export is shipped to the Russian market (95 percent in 2018, and 87 percent in 2019).

**Table 7.25. Armenia's export of spices, green tea, plants used in perfumery or pharmacy and essential oils, USD**

	<b>2014</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>
Spices	51,287	56,685	37,650	31,182	81,959
Green tea	58,771	117,866	33,659	46,538	29,763
Plants used in perfumery, in pharmacy or for insecticidal, fungicidal or similar purposes	483,645	412,285	391,432	445,273	642,027
Essential oils	1,502	-	13,534	5,082	28,511

Source: UN Comtrade Database

The European Union (EU) market for herbs and essential oils continues to be the largest in the world and may offer broad opportunities for Armenian producers. Armenian exporters may benefit from improved access to the EU market under the GSP+ (low customs tariffs, e.g. zero tariffs on the mint, thyme).

The European demand for fresh herbs is increasing, driven by the increasing trend of a healthy lifestyle, and high interest in new tastes. Fresh herbs, particularly basil, mint, and chives, continue to be top consumed products in this category. The cosmetic and medicinal use of herbs and oils is also very common. Essential oils import to the EU market is also increasing. Many spices and herbs are promoted as salt replacers, including by the British Heart Foundation. Examples include mint, rosemary, nutmeg, basil, cardamom, chili, cinnamon, chives, coriander, dill, cumin, ginger, oregano, paprika, parsley, sage, thyme, and turmeric.

Although the European import of spices is increasing, there is a global scarcity of high-quality and sustainably produced spices and herbs. Thus, the production and processing of high-quality and sustainably obtained spices and herbs provide export opportunities for suppliers in developing

countries<sup>7</sup>. Basil is the most popular culinary herb in Europe, making up between 60 and 75 percent of the total consumption of fresh herbs. Other popular herbs include mint, rosemary, sage, thyme, and oregano<sup>8</sup>.

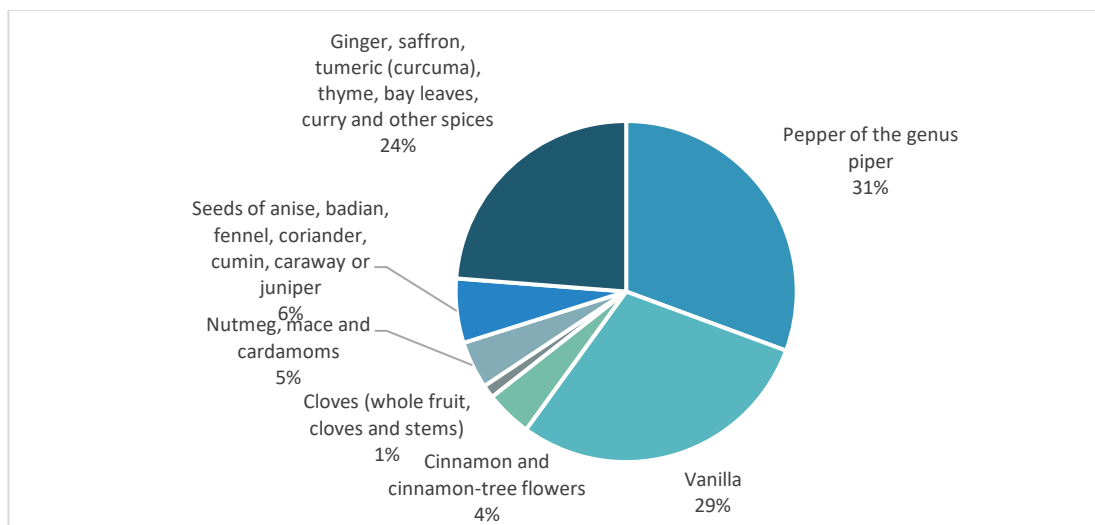
**Table 7.26. Import of spices, green tea, plants used in perfumery or pharmacy and essential oils in EU, mln USD**

	2014	2015	2016	2017	2018
Spices	1,424.9	1,556.8	1,634.4	1,738.0	1,643.0
Green tea	168.1	177.5	174.7	174.4	182.5
Plants used in the perfumery, in pharmacy or for insecticidal, fungicidal or similar purposes	490.3	451.8	490.0	525.3	570.1
Essential oils	890.4	985.8	1,022.0	1,159.1	1,256.1

Source: UN Comtrade Database

The highest share of imports to the EU is attributed to spices with almost 50% of total herbal import in 2018. Essential oils accounted for 30%, while plants used in the perfumery, in pharmacy or for insecticidal, fungicidal or similar purposes - for 15%, and green teas - for 5%. Chart 5.1 illustrates the structure of spice import to the EU.

**Chart 7.12. Import structure of spices in EU, in 2018**



Source: UN Comtrade Database

Among the spices imported to the EU, “ginger, saffron, turmeric, thyme, bay leaves, curry, and other spices” is one of the leading subgroups. Out of the mentioned spices, thyme might be exported from Armenia. The process of cultivation and processing of saffron is more difficult, and Armenian products hardly will be competitive in the international market.

<sup>7</sup><https://www.cbi.eu/market-information/spices-herbs/trends/>

<sup>8</sup>CBI, Ministry of Foreign Affairs, CBI, Product Factsheet, Fresh Herbs in Europe, Updated Jan 31 2019.

### ***The value chain of herbs***

There are two main patterns in the value chain where: (i) farmers grow/wild harvest herbs and sell directly to final consumers in the market, or (ii) farmers grow/wild harvest herbs and sell to middlemen who carry out the packaging and sell to local distributors (shops, supermarkets, HORECA) or partners in the export market. Besides, herb processors themselves also establish plantations and produce herbs for their own use. Local processors (e.g. cosmetics producers) either import herbs or buy directly from farmers or wild collectors. However, the cultivation of herbs increases year by year among farmers as well as processors. As noted above, some environmentally conscious herb processors even refuse to buy herbs from villagers to not damage the biodiversity. Yet, at present many businesses prefer to collect wild herbs with no cost on cultivation and growth, but with high cost on nature.

In general, herb collection, cultivation and primary processing are based mainly on manual work, with little use of automation. In this sector, most of the activities such as harvesting, cultivation, cleaning, sorting, and drying are undertaken largely by women.

### ***Key growth constraints and intervention needs***

- One of the key constraints for the growth of the sector of essential oils, is that the plants used for oil distillation purposes are very much sensitive to post-harvest treatment, storage, and transportation. The quality of the product may dramatically be deteriorated if not properly managed, stored and transported. Besides the mentioned facts, for the distillation of oils is very important the proper harvesting. For ensuring the high quality of the raw material, the harvesting should be implemented in the proper period of vegetation, in proper hours during the day, in proper weather, etc. In general, the sector of essential oils is more vulnerable to external factors, than the sector of herbal teas.

One potential business opportunity to address this challenge would be the establishment of essential oil distillation centers in marzes. Due to this, the raw material may be initially processed, significantly reducing the risks of a further worsening of the quality characteristics of the product.

- Another obstacle for the development of herbs VC is related to irregularities in volume, quality, and timing of supply and demand. In the international market, the processors of essential oils and cosmetics require a stable and timely supply of sufficiently large quantities of herbs, essential oils, etc. Armenian producers usually have very limited volumes of production, and, thus, are not able to cooperate with large scale buyers. In Armenia, Nairyan LLC is the leading organization producing cosmetics means and essential oils. According to an interview with the manager of Nairyan LLC Anahit Markoyan, their production is established in Kotayk marz, and due to long-distance, they don't purchase raw materials from Lori, Tavush and Shirak marzes.

This issue may be addressed through effective cooperation among herb producers/farmers to consolidate, standardize, store and supply the produce. This is critical for supplying both local and international markets. It is also important to join efforts for participating in international exhibitions and fairs. There is a good experience in the wine sector of Armenia. Similarly, the herb/tea producers may establish an association of Armenian herb/tea producers. This may help in ensuring a stable supply of good quality raw materials and effective cooperation between farmers and processors, as well as the marketing of raw materials and finished products in local and international markets.

As discussed earlier, the wild collection is not based on sustainable practices due to a lack of knowledge and a lack of incentives to invest in herb cultivation. The unsustainable collection has a significant negative impact on the environment and biodiversity, and at the same time significantly limits the resource base and, thus, the future growth of the sector. Some herb processors started to invest in herb cultivation to address these challenges, but the scale of herb cultivation is still very small.

It is critical for the Armenian herbal and related sectors to further develop the cultivation of herbs. The herbs might be cultivated not only in orchards or plantations but in the wild nature. The farmers may rent some area from communities or the state agency of forest management (Hayantar SNCO), fence the area, and undertake sustainable production of herbs, which may contribute to protection and rehabilitation of nature. Another opportunity to develop the sector of herbs is that farmers may apply innovative methods for indoor production, like aeroponics, hydroponics, vertical production, etc.

- In tea production is very important the quality of post-harvest processing of the plants. The level of humidity in the dried plants is very important. The quality of the final products worsens due to higher or lower levels than the optimal humidity in herbs by increasing the risk of perishability or deteriorating the essential characteristics of the tea. Currently, the common practice among villagers in Armenia is to dry the plants under direct sunshine, and because of changes in weather conditions, it is impossible to control the quality of the dried plants.

This problem might be solved if farmers or farmers' groups will have electric professional dryers. This may enable farmers not only to enlarge the production capacities but also to control the quality of the dried herbs.

- There is a very high potential of growth for some herbs and products from herbs, such as Glycyrrhiza, Thyme, essential oils. For future development, it would be critical to providing necessary financial and technical assistance to set an effective ground for the production, standardization, packaging, and marketing of such promising products. This can be done through demo sites. Besides, cooperation among farmers and processors also may be built around the development and promotion of these specific product supply chains.
- Tourism is one of the fastest developing sectors in Armenia and is expected to keep its growth pace in the next decade. Herbal products (teas, spices, essential oils) can be sold as Armenian souvenirs to tourists if they are properly branded and packaged. The production sites or plantations can also become touristic attractions and generate additional revenues for farmers and processors. For this opportunity, the main obstacle is the lack of marketing capacities of local producers of herbal products.

