EXPORT SUPPLY CHAIN OF GREENHOUSE CROPS

ARMENIA

IN PARTNERSHIP WITH

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EXECUTIVE SUMMARY

The mapping of the export supply chain of greenhouse crops[1] has been implemented within the framework of the IFC Armenia Investment Climate Reform Project of the World Bank Group. The project aims to contribute to improving the country's investment climate and thereby to attract investments into branches of its economy. One of the project's aspects is to increase the investment attractiveness of several agribusiness branches and to promote the export and competitiveness of selected agricultural products by identifying issues in export supply chains and targeting interventions directed at addressing those issues. The RA Ministry of Economic Development and Investments has given priority to greenhouse crop production, because of its great potential for export.

The mapping of the export supply chain of greenhouse crops aims to:

1. Identify issues present in the greenhouse crop export supply chain, including market imperfections and, legal and regulatory obstacles;
2. Develop recommendations to resolve the problems or challenges so identified, to improve the business and investment environment and to increase productivity and product competitiveness;
3. Contribute to enhancing the investment attractiveness of the greenhouse crop production sector.

The mapping focuses on both government regulations and policy in the agribusiness supply chain as well as market imperfections and their impact on the supply chain operation.

For the mapping, the supply chain and its effectiveness are viewed from a business perspective (including primary producers, exporters, retailers and wholesalers, processors, transporters, and other relevant businesses involved in the supply chain). In order to compile the necessary information, meetings and discussions were held with supply chain participants, including public and private stakeholders. Meetings were also held with international donor organizations active in the Armenian agribusiness sector in an effort to learn from their valuable experiences and views.[2] The review used local and international information sources, official statistical data, and local and international reviews and analytical materials pertaining to greenhouse crop production.[3]

1 In Armenia, two terms are used for greenhouse farms "ջերմոց" (greenhouse) and "ջերմատուն" (hothouse) or «ջերմատնային տնտեսություն» (greenhouse enterprise or farm). The term "Ջերմոց" (greenhouse) refers to structures or farms that lack heating, while "ջերմատուն" (hothouse) refers to structures that are heated. In this paper, for the sake of brevity, the common "greenhouse" term is used to designate both notions.

2 The meetings took place between December 2015 and July 2016.

3 The list of used materials and sources is presented in Annex 3.

A. MAIN ISSUES

Greenhouse crop production in Armenia is an attractive for investors sector with high growth potential in both production and export. It has demonstrated a high growth rate and marked profitability, particularly during the recent four years, when the total area of greenhouse farms increased by nearly 2.5 times, from 510 hectares in 2011 to 1220 hectares (2016). At the same time, the technological sophistication of greenhouse farms has rapidly increased. Most newly built and under-construction large greenhouses are equipped with and deploy modern technologies.

Armenian greenhouse enterprises produce and export vegetables (tomato and cucumber), mushrooms, berries (strawberry), and flowers (roses, gerberas, and carnations). The main export destinations are markets in Russia and other CIS countries.

Promotion of greenhouse crop production and export is important in the agenda of the Government of Armenia, as reflected in a number of its strategic documents and programs aimed at sustainable development and enhancing international competitiveness of the sector (see "Government Programs and Policy" section). To promote investments, the government exempted from VAT the import of greenhouse complexes and of a number of resources used in greenhouse crop production.

Nevertheless, a number of challenges along the sector's development path face both the government and the private business entities. These are briefly introduced below. It is important to note that there are differences between the challenges and opportunities faced by small and medium greenhouse farms on the one hand, and large greenhouse enterprises on the other hand. To simplify, the differences (if any) due to sizes of greenhouses are indicated under each discussed issue, instead of presenting them in separate sections.

Pre-production phase

1. ***Crops, varieties, and the quality of seeds and saplings (planting material):*** From the perspective of enhancing productivity and competitiveness, the selection of high quality and appropriate crop varieties, as well as the use of quality seeds and planting material are important. *Small and medium greenhouse* farms in Armenia lack sufficient knowledge in selection of high-quality crop varieties and seeds, as well as in their appropriate use.

   Furthermore, the selection of crop varieties responding to requirements of domestic and especially foreign markets is very important for *both small and medium and large greenhouse farms*. Greenhouse farmers can and need to introduce high-value crops enjoying demand in internal and external markets, in addition to tomatoes and cucumbers - traditionally produced main greenhouse crops in Armenia. Armenian producers face difficulties achieving competitive-

ness of tomatoes and cucumbers in domestic and international markets, especially during the heating season.

2. ***Import procedures:*** Exemption of the import of greenhouse complexes from VAT since the beginning of 2015 is a positive development that will contribute to steering investments into the greenhouse sector. Reduction of the customs duty (from 10 percent to 5 percent) for planting material of flowers is anticipated within the framework of Armenia's accession to the Eurasian Economic Union (EEU). However, there are problematic issues in relation to customs and technical (phytosanitary) control procedures for imports, which do not allow businesses to utilize effectively the potential benefits of these exemptions. Due to these issues businesses incur extra costs and waste of time. This increases the market prices of those products and hinders attraction of investments into the sector. Particular problems include:
   - Ambiguities and complexity of customs classification and formalities in relation to greenhouse complexes and systems and equipment (including their fittings and spare parts) used in greenhouse complexes;
   - Complexity of customs formalities when importing greenhouse complexes in several batches;
   - Problems associated with classification of drip irrigation systems;
   - Levy of the customs duty and VAT at the border on import of saplings and seedlings;
   - Increase of customs duty (tariff) rates in the framework of the EEU: In the framework of Armenia's membership in the EEU, it is anticipated (after 3-5 years transition period) to increase customs duty rates for import of a number of important greenhouse inputs (for instance, greenhouses, vegetable seeds, fertilizers, and pesticides). In the medium- and long-term perspectives, this may lead to higher market prices of those products.
3. ***Selection of greenhouse structures:*** Most greenhouses in Armenia, especially *small and medium ones,* are equipped with outdated technologies; this results in low productivity and high energy losses. With the increasing number of high-technology greenhouses introduced during the recent years, it is very important to make investments in such advanced greenhouses, which best fit the local conditions in Armenia. For example, according to expert opinion, greenhouses covered with high-quality plastic film (double-layer) may be more effective in Armenia than glass greenhouses. Note that plastic greenhouses require at least 20–30 percent less investment than glass greenhouses. Currently, leading global greenhouse manufacturers offer high-technology plastic film covers both for small- and medium-size greenhouses.
4. ***Cadastral classification of greenhouse structures:*** Economic entities mention uncertainties about provisions related to classification of greenhouse structures. As a result, greenhouse farms face problems associated with tax

procedures, obtaining loans (in respect of collateral) and other dimensions of business operation.

5. ***Availability and accessibility of finance:*** Long-term loans (at least 4–7 years) are necessary for the establishment and operation of high-technology greenhouses. In Armenia, businesses face difficulties in accessing long-term loans. The difficulty of accessing loans, high interest rates, and inflexible loan terms create serious impediments to attracting investments. Other financial resources — such as leasing, funding of projects, credit lines, and so forth — also are inaccessible, This problem occurs both in *small and medium and in large greenhouse enterprises*.

Production phase

6. ***Energy efficiency issues:*** In Armenia, the majority of *greenhouses of all sizes* use natural gas for heating. In the previous four years, the increase of the natural gas price has led to increased production costs of greenhouse farms and hence has weakened their price competitiveness. The recent reduction of the gas price in 2016 is expected to benefit greenhouse crop producers in term of cost reduction. Administrative problems in the gas supply and collection of charges (relationships between HayRusGazArd and economic entities) cause unnecessary costs and encumbrances, including:
   - Claim and collection of one-month advance payment in the beginning (sometimes also during) of the heating season, by HayRusGazArd;
   - Gas supply cut off by HayRusGazArd (due to non-payment for gas supply), causing freezing and damage of harvest;
   - Economic entities also mention poor quality of supplied gas (pressure, density, composition), which increases the volume and thus cost of gas required for heating.
7. ***Import procedures:*** Procedures for the import of fertilizers and pesticides (insecticides, fungicides, others) are complicated and will become even more complicated after Armenia's accession into EEU membership; time is wasted and additional costs are incurred, ultimately increasing the existing market prices of goods. In particular:
   - the technical control procedure for import of fertilizers and pesticides is complicated and includes repeated provision of permission (license) for each batch;
   - phytosanitary certification procedure (requiring sampling and laboratory testing of each batch).
8. ***Application of fertilizers and pesticides:*** The frequency of ineffectiveness of applied fertilizers and pesticides in Armenia is high, which decreases the productivity (increases costs and decreases the yield). Possible causes of this include unawareness of suppliers and users about proper practices of storing

and handling or usage of fertilizers and pesticides, some imperfections of the registration procedure of fertilizers and pesticides, as well as unfair competition practices in the market leading to import and trading of low quality, expired fertilizers and pesticides. This problem is particularly acute in *small and medium greenhouses*, though it exists in *large greenhouses* as well.

9. ***Safety and quality of agricultural products:*** For increasing product competitiveness and entering certain markets (in particular, the EU market where strict food quality and safety standards apply and, after the transition period, the Eurasian Economic Union (EEU) market,), there is a need to enhance productivity and to improve product quality and safety indicators. In Armenian greenhouses, especially in *small and medium* ones, internationally accepted good production and hygiene practices have not yet found widespread application, such as Global GAP (Good Agriculture Practice), particularly for greenhouse crop production, UNECE marketing standards for fruits and vegetables, fruit and vegetable marketing standards and requirements of the EU, and standards and requirements of Codex Alimentarius. In large greenhouses, production conditions and systems are of incomparably higher quality; however, GAP systems have not yet found widespread application there as well. *In small and medium greenhouse farms,* the quality and competitiveness of products suffer also due to failure to place proper efforts in selecting effective crop varieties and insufficient focus on sorting and packaging of products.
10. ***Productivity and production technologies:*** Armenian producers lag foreign competitors in price competitiveness — for example, in winter, tomatoes are imported to Armenia from Turkey at a much cheaper price, ousting the local agricultural produce. Nonetheless, in order to increase competitiveness and to enter foreign markets, the reduction of costs and the increase of productivity have become today's imperatives. In parallel to increasing the productivity, it is critical to pay attention to marketing issues, for ensuring that the increased volume of produce has a market. To reduce costs and increase productivity, it is necessary to take the following measures:
    - For enhancing productivity and quality, and ensuring organization of uninterrupted or shortly interrupted year-round production, it is necessary to introduce modern high-tech greenhouses and to educate businesses and relevant specialists.
    - Simplify import procedures to the extent possible (as mentioned above), which is important for reduction of price, thereby reducing the costs of used raw materials, including seeds and planting materials, fertilizers and chemicals, irrigation and other systems and tools.
    - Increase the productivity and reduce losses through application of appropriate greenhouse management technologies or practices, for instance, through appropriate use of fertilizers and pesticides, accurate evaluation and planning of costs and production growth.

- With regard to productivity, effective marketing is of high importance too. For example, parallel to reduction of costs, the productivity can be increased also through selection of crops; that is, select such crops and packages or otherwise introduce them in a way as to enable their trading at a high price in both internal and external markets.

The space of sophisticated *(particularly large) greenhouses* is rapidly expanding in Armenia, yet it remains small so far (10 percent of the total space). The productivity is low *in small and medium simple greenhouses* (10–20 kg/m^2), and production interruptions throughout a year are long (4–5 months), resulting in the decrease of total annual productivity of greenhouse space. Those interruptions decrease also the competitiveness of greenhouse crop producers in the market, in terms of their inability to ensure uninterrupted supply.

11. ***Human capacities:*** Shortage of specialists may become one of the most influential factors limiting the further development of the greenhouse agriculture sector, unless it receives proper and prompt attention. This equally refers to *greenhouses of all sizes*. In the greenhouse industry, there is an acute need for the following specialists:
    - Agronomist,
    - Agricultural chemist,
    - Hydroponics specialist, and
    - Plant protection specialist.

    At the same time, it is also necessary to strengthen human capacities for the application of GAP and other applicable good practices, systems, or standards.

    From the perspective of human capacity development, it is very important to increase the role of the state and make it more effective. At present, the public expenditure in agricultural extension (advisory) area is too small to ensure any significant outcomes (397.2 million Armenian dram (AMD), or approximately USD 831,000 in 2016). Extension services in Armenia are mainly provided by Regional Agricultural Support Centers, which need significant enhancement of capacities in order to be able to achieve their mission.

12. ***Branch associations and cooperatives:*** Greenhouse Association of Armenia is an important organization functioning in the sector. Accelerated development of the greenhouse crop production has brought challenges with it. To face those challenges, the Greenhouse Association needs further strengthening of its capacities; with its current capacities, the association will be unable to fulfill its tasks duly.

13. ***Availability of cash and access to finance:*** Scarcity of accessible financial resources and small number of financial instruments seriously limit the development of greenhouse crop production. Economic entities, especial *small and medium greenhouses,* face problems in terms of ensuring both working capital and financing. In addition, a serious portion of other problems associated with

scarcity of financial resources or financing relates to poor financial management knowledge and capacities of economic entities. See also paragraph 5 above.

Marketing and export phase

14. ***Export markets and products:*** As mentioned above, for entering new markets and enhancing competitiveness in the existing and new markets, the selection and packaging or otherwise introducing of appropriate crops is a priority. There is a need to invest in high-value crops enjoying demand in internal and international markets, based on studies of international markets.

    Focusing on a single market as large as the Russian market is dangerous. Important developments occurring in the Russian market prove the hazardousness of such focus. The competition in the Russian market has drastically intensified, despite international economic sanctions against Russia and limitations applied by Russia lately on imports from Turkey. After lifting international economic sanctions against Iran last year, the country's role in exporting vegetables and fruits to the Russian market will probably grow; prices of Iranian vegetables are rather competitive. In parallel, competition from other countries intensifies as well. Under the conditions of depreciation of the national currency of Russia, financial risks of Armenian exporters grow, and hence, their competitive positions weaken.

    Considering the limitation and saturation of the Armenian internal market of vegetables and flowers, in the present stage of the greenhouse sector development, prior to expansion of greenhouses, it is important to pay attention to ensuring export markets, as well as to crops and varieties that meet the existing demands of those markets.

15. ***Human capacities:*** For further development of the sector, there is a need to strengthen the knowledge and capacities now, in such areas as external markets and marketing opportunities, as well as development of distribution channels.

    Simultaneously, for effective marketing, *small and medium producers* need to raise the knowledge level required for joint marketing, as well as for organization of trade and cargo shipment logistics (see paragraph 16 below):

16. ***Joint marketing of the produce of small and medium greenhouses:*** To benefit from wide export opportunities effectively, small and medium greenhouses need to join their capacities both for acquisition of raw materials and inputs and for marketing of products. For effective joining of capacities, economic entities must improve their knowledge and skills in such areas as:

    - Selection of marketable and transportable crop varieties, and uniform use of such varieties by economic entities;
    - Organization of the regular supply of sufficient volume;
    - Ensuring compliance with food safety requirements;

- Ensuring stable and homogenous production — ensuring standard appearance and quality through classification and sorting of products, including by sizes, color, ripeness, and firmness or softness, and
- Ensuring standard packaging.

17. **Challenges and opportunities associated with the EEU membership:** Since January 1, 2015, Armenia has been a signatory to the Eurasian Economic Union (EEU), which along with an expected improvement in export opportunities has also brought some changes and uncertainty into export processes. As an example, businesses are often unaware of expected changes in procedures affecting the actual export flow to Russia or other EEU markets.

    After the one-year transition period, changes are expected in the EEU export procedures and in agricultural production requirements. In particular:

    - Provision of certifications (at present, certificates are required for each batch of imported and exported products);
    - In addition to phytosanitary certification, additional mandatory sanitary requirements for vegetables and flowers will be introduced (which implies corresponding documentation requirements as well);
    - Stricter food safety requirements will be introduced for exported products, and particularly, a new mandatory requirement to introduce the HACCP system in production.

    Incorporating these changes will require greenhouse crop producers to introduce new or to improve existing production safety systems; and this, in turn, will require extra investment and staff training. This will be hard to implement especially for *small and medium economic entities*.

18. ***Means of transportation:*** In Armenia, economic entities face difficulties due to shortage of trucks especially in the summer season, when open-field cultivated crops are harvested, and export volumes grow. In that season, cargo shipment prices grow too. The shortage of trucks is often filled by renting Russian or Georgian trucks.

19. ***Export procedures:*** Economic entities incur additional costs and waste of time due to export procedures, which ultimately decreases their competitiveness in external markets. In particular:

    - Border crossing and customs formality procedures at the Georgian-Russian Lars border crossing point are complicated and unpredictable (which also include informal "facilitation fees");
    - Some problematic procedures pertaining to applying the VAT on exported goods.

B. SHORT- TO MEDIUM-TERM RECOMMENDATIONS

Short-term (12 to 18 months)

1. It is necessary to analyze the problems associated with the gas supply (such as advance payment requirement by HayRusGazArd, and gas supply cut off during the cold season) and develop solutions to these problems. Recommended solutions may be: (a) elimination of the advance payment requirement by HayRusGazArd in practice; (b) development of a flexible mechanism of making payments for the supplied gas, which will take into consideration the cycle (seasonality) of the greenhouse production, and (c) increase of effectiveness of gas quality control.

   In parallel, it is important to work towards the use of alternative energy sources at greenhouse farms and introduction of energy-saving technologies and practices (for additional information, see also paragraph 9 in mid-term recommendations section below).

2. For further development of the branch, it is necessary to address the issue of shortage of specialists now. Considering that development of an academic educational program by Armenian National Agrarian University may take a long time, it is necessary to develop promptly professional training modules (jointly with respective professional organizations functioning in the sector) and to organize training of highly qualified technical professionals in the following specialties:
   - Agronomist,
   - Agricultural chemist,
   - Hydroponics specialist, and
   - Plant protection specialist.

3. To spur further development of the branch, it is necessary to enhance among economic entities (especially *small and medium greenhouses*) knowledge and skills in production technologies, export markets and export opportunities, and organization of distribution networks; in particular:
   - Modern greenhouse complexes and systems and supplies used therein;
   - Modern high performance technologies of greenhouse horticulture;
   - Correct selection and use of fertilizers and pesticides;
   - Correct selection of crops, crop varieties, and seeds;
   - Product sorting, packaging, storage and transportation;
   - Marketing and supply chain management;
   - Food safety and quality management good practices (GAP).

4. There is a need for designing and utilizing investment and greenhouse production and export financing mechanisms such as: (a) availability of long-term loans (up to 7 years); (b) introduction of effective leasing mechanisms and

procedures; (c) funding of investment and other projects; (d) provision of credit lines, and (e) insurance of production and export.

For boosting investments, it is very important to develop such flexible mechanisms of financing and insurance coverage, which will take into account the greenhouse production cycle (seasonality) and other peculiarities.

An effective tool of investment promotion policy in the greenhouse sector can be offering of tailor-made investment loans and grants for the establishment of high-tech greenhouses, introduction of energy-efficient technologies, as well as development of supporting facilities, such as cold storage facilities, sorting, packaging or other handling workshops.

Within that framework, it is very important to provide due support to cooperation between economic entities (in a form of cooperatives or associations), directed at ensuring standard, high quality, and safe production that meets market (especially export market) requirements. In particular, providing assistance to the establishment of small and medium-size harvest collection and sorting facilities may be a good example of proposed support.

5. Clarification of relevant legal provisions is necessary with respect to definitions or classifications of greenhouse structures, greenhouse crop production, and related tax procedures.

   In order to enable economic entities to benefit effectively from privileges or special procedures defined by the government, it is necessary to carry out proper awareness raising and explanatory works among the economic entities about relevant policy measures. This relates, particularly, to customs and tax procedures granting privileges defined by RA Government decisions 1118-N, 1119-N and other resolutions; RA Law on the List of Goods Imported by Organizations and Private Entrepreneurs, Subject to a Zero Percent Rate of Customs Duties and Exempt from Excise Tax).

6. There is a need to carry out an additional study of details of import and export procedures, and simplify and facilitate of those procedures, in particular:
   - Improvement and simplification of classification methods and procedures for greenhouses and structures, systems, devices and other commodities used in the greenhouse production;
   - Development of a respective customs formality procedure for import of greenhouse complexes, taking into consideration specifics of the sector and the commodity;
   - Clarification and simplification of VAT application procedures (taking into consideration problems related to the EEU membership, for example, it is necessary to review the procedures in a way that Armenian exporters will not suffer or be punished in cases when their Russian partners delay payment of the VAT in Russia);

- Simplification of phytosanitary control of fertilizers, pesticides and other substances, as well as procedures of issuing licenses or permissions;

7. Conducting studies for the purposes of making use of opportunities arising from the EEU membership, as well as diminishing potential uncertainty and problems due to procedures and requirements; ensuring awareness of representatives of the public and private sectors, particularly about the EEU market export and import customs and technical control procedures and related issues;
8. Capacity strengthening in organizations and cooperatives functioning in the greenhouse agriculture sector, enabling them to address effectively the requirements arising from accelerated development of the greenhouse crop production. The Greenhouse Association of Armenia in particular needs capacity strengthening.

   Promotion of cooperation between economic entities engaged in the greenhouse sector is important particularly for defining and meeting product safety and quality standards, as well as for collecting and packaging of products for export.
9. For the purpose of diversification of export markets, conduct studies of other export markets besides Russian, in order to explore entry potentials and to take steps of entering those markets. In this respect, Armenian economic entities should pay attention to increasing competitiveness of their products, in terms of both cost reduction and product assortment and quality.
10. From a perspective of human capacity development, it is very important to increase significantly the amount and effectiveness of the public expenditures and enhance the role of the government in the areas of provision of advice and propagation of knowledge.
11. Include fruits and vegetables in the list of priority products enjoying export support from the Export Promotion Committee (defined by the RA Prime Minister's Decision No 5-A of January 13, 2016).

Medium-term (18 months to 3 years)

12. It is important to increase energy efficiency in greenhouse farms through application of modern technologies. Ensuring energy efficiency in the greenhouse enterprises is of vital importance for increasing the competitiveness of the Armenian greenhouse products. Potential measures of increasing energy efficiency include (among others):
    - Besides natural gas, use of alternative energy sources, such as solar energy or geothermal energy, which may help to reduce heating costs;
    - Use of high energy-efficient and energy-saving heating and cooling systems in the greenhouses;
    - Use of high energy-saving greenhouses, such as double-layer and air-inflated

plastic greenhouses that ensure high energy saving, and

- Use of energy-saving lighting and other equipment in the greenhouses.