## 8. RECOMMENDATIONS ON POSSIBLE INTERVENTIONS IN SELECTED VALUE CHAINS

Area of intervention	Possible interventions/actions in the frame of EU GAIA
<p><b>The policy, legal and institutional environment</b></p>	<ul style="list-style-type: none"> <li>• Support the Government and local authorities in designing and implementing policies/programs aimed at:</li> <li>• Promoting sustainable farming practices, particularly: sustainable irrigation, crop rotation, proper application of pesticides and fertilizers, use of organic fertilizers and plant protection means.</li> <li>• Promoting organic agriculture by the provision of government subsidies</li> <li>• Regulating wild herb collection to reduce and eliminate negative impact on ecosystems and biodiversity</li> <li>• Enhancing quality standards and infrastructure</li> <li>• Conduct capacity development events for public sectors and non-state actors, to raise awareness on Green Agriculture practice</li> <li>• Support the relevant government authorities in building soil analysis and monitoring capacities and data basis (maps, chemical composition)</li> <li>• Designing effective programs and contracts for pasture investment, renting, and management</li> <li>• Promoting sustainable grazing and pasture management practices by public and private entities.</li> </ul>
<p><b>Access to inputs, equipment, infrastructures and services</b></p>	<ul style="list-style-type: none"> <li>• Create conditions to have access to organic fertilizers and organic plant protection means</li> <li>• Setting up local production of seeds</li> <li>• Establish an effective incentive framework (e.g. flexible financing tools) to promote and facilitate investment by farmers and processors in sustainable technologies such as: <ul style="list-style-type: none"> <li><i>Herbs</i> <ul style="list-style-type: none"> <li>○ Good herb cultivation and management practices</li> <li>○ Distillation facilities</li> <li>○ Cold storage facilities</li> <li>○ Organic fertilizers and organic plant protection means</li> <li>○ Organic waste composting</li> </ul> </li> <li><i>Legumes</i> <ul style="list-style-type: none"> <li>○ Agricultural machinery</li> <li>○ Sorting, grading and packaging machines</li> <li>○ Sustainable agricultural practices</li> <li>○ Good plant and farm management practices (incl. cost management)</li> <li>○ Sustainable irrigation</li> <li>○ Proper waste management</li> <li>○ Crop rotation</li> </ul> </li> </ul> </li> </ul>

	<p><i>Fruits &amp; berries</i></p> <ul style="list-style-type: none"> <li>○ Sustainable agricultural practices (modern irrigation, application of pesticides, etc.)</li> <li>○ Sorting, grading and packaging equipment</li> <li>○ Good orchard management practices (incl. cost management)</li> <li>○ Cold storage facilities</li> <li>○ Anti-hail and other equipment against natural disasters</li> </ul> <p><i>Sheep</i></p> <ul style="list-style-type: none"> <li>○ Sustainable animal farming practices (e.g. animal feeding and grazing practices)</li> <li>○ Milking equipment, and milk collection and storage equipment</li> <li>○ Dairy production facilities and equipment (yogurt, cheese)</li> <li>○ Small- to medium scale or mobile slaughterhouses</li> <li>○ Good animal treatment and management (to increase milk/meat/wool productivity)</li> <li>○ Proper housing for animals</li> <li>○ Investment in pastures and related facilities and infrastructures</li> </ul>
<p><b>Learning on innovation (green technologies, good agricultural practices)</b></p>	<ul style="list-style-type: none"> <li>● Provision of technical/professional advice and training for farmers, service providers and processors in relation to effective herb and fruit/berry production and marketing, effective cultivation and marketing of legumes (including good cost management)</li> <li>● Organize demo herb plantations and farms targeted locations to demonstrate green agriculture practices and their benefits</li> <li>● Organize demo orchards in targeted locations to demonstrate green agriculture practices and their benefits</li> <li>● Prepare and disseminate practical information about sustainable farming and marketing practices among stakeholders</li> <li>● Prepare and disseminate practical information about sustainable herb collection and cultivation and marketing practices among stakeholders</li> <li>● Organize demo animal farm and or pasture in targeted locations to demonstrate green agriculture practices and their benefits</li> <li>● Support for the introduction and wider use of new or improved animal breeds with high meat, milk or wool yield</li> <li>● Awareness-raising activities about environmental challenges related to unsustainable sheep grazing, and ways to mitigate those challenges</li> </ul>
<p><b>Improved processing capacities</b></p>	<ul style="list-style-type: none"> <li>● Support for the introduction and wider production of perspective herbs (such as Liquorice (root of Glycyrrhiza), Thyme, Basil, Mint, etc.)</li> <li>● Bridge suppliers, producers, and processors and buyers together for sustainable cooperation <ul style="list-style-type: none"> <li>○ Conducting targeted workshops</li> <li>○ Building capacity of input suppliers and service providers to become promoters of good practices</li> </ul> </li> </ul>

<p><b>Access to markets (integration in national/global value chains, distribution, marketing, branding)</b></p>	<ul style="list-style-type: none"> <li>• Support in measures aimed at strengthening the competitiveness of local produce and building local brands</li> <li>• Quality standards and quality management</li> <li>• Demo cooperation among enthusiastic farmer groups to promote high safety and quality standards</li> <li>• Support in enhancing marketing practices and logistics: <ul style="list-style-type: none"> <li>○ to set up own product consolidation and standardization (and transport logistics)</li> <li>○ sorting, grading, and packaging equipment and practices</li> </ul> </li> <li>• Position and promote organic herbs, fruits, berries, and legumes in national and international markets by creating Armenian organic brand</li> <li>• Support in enhancing marketing practices and logistics: i.e. (i) to set up own product consolidation and distribution network or (ii) establish effective cooperation platform with large wholesalers and distributors</li> <li>• Support in positioning and promoting locally collected, produced, and processed herbs in the local and international markets</li> <li>• Provide information about international herb and related markets and indicate marketing opportunities</li> <li>• Link with processors and transport companies</li> </ul>
<p><b>Promoting organic agribusinesses</b></p>	<ul style="list-style-type: none"> <li>• Provide technical assistance to farmers in: <ul style="list-style-type: none"> <li>• establishing organic herb plantations and orchards,</li> <li>• implementing organic production practices</li> <li>• undertaking organic certification (local, and, where necessary, international certification)</li> </ul> </li> <li>• Create incentives (financial, social) for farmers to engage into organic herbs production and horticulture</li> <li>• Support cooperation among farmers who wish to become organic producer</li> <li>• Improve access to organic fertilizers and organic plant protection means</li> <li>• Awareness raising activities among farmers and service providers and support in promoting the organic sheep/goat meat and cheese production</li> <li>• Awareness raising activities about the markets of organic sheep meat and cheese, and opportunities</li> </ul>

## 9. SOCIO-ECONOMIC IMPACT OF THE DEVELOPMENT OF SELECTED VALUE CHAINS

The socio-economic impact of the current program can be assessed in two dimensions: women engagement in agricultural activities and job creation potential.

Women play an essential role in the development and growth of agriculture in the global world. Women account for about 43% of the agricultural labor force according to FAO 2011 report. When it comes to agriculture, women do a variety of jobs, from unpaid housework to farming and entrepreneurship. Based on existing practice agricultural work is divided into pure men job (ex: driving a tractor), where men are dominated by the sphere of work, pure women job (ex: milking a cow), where women are dominated by the sphere of work and unisex job, where both can do the same job equally.

There are a lot of opportunities to involve women in agricultural activities in Armenia. Women are mainly involved in activities like collecting, sorting, storing and packaging, as well as the sorting of seeds and harvesting. While men are the ones who are involved in all the work that involves machinery, irrigation, loading/unloading.

The women involvement potential is high in the fields of berries and herbs. In the case of berries, women are involved in the whole value chain starting from planting bushes ending up with the collection, sorting, processing, packaging, and sales. The situation is similar in the case of herbs VC, where the work is done mainly by women, including the cultivation of herbs and wild herbs collection, sorting, drying, further processing and packaging.

Also, women have significant opportunities to be involved in the VCs of fruits, potatoes, legumes, and vegetables. In these VCs they can be involved in the works like sorting of seeds, harvesting, sorting, storing, processing, packaging, etc. These chains also provide a good opportunity to involve vulnerable groups in the process of growing, harvesting, and processing.

There is untapped potential for job creation and additional income generation in selected value chains. Currently, most of the farmers harvest and sell the produce to processors or resellers. Instead, they can add extra value, if they conduct additional post-harvesting activities such as grading, storing in cold-storages and packaging to sell it with higher value during the off-season as well processing i.e. drying, deep freezing, production of canned food.

Besides, the development of agricultural business infrastructure and extension service providers will create more jobs and revenues in adjacent sectors.

Development of wool processing and dairy processing capacities will create opportunities for the realization of wool and milk hence increasing the revenues of sheep farms and create non-agricultural jobs in the rural areas.



## ANNEX 1: CLIMATE CHANGE AND DRR ASSESSMENT

### ASSESSMENT OF CLIMATE CHANGE IMPACT ON VC

VCs	Climate change impact	
<b>Vegetables</b>	High	It has a significant impact on this VC, as it is adversely affected by extreme climatic conditions as drastic temperature fluctuations, high rainfall or drought, hailstorms, strong winds and storms. With CC increases the risk of new and emerging diseases and pests of various plants, leading to decrease yield, and product quality, increase of frequency of pesticides and chemical fertilizers usage.
<b>Potato</b>	Medium	It has a significant impact on potato VC. On the one hand dangerous meteorological conditions and the other hand, new emerging/quarantine diseases and pests (e.g. potato moth). The adverse effects of CC result in a decrease in crop yield, increase of water demand, poor product appearance and quality, increase of usage frequency of pesticides and chemical fertilizers.
<b>Legumes</b>	Medium	It has a certain impact on this VC due to extreme climatic conditions and increased risk of new and emerging diseases and pests of various plants, leading to decrease yield, and product quality, increase of frequency of pesticides and chemical fertilizers usage.
<b>Grains</b>	High	CC has a huge impact on this VC since most crops are grown without irrigation and are directly dependent on the climate. It is particularly affected by the lack of precipitation and hail during vegetation.
<b>Fruits</b>	Medium	CC has a significant impact on this VC due to hydro-meteorological hazardous conditions such as early spring frosts, high winds, drought, hail, crust, intensive evaporation of surface water leading to increase in water demand. The adverse effects of CC result in a decrease in crop yield, increase of water demand, poor product appearance and quality, increase of usage frequency of pesticides and chemical fertilizers.
<b>Berries</b>	Medium	CC has a significant impact on this VC due to hydro-meteorological hazardous conditions such as early spring frosts, high winds, drought, hail, crust, intensive evaporation of surface water leading to increase in water demand. The adverse effects of CC results in a decrease in crop yield, an increase of water demand, poor product appearance and quality, increase in usage frequency of pesticides and chemical fertilizers.
<b>Herbs</b>	Medium	Hydro-meteorological conditions have a negative impact on the VC resulting in intensive evaporation of surface water, which increases water demand, as well increase of new diseases and pests. CC can result in yield and quality decrease, poor product appearance and increase in usage frequency of pesticides and chemical fertilizers. For wild collection,

		the adverse effect is more dangerous, as CC has a significant effect in the ecosystem and adding human factor can cause irreversible consequences.
<b>Forage</b>	High	CC has a major impact on this value chain, as a large portion of forage crops are cultivated in dry conditions and are directly dependent on climate. It is particularly affected by the lack of precipitation and hail during vegetation. Many perennial fodder crops do not suffer much from the CC due to their strong root system, although the yield and quality will decrease significantly.
<b>Cattle breeding</b>	Medium	It has a significant negative impact on cattle breeding, as the productivity of pastures is directly dependent on the climate conditions of the year, and animal productivity depends on pastures. CC also has some effect on animal health and the spread of various diseases.
<b>Sheep</b>	Medium	It has a significant negative impact on cattle breeding, as the productivity of pastures is directly dependent on the climate conditions of the year, and animal productivity depends on pastures. CC also has some effect on animal health and the spread of various diseases. Given that this VC has a negative impact on biodiversity and land degradation, greater attention should be paid on pasture management and animal health veterinary control.
<b>Swine</b>	Low	CC does not have much impact on this value chain if breeding is in barns. There may be a certain increase in energy consumption due to barn ventilation and heating. CC may cause also certain diseases, including those not encountered previously.
<b>Poultry</b>	Low	This value chain does not have a significant impact, as poultry farming is generally carried on in closed conditions. There may be a certain increase in energy consumption due to ventilation and heating. CC can also be a cause of certain bird diseases, including those that have not been encountered before.
<b>Beekeeping</b>	Medium	CC has a significant impact on beekeeping, as its efficiency depends directly on the ecosystem, which in turn depends on climate conditions. Drought, strong and prolonged winds, temperature fluctuations, and other climatic “surprises” can lead to severe adverse effects on beekeeping and a decrease the amount of honey production and sometimes even elimination of bee families. CC can be a cause and spread of certain bee diseases.