Consideration of opportunities of introducing and using Combined Heat and Power (CHP) systems in the greenhouses may be justified from the energy-saving perspective (especially in large, technologically sophisticated greenhouse enterprises).

An effective tool of the policy of promoting introduction of alternative and energy saving technologies in the greenhouse sector may be offering of tailor made investment loans or grants on terms designed specifically for introduction of such technologies.

13. The development and implementation of an investment promotion program in the greenhouse crop production sector would be required to attract investments into establishment of both greenhouses and supporting infrastructures, such as cold storages facilities and warehouses.
14. It is necessary to develop and introduce relevant educational programs at the Armenian National Agrarian University (or another educational institution), in order to train highly qualified professionals specialized in the greenhouse farming industry.
15. It is important to ensure the establishment and development of centers for local production of planting materials and seeds.
16. Measures shall be taken to simplify export procedures for EEU markets while expediting the smooth transition to new requirements and procedures. In particular, this refers to:
    - Measures directed at smooth transition while reducing or eliminating possible difficulties associated with the new food safety and sanitary control requirements and procedures after the one-year transition period;
    - Developing comprehensive and simple export procedure guidelines for businesses pertaining to EEU markets (Russia in particular);
    - Continuing collaboration, and reaching agreements, with the relevant Russian and Georgian authorities, on issues related to maintaining clarity and consistency of the procedure applied at the Lars border crossing point.
    - Identifying alternative import and export transportation routes other than the route through Lars, making the arrangements necessary for effective utilization of those routes (for instance, the routes through Black sea ports).

GREENHOUSE CROPS EXPORT SUPPLY CHAIN ANALYSIS

The mapping considers the chain and its efficiency from the business perspective of producers and importers of seeds and other raw materials, greenhouse farmers, exporters, retailers and wholesalers, processors, freight forwarders, and others. Export chains include both pre-production phase, such as obtaining (or importing) raw materials and relevant permits, and post-production phase, such as product shipment, packaging, storing, and export-related procedures. See the diagram of the greenhouse crops export chain in figure 8.

1. BRIEF SECTOR REVIEW

Greenhouse crop production in Armenia is an economic sector with both high production and export growth potential and, therefore, attractive for investors. It has demonstrated and continues to demonstrate a high growth rate and profitability. The branch development has gathered great momentum especially over the last four to five years.

As of July 1, 2016, greenhouse farms operating in Armenia covered a total of 1220 hectares.[4] Note that four years ago greenhouse farms occupied only 500 hectares of area (figure 1).

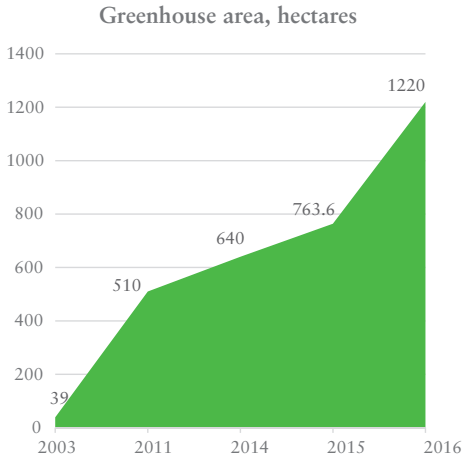


Figure 1. Source: Ministry of Agriculture of Armenia

Investments in the sector have grown drastically.[5] Advanced technology greenhouses (particularly those equipped with Dutch and French technologies) are being established, ensuring high productivity and quality. As of mid-2016, modern, advanced-technology greenhouses occupied 100 hectares of total area.

Data on the volumes of agricultural production of greenhouse farms are not available. Official segregated statistics on greenhouse production are not maintained.

4 According to working data from the Ministry of Agriculture. Source: official website of the Ministry of Agriculture www.minagro.am (last accessed September 23, 2016):

5 Source: RA Ministry of Agriculture: http://minagro.am/en/agriculture-in-armenia/horticulture/.

Brief analysis of the Armenian greenhouse sector

STRENGTHS	WEAKNESSES
⅄ Large number of sunny days, which contributes to ensuring higher yield and longer duration of supply ⅄ Solar radiation intensity ⅄ High reputation of Armenian vegetables and fruits in the markets of Russia and other CIS countries (taste characteristics) ⅄ Growth of introduction of high-tech greenhouses in the last years ⅄ Favorable conditions for investments in greenhouses (import of greenhouse complexes is VAT exempt)	⅄ Acute shortage of agronomists, plant protection specialists, and other greenhouse operations specialists ⅄ Inability of the educational system to prepare highly qualified specialists ⅄ Complexity of import procedures ⅄ High heating costs ⅄ High cost of greenhouse vegetables during the heating season ⅄ Difficulty of accessing investment and financial resources ⅄ Difficulty of ensuring stable quality and quantity due to small sizes and low technologies of greenhouses ⅄ Weak marketing in terms of introducing new export crops and occupying the market ⅄ Absence or insufficiency of production safety and quality management systems

OPPORTUNITIES	THREATS
⅄ Encouragement of greenhouse sector by the RA government ⅄ Increase of productivity and energy saving through introduction of high-tech greenhouses and systems ⅄ Presence of the traditional large Russian market (increase of opportunities in the background of economic sanctions against Russia) ⅄ Banning of imports from Turkey to Russia ⅄ Opportunities of exporting to other markets	⅄ Concentration on the Russian market ⅄ Iran's entry into the Russian market (due to lifting of sanctions against Iran) ⅄ Intensification of general competition in the traditional Russian market; entry of other countries or strengthening of their positions ⅄ Potential tightening of safety and quality requirements in traditional and other export markets

2. PRE-PRODUCTION PHASE

2.1 Land

Currently, the area of land under greenhouses in Armenia is about 763.6 hectares, marking a rapid expansion tendency.

Land allocation, principles and procedures of land category determination, and respective tax relations are of primary significance for greenhouse farming.

To establish and operate a greenhouse in Armenia, no special permission for land use or agricultural activity is required. In case of establishing a greenhouse, the land under the greenhouse is classified as land for "Other production purposes" (see box 1).

Box 1.

According to provisions of Article 6 of the RA Land Code, based on its intended purpose of land use (categories), the land in the Republic of Armenia is classified:

1. Agricultural
2. Settlement
3. Industrial, for entrails-use and other production purposes
4. Energetic, transport, communicational, public structural
5. Specially protected areas
6. Special importance
7. Forestry
8. Water
9. Reserved land

The calculated net income determined by the cadastral evaluation of the land shall be the object of taxation for **agricultural lands**. The value of the land according to the cadastral evaluation shall be the object of taxation of **non-agricultural lands.**

The land tax rate for the agricultural lands (including land lots allotted for housing in settlements, and garden-plots) shall be 15 percent of the calculated net income determined by their cadastral evaluation.

For non-agricultural lands, the land tax rates are defined 1 percent — inside the settlements, and 0.5 percent — outside the settlements.

Lands under greenhouses, according to the RA Land Code, are classified to "Other" land category as "Agricultural production objects".

The cadastral value of lands is determined in accordance with the procedure and based on the zoning defined by the RA Government Decision No 1746-N dated April 17, 2003 "On Approval of Regulation of Cadastral Valuation of the Land, Location Zoning Coefficients and Boundaries of RA settlements."

To establish a greenhouse, the need to change the land category or the purpose of land use often arises. In case of changing the land category from "agricultural" to "industrial," the cadastral value of the land and the land tax calculation method and rate change as well.

Until 2013, the procedures of land allocation and change of land category (for instance, from "agricultural" to "industrial") were very complex, time consuming and expensive. They included seeking approvals of a large number of departmental agencies, discussions at an ad hoc interdepartmental commission and final approval of the government, which often took long months. In addition, payments charged from economic entities for the change of the land category were very high. Thus, according to the previous procedure, economic entities were required to pay to the community budget the difference between the cadastral values of the land when changing its purpose from "agricultural" to "industrial," which quite often totaled to a large sum (possibly to millions of drams per hectare).

The procedure of land allotment and changing the target purpose of the land has been simplified essentially and reduced in costs since 2013.[6] The previous complex procedure is now replaced with the following:

- Larger powers are vested in municipal authorities; economic entities may resolve issues directed with and by the consent of municipalities. Thus, the head of the community now has the right to change the target purpose of a land parcel and to issue a construction permit.
- Economic entities engaged in greenhouse and a number of other agricultural activities are not required to pay to the community budget "the difference of the cadastral values of land parcels existing at the time of changing the target purpose, if after the changing of target purpose of the land parcels its cadastral value is higher than before the change."

Nevertheless, for instance the law amendment regarding simplification of the procedure and shortening of the duration fully facilities the process only in cases when the master plan of the municipality envisages an "industrial" land in the particular location. Otherwise, to change the category of the land, the head of the municipality must initiate and process the same complex and long procedure with respect to changing the master plan.

2.2. Greenhouse structures and complexes

Greenhouses used in Armenia

Operating greenhouses in Armenia may be grouped by their structure as follows:

- Film plastic (polyethylene) greenhouses designed for production of herbs, seed-

6 Corresponding amendments were incorporated in Article 7 of the RA Land Code, as well as in the RA Law on Urban Development.

lings and small volume of vegetables (these greenhouses do not require large investment and construction works). In general, plastic greenhouses may occupy rather large area and allow large-scale production.

- Metal or polymer framed heated greenhouses covered with glass, rough polymer material or membranous plastic film designed for larger scale (commercial production). Such greenhouses are not equipped with improved technologies (low technology greenhouses). For examples, they lack nutrition, cooling, moisturizing, or shading systems, as well as computerized control systems.

Figure 2. Low technology glass greenhouse, cucumber

Figure 3. Simple plastic greenhouse

- Large plastic or glass greenhouses mainly installed on metal frame, equipped with advanced technologies (including improved technologies of plant irrigation and nutrition systems, heating and cooling, moisturizing, light and shade control, and computerized control systems). High-tech film manufacturing technologies permit constructing commercial-size large greenhouses, which are not inferior to glass greenhouses in any way.

Figure 4. High-technology glass greenhouse, cucumber

Figure 5. High-technology plastic greenhouse, tomato

Figure 6. High-technology glass greenhouse, roses

Figure 7. High-technology glass greenhouse, tomato

Moreover, there is an opinion among greenhouse specialists that the use of high-tech film plastic greenhouses would be more effective in the climatic conditions present in Armenia (high temperature and solar radiation, long sunny period). Nowadays, over 85 percent of greenhouses worldwide are plastic greenhouses. Plastic greenhouses have several advantages over glass greenhouses, such as:

- Improved sunlight penetration and dispersion properties;
- Higher energy saving, particularly the greenhouses covered with double-layer and gas-inflated plastic film (energy savings of 30 percent more than single-layer plastic film covered greenhouses);
- Improved air ventilation and moisture control properties, particularly through opening of the roof (while using insect-proof nets);
- Greater height (up to 16 meters) and larger volume of the greenhouse structure;
- Plastic greenhouses require relatively smaller amount of investments — 20–30 percent less than corresponding glass greenhouses.

One of the disadvantages of the plastic greenhouses is the need to change the film every several years (3–5 year or more), depending of the solar radiation.

Improved high-tech greenhouse complexes are imported (Dutch and French complexes enjoy high reputation in the market). Nevertheless, to promote investments in the sector, it is important to ensure simple and easy import procedures and requirements. Currently, there is a need for clarification of the relevant regulations and laws with respect to definitions or classifications of greenhouse structures and greenhouse crop production activities, as well as related customs and tax procedures. A number of important regulatory and procedural issues related to import are discussed below.