## DRR AND CLIMATE CHANGE ADAPTATION

VCs	DRR and climate change adaptation
<b>Vegetables</b>	The negative impacts of climate change can be mitigated by indoor cultivation, the introduction of new agrotechnologies, the introduction of effective irrigation and hail protection technologies, development of new climate-resistant sorts and other modern scientific and technological innovations.
<b>Potato</b>	The negative impacts of CC can be mitigated by the introduction of new agrotechnologies, new climate-resistant crop varieties/sorts and hybrids, the introduction of integrated irrigation and plant protection systems and other effective technologies.
<b>Legumes</b>	The negative impacts of CC can be mitigated by the introduction of new agrotechnologies, new climate-resistant crop varieties/sorts and hybrids and other modern high-tech methods.
<b>Grains</b>	The negative impacts of CC can be mitigated by the introduction of new agrotechnologies, new climate-resistant crop varieties/sorts and hybrids, early cultivated and high yield varieties.
<b>Fruits</b>	The negative impacts of the CC can be mitigated by the introduction of modern hail protection and irrigation technologies, the application of new-generation climate-resistant seedlings, the covering of root area, the introduction of integrated plant protection systems and other effective agrotechnical measures. It is also important to implement effective post-harvest collection, storage and deep freezing systems, which will strengthen processing infrastructure.
<b>Berries</b>	The negative impacts of the CC can be mitigated by the introduction of modern hail protection and irrigation technologies, the application of new-generation climate-resistant seedlings, the covering of root area, the introduction of integrated plant protection systems and other effective agrotechnical measures. It is also important to implement effective post-harvest collection and strengthen processing infrastructures (introduction of storage and deep freezing).
<b>Herbs</b>	The negative impacts of the CC can be mitigated by the introduction of modern hail protection and irrigation technologies, the application of new-generation climate-resistant seedlings, the covering of root area, the introduction of integrated plant protection systems and other effective agrotechnical measures. It is also important to implement effective post-harvest collection and strengthen processing infrastructures (introduction

	of storage and deep freezing). In the case of wild collection, it's necessary to raise awareness and increase control over the collection of vulnerable species.
<b>Forage</b>	The negative impacts of CC can be mitigated by the application of effective agrotechnologies (sowing, mixed sowing, etc.), the introduction of new climate-resistant varieties with less water demand, as well as multi-root crops with strong root systems.
<b>Cattle breeding</b>	To mitigate the adverse impacts of CC: proper pasture management practices should be introduced to reduce the pressure on community pastures by using remote pasture opportunities, improvement of the quality of veterinary services, monitoring of emerging diseases and breeding of more resistant breeds should be introduced
<b>Sheep</b>	To mitigate the adverse impacts of CC: proper pasture management practices should be introduced to reduce the pressure on community pastures by using remote pasture opportunities, improvement of the quality of veterinary services, monitoring of emerging diseases and breeding of more resistant breeds should be introduced
<b>Swine</b>	The impact can be mitigated by the introduction of smart climate control systems inside barns. Improve the quality of veterinary services, monitor, and control the spread of new diseases by breeding more adaptable types for local climate conditions and more resistant to adverse climate impacts.
<b>Poultry</b>	The impact can be mitigated by the introduction of smart climate control systems in poultry buildings, improve the quality of veterinary services, monitor and control new diseases and breed of new types adapted to conditions and more resistant to adverse climate impacts.
<b>Beekeeping</b>	Adverse effects of CC can be mitigated, and bee-keeping efficiency increased by moving beehives to different climatic zones/areas, taking into consideration the flowering period, using additional feeding, taking preventive measures against diseases and pests, as well as following up with hydrological changes.

## ANNEX 2: ASSESSMENT FRAMEWORK OF ENVIRONMENTAL SUSTAINABILITY OF THE VALUE CHAINS

Assessment components	Impact of VC on the environment
1. Air	<ul style="list-style-type: none"> <li>- The amount of dust in the air, emissions from fuel used for cultivation</li> <li>- Emission of residual quantities of pesticides and chemical fertilizers (in the form of aerosols, with dust, etc.)</li> <li>- Emission of methane, ammonia, sulfur, nitrogen oxides, etc. into the atmosphere, as a result of decomposition of animal and plant residues (from manure, poultry, vegetables and other animal residues)</li> <li>- Improper waste management and emission of gases from the burning of the waste (burning of fields after harvest, burning chemicals' and pesticides' containers)</li> </ul>
2. Soil	<ul style="list-style-type: none"> <li>- Negative impact on soil fertility, the potential for soil erosion and desertification as a result of wrong agro-technical methods, improper use of irrigation methods, pasture norms violations, etc.)</li> <li>- Soil contamination and salinization because of the overdose of pesticides and chemical fertilizers, violations of water standards, etc.</li> <li>- impact on soil structure and mechanical composition (use of heavy machinery, application of deep ploughing, violation of grazing norms and timing, disproportionate use of pastures, etc.)</li> <li>- Impact of the usage of pesticides and chemical fertilizers on soil microflora (lack of organic material in soil, violations of norms and frequency of use of pesticides and chemical fertilizers)</li> </ul>
3. Water	<ul style="list-style-type: none"> <li>- Water sensitivity and water demand in the specific area of agricultural activity</li> <li>- Impact on surface and groundwater quality, contamination with pesticides, chemical fertilizers, veterinary medicine</li> <li>- Liquid emissions resulting from this activity and the possibilities for their elimination (manure, disinfectants, etc.)</li> <li>- Surface water contamination with organic leftovers and its eutrophication (flow of liquids containing organic matter and fertilizer into open waterways, which promotes intensive growth of algae and phytoplankton)</li> </ul>

	<ul style="list-style-type: none"> <li>- Negative impacts on water reservoirs and their adjacent areas (due to the lack of animal aquifers, their groups enter the coastal areas of rivers and lakes and their contamination and trapping)</li> </ul>
4. Waste	<ul style="list-style-type: none"> <li>- Organic and non-organic solid waste, post-collection plant leftovers, waste generated during storage: containers and packaging materials</li> <li>- Leakage of oil and fuels used for machinery</li> <li>- Additional quantities of chemicals: pesticides, POPs, residues of disinfectants and veterinary medicines, fodder residues, etc.</li> <li>- Emissions of other biological pollutants biogenic, microbiological and genetic</li> </ul>
5. Biodiversity	<p>Biodiversity in arable and horticultural areas is extremely limited and is largely human-controlled</p> <ul style="list-style-type: none"> <li>- Impact on wildlife health, habitats, feed safety and distribution (pesticides used to fight rodents often lead to mass destruction of animals, birds and insects, as well as the migration of predatory animals and birds; the destruction of birds' nests)</li> <li>- Impact on wild plant growth and distribution areas (intensive use of pastures, early spring and late fall grazing results in the destruction of many plant species, mismanagement of grasses leads to a reduction of herbs)</li> <li>- Impact on natural water reservoirs, springs and groundwater (contamination of streams with manure residual and pesticide, leading in water biodiversity destruction and hydro-ecological change)</li> <li>- Impact on cultivated soils on soil-dwelling species and micro-organisms (lack of organic matter in the soil, excessive use of pesticides and chemical fertilizers lead to a reduction of soil microflora and species)</li> </ul>

## ANNEX 3: DETAILED DESCRIPTION OF DIMENSION B: ASSESSMENT OF DEMAND GROWTH

### B1: Export growth potential

Value Chain	Assessment results	Assessment Rationale
Vegetables	High	<p>During 2014-2018, the export of vegetables fluctuated slightly from year to year. The export of vegetables has around 20% share in total primary agro produce, with its highest value of USD 28.3mln in 2018.</p> <p>Tomatoes (code: 0702) ensure about 80% of total export value, while cucumbers and gherkins (code: 0707), cabbages (code: 0704) and carrots (code: 0706) together cover some 1%.</p> <p>Historically, Russia is the dominant export market for Armenia.</p> <p>There is a high potential for increasing exports to Russia as well as to other markets (e.g. the Middle East). For this, there will be a need to improve production technologies and safety and quality standards. At the same time, it is very important to enhance export logistics.</p>
Potato	Low	<p>The export volumes of potatoes were very low from 2014 through 2018. Comparatively higher volumes were recorded in 2014 and 2015, which were rather sporadic and not sustained. In 2015 over 70% of exported potatoes were shipped to Georgia, and the remaining to Russia. However, this was a discrete jump in export, followed by significant reduction, meaning that potato export has low and unstable potential.</p>
Legumes	Low	<p>In 2014-2018, the value of export of legumes didn't exceed USD 200k, and the volumes were not regular as well. Instead, Armenia imports significantly higher volumes of legumes.</p>
Grains	Low	<p>Historically, Armenia was not a large player in grains export market.</p>
Fruits	Low (for Shirak and Lori) High (Tavush)	<p>The share of fruits in the primary agro produce export has been gradually increasing during the recent years, and reached about 22% in 2018, with over USD 25mln of fruits were exported from Armenia.</p>

		<p>Historically, Armenia exported mainly apricot, apples, peaches, plums, grapes. In 2018 about 7.2 thousand tons of apricots (about USD 5mln), 5.4 thousand tons of peaches (about USD 3.3mln), 1.6 thousand tons of plums (about USD 0.8mln) were exported from Armenia. Russia is the main destination for Armenian fruit exports.</p> <p>The export potential of Fruits VC is labelled with high for Tavush marz with its exportable fruits' varieties and volume, while Shirak and Lori do not have "exportable" fruits (fruit are mainly grown in backyards in comparatively small volumes).</p>
Berries	High	<p>So far, strawberries have been the key variety of berries exported from Armenia. The key countries of export are Russia and the United Arab Emirates.</p> <p>However, according to expert estimates raspberry is another crop with high export potential. At the current stage, the berry plantations are expanding in Armenia, and selling channels of strawberry exportation will positively impact on the export promotion for raspberries as well.</p>
Herbs	Medium	<p>Armenia provides a wide variety of herbs, both wild and cultivated, including "ecologically clean" herbs from the forests and mountains. Herbal teas represent a product group with gradual growth. Russia has been the key market of exportation of herbs so far. According to expert opinions,<sup>9</sup> there is a potential for exporting of herbs from Armenia to the EU market, in case of satisfying regulation standards on quality and safety.</p> <p>From the other side, export statistics of "Plants and parts used for primarily in perfumery, pharmacy or for insecticidal, fungicidal purposes"<sup>10</sup> demonstrated fluctuating nature during 2014-2018. In 2018 exports from Armenia amounted 642,000 USD (about 475 tons) the highest level since 2014. About 80% of these plants were exported to Iran, France and the USA. It is noteworthy, that the export increase in monetary terms surpasses the volume in physical terms significantly. This indicates a move towards high-value products.</p>
Forage	Low	<p>The statistical data state that forages export is not traditional for Armenia. There is some potential for exporting forage to neighboring Georgia, though the Georgian market is limited. Additionally, the high transportation costs per product unit affect the price competitiveness of forage in the export market as well as there is a large untapped demand in the local market.</p>

<sup>9</sup> ICARE Wild Collection Value Chain Assessment. [http://icare.am/wp-content/uploads/2019/10/Wild-Harvest-Sector-review-report\\_Arm.pdf](http://icare.am/wp-content/uploads/2019/10/Wild-Harvest-Sector-review-report_Arm.pdf)

<sup>10</sup> HS Code: 121190 - Plants and parts (including seeds and fruits) n.e.c. in heading no. 1211, used primarily in perfumery, pharmacy or for insecticidal, fungicidal purposes; fresh or dried, whether or not cut, crushed or powdered.



Cattle	Medium	<p>Export of Bovine animals from Armenia has a comparatively higher value. Iraq is the key export partner and in some periods the only country of export. The average annual export value is about USD 1.2 mln.</p> <p>Armenia has no experience in milk export (code: 0401- Milk and cream; not concentrated, not containing added sugar or other sweetening matter).</p> <p>Cheese and curd (code: 0406) have higher export potential, especially to the Russian market.</p> <p>For further expansion of dairy exports, it is critical to ensure an adequate increase of forage and fodder supply. Meat and dairy are put under Cattle conditionally. It is understood that meat and dairy are two different and distinct value chains. They will be discussed in more detail in the next stage of analysis.</p>
Sheep	High	<p>Armenia has increasing export of live sheep and goats, and sheep and goat meat. Recently Armenia has introduced HALAL certification, which increased opportunities for exporting not only live animals but also meat and meat products to Muslim countries such as Iran, Kuwait, Qatar.</p> <p>The meat of sheep or goats is mostly exported to Iran (c99% in 2018), while Qatar and Kuwait are key markets for exporting live sheep and goats.</p>
Swine	Low	<p>Armenia is out of the pork exporting market but is an active importer of pork.</p>
Poultry	Low	<p>Poultry export from Armenia has been discrete and modest during the 2014-2018 period, while imports have been stable.</p>
Beekeeping	Medium	<p>The highest volume of natural honey (code: 0409) exported from Armenia was 55 tons in 2017, with a value of USD 340k. Given the production capacity of Armenia, there is potential for expanding the export of the product from Armenia. That's why the potential was estimated as "Medium".</p>

## B2: Import substitution potential

Value Chain	Assessment results	Assessment Rationale
Vegetables	Low	<p>The annual vegetable import volumes to Armenia are over 10k tons. Despite the increasing trend in 2017-2018, vegetable import volumes have been fluctuating from year to year. In 2018 Armenia imported USD 3.3mln more vegetables than in 2017 (or +57% in net weight).</p> <p>The key vegetable groups are onions, shallots, garlic, leeks and other alliaceous vegetables; fresh or chilled (code: 0703), carrots, turnips, salad beetroot, salsify, celeriac, radishes and similar edible roots; fresh or chilled (code: 0706), Tomatoes; fresh or chilled (code: 0702), cabbages, cauliflowers, kohlrabi, kale and similar edible brassicas; fresh or chilled (code: 0704), which together cover about 60% of vegetable import value in the monetary expression.</p> <p>From 2014 to 2018, the import of vegetables made about 3.5% share in total primary agro produce (including potatoes and legumes), with USD 11.9 mln worth import in 2018.</p> <p>Turkey, Georgia, Russia, Egypt, Iran are the main vegetable import partners for Armenia.</p> <p>There is some potential for import substitution concerning some vegetables imported offseason, e.g. tomatoes, cucumbers. Imports from other countries (Turkey) such as tomatoes, cucumbers, peppers are more competitive in terms of low price. Energy efficiency technologies could help Armenian greenhouse crop producers in order to increase their price competitiveness.</p>
Potato	Low	<p>During 2014-2018, Armenia imported on average USD 2mln or 3.8k tons of potato. Overall, the import volumes of potatoes have been decreasing during 2014-2018. The largest part of imports is coming from the Netherlands and Germany, recorded under HS Code 070110 as potato seeds. Armenia is self-sufficient in potato production and does not import for final consumption. The only exemption is the semi-finished preparations for fast food restaurants.</p>
Legumes	Medium	<p>Armenia imports about 5k tons of legumes (i.e. lentil, beans, etc.) annually. The imports legumes amounted 5.4k tons in 2018 (or USD2.6mln), with slightly decreasing trends for the reviewed period. 2.8K tons of it is lentils AND 1.4k tons – peas imported mostly from the Russian Federation.</p>

Grains	Medium	<p>Import of grains is among the larger import group in the primary agro produce import in Armenia. Particularly, in some years the share of grains imports exceeded 30 % (or over USD 120mln in monetary terms) in total agro produce import. In average Armenia imports about 370k tons of grains annually. Wheat and meslin (code: 1001) and maize (code: 1005) together make about 90% of cereals import to Armenia.</p> <p>Russia is the key supplier for grains to Armenia. Grains (wheat, etc.) are low-value commodity products, and Armenia's productivity in wheat-growing is low compared to partner countries.</p>
Fruits	Low	<p>In average, fruits represent 10% of primary agro produce import to Armenia. Overall, the annual import value of fruits exceeds USD50mln. Moreover, during the recent year, the volumes of fruits import to Armenia have been growing steadily and reached 83k tons in 2018.</p> <p>However, 80% of total fruits imports count for tropical fruits such as bananas, pineapple, citrus, which are not growing in Armenia. In 2018 over USD 33mln of citrus fruits were imported to Armenia, while the whole value of imported fruit, besides berries, was around USD 48mln.</p>
Berries	Low	<p>The average annual volume of berries' imports for 2014-2018 was low - 3 tons or about USD 30k, and there is no solid ground for import substitution. Armenia is gradually progressing in production of berries domestically.</p>
Herbs	Low	<p>There are many varieties of wild and cultivated herbs in Armenia, which are used as tea, food, etc. In essence, Armenia covers all the local market demand by using its natural capacities.</p>
Forage	Low	<p>Forage import volumes are significantly small in Armenia. Russia and China are the larger suppliers of forage to Armenia.</p> <p>Note that the combined feed being used for animal husbandry is made of barley, maize and rye, which are recorded under the "Grains" VC. The annual volume of forage import was below 500 tons.</p>
Cattle	Medium	<p><i>Meat</i></p> <p>The import of live animals to Armenia increased during 2014-2018. They are imported for breed improvement from Austria, Denmark, Russian Federation and Ukraine.</p>

		<p>As to meat Armenia is importing mostly frozen buffalo meat which is used only by food processing companies. In 2018, the import value of fresh or chilled meat amounted USD 1.8 mln (leading source country Belarus) while frozen meat of the bovine animal was USD 12.7 mln sourced mostly from Ukraine, India and Brazil.</p> <p><i>Dairy products</i></p> <p>Armenia imports different varieties of dairy products, which are not produced in Armenia or the local production does not cover the local demand. The total value of imports amounted USD 45.7 mln in 2018 about half of which is butter and other fats and oils derived from milk.</p>
Sheep	Low	Armenia does not import sheep meet and is an exporter of sheep meat to Iran.
Swine	High	The import of swine meat has a modest share in the import of primary agro produce comprising about 5%. The swine meat import was increasing by about 20% during the recent 2 years, by recording import values of USD 15mln per year. A large portion of imported swine meet is used by the processing industry.
Poultry	Medium	<p>Armenia is a net importer of poultry meat. The fresh or chilled poultry meat is supplied by local producers, while a significant part of frozen poultry meat is imported. In average Armenia imports 30k tons or value of USD 35 mln frozen <i>Meat and edible offal of poultry (HS code: 0207 - Meat and edible offal of poultry; of the poultry of heading no. 0105, (i.e. fowls of the species Gallus domesticus), fresh, chilled or frozen)</i> from USA, Russia, Brazil, Belgium.</p> <p>Price competitiveness is the most important factor for import substitution there the cost of feed and economies of scale play an important role.</p> <p>In terms of eggs, Armenia is self-sufficient.</p>
Beekeeping	Low	During 2016-2018 the volumes of natural honey import were insignificant varying between 13 to 21 tons annually. Armenian producers mostly cover local demand.

### B3: Consumption

As a result of major development in the world, income growth and consumer preference changes, food consumption has been growing at a faster pace than the world population. As a result of these developments consumption of high-value products increased in emerging economies. In

parallel, consumer preferences have changed in developed countries with rising societal and environmental concerns. For instance, these changes resulted in lower red meat consumption in developed countries.<sup>11</sup> Armenia is a developing country and follows global trends with increasing consumption of high-value products. At the same time, there is some traditional preference of the population in food consumption. Armenian consumers are very price-sensitive and consumer spending can be divided into several categories<sup>12</sup>:

1. Primary consumption products
  - Bread, bakery, pasta, grains, potato
  - Meat: beef, chicken meat, pork, other meat products
2. Secondary importance consumption products
  - Fruits and vegetables
  - Dairy products and egg (cheese, milk, eggs, ice cream, yoghurt, sour cream, etc.)
3. Third importance consumption products
  - Tobacco products
  - Sugar, tea, coffee, sweets
  - Butter and oil
  - Food and drinks in HORECA

Considering above mentioned factors and the importance of consumer products, the following assessment result was generated. Primary consumption products, not high value, will grow slightly, while the increase in income level and change of diet preference will lead to increasing the consumption of high-value products.

Value Chain	Vegetables	Potato	Legumes	Grains	Fruits	Berries	Herbs	Forage
<i>Assessment</i>	Medium	Low	High	Low	Medium	High	Medium	High

Value Chain	Cattle	Sheep	Swine	Poultry	Beekeeping
<i>Assessment</i>	High	Low	High	Medium	High

<sup>11</sup> [https://ec.europa.eu/info/news/global-food-consumption-growing-faster-population-growth-past-two-decades-2019-sep-10\\_en](https://ec.europa.eu/info/news/global-food-consumption-growing-faster-population-growth-past-two-decades-2019-sep-10_en)

<sup>12</sup> [https://asue.am/upload/files/amberd-competition/Amberd\\_23.pdf](https://asue.am/upload/files/amberd-competition/Amberd_23.pdf)

## ANNEX 4: DETAILED DESCRIPTION OF DIMENSION C1: ASSESSMENT OF VC EXTENSION POTENTIAL

Value chain	Assessment results	Assessment Rationale
Vegetables	High	Vegetables VC has high extension potential. It can be freshly packaged in whole, or packaged as fresh salads, dehydrated, dried, preserved, processed into juice (tomato), pickles, sauces, frozen, etc.,
Potato	Medium	Potato is considered as primary consumption product, with low opportunities for adding value. However, potato VC has significant extension potential. There are around 150 types of products made from potato, including potato chips, fries, mashed potato, etc.
Legumes	Medium	This VC has significant extension potential in terms of packaging, preserving or using as healthy lifestyle product, which has series of benefits: high protein, high dietary fibre, low fat, gluten-free, high in antioxidants, high in energy, source of micronutrients antidiabetic and anticancer properties, no cholesterol.
Grains	Medium	This VC has significant potential for extension through processing and packaging. Grains are used for flour, bread, beer, crispbread, confectionery and animal fodder production.
Fruits	High	This VC has one of the highest potentials for an extension. In addition to direct consumption in fresh form, fruits can be, packaged, peeled and packaged fresh, processed (juice, jam, marmalade, wine, etc.), dried, frozen, preserved. Dried fruits and jams may be used in the production of confectionery products, production of specialized healthy food for various groups of consumers.
Berries	High	This VC has one of the highest potentials for extension similar to fruits.
Herbs	Medium	This VC has a medium opportunity for extension. Traditionally, herbs are dried, packaged and sold for herbal tea or medical treatment, though it has a broader opportunity for more value-added, e.g. making cosmetic products, oils, extracts, spices, medicine, tea, etc.
Forage	Low	Forage VC has limited opportunity for processing. It mainly goes to animal fodder or combined feed processing. Forage has little opportunity for further processing but is an important input for animal husbandry, meat and dairy production industries.
Cattle	High	This VC is the one with the highest potential for extension. In terms of dairy products and meat products. Leather also has a high potential for value addition and can be used in shoemaking, accessories, apparel and other industries.