The import of greenhouses has been VAT exempt since 2015.[7] It is an import-

7 RA Law On Approving List of Goods Imported by Organizations and Private Entrepreneurs, Subject to a Zero Percent Rate of Customs Duties and Exempt from Excise Tax, adopted on February 26, 2015.

ant change, which, if enforced effectively, may spur investments and positively affect the sector's development. Before this exemption, VAT was levied on import of greenhouses and collected by customs at the border, and as businesses report, the greenhouse import procedures before 2015 were complicated, lengthy and expensive.

Economic entities report that during customs formalities of importing greenhouse complexes, often the customs body requires to classify and clear the complex part-by-part, rather than as a whole assembly. For example, first declare and clear metal pipes, poles, or columns separately (by weight), then cooling, shading, or nutrition supplying devices, and so forth. This approach results in changing the customs classification code of the commodity and customs and tax regimes applied to the commodity, leading to considerable increase of customs duties and taxes due.

There is another important peculiarity and circumstance concerning import of greenhouse complexes: A modern greenhouse complex is a large and bulky commodity and, often, it may be impossible to manufacture and supply all of its assembled components at the same time, in a single batch. In addition, an investor may find expedient, from mere technical considerations, to import the complex part by part, based on the sequence of building works. In other words, a greenhouse complex (which is bulky enough to be transported in ten or more trucks), often may be imported in several batches (shipment lots) rather than simultaneously, in a single batch. In this case, to avoid unnecessary waste of money and time, it is important to design customs and other formalities and procedures related to the import in a way as to consider all those circumstances, where appropriate.

Economic entities report that customs and other import formalities and procedures often do not take into consideration the peculiarity of a greenhouse import; the customs body requires declaring each batch as a separate independent import, rather than a part of the complex. Nevertheless, if the importer wishes to declare it as a "greenhouse complex," then he should place the already arrived part(s) of the complex in the customs warehouse and wait for the arrival of the next batch(es), until the greenhouse complex is replenished. In that case, the importer incurs fines for the delay of the customs formality and additional costs for storage.

In this respect, after Armenia's accession to membership in the Eurasian Economic Union (EEU), an important change has occurred in the customs formality procedure, which may help to resolve some of the problems associated with the import of greenhouses. In particular, under the new procedures, economic entities can apply for preliminary classification of a greenhouse complex, based on an application submitted in advance. According to Article 64 of the RA Law on Customs Regulation, "A product which has not been assembled or has been disassembled, including an incomplete or unaccomplished set, and is going to be imported or exported by separate shipment lots within a period of time not exceeding the

term defined by Article 170 of the Customs Code of the Customs Union, may be declared with one classification code, being stated according the Commodity Classification of Foreign Economic Activities, provided there is a customs body's decision on classification of the product." The EEU Customs Code (Article 170) prescribes a 2–4 month period for temporary storage of commodities.

Enforcement of this change can ease the import of greenhouses, if economic entities are provided with an opportunity of transporting the separate shipment lots to its premises (rather than incur large costs for storage in the customs warehouse until the arrival of the next batch).

In order to enable economic entities to benefit effectively from privileges or special procedures defined by the government, it is necessary to make clarifications and amendments in relevant regulations, and awareness raising among the economic entities (for example, in relation to customs and tax procedures granting privileges, which are defined in the Customs Code of the EEU, in RA Government decisions 1118-N, 1119-N and other resolutions; RA Law on Approval of List of Goods Imported by Organizations and Private Entrepreneurs, Subject to a Zero Percent Rate of Customs Duties and Exempt from Excise Tax).

Another peculiarity of importing greenhouses is their measurement in kilograms for customs purposes. Such situation, from an investment or economic perspective, in essence means that an investor acquires a high-tech greenhouse complex by area (square meters) and by technological equipment (performance level), yet declares it by weight, in tons (as scrap metal).

In the framework of Armenia's membership in the Eurasian Economic Union (EEU), the customs duty rate on import of greenhouses will be increased up to 8.8 percent (instead of previously effective 0 percent) from 2019.[8] That change will also affect greenhouse prices, causing a price hike. It is anticipated, that the customs duty rate will remain unchanged (0 percent) until 2017 inclusively; in 2018, it will increase to 2 percent, and reach to 8.8 percent starting from 2019. Additional details on the timeline of the customs duty (tariff) rates applied to goods imported into Armenia from third countries within the EEU framework are provided in Annex 1.

Cadastral classification of the greenhouse structures is one of the important issues of the greenhouse industry. Economic entities express concerns regarding

8 Sources:

(1) The Treaty on the Accession of the Republic of Armenia to the Treaty on the Eurasian Economic Union, May 29, 2014; EEU official website: http://www.eurasiancommission.org/ru/Lists/EECDocs/635486381049072687.pdf. last visited on January 20, 2016.

(2) Eurasian Economic Commission Council Resolution No 54, dated July 16, 2012. Eurasian Economic Commission official website: http://www.eurasiancommission.org/ru/act/trade/catr/ett/Documents/ett94%2020.09.2015.pdf (last visited on January 1, 2016).

ambiguities of the legal provisions pertaining to the classification of greenhouse structures, which lead to problems in taxation procedures and in other dimensions of their business activity. This includes, for instance: (a) insufficient clarity of state registration procedures of property rights for greenhouses, due to which businesses face collateral difficulties when obtaining loans from banks; (b) limitations in relation to allocating land for production purposes, including greenhouse crop production, in a number of villages and towns. These issues are regulated by the Law on State Registration of Property Right, the Government Decision No 498 of 11 May 2002[9], and other legal acts.

2.3 Greenhouse irrigation systems and other equipment

The introduction of advanced irrigation systems, particularly drip irrigation systems, is becoming widespread in the greenhouse operations. Drip irrigation systems are imported from different countries, such as Korea, EU countries, Israel, and China.

VAT on the import of drip systems is not calculated and collected at the border.

As mentioned by business entities, tariff classification of goods is one of the problems they encounter in the customs procedures when importing drip irrigation systems. The customs body often requires filing of additional documents, in order to classify a drip system as such, instead of an ordinary rubber or plastic pipe. There are instances, when classification of the drip irrigation system as an ordinary pipe leads to changing customs and tax regimes applied thereof (as a result, due duty and tax amounts increase).

2.4 Seeds and planting material

A large portion of vegetable seeds used for agricultural production in Armenia is imported. The country produces less than 10 percent of about 24 tons of total vegetable seeds used annually. The geographic scope of vegetable seed imports is wide and diversified, including EU countries, Russia, the United States, and Turkey. So is the assortment of imported seeds; producers have wide choices.

The main local producer of seeds is the Scientific Center of Vegetable, Melon and Industrial Crops (SCVIC), a state non-commercial organization (SNCO), which produces 500–800 kg of seeds annually (tomato, cucumber, beans, and pepper). The SCVIC also produces 3 million seeds in open fields and 200,000 seedlings in greenhouses annually.

The shortage of treated (infection-resistant) planting material in Armenia is a problem, which affects the productivity, as well as the choice of the crop to be cultivated. For instance, according to the specialists (from SCVIC), the lack of the

9 RA Government Decision No 498 of May 11, 2002, "On Restricting Construction of Residential, Public and Production Buildings and Structures on Agricultural Lands owned by Citizens and Legal Entities."

treated plant material was one the main reasons of the reduction of carnation production in Armenia in recent years.

Small greenhouse farmers often lack sufficient knowledge of selecting high quality seeds and using them correctly. Their knowledge is insufficient also in selection of competitive and marketable varieties. For example, selection of crop varieties that have long durability and high transportability may increase competitiveness of greenhouse crops in local and external markets.

The import of planting materials of saplings, seedlings, and especially flowers is subject to customs duty and collection of VAT at the border, which increases their prices in the market. According to economic entities, the high price not only increases the costs (and decreases the rate of return), but also decreases the productivity. For example, the high price prompts the economic entities to use the plants longer, in consideration of saving, as well as to organize independently, with no relevant knowledge, the reproduction of the planting material.[10] These practices reduce productivity and often result in origination and spreading of plant diseases.

Prior to Armenia's accession to membership in the EEU, the customs duty rate on import of seedlings and planting material (saplings) was 10 percent. In the framework of the EEU membership, customs duty on seedlings and planting material (sapling) will remain effective, yet at a lesser rate — 5 percent (no transition period).[11] The customs duty rate of 9 percent applies to import of rose bushes. For details on customs duty rates, see Annex 1.

There were no major issues indicated by businesses in relation to importation of seeds.

2.5 Availability of investment and financial resources

Introduction of advanced technology greenhouses and expansion of greenhouse crop production require significant financial investments. Meanwhile, such investments often require long-term financing. For example, according to business entities, the term of the loan for the establishment of up to 1 hectare of sophisticated greenhouse should be at least 4 years, and up to 7 years, for several hectares of greenhouse area.

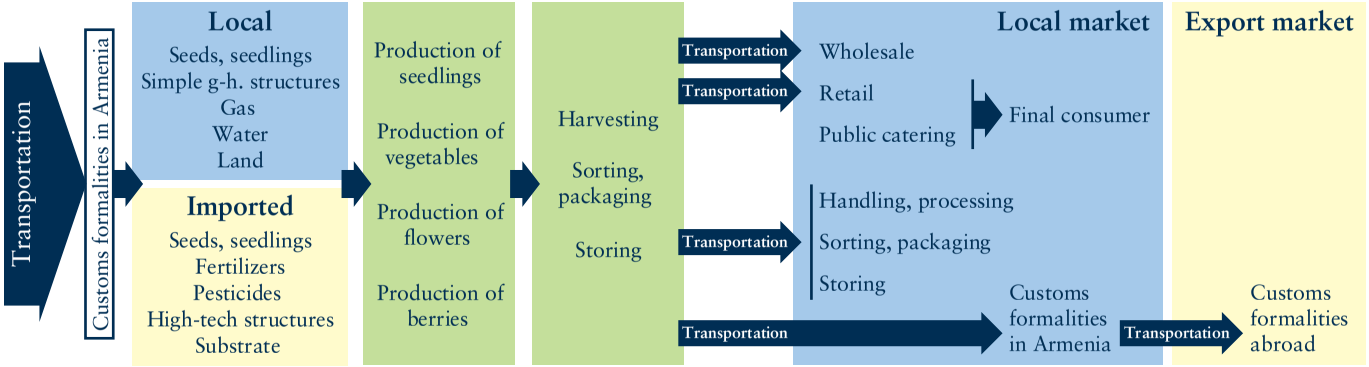
It is difficult for businesses to access long-term loans in Armenia. Difficult access to loans is a serious hampering factor from a perspective of investment promotion.

Other financing resources too are not accessible, such as leasing, project financing, credit lines, and so forth.