Sheep	Medium	This VC in Armenia is not developed and has significant potential for extension. Sheep meat consumption in the country is not high, instead, the export of sheep is very high. Locally sheep milk is used to process cheese and yoghurt, and wool is used to get different types of natural wool products including a thread for carpet production.
Swine	Medium	Pork in Armenia is very popular mainly for barbeque, but it was a significant opportunity for processing: cutting into different parts (different parts have a different value), while in Armenia all is sold under one price, processing into bacon, ham, smoked parts, sausage & salami, salo (fat), etc.
Poultry	Medium	Poultry is one of the fastest-growing agricultural segments and has high VC extension potential. It can be divided into two major VCs egg and meat production. Eggs can be packaged, powdered, used in other production. Meat can be frozen, processed into other meat products, turned into semi-finished products, etc.
Beekeeping	Medium	This VC has significant potential for extension, mainly: mixing honey to get honey cream, packaging in jars, using bee products in cosmetics and beauty products, beeswax, pollen, royal jelly, propolis, was for skin, bee venom, etc., production.

## ANNEX 5: DETAILED DESCRIPTION OF DIMENSION D: ASSESSMENT OF SOCIAL IMPACT

### D1: Women engagement in agricultural activities

Value chain	Assessment result	Assessment Rationale
Vegetables	Medium	Men and women are equally involved in vegetable production. Men cultivate, plow the land, apply herbs and pests, irrigate, etc., while women are involved mainly in collecting, sorting, storing, and packaging activities.
Potato	Medium	In the potato production, men are involved in all the work that involves machinery, irrigation, loading/unloading, and women are involved in the sorting of seeds, harvesting, and sorting and storing.
Legumes	Medium	Men do cultivation, application of pesticides and herbicides, irrigation of the field and collection (done by combine). Sorting of seeds, collection (mostly done manually by women), sorting, packaging, storing is done by women.
Grains	Low	Most of the work in grain production is done by man, as it mostly involves machinery work
Fruits	Medium	During fruit production, main cultivation, planting, irrigation and pruning works are done by men. Men equally with women participate in the collection of fruits, while men are taking care of carrying heavy boxes, women take care of sorting, drying, processing, packaging.
Berries	High	Unlike fruit, where a lot of heavy work is done by men, in berries' VC women involvement is very high, starting from planting bushes ending up with collection, sorting, processing, packaging and sells
Herbs	High	Herbs and wild herbs collection, sorting, drying, further processing and packaging involve mainly women, man involvement is very low, only in case of carrying the collected product and heavy duties if there are such in the VC.
Forage	Low	Forage VC does not require a lot of workforces, majority of activities: cultivation, irrigation, sawing, collection and transportation, are done by agricultural machinery, which involves mostly men.



Cattle	Medium	Cattle breeding VC requires equal participation for men and women. The VC has a male-specific job (taking cows to pastures, slaughtering, leatherwork, etc.) and women-specific job (milking, dairy processing, etc.) feeding usually is done by both no specific division.
Sheep	Low	Traditionally sheep breeding considered a male job. Starting from spring, sheep were taken to the mountains and returned home closer to winter. Living in the mountains, facing attacks of wolves and harsh weather conditions made the sheep grazing a male job. Nowadays women engagement is very low only in case of milking or preparing value-added products from wool.
Swine	Low	Women engagement in small and big farms of swine breeding is low. In Armenia swine is breded mainly for meet and piglet sells.
Poultry	Medium	Traditionally, poultry farming is perceived as a female job. Almost every household in Armenian rural communities farms several chickens/hens for own consumption. For the assessment of this VC, a large poultry farm was taken into consideration. In large farms, mostly male is involved in the production process. Most of the work is automated and there is a need for several workers to maintain the machinery and carry feed and boxes of products and sort eggs.
Beekeeping	Low	Beekeeping is frequently perceived to be a male activity (from cultural and traditional perspective) and women's participation in beekeeping is lower than might be expected. Carrying heavy beehives, transportation of hives from one location to another, being under attack of bees made beekeeping a male job. Women can be involved in beekeeping VC to make value-added products such as candles from beeswax, propolis, beeswax, filling and packaging honey in the jars.

## D2: Job creation potential

Value chain	Assessment result	Assessment Rationale
Vegetables	High	There are a lot of opportunities to create extra jobs and income along with the vegetables VC, i.e. at various stages of processing (drying, canning, packaging, using in other production, etc.). This chain provides a good opportunity to involve vulnerable groups in the process of growing and processing.
Potato	Medium	Currently, potato production in Armenia includes growing and taking to market, selling to a reseller or exporting. There is an untapped opportunity to add value and make other types of potato products (fries, chips, mashed potato, etc.).
Legumes	Low	Creation of extra income or extra job opportunities in Legumes VC is low. There is a lack of opportunity to add value to existing products, it's mainly sold in the markets and HORECA with its original form.
Grains	Low	Low job creation potential. The only value that is added to grains is either turning grains to feeding or flour, which requires the involvement of one person. The involvement of vulnerable groups is also low in this VC.
Fruits	High	High job creation potential along the whole fruit value chain. Fruit VC includes growing, processing (dry fruits, canned fruits, juice, confectionery, etc.), packaging, export. All the value-added parts of the chain create high income and high involvement of the workforce. Vulnerable groups can be involved in the collection, sorting and processing of fruits.
Berries	High	High job creation potential similar to fruits. This VC doesn't need high investment in the production. Mostly households collect and sell either to processors, direct consumers or resellers. Instead, they can add extra value, like a package, store in cold storages, process, dry, and get more value out of berries.
Herbs	High	The popularity and demand for wild herbs and tea are increasing every year, as people are more and more moving to an active and healthy lifestyle. With increasing demand and popularity wild collection in rural areas is also becoming a source of extra income generation opportunity. There is a possibility to add value to herbs by sorting, mixing, packaging and delivering, which will bring extra income and job opportunities. This VC is a good opportunity to involve vulnerable people.

Forage	Low	Forage VC is very limited in terms of added value and creation of extra jobs, hence extra income. One person can implement growing, harvesting, collection. Only during transportation to the storage or silage making storages can involve 2-3 male workers.
Cattle	Medium	Sub VCs of cattle breeding (milk, meat, leather) can generate extra income and create extra job opportunities in the field of dairy processing/production, leather processing, meat processing.
Sheep	Medium	Sheep breeding VC can create extra jobs and can generate extra income by processing the wool and making different types of wool product: felting, thread making, carpet making, sheep milk processing, etc. This also can increase women involvement, also allow disadvantaged/vulnerable groups to be involved in the wool processing business.
Swine	Low	There is less opportunity to create extra value in swine VC. It's going from producer to market or producer to HORECA.
Poultry	Low	Extra income generation/job creation opportunity within this VC considered low. There is a lack of opportunities to create extra value and add extra jobs, thus generating extra income with the involvement of more people.
Beekeeping	Medium	The VC of beekeeping is very short. A big portion of the honey is purchased directly from the producer, as there is a perception of quality. It's perceived that cheap honey has low quality, best honey can be purchased directly from hive owner and not the shop, the honey in the shop has suspicious quality and origin. Besides honey production, beekeeping VC includes other value-added products: candles, beeswax, hives, propolis, honeycomb, etc..

## ANNEX 6: DETAILS OF ENVIRONMENTAL IMPACT ASSESSMENT AND GREEN OPPORTUNITIES

VCs	Impact of VC on the environment (positive or adverse)		The opportunities for becoming “greener”
Vegetables including potato	Air	Air pollution through aerosols and dust resulted from the spraying of pesticides and fertilizers, emission of CO <sub>2</sub> from fuel and combustion of organic and non-organic waste.	Use of organic fertilizers and plant protection products. Proper management of organic and other wastes, exclusion of combustion and use of liquid biofuels for cultivation.
	Soil	Overdose of pesticides and chemical fertilizers. Degradation and contamination of soil. A strong influence on soil structure and mechanical composition (heavy machinery, deep plough).	Use of organic fertilizers and organic plant protection means. Implementation of crop rotation, mixed sowing, shallow or no plough technology. Management of organic and nonorganic waste.
	Water	High water demand and sensitivity. Strong effect on surface and groundwater quality. Water pollution with pesticides and fertilizers.	Introduction of modern water-saving technologies (drip and rain irrigation, mulching, use of agro-fibres. Application of organic fertilizers and plant protection means
	Waste	Inorganic solid waste (containers, packaging materials, - polyethylene films, sacks), leakage of oils and fuel, post-harvest organic waste generated during storage.	Proper waste management. Humus generation by composting of organic waste.
	Biodiversity	The strong influence of pesticides and chemical fertilizers on soil microflora and land animals, as well as insects and other animal species. The flow of pesticides and fertilizers into open water with a negative effect on aquatic ecosystems.	Application of organic fertilizers and plant protection products. Introduction of new technologies supporting bio-fertilizers and soil microflora recovery. Introduction of water-saving irrigation systems and exclusion of water leakage from cultivated areas.
Legumes	Air	A relatively small amount of pesticides and chemical fertilizers is used during the cultivation process. Emission of CO <sub>2</sub> as a result of fuel and waste burning.	Use of organic fertilizers and plant protection products. Proper management of organic and other wastes, exclusion of combustion and use of liquid biofuels.
	Soil	It can have a negative impact on soil quality if pesticides and chemical fertilizers are used during cultivation.	Stimulating the growth of nitrogen-fixing and phosphorus-mobilizing bacteria. Involvement in crop rotation significantly decreases the demand for chemical nitrogen and increases soil quality and productivity. Recommended using in combination/ together with other crops.

	Water	The water demand is not very high, especially if suitable varieties are selected to grow in a given climate zone. There may be some adverse effects on water quality if pesticides and chemical fertilizers are used during cultivation.	The role of legumes can be very important in the development of green agriculture, the right crop rotation and soil cultivation can increase yields and reduce water demand.
	Waste	Organic waste generated during post-harvest, storage and preprocessing.	Proper waste management, composting of biomass, generation of humus.
	Biodiversity	The impact on biodiversity is small as a relatively small amount of pesticides and chemical fertilizers are used during the cultivation process.	Positive impact on soil biodiversity. Important crop for sustainable agriculture.
Grains	Air	Combustion of post-harvest organic leftovers has a negative impact on air quality and greenhouse gas emissions level.	Proper waste management can decrease the emission of greenhouse gases.
	Soil	Combustion of stubble field and straw has a significant negative impact on the fertile soil.	It's necessary to introduce such cultivation technologies and new mechanisms that will reduce the cost of crop-derived biomass and mix it with the upper level of soil at a low cost.
	Water	Demand and impact on water quality are very small, mostly cultivated in non-irrigated fields.	Mixing biomass, produced during grain cultivation, with soil will improve soil quality, water absorption and retention in the soil, which will reduce water demand for following years.
	Waste	Large amounts of organic waste generated during post-collection, storage and pre-processing which are poorly managed.	Proper management and use of biomass in this VC have great potential to become biofuel, animal feed or apply to improve the soil quality.
	Biodiversity	In some cases, the negative impact is very high due to the increased number of rodents in the fields and chemicals used to fight, which results in the extinction of birds and animals in the area.	Grains have a positive effect on increasing the number of birds in the field. Proper management of some rodents in the field can make production greener.
Fruits	Air	Spraying of pesticides and fertilizers through aerosols and dust causes air pollution. Emission of CO <sub>2</sub> from fuel and combustion of organic and non-organic waste.	Use of organic fertilizers and plant protection products. Proper management of organic and other wastes, exclusion of combustion and use of liquid biofuels.
	Soil	Intense use of pesticides and fertilizers pollutes the soil.	Application of organic fertilizers and plant protection products, cultivation of perennial plants in interplanetary

			spaces, the introduction of sustainable technologies for the management of inferior parts of trees
	Water	High water demand and high negative impact on water quality as a result of the intense use of pesticides and chemical fertilizers.	Introduction of modern water-saving technologies (drip irrigation, covering of root area). Usage of anti-hail nets, which creates shadow and lowers water demand.
	Waste	Inorganic solid waste (containers, packaging materials, polyethylene films for packing, sacks), pruning leftovers, large amounts of organic waste generated during post-harvest, storage and primary processing.	Implementation of proper waste management techniques: composting, production of humus and biofuel. Usage of cold storage to decrease post-harvest waste.
	Biodiversity	Intensive use of pesticides and chemical fertilizers has a strong effect on soil microflora, entomofauna and ornithofauna.	Use of organic fertilizers and organic plant protection means, bio-fertilizers and soil microflora recovery methods. The introduction of anti-hail nets can also help reduce the negative impact on some types of biodiversity and save on plant protection means.
Berries	Air	Significant use of pesticides and chemical fertilizers (in case of cultivated berries) and emission of gases as a result of waste combustion.	Use of organic fertilizers and plant protection means, proper management of organic and other wastes, exclusion of combustion in open areas
	Soil	Significant use of soil pollution as a result of the use of pesticides and chemical fertilizers (in case of cultivated berries)	Use of organic fertilizers and organic plant protection means. Application of land cover methods in the root areas.
	Water	High water demand and sensitivity. Medium effect on water quality and pollution with pesticides and chemical fertilizers.	Introduction of modern water-saving technologies (drip irrigation, covering of root area). Use of organic fertilizers and plant protection means. Use of anti-hail nets to decrease water demand by creating shadows.
	Waste	Inorganic solid waste (containers, packaging materials, polyethylene films, sacks), pruning leftovers, large amounts of organic waste generated during post-harvest, storage and primary processing.	Proper waste management, implementation of new methods of organic waste usage: composting, production of humus and biofuel.
	Biodiversity	Use of pesticides and chemical fertilizers has some effect on soil microflora, entomofauna and ornithofauna.	Use of organic fertilizers and organic plant protection means, new technologies for bio-fertilizers and soil

			microflora recovery. Use of anti-hail nets to decrease the negative impact on some type of biodiversity.
Herbs	Air	A relatively small amount of pesticides and chemical fertilizers is used during the cultivation process. Emission of gases as a result of diesel fuel and waste combustion.	Use of organic fertilizers and organic plant protection means. Proper management of organic and other wastes, exclusion of combustion and use of liquid biofuels.
	Soil	Contamination and degradation of soil as a result of pesticides and chemical fertilizers residues, a strong influence on soil structure and mechanical composition. In the case of wild collection, the collection of certain herbs with roots and bulbs can cause local soil damage and erosion.	Use of organic fertilizers and organic plant protection means. Organic and other waste management.
	Water	High water demand and sensitivity. Medium effect on water quality and pollution with pesticides and chemical fertilizers.	Introduction of modern water-saving technologies (drip and rain irrigation, mulching, use of agro-fibres). Application of organic fertilizers and plant protection means.
	Waste	Organic waste generated during post-harvest, storage and primary processing	Proper waste management, composting of organic waste, generation of humus.
	Biodiversity	The wild collection has a significant adverse effect on biodiversity, especially in the case of incorrect and large quantities collection of specific species. It can also have a negative impact on animals by damaging nests, reducing feed base, etc.	Use of organic fertilizers and organic plant protection means, new technologies for bio-fertilizers and soil microflora recovery.
Forage	Air	Depending on the type of crop and the method of cultivation, different amounts of pesticides and chemical fertilizers are used, as well as the emission of diesel fuels and combustion of organic waste.	Use of proper management of organic and other wastes, exclusion of combustion and use of liquid biofuels.
	Soil	Depending on the type of fodder crop and the method of cultivation, the impact on soils is very different. Leguminosae plants have almost no adverse effects, while in the case of several other crops, they can have a significant adverse effect on soil quality and mineral composition.	Perennial fodder crop cultivation can significantly reduce the need for fertilizers, improves soil quality and productivity. Recommended growing perennial plants like alfalfa, clover especially uncultivated and non-irrigable soils.

	Water	In the case of annual plants, the water demand is high, but many perennial crops can be cultivated in dry conditions. In general, the effect of fodder crops on the water is not that big.	Use of organic fertilizers and organic plant protection means. Proper management of organic and other wastes, exclusion of combustion and use of liquid biofuels.
	Waste	Usually, the amount of waste generated during crop cultivation is not big, some waste is generated as a result of animal feeding leftovers.	Proper waste management, composting of organic waste, production of biofuels and humus.
	Biodiversity	The impact of fodder crops on biodiversity is not significant though sometimes pesticides can be used to fight diseases.	Use of organic fertilizers and organic plant protection means.
Cattle breeding	Air	The movement of large groups of animals generates dust, which pollutes the air. Large volumes of methane, very strong greenhouse gas, is generated from the stomachs of animals. Degradation of manure results emission of following gases into the atmosphere: ammonia, hydrogen sulfide, nitrogen oxides, etc.	Given the biological features of this species, it is almost impossible to reduce the amount of methane emitted from the pancreas into the atmosphere. It is also not possible to reduce the amount of dust. It's possible to introduce manure management methods to organize biomass and biogas production, which may reduce the emission of some gases.
	Soil	The erosion impact on soil is high, especially on the roads leading to the natural pastures and community pastures.	Proper management practices (pasture management, use of remote pastures, the establishment of animal watering facilities) can partially mitigate adverse impacts on land.
	Water	Water is directly affected due to the access of animals to the coastal areas of rivers and lakes. Pollution of open water flows with manure, veterinary preparations and disinfectants.	The impact can be mitigated through the establishment of pasture-watering facilities and the introduction of proper animal and veterinary waste management practices.
	Waste	The main sources of waste are manure, feed leftover, veterinary waste, disinfectants, liquid and solid waste generated during milk processing and after slaughter waste.	Proper waste management practices need to be introduced in the processes of veterinary, milk and meat production.
	Biodiversity	Intensive use of pastures destroys some wildlife and plant species. Pollution by animal and veterinary waste leads to the destruction of biodiversity and hydro-ecological changes.	The introduction of proper pasture management practices can have a certain positive impact on the conservation of biodiversity in that area. Prevention of outflow of animal and veterinary waste into natural watercourses can minimize their adverse impact on the aquatic ecosystem.



Sheep	Air	The movement of large groups of animals generates dust, which pollutes the air. Large volumes of methane, very strong greenhouse gas, is generated from the stomachs of animals. Degradation of manure results emission of following gases into the atmosphere: ammonia, hydrogen sulfide, nitrogen oxides, etc.	Given the biological features of this species, it is almost impossible to reduce the amount of methane emitted from the pancreas into the atmosphere. It is also not possible to reduce the amount of dust. It's possible to introduce manure management methods to organize biomass and biogas production, which may reduce the emission of some gases.
	Soil	The erosion impact on soils is considerable, especially on the roads leading to the wild and community pastures and in the pasture-watering facilities.	Proper management practices (pasture management, use of remote pastures, the establishment of animal watering facilities, setting pasturing norms) can partially mitigate adverse impacts on land.
	Water	High impact on water due to lack of animal watering facilities and movement of animals to lakes/ivers. Pollution of open water flows with manure, veterinary preparations and disinfectants.	The impact can be mitigated to some extent through the establishment of pasture-watering facilities and introduction of animal husbandry and veterinary waste management practices.
	Waste	The main sources of waste are manure, feed leftover, veterinary waste, disinfectants, liquid and solid waste generated during milk processing and slaughtering of animals.	Proper waste management practices need to be introduced in animal husbandry and veterinary and milk and meat production.
	Biodiversity	Intensive use of pastures destroys some animals and plant species. Pollution of watercourses with animal and veterinary waste leads to hydro-ecological changes and destruction of aquatic biodiversity.	The introduction of proper pasture management practices can have a certain positive impact on the conservation of biodiversity in that area. Prevention of outflow of animal and veterinary waste into natural watercourses can minimize their adverse impact on the aquatic ecosystem.
Swine	Air	The main impact on the air is the emission of gases into the atmosphere, including methane, ammonia, sulfur, nitrogen oxides.	Proper manure management practices (biomass of manure, biogas production, etc.) should be implemented in the case of swine breeding in barns, which may reduce the emission of some gases into the atmosphere.
	Soil	There is a low negative impact in case of breeding in the barns and some negative effect in the case of open-air breeding.	It's impossible to prevent the negative effect on the soil in case of open-air breeding.

	Water	The main impact on the water is due to the contamination of open waterways with manure, veterinary preparations and disinfectants.	The impact can be mitigated to some extent by the introduction of proper veterinary waste management practices.
	Waste	The main sources of waste are manure, veterinary waste, disinfectants, liquid and solid waste after slaughtering the animal.	Proper waste management practices need to be introduced in the processes of veterinary and slaughter.
	Biodiversity	In the case of breeding in barns impact on ecosystems is not so high and in the case of open-air breeding, the impact is high. Pollution of waters with animal and veterinary waste leads to certain biodiversity destruction and hydro-ecological changes.	Preventing the outflow of livestock and veterinary wastes to watercourses and designing appropriate water treatment systems can minimize the adverse impact on aquatic ecosystems. In the case of open-air breeding, it is not possible to control the impact on biodiversity.
Poultry	Air	Air pollution is characterized by the release of dust and small particles of the feather, as well as by emission of gases (methane, ammonia, sulfur, nitrogen oxides) as a result of decomposition of poultry manure.	Implementation of proper poultry manure management practices (biothermal degradation, biogas production) to reduce the emission of some gases.
	Soil	Low negative impact on the soil as commercial poultry is implemented in closed buildings.	Usage of poultry manure can be used as organic fertilizer by enriching the soil with nitrogen.
	Water	The main impact is due to the flow of poultry manure, veterinary waste and disinfectants into open water.	Can be lowered by proper waste management
	Waste	Main sources of waste are poultry manure, veterinary waste, disinfectants, waste generated after slaughter.	Proper waste management practices need to be introduced to control poultry manure, veterinary and slaughter waste.
	Biodiversity	The impact is low, but contamination of the watercourses with bird and veterinary waste results in the destruction of aquatic biodiversity and certain hydro-ecological changes.	Preventing direct outflow of bird and veterinary waste into watercourses and designing appropriate treatment systems can minimize their adverse effects on aquatic ecosystems.
Beekeeping	Air	There is no negative impact	N/A
	Soil	No or low negative impact on the soil. Sometimes low negative impact as a result of waste generated during bee treatment or beekeeping waste left in the soil.	Introduction of proper bee waste management. Control of medical substances and disinfectants, which will eliminate soil pollution.
	Water	No negative impact on water. Sometimes low negative impact as a result of waste generated during bee treatment.	Introduction of proper management of bee waste, medical substances and disinfectants, which will eliminate water pollution.