10 For instance, in Holland, the gerbera daisy plant is used 2–3 years, while Armenian producers use it up to 5–6 years.

11 With the exception of grapevine sapling, where 0 percent EEU import tariff rate is applied.

Figure 8. Export chain of greenhouse crops



- Import permission
- Import customs procedure
- Import phytosanitary procedure
- Lars border crossing procedures
- Poti seaport procedures (Georgia)

- Land allocation and category determination procedures
- Procedures of determining cadastral status of a greenhouse structure
- Requirements to points of sale of fertilizers and pesticides
- Certification

- GAP
- GMP
- GHP
- Sanitary rules & norms
- Certification
- Cold storage facility
- Greenhouse products classification and customs/tax regulation
- Knowledge in use of fertilizers and pesticides
- Production technologies
- Selection of varieties

- GHP
- GMP
- Sanitary rules & norms
- Certification
- Cold storage facility

- RA customs procedure
- Transportation costs
- Refrigerated trucks
- Airport procedures
- Lars border crossing procedures
- Poti seaport procedures (Georgia)
- Trade financing

3. PRODUCTION PHASE

In 2015, greenhouse enterprises in Armenia covered 764 hectares of total space. Segregated statistics (by crops) on greenhouse production are not collected and maintained. The breakdown of greenhouse production, according to expert valuations, is as follows:

- Vegetables — 60 percent (mainly tomato, cucumber, and less amount of pepper bean)
- Flowers and decorative plants — 35 percent (roses, gerbera, carnation)
- Berries — 5 percent (strawberry)

3.1 Some characteristics of the production in Armenia

One of the advantages of the Armenian climate is the abundance of solar light and large number of sunny days particularly in the sub-mountainous regions, such as Kotayk, Aragatsotn, and Vayots Dzor. This important advantage may allow attaining higher productivity and qualitative properties.

3.2 Water, heating and gas

Greenhouse enterprises use mostly natural gas for heating. The share of gas heating spending in the total costs is high, reaching to 40-50 percent of total production costs.

Due to the rise in gas prices in 2015, the costs of greenhouse operations have increased and, accordingly, the rate of return has decreased. The gas prices have increased by 20 percent in the last 3–4 years. The gas tariff for large consumers (spending over 10,000 cubic meters monthly), such as greenhouses, is AMD equivalent of USD 276,98 per 1,000 cubic meters (VAT included).[12] Since July 2016, the gas price for larger consumers reduced to USD 214.63, which will contribute to cost reduction in greenhouse crop production. Considering the fact that the gas tariff supplied to greenhouses is calculated in Armenian dram equivalent to USD, greenhouse enterprises incur significant losses due to depreciation of the national currency as well (as it happened in the yearend of 2014 and the beginning of 2015).[13]

12 Source: RA Public Services Regulatory Commission: http://www.psrc.am/am/sectors/gas/tariffs (last visited on October 30, 2015). In Armenia, a two-layer tariff system is introduced, where different tariffs and calculation methods are applied to consumers spending (a) up to 10,000 cubic meters and (b) 10,000 and over cubic meters of gas. Thus, the gas tariff for consumers spending up to 10,000 cubic meters of gas (households fall under this classification) is 156 Armenian dram; the calculation is made in AMD. Since July 1, 2016, the prices were reduced to USD 214.63 and 122.25 AMD, respectively.

13 Sources: Foreign exchange rates quoted in the box retrieved from the official website of the Central Bank of Armenia https://www.cba.am/am/sitepages/exchangearchive.aspx?DateFrom=2014-10-01&DateTo=2015-02-28&ISOCodes=USD, (last accessed on September 9, 2015); and calculations of the author.

According to information provided by economic entities, one of the problems associated with the gas supply is HayRusGazArd's frequent claims to pay an advance payment under the threat of cutting off the gas in the beginning of the heating season. As a rule, advance payment is requested in the beginning of the heating season, at the amount of one-month gas consumption charge. The requirement to effect advance payment, in fact, is a violation of contractual provisions.

Box 2. Exchange rate fluctuation and gas price

Between October 2014 and February 2015, when comparatively large amount of gas is required for heating of greenhouses, the exchange rate of Armenian dram (AMD) to US dollar dropped by 17 percent, which in turn resulted in at least 17 percent increase of gas spending.

	Oct. 2014	Feb. 2015
Price of 1m^3 gas in USD	0.277	0.277
USD/AMD	409.98	478.39
Price of 1m^3 gas in AMD	113.56	132.50

Another problem facing greenhouse farms relates to working capital flow, which mainly becomes available after the harvest season, while economic entities cannot accurately control the date and time of crop ripening. Therefore, sometimes greenhouse farms fail to pay bills for gas in time, due to mismatching of working capital flow and payment periods. As reported, there were some cases when representatives of the gas supplying company cut off the gas supply causing destructions of greenhouse crops (especially in cold season).

Economic entities also mention about the poor quality of supplied gas (pressure, density, composition), which increases the volume of gas required for heating and, consequently, spending. The energy efficiency can be increased by introducing and using modern technologies in greenhouse farms. Ensuring energy efficiency in the greenhouse enterprises is of vital importance for increasing the competitiveness of the Armenian greenhouse products. Potential measures of increasing energy efficiency include (among others):

- Besides natural gas, use of alternative energy sources, such as solar energy or geothermal energy, which may help to reduce heating costs;
- Use of high energy-efficient and energy-saving heating and cooling systems in greenhouses;
- Use of high energy-saving greenhouses, such as greenhouses covered with double-layer and air-inflated plastic film that ensures high energy saving; and
- Use of energy-saving lighting and other equipment in the greenhouses.

Consideration of opportunities of introducing and using Combined Heat and Power (CHP) systems in the greenhouses may be justified from an energy-saving perspective (especially in large, sophisticated greenhouse enterprises).

3.3 Technologies and productivity

Greenhouses

Since 2011, the total area of greenhouse farms equipped with sophisticated technologies has increased drastically. According to expert estimation, in 2011, the total area of high-tech greenhouse operations was less than 5 hectares; in mid-2016, that indicator reached to 100 hectares.

In spite of the increase of high-tech greenhouses, its space still remains small, constituting only 10 percent of the total greenhouse space. Most greenhouses are not equipped with heating, cooling, moisturizing, shading, nutrition applying, computer control and other modern improved systems.

According to expert estimation, establishment of a high-tech glass greenhouse installed on metal frame requires 150–200 USD investment per square meter — so establishment of 1 hectare of sophisticated greenhouse farm requires an investment amount of $1.5–2M.

There are also technologically equipped plastic greenhouse farms in the market; the amount of investments required for establishment of a square meter of greenhouse is $80–100 (or $0.8–1 million per ha).

Production methods

In Armenian greenhouses, crops are cultivated both by traditional (in soil) and hydroponics (on substrates) planting methods (including vegetables, flowers, and berries).

Drip irrigation and nutrition-applying technologies have been used in greenhouse production of Armenia for over a decade.

About three-fourths of large greenhouses use improved-performance technologies, which, by their characteristics, may be classified in two groups:

- Saving technologies (labor saving, cost reducing)
- Economies of scale technologies (increase of scale and growth of productivity).

The larger the greenhouse farm, the higher is the use of technologies that increase productivity. [14]

To increase product competitiveness and to enter foreign markets (in particular, the EU market where strict food quality and safety standard apply and, after the transition period, the EEU market,), there is a need for improvements in productivity[15] and product quality and safety.

14 AmeriaGroup, "Industrial Agriculture in Armenia: Development Trends," 2014.

15 In parallel to a productivity increase, it is critical to pay due attention to ensuring that production is backed by actual market demand and access to that market.

This can be achieved through:

- The introduction and application of Global GAP (Good Agriculture Practice), in particular, for greenhouse agricultural crops[16]; UNECE[17] marketing standards for fruits and vegetables; fruit and vegetable marketing standards of the EU[18]; standards and requirements of Codex Alimentarius[19]; and other internationally accepted practices, standards and systems, and
- Strengthening of human resource capacity to use GAP and other applicable practices and standards.

Productivity

Vegetables: The productivity of tomatoes and cucumbers is several times higher in sophisticated greenhouses than in simple technology greenhouses. In simple, low technology greenhouses, the annual productivity of soil-grown tomatoes and cucumbers per square meter ranges between 10 and 20 kilograms, while in high-tech greenhouses using hydroponics method of cultivation the annual productivity reaches 50–60 kg per square meter. The productivity in Armenian sophisticated greenhouses is close to the international high productivity level.

Flowers: The annual productivity of roses in sophisticated greenhouses is 120–130 flowers per square meter.

The annual productivity of gerbera reaches 300 flowers per square meter.

In recent years, the cultivation of carnations has decreased, while the cultivation of roses has increased and marks a rapid growth trend. The planting material of roses can be kept longer (3–5 years), as compared to planting materials of carnations and gerberas. The planting material of gerberas can be kept for 2–3 years. Roses are less fastidious about temperature — they tolerate 8 to 22 degrees C.

Knowledge gap around high performance technologies and practices is observed in *small and medium greenhouse farms*. This refers to both agronomy and plant protection practices, as well as to plant density and arrangement decisions.[20]

16 FAO Good Agricultural Practice for Greenhouse Agricultural Crops (principles for Mediterranean climate areas), Rome, 2013.

17 United Nations Economic Commission for Europe (UNECE)՝ պաշտոնական կայք՝ http://www.unece.org/trade/agr/standard/fresh/ffv-standardse.html

18 Council Regulation (EC) No 1234/2007; Commission Regulation (EC) No 1221/2008, Commission Implementing Regulation (EU) No 543/2011.

19 Official website of Codex Alimentarius: http://www.fao.org/fao-who-codexalimentarius/standards/list-of-standards/en/

20 For example, Armenian floriculturists often grow 2–3 times more gerbera bushes in one square meter than Dutch floriculturists; while Armenian flower growers do not pay due attention to keeping proper inter-bush distance. This affects both the productivity and the quality of the flowers.

Production cycle

In Armenia, small and medium greenhouses deploying simple technologies face difficulty in ensuring year-round uninterrupted production of vegetables (tomato, cucumber, pepper). There, the production interrupts two times, in long intervals. The majority of greenhouses do not have any harvest in the periods from January through March and September to October. The map of production cycle of greenhouses is introduced in figures 9 and 10.

Prices of greenhouse vegetables noticeably drop in the period when open-field crops (tomatoes and cucumbers) are harvested and sold (September to October).

The reasons of production interruptions include:

- The existing level of technologies does not allow organizing uninterrupted production in nearly 90 percent of lands under greenhouses. Furthermore, interruptions are significantly longer in greenhouses deploying simple technologies.
- Most greenhouses (especially SMEs) are not engaged in export and sell their products at local markets. Accordingly, greenhouses plan their production load based on the characteristics of the local market demand. For example, greenhouse farms plan limited or no production in January, after the New Year holidays, when food (including vegetables) consumption (demand) declines after large holiday spending.

Contrary to simple technology greenhouses, improved greenhouses (mostly large enterprises) succeed in ensuring more flexibility in terms of production time planning. For these greenhouses, the decline of local market demand is of lesser concern, since they export the major portion of their products.

Greenhouse vegetable production cycle

January	February	March	April	May	June	July	August	September	October	November	December
⅄ No production in January-February-March ⅄ Planting of seedlings starts from January 5			⅄ Harvesting & sale start from the end of March and last until July-August ⅄ Sowing of seeds (no seedling planting phase), August 25 - Sept 5					⅄ Sept - mid Oct, no harvest in the greenhouse ⅄ Sept - mid October - open field harvest		⅄ Mid October - second half of December - sale of harvest ⅄ From December 1 - sowing of seeds for seedlings	

Figure 9. Vegetable production cycle in simple greenhouses

January	February	March	April	May	June	July	August	September	October	November	December
⅄ Harvest and sale							⅄ Mid July - August, planting of new plants ⅄ Cultivation - three months, starting from, August				⅄ Harvest

Figure 10. Vegetable production cycle in high-tech greenhouse (no crop rotation)

3.4 Fertilizers and pesticides

Import and import procedures

Armenian greenhouses use mostly imported fertilizers and pesticides. Greenhouses with drip irrigation system use water-soluble fertilizers. In general, the assortment of imported fertilizers is wide, and the geography of imports is broad, including the EU countries, USA, China, and Russia.