	Waste	Low level of waste, mainly organic that has no negative impact on the environment. May generate little waste from medical substances and disinfectants.	Introduce proper management of bee waste, medical substances and disinfectants.
	Biodiversity	No negative impact on biodiversity.	Positive impact on biodiversity as a result of pollination carried out by bees.

## ANNEX 7: DETAILED STATISTICS ON SELECTED VALUE CHAINS

**Table A7.1: Production area and gross harvest in target marzes, average 2016-2018**

Crop type	Lori	Share in Armenia	Shirak	Share in Armenia	Tavush	Share in Armenia	Target marzes together	Share of target marzes in Armenia	Armenia, Total
<b>Sown area, ha</b>									
Peas for grain	93.3	42%	24.3	11%	5.0	2%	122.7	54.6%	224.7
Beans	164.7	10%	25.0	2%	472.0	28%	661.7	39.9%	1,658.3
Lentils	11.0	12%	31.0	35%	2.0	2%	44.0	49.4%	89.0
Chickpeas	6.3	9%	15.3	22%	1.0	1%	22.7	33.2%	68.3
Other leguminous	1.5	16%	6.3	66%	-	0%	7.8	81.0%	9.7
<b>Total</b>	<b>276.8</b>	<b>14%</b>	<b>102.0</b>	<b>5%</b>	<b>480.0</b>	<b>23%</b>	<b>858.8</b>	<b>42%</b>	<b>2,050.0</b>

**Gross harvest, in tons, average 2016-2018**

Peas for grain	161.1	36.7%	83.0	18.9%	5.7	1.3%	249.8	56.9%	438.6
Beans	328.7	9.1%	113.8	3.1%	640.6	17.7%	1,083.1	29.9%	3,620.7
Lentils	11.4	10.0%	45.4	39.8%	1.6	1.4%	58.4	51.2%	114.2
Chickpeas	8.1	6.5%	23.4	18.9%	0.6	0.5%	32.1	25.9%	123.9
Other leguminous	2.0	16.8%	8.2	68.9%	-	0.0%	10.2	85.7%	11.9
<b>Total</b>	<b>511.2</b>	<b>11.9%</b>	<b>273.8</b>	<b>6.4%</b>	<b>648.5</b>	<b>15.0%</b>	<b>1,433.5</b>	<b>33.3%</b>	<b>4,309.4</b>

Source: SC RA

**Table A7.2: Sown area, in ha, average 2016-2018**

Crop type	Lori	Share in % in marz	Share in Armenia	Shirak	Share in % in marz	Share in Armenia	Tavush	Share in % in marz	Share in Armenia	Armenia
<b>Potato</b>	<b>4,133.0</b>	<b>72%</b>	<b>16%</b>	<b>3,830.7</b>	<b>69%</b>	<b>15%</b>	<b>1,454.7</b>	<b>62%</b>	<b>6%</b>	<b>25,423.7</b>
<b>Vegetable crops</b>	<b>1,580.0</b>	<b>28%</b>	<b>6%</b>	<b>1,701.0</b>	<b>31%</b>	<b>6%</b>	<b>893.0</b>	<b>38%</b>	<b>3%</b>	<b>26,723.3</b>
Cabbage	610.0	11%	16%	497.0	9%	13%	59.7	3%	2%	3,756.7
<i>of which: cauliflower</i>	14.3	0%	3%	101.3	2%	23%	-	0%	0%	440.3
Cucumber	104.7	2%	4%	75.0	1%	3%	129.0	5%	5%	2,351.3
Tomato	89.7	2%	1%	58.7	1%	1%	150.7	6%	2%	6,083.3
Eggplant	1.7	0%	0%	2.7	0%	0%	23.3	1%	1%	2,068.3
Pepper	9.7	0%	0%	18.3	0%	1%	45.0	2%	2%	2,350.3
Beet	121.0	2%	16%	320.7	6%	42%	37.0	2%	5%	771.0
Carrot	121.3	2%	14%	312.0	6%	36%	25.3	1%	3%	869.0
Onion	102.0	2%	5%	42.3	1%	2%	126.7	5%	7%	1,868.0
Garlic	172.3	3%	17%	131.0	2%	13%	67.3	3%	7%	1,011.7
Green peas	24.3	0%	21%	15.7	0%	14%	20.7	1%	18%	116.0
Green beans	119.7	2%	9%	46.7	1%	4%	132.0	6%	10%	1,279.3
Other vegetables	103.7	2%	3%	124.7	2%	4%	73.3	3%	2%	3,211.7
<b>Total sown area</b>	<b>5,713.0</b>	<b>100%</b>	<b>11%</b>	<b>5,531.7</b>	<b>100%</b>	<b>11%</b>	<b>2,347.7</b>	<b>100%</b>	<b>5%</b>	<b>52,147.0</b>

Source: SC RA

**Table A7.3: Gross harvest, in 1000 tons, average 2016-2018**

Crop type	Lori	Share in Armenia	Shirak	Share in Armenia	Tavush	Share in Armenia	Share of target marzes in Armenia	Armenia
<b>Potato</b>	<b>66.8</b>	<b>13%</b>	<b>93.7</b>	<b>18%</b>	<b>15.1</b>	<b>3%</b>	<b>34%</b>	<b>520.7</b>
<b>Vegetable crops</b>	<b>26.5</b>	<b>4%</b>	<b>45.7</b>	<b>6%</b>	<b>8.6</b>	<b>1%</b>	<b>11%</b>	<b>731.1</b>
Cabbage	19.8	16%	17.1	14%	1.1	1%	31%	124.1
<i>of which: cauliflower</i>	0.1	1%	3.4	24%	0.0	0%	25%	14.3
Cucumber	0.7	1%	1.8	3%	1.4	2%	6%	61.8
Tomato	0.7	0%	1.4	1%	1.6	1%	2%	218.0
Eggplant	0.0	0%	0.1	0%	0.2	0%	0%	69.8
Pepper	0.1	0%	0.3	0%	0.3	0%	1%	69.9
Beet	1.4	8%	10.0	55%	0.5	3%	66%	18.2
Carrot	1.2	6%	7.6	38%	0.2	1%	46%	19.8
Onion	0.5	1%	1.0	2%	1.1	2%	6%	47.0
Garlic	0.9	7%	2.4	20%	0.4	3%	30%	12.4
Green peas	0.1	7%	0.3	33%	0.1	12%	53%	0.9
Green beans	0.6	4%	0.9	6%	0.9	6%	15%	16.1
Other vegetables	0.6	1%	2.6	4%	0.7	1%	5%	72.8
<b>Total harvest, 1000 tons</b>	<b>93.3</b>	<b>7%</b>	<b>139.4</b>	<b>11%</b>	<b>23.7</b>	<b>2%</b>	<b>20%</b>	<b>1,251.7</b>

Source: SC RA

## ANNEX 8: SWOT ANALYSIS OF SELECTED VALUE CHAINS

<b>Strength</b>	
<b>Legumes</b>	<ul style="list-style-type: none"> <li>– Good taste and flavor due to specifics of soil, water, and sun</li> <li>– Benefits from combination with grain production, i.e. good crop rotation and enhancing productivity</li> <li>– Experience in the cultivation of legumes</li> <li>– Benefits from the possibility of using the same production technology and machines used in grain production</li> </ul>
<b>Vegetables</b>	<ul style="list-style-type: none"> <li>– Good taste and flavor due to specifics of soil, water, and sun</li> <li>– Favorable climate and high productivity for many vegetables (garlic, carrots, onions, green peas, asparagus, etc.)</li> <li>– Relatively low use of chemicals and pesticides</li> </ul>
<b>Fruits &amp; Berries</b>	<ul style="list-style-type: none"> <li>– High-quality product, with good taste and flavor due to specifics of soil, water, and sun</li> <li>– Relatively high employment generation potential in rural areas</li> </ul>
<b>Sheep</b>	<ul style="list-style-type: none"> <li>– Long tradition of sheep husbandry in certain regions/communities</li> <li>– Comparatively low risk agricultural activity</li> <li>– Relatively lower need for initial investments and operational expenses for breeding</li> </ul>
<b>Herbs</b>	<ul style="list-style-type: none"> <li>– High-quality product, with good taste and flavor due to specifics of soil, water and sun</li> <li>– Relatively high employment generation potential in rural areas</li> <li>– Rich biodiversity of herbs and availability of various eco-zones in the country</li> <li>– Long tradition for medical use of herbs and the national diet</li> </ul>
<b>Weaknesses</b>	
<b>Legumes</b>	<ul style="list-style-type: none"> <li>– Inefficiencies in production – higher costs and low economy of scale</li> <li>– Difficulties to meet demands of large wholesalers and distributors</li> <li>– Poor quality food control in Armenia. Sub-quality imports, as well as local products, can enter into the retail market and destroy the competition</li> <li>– Lack of local seed production/supply</li> <li>– Outdated machinery</li> <li>– Non-implementation of pre-planting seed treatment (use of inoculants to stimulate the development of nitrogen-fixing bacteria on the roots)</li> <li>– Limited access to consultancy or extension service</li> </ul>
<b>Vegetables</b>	<ul style="list-style-type: none"> <li>– Difficulties to meet demands of large wholesalers and distributors</li> <li>– Logistical difficulties in marketing/export</li> <li>– Lack of knowledge and low application of good vegetable production practices</li> <li>– Irrigation water access and quality issues. Poor water quality for drip irrigation.</li> <li>– Poor quality management practices among farmers.</li> <li>– Weak official quality control system</li> <li>– Poor agricultural services (e.g. soil quality monitoring, agronomy, machinery)</li> <li>– Lack of proper marketing activities (market information, packaging, branding, positioning, etc.)</li> <li>– Old agricultural machinery</li> <li>– High production cost compared to foreign competitors</li> </ul>

<b>Fruits &amp; Berries</b>	<ul style="list-style-type: none"> <li>– Difficulties to meet demands of processors, large wholesalers and distributors</li> <li>– Logistical difficulties in marketing/export</li> <li>– Lack of knowledge and environmentally responsible behavior among collectors/ farmers</li> <li>– Low experience in herb cultivation among farmers and processors</li> <li>– Poor quality management practices among farmers and weak quality infrastructure</li> <li>– High production cost compared to foreign competitors</li> <li>– Lack of proper marketing activities (market information, packaging, branding, positioning, etc.)</li> </ul>
<b>Sheep</b>	<ul style="list-style-type: none"> <li>– Poor farming and animal management and feeding practices leading to low productivity and environmental challenges</li> <li>– Absence of local professional animal breeding capacity</li> <li>– Strong taste and smell of sheep and goat cheeses due to poor feeding and milking, and cheese production practices</li> <li>– Lack of milking equipment for sheep and proper milking facilities in remote pastures which significantly affects the quality of the milk making it less marketable</li> <li>– Limited capacity of wool processing and underdeveloped business of wool products</li> <li>– Lack of good shepherds (Shepherd job is not attractive and it is challenging for farmers to find good shepherds)</li> <li>– Poor veterinary service system</li> </ul>
<b>Herbs</b>	<ul style="list-style-type: none"> <li>– Difficulties to meet the demands of processors, large wholesalers and distributors</li> <li>– Logistical difficulties in marketing/export</li> <li>– Lack of knowledge and environmentally responsible behavior among collectors/farmers</li> <li>– Low experience in herb cultivation among farmers and processors</li> <li>– Poor quality management practices among farmers and weak quality infrastructure</li> <li>– High production cost compared to foreign competitors</li> <li>– Lack of proper marketing activities (market information, proper packaging, branding, positioning, etc.)</li> </ul>
<b>Opportunities</b>	
<b>Legumes</b>	<ul style="list-style-type: none"> <li>– Import substitution potential</li> <li>– High nutritional value and increasing demand in healthy lifestyle /gym among youth</li> <li>– Export potential for organic product</li> <li>– Well adaptation to non-favorable climatic and various soil conditions to produce in higher altitudes and generate higher income compares to cereal crops</li> <li>– As rotational crops improve soil quality and positively influence on the yield of following cereal crops</li> </ul>
<b>Vegetables</b>	<ul style="list-style-type: none"> <li>– High demand for Armenian fruits in Russia, CIS, US and in Armenian diaspora</li> <li>– New market opportunities for non-traditional vegetables (e.g. UAE for asparagus, etc.)</li> <li>– Processing factories across Armenia</li> <li>– Foreign donor assistance to agricultural sector</li> <li>– Availability of crop breeding station in Shirak region (to improve input quality and introduce new varieties)</li> </ul>
<b>Fruits &amp; Berries</b>	<ul style="list-style-type: none"> <li>– Increasing global demand for herbal products</li> <li>– Familiarity with Armenian herbs in Russia, CIS, USA and in other countries with large Armenian diaspora</li> <li>– Wider expansion possibilities in foreign markets: EAEU an EU</li> <li>– Foreign donor assistance to agricultural sector</li> </ul>

	<ul style="list-style-type: none"> <li>– Opportunities for cultivation of herbs which will help to reduce or eliminate the negative impact due to unsustainable wild herb collection</li> </ul>
<b>Sheep</b>	<ul style="list-style-type: none"> <li>– High reputation of sheep, goat cheeses among local customers</li> <li>– Availability of local processing facilities: skin processing in Yerevan and wool processing in Amasia,</li> <li>– Existence of strong rug/carpet production in Armenia</li> <li>– High demand for sheep meat in Middle East muslim countries</li> <li>– New productive breeds that are adapted to local conditions</li> <li>– Support from international donor organizations</li> <li>– Support under GoA programs provides opportunities for expanding the production and improving the quality and productivity of farms/animals</li> <li>– Low % loans provided to sheep farmers</li> </ul>
<b>Herbs</b>	<ul style="list-style-type: none"> <li>– Increasing global demand for herbal products</li> <li>– Familiarity with Armenian herbs in Russia, CIS, USA and other countries with a large Armenian diaspora</li> <li>– Wider expansion possibilities in foreign markets: EAEU an EU</li> <li>– Foreign donor assistance to the agricultural sector</li> <li>– Opportunities for the cultivation of herbs which will help to reduce or eliminate the negative impact due to unsustainable wild herb collection</li> <li>– Ecotourism and agroforestry development</li> </ul>
<b>Threats</b>	
<b>Legumes</b>	<ul style="list-style-type: none"> <li>– Price pressure by imports from EEU countries and China</li> </ul>
<b>Vegetables</b>	<ul style="list-style-type: none"> <li>– Financial Risks/high % loans</li> <li>– Natural disasters (hail, drought, etc.)</li> <li>– Risks associated with engaging in export activities (e.g. foreign exchange risk)</li> <li>– Water pollution due to poor wastewater management (which will deteriorate safety and quality of vegetables)</li> <li>– Soil pollution due to improper application of pesticides and fertilizers</li> <li>– Lack of cold storages may limit the export growth potential and affect product quality</li> <li>– Climate change impact, e.g. new diseases, reduced precipitation</li> </ul>
<b>Fruits &amp; Berries</b>	<ul style="list-style-type: none"> <li>– Environmental risks - destruction of biodiversity in forests and alpine meadows due to unsustainable collection</li> </ul>
<b>Sheep</b>	<ul style="list-style-type: none"> <li>– Attacks of wolves in the pastures as well as in barns</li> <li>– Environmental risks - soil degradation and desertification, and destruction of biodiversity in the pastures</li> <li>– Disease like brucellosis, which is stronger than in case of cows</li> <li>– Poor equipment and management of pastures may significantly limit the possibilities of further growth (due to lack of feed)</li> </ul>
<b>Herbs</b>	<ul style="list-style-type: none"> <li>– In the case of wild collection, there are some environmental risks that non-sustainable management of harvesting of wild plants, may result in the destruction of biodiversity in forests and alpine meadows due to unsustainable collection</li> </ul>



## ANNEX 9: LIST OF PRODUCERS IN TARGET MARZES

### Lori

Name	Community	Sector	Sub-sector	Scale
Liparit Darchinyan	Spitak	Vegetables	Cabbage	1 ha
Artem Papoyan	Spitak, Shirakamut	Vegetables	Garlic, Onion, Carrots	0.5 ha
Samvel Nalbandyan	Odzun	Vegetables	Green beans, green peas	1 ha
		Legumes	Beans	1 ha
Alvard Davoyan	Vardablur	Non-traditional and traditional vegetables	Artichoke, rucola	1 ha
Artashes Karapetyan	Spitak	Non-traditional and traditional vegetables	Cucumber, tomatoes, greens, kale asparagus	0.3 ha green house+5 ha garden
Alvard Mkrtchyan	Spitak	Non-traditional and high value vegetables	Broccoli, cucumber, greens	0.2 ha
Karen Zalinyan	Gargar	Non-traditional vegetables	Broccoli, Brussels cucumber	1 ha
Karen Simonyan	Aqori	Vegetables	Greenhouse tomato, green beans, onion, cucumber	many
		Fruits and berries	Raspberry, blackberry, cornel	9 ha
Karen Voskanyan	Spitak, Ayrum	Fruits and berries	Nuts, cherry, persimmon, almonds, figs, peach	nuts- 2.5 ha, other- 5ha
Arsen Gharibyan	Odzun	Fruits and berries	Cherry, persimmon, raspberry	big
		Legumes	Maize, beans	20-35 ah
Arman Matinyan	Odzun	Fruits and berries	Blackberry, black currant	3.6 ha
		Herbs	Herbs	
Arsen Harutyunyan	Lernantsq	Fruits and berries	Raspberry, apple, pear	3 ha
Karen Tamazyan	Aqori,	Fruits and berries	Raspberry, blackberry, cornel	0.5 ha
Ararat Atoyan	Shaumyan	Fruits and berries	Raspberry	3 ha
Marine Harutunyan	Kurtan	Fruits and berries	Raspberry, blackberry	1 ha
Aghasi Zafaryan, Vardan Matosyan	Aygehat	Fruits and berries	Nuts, apricot	20 ha
Ruslan Kirakosyan	Alaverdi	Fruits and berries	Blackberry, raspberry, cornus	
Narek Simonyan	Akori	Fruits and berries	Raspberry, blackberry, cornel	2 ha
Arkadi Qochinyan	Vahagni	Fruits and berries	Raspberry	1 ha
Aleksandr Ghukasyan	Hobardzi	Fruits and berries	Raspberry, dried fruits	
Narek Gevorgyan	Kurtan	Fruits and berries	Raspberry	
Martik Virabyan	Lernantsq	Legumes	Lentil, pea, peas	25 ha

Levik Abgaryan	Spitak, Lernancq	Legumes	Buckwheat	2 ha
Hrayr Yaghubyan	Mets Parni	Legumes+ processing	Flax, pea	10 ha
Artur Danilyan	Odzun	Legumes	Maize	10 ha-with potato and forage
Vachagan Hovhannisyan	Karmir Aghek	Legumes	Maize	30 ha-with potato and wheat
Arsen Titanyan	Odzun	Legumes	Maize,	30-40 ha with potato and grains
Rafik Ghazinyan	Alaverdi	Herbs	Herbs	0.04 ha
Gagik Avagyan	Gogaran	Sheep	Sheep	
Garnik Margaryan	Margahovit	Sheep	Sheep	
"Erfyan" LLC, Rafik	Saralanj	Sheep	Sheep	
Sargis Ramazyan	Qarinj	Sheep	Sheep	
Norayr Poghosyan	Qarinj	Sheep	Sheep	
Levon Poghosyan	Atan	Sheep	Sheep	

## Shirak

Name	Community	Sector	Sub-sector	Scale
Harut Khachatryan	Marmashen	Legumes	Green peas	1 ha
			Beans	1 ha
Karen Minasyan	Mayisyan	Legumes	Beans	0.5 ha
		Vegetables	Carrot	1 ha
			Cabbage	1 ha
Spiridon Melkonyan	Arevik	Legumes	Beans	1 ha
		Vegetables	Carrot	1 ha
Levon Tarloyan	Marmashen	Vegetables	Carrot	1 ha
			Cauliflower, Cabbage	2 ha
Minas Kavelyan	Shirak	Vegetables	Carrot	2 ha
		Sheep	Sheep	40
Rustam Manukyan	Marmashen	Vegetables	Carrot	1 ha
		Sheep	Sheep	40
Manvel Papoyan	Marmashen	Fruits and berries	Peach, Apricot	1.5 ha
Karen Arshakyan	Marmashen	Fruits and berries	Raspberries	3 ha
Ruben Torosyan	Marmashen	Sheep	Sheep	100
Samvel Ghazaryan	Ghazannchi	Legumes	Lentils, peas	
		Vegetables	Green peas	
Koryun Sumbulyan	Bavra	Legumes	Lentils, peas, green peas	
		Vegetables	Green peas	

		Fruits and berries	Strawberries, blackberries, blueberries, gooseberry, yochta	
Sergey Soghoyan	Mets Sepasar	Legumes	Lentils, green peas	
Stepan Nazaryan	Arapi	Legumes	Beans	
		Vegetables	Kohlrabi	
			Coriander, dill, mint parsley, rosemary	10 ha
Garegin Muradyan	Tavshut	Legumes	Green peas	
Grigor Aleksanyan	Voghji	Legumes	Beans, lentils	
Vahag Hovhannisyan	Krasar	Legumes	Green peas	
Ararat Poghosyan	Sizavet	Vegetables	Garlic	
		Legumes	Lentils, flex, chickpeas, peas, oats	5 ha
Vardan Papoyan	Azatan	Vegetables	Wheat, barley, corn, potatoes	15 ha
Vasya Arshakyan	Voskehask	Berries	Raspberries	
Norayr Harutyunyan	Gharibjanyan	Vegetables	Cabbage, cauliflower, broccoli, potatoes	10 ha
Hovhannes Gaboyan	Karnut	Vegetables	Carrot, potato, cabbage, beet	150 ha
		Sheep	Sheep	

## Tavush

Name	Community	Sector	Sub-sector	Scale
Yuri Khachatryan	Haghtanak	Fruits and berries	Peach, goldcrest	14 ha
Samvel Gasparyan	Noyemberyan	Fruits and berries	Raspberries, apples, cornel	50 ha
Slavik Zurnachyan	Haghtanak	Fruits and berries	Cornel. Goldcrest	55 ha
Rafik Ohanyan	Ptghavan	Fruits and berries	Peach, goldcrest, artichoke, strawberries	70 ha
Mher Baghinyan	Haghtanak	Vegetables	radish	40 ha
Hayk Petrosyan	Getahovit	Sheep	Sheep	
Gor Abrahamyan	Norashen	Fruits and berries		60 ha
Samvel Stepanyan	Gandzakar	Legumes	Beans	1 ha