Nearly a dozen importers offer their services in the Armenian market.

Armenia allows import of state registered fertilizers and pesticides only. To obtain state registration, substances undergo documentary analysis, chemical and other types of testing and other procedures, to attest their safety and effectiveness. The effective period of state registration is five years.

Economic entities incur additional costs and spend extra time due to import procedures of insecticides and other pesticides, which in turn ultimately results in increasing effective market prices of the commodities.

For the import of each batch of pesticides into Armenia, the importer should obtain one-time import permission (license) from the Ministry of Agriculture, as well as a certification from the RA State Service for Food Safety (Phytosanitary Inspectorate) which includes sampling, laboratory testing, and issuance of a conclusion about conformity from the State Service for Food Safety. The procedures include repeated actions of document collection and submission of such documents to bodies at the structure of the RA Ministry of Agriculture.

The procedures of one-time license by the Ministry of Agriculture are set out in the Order of the Ministry of Agriculture No 6 of January 15, 2015. Licenses are issued for each consignment (batch), within three days after the application by the importer.[21] The legal basis for the testing and issuance of conformity conclusions (certificates) for the imported pesticides and other agricultural chemicals includes:

- The Law on Phytosanitary
- The Law on State Control of Food Safety (Article 18)
- RA Government Decision No 1192-N of October 4, 2007[22]

21 This licensing requirement was adopted in compliance to Armenia's commitments under the EEU (specifically, Decision No 134 of the Eurasian Economic Commission of August 16, 2012, "On Normative Legal Acts in the Field of Non-Tariff Regulations"). The Minister's Order is based on the Government Decision No 1524-N of December 25, 2014 "On Approving the List of Prohibited Products or Products Subject to Restrictions for Crossing the Territory of Armenia, Defining Authorized Agencies, and Approving the Framework Regulation for Issuing Licenses and Permissions for Import and/or Export."

22 RA Government Decision No 1192-N of October 4, 2007, "On Approval of the Procedure of Carrying out Testing of Pesticides and Fertilizers and pesticides, and Defining the Forms of Conclusion on Import and Export of Pesticides and Fertilizers, and Declaring Invalid RA Decision No 1151, dated October 4, 2007."

This conformity certification process, which in essence is a **quality conformity (rather than safety)** control during the import of each batch, includes physical examination, sample taking, and laboratory testing — time-consuming processes. The importer must visit several times different subdivisions of the State Service for Food Safety, while the cargo remains in the customs warehouse The cargo does not undergo customs clearance until the completion of technical control procedures.

The phytosanitary control of imports must be limited to the control of safety requirements, in compliance with the best international practices and the principles adopted under the World Trade Organization (WTO). Considering the fact that Armenia can import only those commodities that have obtained state registration, it is assumed that their safety indicators are already inspected and approved, while the inspection of safety of registered substances is already conducted during their state registration (for a five-year effective period).

Prior to Armenia's accession to the membership in the EEU, the customs duty rate on the import of **fertilizers** was 0 percent. In the framework of the EEU membership, the customs duty rates on import of fertilizers must be increased up to 6.5 percent. This change will affect the price of fertilizer. For effecting the change of customs duty rate on some fertilizers no transition period is established, whereas for others, the rate will remain 0 percent until 2017 inclusively, increase to 2 percent in 2018 and to 4 percent from 2019; while the EEU 6.5 percent rate will become effective since 2020.

In the framework of the EEU membership, the customs duty rate on import of **pesticides** must be increased up to 5 percent (instead of previously applied 0 percent). Additional details on the timeline of the customs duty rates applied to goods imported into Armenia from third countries within the EEU framework are provided in Annex 1.

Selling at local market

According to economic entities, meeting the government's requirements to trading of fertilizers and pesticides at the local market and to retailers engaged in trading of those commodities is fully or partially infeasible in practice.[23]

Pesticide application practices

Interviews with economic entities show that the frequency of ineffectiveness of using pesticides is high, which decreases the productivity (increases costs and

23 Those requirements are defined in Order No 790 of the RA Minister of Health "On Approving Sanitary Norms and Standards for Storage, Transportation, Use and Trade of Fertilizers and Agrochemicals (Pesticides)" dated August 30, 2005. The Order, in particular, requires that "Retail organizations trading in fertilizers and agrochemicals (pesticides) should have 50 meters of sanitary protection zone," "trade shop" (at least 20 m^2 space), storage area (at least 9 m^2), dosage preparation station (at least 6 m^2), and sanitary-hygienic facilities." According to economic entities, requirements for premises are difficult to meet.

decreases the yield). High frequency of ineffectiveness may be attributed to several reasons or their combination. In particular:

- Abundance of fake and expired pesticides in the market;
- Unfair import competition, where there is a dominant importer in the market importing low quality or fake, but cheap pesticides (prompting agricultural producers to buy pesticides more frequently), while creating artificial administrative and other difficulties for potential competitors, including artificial complication of import customs procedure;
- Knowledge gap among producers and, consequently, wrong diagnosis of plant diseases or incorrect use or application of pesticides, which results in the decrease or neutralization of expected effect of pesticides;
- Knowledge gap or unfair practices at retail outlets engaged in trading of pesticides, which fail to provide accurate information to agricultural producers on the application of pesticides and to comply with storing requirement; and sell expired substances.

3.5 Human capacities

The shortage of qualified specialists is one of the serious problems hindering the development of greenhouse farming in Armenia. All economic entities engaged in greenhouse farming observe this problem, though sometimes they fail to identify specifically which specialists are needed. For example, businesses use the general term "greenhouse specialist" without distinct reference to narrow specializations.

For proper establishment and efficient exploitation of greenhouse farms, professionals with relevant knowledge and skills are required, such as:

- Agronomist,
- Agricultural chemist,
- Hydroponics specialist, and
- Plant protection specialist.

It is important that those specialists possess also skills of operating computer software and management systems, so that they can work at high-tech greenhouses.

The Armenian National Agrarian University has not yet designed academic programs for greenhouse agricultural chemists and plant protection specialists. Businesses think that knowledge and skills of the university alumni are far from being satisfactory.

Due to shortage of required specialists in the local labor market, greenhouses equipped with sophisticated technologies have to invite specialists from other countries, who, as a rule, are very expensive and cannot stay in Armenian permanently; they arrive in the country for a short stay and provide advice. However, permanent presence of highly qualified specialists is very important for the effective organization of greenhouse operations.

3.6 Greenhouse association

The Greenhouse Association of Armenia (GAA) has worked in the greenhouse sector since 1999; the Association has 23 members (with a total area of 12 hectares). The greenhouse area operated by GAA members is anticipated to increase by another 16 hectares. The association represents and protects interests of greenhouse farmers, coordinates collaboration between them and provides services, such as:

- Acquisition and supply of greenhouse inputs (seeds, planting materials, fertilizers, and pesticides) and devices and equipment for association members;
- Practical advisory services and promotion of experience exchange (including training and seminars);
- Collaboration with public authorities, foreign and international structures, and addressing of problems or issues concerning the sector;
- Provision of assistance in issues related to greenhouse crop marketing and export; and
- Conducting of analyses, studies, and research.

The main funding source of the association is membership fees. At present, the executive board of the GAA has four employees.

Accelerated development of the greenhouse crop production has brought challenges with it. To face those challenges the Greenhouse Association needs further strengthening of its capacities. With its current capacities, the association will be unable to fulfill its tasks duly.

3.7 Sustainable development and environmental issues

Development and expansion of high technology greenhouse farms may have a positive effect on the efforts of facing global climate change and mitigating associated risks. At the same time, the development of greenhouse farms contributes to more effective, profitable, and targeted use of lands.

3.8 Availability of investment and financial resources

Scarcity of accessible financial resources and small assortment of financial instruments seriously limit the greenhouse sector development. Business entities face problems in terms of ensuring both working capital and investment funds.

4. POST-PRODUCTION PHASE

4.1 Selling into the local market

Medium and small producers of vegetables, as a rule, market their products via two distribution channels: direct selling and selling through intermediaries (brokers).

Direct selling: The first channel implies direct selling of vegetables by producers to retail outlets or at the agricultural markets.

Figure 11. Greenhouse vegetable marketing chain: direct selling of greenhouse vegetables

Selling through intermediaries: Intermediaries (brokers) visit greenhouses with their trucks and buy the products, to sell them later in the market.

Figure 12. Greenhouse vegetable marketing chain: selling through intermediaries

At meetings with producers, it was observed that they avoid entering into trading transactions with large buyers, giving preference to small and medium sellers. In this case, business relations of supplying and buying are often informal, not regulated on a contractual basis.

The reason for that, most likely, is the producers' intention of reducing potential risks of non-payments or other problems. The logic of such approach is that producers prefer dealing (or having potential problems) with several small bulk buyers, rather than with a single large one. In addition, in order to work with large buyers, agricultural producers must ensure regular supply of large volumes of production, at stable quality, standard appearance and size, meeting food safety requirements.

For SME greenhouses, compliance with food safety requirements is associated with some problems. In particular, to supply products of corresponding volume and standard indicators, producers must collect (unite) and sort their production. The practice of banding together in order to market greenhouse crops jointly, to meet required volumes and standards, is not yet established in Armenia. Agricultural producers' unions and cooperatives may play an important role in that process. For example, the Greenhouse Association of Armenia may coordinate and unite capacities of its members.

Competing with imported vegetables

In the winter months, the cost of imports (particularly, from Turkey) is lower than the cost of locally produced vegetables; due to this, locally produced vegetables are not competitive in the market, in comparison with imports.

4.2 Export

Exported products and volumes

Statistical data on production and export of vegetables, flowers and berries are not segregated by greenhouse and open-field productions. This means that no data are available on greenhouse crop production and export volumes.[24] Nevertheless, below are data on volumes of vegetables, flowers, and berries exported from Armenia.

Vegetables (fresh)

The assortment of exported vegetables (including greenhouse vegetables) includes tomatoes, cucumbers, beans and peppers, where cucumbers have the largest export share. In 2014, 1,129 tons of fresh cucumbers were exported with a value of $2.16M.

2014	Weight (kg)	Value ($)
Tomato	217,630	268,630
Cucumber	1,129,227	2,157,987
Pepper	68,837	70,436

Berries (fresh)

The assortment of exported berries includes strawberries, raspberries and pomegranates, where strawberries have the largest export share. In 2014, 35.7 tons of fresh strawberries were exported with a value of about $108,000.

2014	Weight (kg)	Value ($)
Strawberry	35,675	107,788
Raspberry	723	1,414
Pomegranate	284,981	482,427

24 As cited in the Concept Paper on Promotion of Creation of Greenhouses in Farming Entities, according to the data of the RA NSS, 5,986 tons of vegetables were produced in 97 hectares of covered ground in 2011 and 12,346 tons in 173 hectares of covered ground (greenhouse) in 2012. However, data in the publication are introduced in one line, with no indication whether the hectares refer to hothouses or simple film covered greenhouses.

Flowers (cut)

Taking into consideration the fact that flowers grown for commercial purposes are mainly produced in greenhouses, we may assume that general information regarding export of flowers refer to greenhouse flowers. Armenia mainly exports roses (and small amount of gerberas and carnations).

In 2014, Armenia exported over three million roses (3,174,000 cut roses) with a value of $20,607.36.

Mushrooms

Since mushrooms grown for commercial purposes are mainly produced in greenhouses, we may assume that general information regarding export of mushrooms refer to mushrooms grown in greenhouses. Armenia exports mainly champignons.

2014	Weight (kg)	Value ($)
Mushroom	474,000	1,463,800

In the current stage of development, the selection of appropriate crop varieties meeting internal and especially external market demands is very important both *for small and medium and for large greenhouse farms*. In addition to main greenhouse vegetables — tomatoes and cucumbers with which it is difficult for Armenian producers to ensure competitiveness particularly in the heating season — it is necessary to introduce high value crops enjoying high demand in internal and external markets.

Export markets

The geography of export is focused: greenhouse crops are mainly exported to Russia and, in small numbers, to Belarus and Georgia.

Vegetables: tomato and cucumber — mostly to Russia

Flowers — Russia, Georgia, and Belarus

Berries (strawberry) — mostly to Russia

Export expansion opportunity

The demand for greenhouse crops (particularly, for Armenian crops) is gradually increasing in the Russian market; this opens wide export opportunities for Armenian economic entities (including small and medium greenhouses). To benefit from export opportunities effectively, small and medium greenhouses need to join their capacities. To achieve this target, they need to ensure:

- Selection of marketable and transportable crop varieties, as well as production of such varieties by all involved greenhouse producers;
- Regular supply of sufficient volume;

- Compliance with food safety requirements;
- Stable standard appearance and quality of products, through classification and sorting of products by sizes, color, ripeness, firmness or softness; and
- Standard packaging.

At the same time, there are important developments taking place in the Russian market. Particularly, competition in the Russian market drastically intensifies, despite international economic sanctions against Russia and limitations applied by Russia lately on imports from Turkey.

After lifting international economic sanctions against Iran last year, Iran's role in exporting vegetables and fruits to the Russian market will probably grow. As shown in tables below, prices offered by Iranian vegetable producers are rather competitive. At the same time, competition from other countries grows as well. Israel too, which has over 8,000 hectares under greenhouse crops, may play a serious role in supplying certain crops, such as strawberries, to the Russian market.

In addition, there is such factors as notable expansion of greenhouse areas and developments in the Russian greenhouse sector, and Russian greenhouse producers also are serious competitors.

For comparison with international prices, the tables below introduce prices (particularly, producer prices) of several crops.[25] Such comparison is useful, though prices introduced are not differentiated by greenhouse and open-field crops.

	Cucumber, producer price, USD/ton			Tomato, producer price, USD/ton		
	2012	2013	2014	2012	2013	2014
Armenia	411.26	462.95	362.40	271.15	313.86	268.45
Azerbaijan	632.91	615.38	611.85	1037.97	974.36	865.52
Byelorussia	1108.84	1206.47	1181.09	1180.82	1218.09	1205.79
Georgia	352.97	479.92	520.83	401.64	541.43	396.06
Iran	583.1	654.1	381.02	289.52	432.25	189.33
Israel	700.66	819.18	820.64	861.96	872.98	1060.82
Kazakhstan	510.6	555.79	529.19	761.68	757.76	658.80
Russia	1769.42	1768.52	1648.77	1550.98	1590.72	1540.73
Turkey	625.71	595.19	531.26	443.72	475.58	480.41
Serbia	356.97	335.61	432.02	680.63	422.39	749.27
China	443.74	427.75		507.13	562.21	

25 Data source: Food and Agriculture Organization (FAO STAT): http://faostat3.fao.org/download/P/PP/E, as of March 22, 2016.

	Mushroom, producer price, USD/ton			Strawberry, producer price, USD/ton		
	2012	2013	2014	2012	2013	2014
Armenia	1170.52	1309.05	1684.96	1667.11	2106.26	2584.33
Azerbaijan	-	-	-	1429.96	2486.85	2729.77
Byelorussia	-	-	-	2478.2	2602.03	1939.6
Georgia	-	-	-	4028.31	2717.58	3022.46
Iran	-	-	-	1646.04	1634.53	1379.09
Israel	3722.86	3970.95	4200.38	1217.9	940.73	1136.24
Kazakhstan	-	-	-	1724.57	1293.58	723.16
Russia	-	-	-	1077.65	1565.72	
Turkey	1558.00	1438.16	1511.67	1667.11	2106.26	2584.33
Serbia	-	-	-	1429.96	2486.85	2729.77
China	908.08	992.70	-	2478.2	2602.03	1939.6

Rapid expansion of greenhouse farms is also taking place in other countries of the region. For comparison, the table below shows areas under greenhouses in a number of countries.

Greenhouse space (ha), 2014	
Armenia	760
Israel	8,000
Turkey	35,000
Netherlands	~10,000

With the depreciation of the national currency of Russia, financial risks of Armenian exporters grow, and hence, their competitive positions weaken. In this respect, Armenian businesses should pay attention to increasing competitiveness of their products, in terms of both cost reduction and product assortment and quality. In parallel, efforts should be directed at exploring and entering other markets, besides Russian.

Product quality, sorting and packaging

Large greenhouses, which deal with large buyers, apply advance technologies of product sorting and packaging. However, improved technologies of product sorting, ensuring stable quality and appearance, packaging, and marketing are not yet widespread among *SMEs* in the greenhouse sector.

As mentioned above, the practice of banding together in order to market green-

house crops jointly has not yet been adopted in Armenia. Agricultural producers' unions and cooperatives may play an important role in that process. For example, the Greenhouse Association of Armenia may coordinate and unite capacities of its members. In this context, several Russian organizations have already applied to the Greenhouse Association of Armenia for arranging the export of vegetables; currently, the association faces difficulties in terms of collecting and delivering sufficient amount of vegetables.

For uniting capacities of *small and medium producers,* it is also very important to ensure the availability of cold storage facilities, where producers can collect, sort, and package their products. With regard to export promotion, defining, and enforcement of internationally compatible standards and technical requirements among producers shall be highly prioritized. This equally refers to both greenhouse and open-field agricultural production.

At present, vegetables (cucumber, tomato) are transported and exported in cardboard boxes with 7–8 kg carrying capacity. Business entities mention about the difficulty of acquiring quality boxes and packages 2–3 years ago; but nowadays, local Armenian producers are capable of manufacturing and supplying cardboard boxes of high quality.

Export permissions and procedures

To export vegetables from Armenia, it is necessary to obtain a phytosanitary certificate, which is issued by the Phytosanitary Inspectorate of the State Service for Food Safety of the RA Ministry of Agriculture. Businesses have not reported problems associated with obtaining phytosanitary certificates.

Transportation routes and means

Most of the vegetable exports are transported by road (trucks) and only a small portion by air. Flowers are exported both by air and by trucks.

Air transportation is fast, of course, which is a very important advantage especially for the export of flowers. Fresh flowers are delivered to the airport in refrigerated trucks. According to businesses, average costs of shipment of flowers via cargo airplanes from Armenia to Russia (Yerevan to Anapa) would amount to $27,000.

Export by passenger airplane is significantly cheaper, yet, it has limited development opportunities, especially in terms of volume. Currently, there are 12 daily flights from Yerevan to Moscow, which at best will provide an opportunity of exporting 10–15 tons of products daily.[26] The average cost of shipment by passenger airplane per flower will amount to 60 AMD (USD 0.13).

Export by trucks extends along a transit road through Georgia, entering Russia at the Lars border crossing point. It is significantly slower than shipment by air

26 According to businesses, 160 kg flowers are delivered in a cubic meter space.

(taking several days to reach Moscow versus several hours by plane). The average cost of transporting by a 20-ton truck is $2500–3000, plus unofficial payments per each ton of goods.[27]

Usually, refrigerated trucks are used for transportation of fresh vegetables.

Business entities mention about shortage of trucks in the summer season, when open field crops are harvested, and export volumes grow. In that case, Armenian exporters use the services of ground cargo carriers from other countries, in particular, Russian or Georgian trucks.

Shipment by ferry through Georgian seaports is not yet widespread for export of vegetables; however, it could become an important route of exporting processed products.

Knowledge and capacity: For further development of the sector, there is a need to enhance capacities and the knowledge of external markets and export opportunities, as well as techniques of distribution channels development.

4.3 Export financing and insurance

Insurance of export can be obtained in the market; however, business entities face difficulties in receiving compensation for cargo loss or damage. It is difficult and, often, impossible to receive compensation from insurance companies.

In spite of the fact that risks at greenhouse farms are lower in comparison with the entire agricultural sector, the insurance system fails to function in the greenhouse sector as well, due to the high-risk level.

27 According to businesses, unofficial payments may reach up to $0.2 per each kilogram.

5. SUPPORTING INFRASTRUCTURES AND FACILITIES

5.1 Warehouses and storage

To promote the development of the greenhouse sector and the production of processed greenhouse products, Armenia will need adequate cold storage facilities for collection, handling, and storing of fresh products, which in turn will require (a) attraction of investment funds, and (b) training and development of specialists.

The establishment of small and medium-scale crop collection, handling and sorting enterprises will contribute to cooperation between economic entities (in a form of cooperatives or associations), aimed at ensuring standard, high-quality, and safe production meeting requirements dictated by the market, especially export markets.

5.2 Financing and financial institutions

In general, the shortage of and the difficulty of accessing long-term and affordable financial resources restricts the growth and development of businesses. Interviews with businesses show that the application of sophisticated export and investment finance instruments (such as working capital financing, funding of projects, trade finance instruments like credit lines, insurance, effective monitoring, and so forth) needs to expand further, if it is to really fuel production and export development, while integrating environment-friendly technologies and advanced systems of food safety.

6. CONSIDERATIONS ON ECONOMIC AND FINANCIAL PERORMANCE

Investment requirements and economic and financial performance indicators are critical for understanding the viability of greenhouse crop production, as well as for making various business decisions. Below is a brief discussion about selected economic and financial aspects of greenhouse crop production, to provide a general picture about the business and its investment attractiveness.[28] The analysis in this section is for rough estimation purposes and is based on data collected from businesses about market prices and investment and operational costs in the sector in the given period, which may change over time and depending on the market and be different from the figures presented below.

6.1 Investment requirements

Based on the experience in the greenhouse sector in Armenia, the investment cost of a greenhouse may vary in the range USD 80–200 per square meter of a greenhouse area. This relates, particularly, to greenhouse systems often imported by Armenian businesses from EU countries:

- Plastic greenhouse systems with heating, cooling and watering systems — USD 80 per square meter, which is effective for establishing small greenhouses up to 1 hectare, as well as large greenhouses. This includes transportation to Armenia, installation, and advice on operation of the greenhouse.
- Glass greenhouse systems, for hydroponic production, including sophisticated heating, cooling, and watering systems — USD 150–200 per square meter. This includes transportation to Armenia, installation, and advice on operation of the greenhouse.

Note also that a simple, non-sophisticated greenhouse may cost around USD40–50 per square meter.

6.2 Greenhouse operation

For estimation of operation costs, the following three scenarios were considered.

1. Production of tomatoes in a plastic greenhouse of up to 1 hectare, with crop cultivation in soil.
2. Production of tomatoes in a glass greenhouse of 5 hectares, with hydroponic crop cultivation.
3. Production of flowers (carnations) in a plastic greenhouse of one hectares.

Calculations of costs are based on practical information on annual average costs and prices collected in the market and through interviews with businesses

28 For simplicity, the calculations in this section are not very detailed; they do not include depreciation of greenhouses and equipment. These details can be added.

involved in greenhouse crop production and marketing. The calculations in this section are for demonstration purposes, and may differ from business to business, depending on markets, the seasonality, exchange rate fluctuations, and other factors.

Production and marketing costs per kilogram of tomato		
	Tomato production in soil, plastic greenhouse, 1 ha	Tomato production, in hydroponic, glass greenhouse, ≥ 5 ha
Seed	0.021	0.036
Soil/hydroponics	0.002	0.009
Fertilizers & chemicals	0.04	0.03
Electricity, water, others	0.43	0.152
Labor	0.23	0.075
Other costs	0.02	0.009
Farm gate price, USD/kg	0.74	0.312
Packaging	0.06	0.06
Transport	0.14	0.14
Break-even price	0.94	0.512

It can be seen from the table above that due to production efficiencies (higher yield) the costs of producing 1 kilogram of produce much lower in case of large hydroponic production. In Armenia, the yield per square meter of greenhouse area is no more than 20 kg/m^2 while the yield in a sophisticated hydroponic greenhouse is 50–60 kg/ m^2. As a result, the farm gate price of one kilogram of tomato is more than 1.7 times lower in the large sophisticated greenhouse. Gas cost is a major cost item, which affects the price competitiveness of greenhouse vegetables produced in Armenia. In *small greenhouses* gas cost represent a higher proportion in the total production costs (more than 58%), compared to the cost structure in *large greenhouses* with advanced technologies (around 49%).

The table below presents similar information on flower (carnations) production.

Production and marketing costs flowers (carnation), per flower	
	Flower production, plastic greenhouse, 1 ha
Planting material	0.036
Soil/hydroponics	0.000
Fertilizers & chemicals	0.004
Electricity, water, others	0.007
Labor	0.008
Other costs	0.0001
Farm gate price, USD per flower	0.056
Packaging	0.002
Transport	0.128
Break-even price, USD per flower	0.190

Sales price of one flower in the Russian market, for example, is about USD 0.50.

6.3 Profitability and return on investment

Assuming that the producer is able to sell all its produce in the market, and based on the figures presented above, the profitability and return on investment figures for the tomato and flower (carnation) production will be as follows. As it could be expected, a sophisticated greenhouse vegetable production provides much higher return on investment and profitability. In comparison to tomato production, in terms of profitability and return on investment, flower production provides higher performance.

Selected financial figures		
	EBIT (annual)	IRR (10-years project)
Tomato production in soil, plastic or glass greenhouse, 0.5 hectares	USD 3,800	-27 percent
Tomato production, in hydroponic, glass greenhouse, ≥ 5 hectares	USD 1.78 million	20 percent
Flower (carnation) production, plastic greenhouse, 1 hectare	USD 1.1 million	120 percent

7. GOVERNMENT POLICIES AND PROGRAMS

Promoting the production and export of greenhouse products is one of the priority directions in the agenda of the RA government. In 2013, the government adopted[29] a Concept of Promotion of Creation of Greenhouses in RA Farming Entities. Based on Armenia's current situation in greenhouse agriculture, the concept designs measures directed at:

- Ensuring financial resources for construction and modernization of greenhouse,[30]
- Training of agronomist-specialists servicing greenhouses, and
- Statistical accounting of greenhouses by regions, and improvement of statistical data collection by the RA National Statistical Service.

By 2018, the concept plans increasing the greenhouse areas by three times, and import substitution of greenhouse vegetables in the winter months. Measures planned under the concept are not implemented yet.

For promoting the development of greenhouse agriculture and the introduction and application of advanced technologies, the RA government has established a VAT privilege for the import of greenhouse structures.

At the same time, for promotion of investments, the government has defined special procedures providing customs duty and tax (particularly, VAT) privileges (for instance, relief from customs duty payment and postponement of VAT payment) under RA Government decisions No 1118-N and 1119-N.[31] In order to enable economic entities to benefit effectively from the opportunities provided by these decisions, there is a need to raise awareness among businesses.

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29 RA Government Protocol Decision No 53 of December 26, 2013, "On Approving the Concept and the Timetable of Promotion of Creation of Greenhouses in RA Farming Entities."

30 The concept envisages conducting negotiations with the Greenhouse Association of Armenia regarding setting of a revolving fund. Financial resources accumulated in the revolving fund will be provided, in preferential terms, for construction, reconstruction and modernization of greenhouses, acquisition of solar water heating collectors, thermal pumps, or for supporting the implementation of other similar works.

31 RA Government Decision No 1118-N of September 17, 2015 "On Approving necessary conditions for enforcement of the relief from import duty on technological equipment, components and accessories thereof, raw material and substances imported within the frameworks of the investment program in priority sectors, and recognizing an authorized body."

RA Government Decision No 1119-N of August 4, 2011, "On approving the procedures of electing organizations and private entrepreneurs for the extension of periods of 'Temporary exportation' applied to goods exported under the customs arrangement of 'Temporary exportation' and deadline delays, and electing organizations and private entrepreneurs for the payment delay of value added tax amount calculated by customs bodies in case of importation of goods, and on the revocation of RA Government Decision No 600-N of April 30, 2009."

For further development of the sector, taking targeted measures by the government becomes high priority, in order to promote target investments. Such measures imply development and encouragement of special loan and grant terms (a) to encourage investments in introduction of high (highly productive, energy-saving and environmentally friendly) technologies, and (b) to establish and develop warehouses and cold storage facilities.

There is a need for development, adoption, and enforcement of effective quality and safety standards to production and products, based on the requirements dictated by markets, especially export markets. This can be promoted through supporting establishment of small and medium-scale harvest collection, handling and sorting facilities.

In 2016, the Export Promotion Council was set by RA Prime Minister's Decision No 5-A.[32] The Council's mission is to provide target assistance to economic entities exporting goods from Armenia. Fresh fruits and vegetables are not included in the list of priority products. The list of products defined as priorities in the first half of 2016 includes:

- Wine
- Fruit spirits
- Canned goods
- Meat products
- Fish, fisheries

32 Decision No 5-A of the RA Prime Minister of January 13, 2016, "On the foundation of an Export Promotion Council for supporting exports, approving the working procedure of the Export Promotion Council, the procedures of submission and evaluation of requests from RA resident economic entities to receive support, aproval of requests and provision of support, forms of the request of receiving assistance for export of domestic products and the application submitted for receiving support, and the list of types of Armenian products deemed priority for provision of direct export support in 2016."

ANNEX 1. ARMENIA-EEU RELATED INFORMATION

Timeline of customs duty rates (import tariffs) applied to the goods imported into Armenia from third countries in the EEU framework[33]

Commodity	Code EEU	Before EEU 2014, %	2015	2016	2017	2018	2019	2020	2021	2022	EEU, %
Green-houses	9406003100	0	0%	0%	0%	2%	EEU	EEU	EEU	EEU	8.8[35]
Seeds	1209	0	EEU	EEU	EEU	EEU	EEU	EEU	EEU	EEU	5[36]
Vegetable seeds	1209 91	0	EEU	EEU	EEU	EEU	EEU	EEU	EEU	EEU	5
Plant bulbs	0601	10	EEU	EEU	EEU	EEU	EEU	EEU	EEU	EEU	5[37]
Live plant or planting material	0602	10	EEU	EEU	EEU	EEU	EEU	EEU	EEU	EEU	5 or 9[38]
Rose bush	0602 400000	10	EEU	EEU	EEU	EEU	EEU	EEU	EEU	EEU	9
Vegetables, strawberry seedlings	0602 903000	10	EEU	EEU	EEU	EEU	EEU	EEU	EEU	EEU	5
Flower planting material[39]	0602907000	10	EEU	EEU	EEU	EEU	EEU	EEU	EEU	EEU	5

33 The Treaty on the Accession of the Republic of Armenia to the Treaty on the Eurasian Economic Union, May 29, 2014; Official Website of EEU: http://www.eurasiancommission.org/ru/Lists/EECDocs/635486381049072687.pdf., last visited on January 20, 2016.

34 Source: Official website of the Eurasian Economic Union, http://www.eurasiancommission.org/ru/act/trade/catr/ett/Documents/ett94 percent2020.09.2015.pdf (last visited on January 19, 2016).

35 Source: Official website of the Eurasian Economic Union, http://www.eurasiancommission.org/ru/act/trade/catr/ett/Documents/ett12 percent2001.09.2014.pdf (last visited on January 19, 2016).

36 Source: Official website of the Eurasian Economic Union, http://www.eurasiancommission.org/ru/act/trade/catr/ett/Documents/ett06 percent2020.09.2015.pdf (last visited on January 19, 2016). With the exception of grapevine sapling, where 0 percent EEU import tariff rate is defined.

37 Source: Official website of the Eurasian Economic Union, http://www.eurasiancommission.org/ru/act/trade/catr/ett/Documents/ett06 percent2020.09.2015.pdf (last visited on January 19, 2016).

38 Includes planting material or roots of gerbera, carnation, chrysanthemum and rose.

Commodity	Code EEU	Before EEU 2014, %	2015	2016	2017	2018	2019	2020	2021	2022	EEU, %
Fertilizer, of which	31	0	0%	0%	0%	2%	4%	EEU	EEU	EEU	6.5[40]
	3102 109000	0	EEU	EEU	EEU	EEU	EEU	EEU	EEU	EEU	6.5
	3102 50	0	EEU	EEU	EEU	EEU	EEU	EEU	EEU	EEU	6.5
	3102 600000	0	EEU	EEU	EEU	EEU	EEU	EEU	EEU	EEU	6.5
	3102 800000	0	EEU	EEU	EEU	EEU	EEU	EEU	EEU	EEU	6.5
	3102 900000	0	EEU	EEU	EEU	EEU	EEU	EEU	EEU	EEU	6.5
	3104 201000	0	EEU	EEU	EEU	EEU	EEU	EEU	EEU	EEU	6.5
	3104 900001	0	EEU	EEU	EEU	EEU	EEU	EEU	EEU	EEU	0
	3104 900009	0	EEU	EEU	EEU	EEU	EEU	EEU	EEU	EEU	6.5
	3105 901000	0	EEU	EEU	EEU	EEU	EEU	EEU	EEU	EEU	6.5
	3105 909100	0	EEU	EEU	EEU	EEU	EEU	EEU	EEU	EEU	6.5
	3105 909900	0	EEU	EEU	EEU	EEU	EEU	EEU	EEU	EEU	6.5
Chemical, of which	3808	0	EEU	EEU	EEU	EEU	EEU	EEU	EEU	EEU	3 or 5[41]
Insecticide, other	3808 91900 0	0	0	0	0	0	2	EEU	EEU	EEU	5
Fungicide, with copper	3808 92100 0	0	0	0	0	0	2	EEU	EEU	EEU	3
Fungicides, other	3808 92900 0	0	0	0	0	0	2	EEU	EEU	EEU	5
Plant growth regulators	3808 93900 0	0	0	0	0	0	2	EEU	EEU	EEU	5
Disinfec-tant, other	3808 94900 0	0	0	0	0	0	2	EEU	EEU	EEU	5

39 Source: Official website of the Eurasian Economic Union, http://www.eurasiancommission.org/ru/act/trade/catr/ett/Documents/ett31 percent2001.09.2015.pdf (last visited on January 19, 2016).

40 Source: Official website of Eurasian Economic Commission, http://www.eurasiancommission.org/ru/act/trade/catr/ett/Documents/ett38 percent2001.09.2015.pdf (last visited on January 19, 2016)

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