SMART INVESTOR: BASICS ON TOMATO GREENHOUSES IN ARMENIA
EXECUTIVE SUMMARY

This program is a guide for investors to explore opportunities in establishment of a large, six hectare size tomato greenhouse in Armenia. Although authors attempted to integrate the latest data on markets, legislation and financial indicators, an investor should not rely upon provided information solely.

This guide provides basic information on the following themes:

a) Short information on economy and current situation on greenhouses in Armenia. A short overview on the economy and greenhouses.

b) Government support measures and basic benefits. Information on government support programs as well as tax and customs benefits.

c) Description of geography, climate, weather conditions and basic agricultural inputs and resources. This section portrays geography of Armenia and most suitable locations for the greenhouse construction based on climate and weather.

d) Types of greenhouses suitable for Armenian geography and tomato varieties, based on international best practices and domestic experience. Section concentrates on identifying most suitable and efficient greenhouse constructions as well as provides information on most popular varieties of tomatoes for greenhouses.

e) Markets and trade agreements. This section not only focuses on obligations of Armenia before World Trade Organization (WTO), Eurasian Economic Union (EEU) but also provide information on preferential trade regimes and free trade agreements.

f) Section on Marketing planning will provide basics on product, distribution, promotion and pricing policies. This section also portrays up-to-date information on prices of tomato at domestic and EEU markets.

g) Financial calculations to provide general picture on the size of investments, profitability, payback period and other financial indicators.

h) Risks mitigation strategies.
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ARMENIAN ECONOMY

After independence and during the entire transition period Armenia had gone through a decade of severe economic reforms toward liberal economic order. In particular, it was among the first post-soviet states having implemented privatization of land and property; executed price liberation policy and liberalized trade through joining the World Trade Organization (WTO). In 2002 Armenia was able to restore its economy to the level of the last years of Soviet Armenia, and was demonstrating significant economic growth at double digit for five years which, however, slowed down as a result of global financial crisis in 2008. Since 2002 Armenian economy has grown by around 58%.

GREENHOUSES IN ARMENIA

During the transition years share of agriculture in the Armenian economy has significantly increased, but due to difficulties and challenges many sectors have deteriorated. One of those sectors is greenhouse industry. It is mainly associated with the economic and political difficulties of transition period, namely: a) greenhouses and land were privatized, and many owners had sold these greenhouses for spare materials; b) due to massive migration it was difficult to find good specialists to operate greenhouses; c) access to markets was limited due to economic blockade and underdeveloped logistics; d) there was no access to new technologies of production and postharvest. As a result, the greenhouse industry in Armenia has been declining until recently, when investors have recognized that Armenia has many competitive and comparative advantages in vegetable and flower production.

After a few large investments, the sector has been dynamically developing, as more investments were flowing into construction of modern greenhouses. According to the recent estimates, the total area of greenhouses in Armenia constitutes about 764 hectares, of which 120 hectares are equipped with the newest technologies (IFC 2015). Modern greenhouses are constructed by Dutch, French and Israeli companies using different technologies. While there are a number of technologies used, the most popular is Venlo type, which is suitable for Armenia’s geography and climate. Details on selection of the appropriate type of greenhouses are described in the section on types of greenhouses.
CRITICAL SUCCESS FACTORS OF INVESTING IN GREENHOUSES

The renewed interest for developing greenhouse industry is the result of a number of factors such as a) excellent climate and weather conditions. Yields and quality of the product are directly correlated to availability, intensity and duration of sunlight; b) relatively low cost of energy and especially natural gas supplies as well as many opportunities for application of alternative energy sources; c) quality of water and soil; d) growing demand for non-seasonal vegetables in the Eurasian Economic Union and international markets where Armenian products benefit from preferential trade regimes; e) support from local and central government; f) availability of relatively affordable labor force.

Furthermore, Armenian agricultural products also benefit from brand recognition at local and foreign markets, particularly in countries of the former Soviet Union. During recent years, Armenian agricultural producers have penetrated into Gulf States markets, where growth potential is high. Although Armenian fresh and processed tomato industries target almost the same markets, however, greenhouse tomatoes are usually sold in fresh state and not used in processing industry. Armenian producers benefiting from all aforementioned advantages, however, an investor should take into consideration that in addition to climate and weather conditions and appropriate greenhouse construction and technology, technical experts are critical to ensure high average yield. The best illustration of importance of all mentioned factors is the fact that in some counties of Spain average yield of tomato is 28 kg per square meter, while in the Netherlands and in Canada it reaches 60 kilograms. Although Spain has more favorable weather conditions, the yield is lower; therefore, all factors of production have to be considered to ensure high yield and good quality of product. Thus, an investor should first study the climate and weather data to make sure that the selected location is favorable in the perspective of duration and availability of sunshine as well as is not situated in the areas where there are large fluctuations of temperature during daytime and nighttime. Secondly, select a proper greenhouse model; in Armenia most of the modern greenhouses are Venlo type. And finally ensure that professional agronomists and other experts are available.
GOVERNMENT SUPPORT AND BENEFITS

There are a number of programs implemented by the Government of Armenia aiming at facilitating investments and creating favorable conditions for foreign businesses. Armenia is ranked 35th out of 189 and 7th among Europe and Central Asia in Doing Business Index (World Bank Group 2016). Furthermore, Armenia has eliminated the minimum capital requirement for registering a business and simplified business registration procedures. It is ranked the 54th out of 178 countries in economic freedom index, the highest among CIS countries (Miller et al 2016). The Armenian Government is investing in infrastructure and regularly improving legislation to ensure that foreign companies and businesses do not face challenges and operate in smooth and stable environment. In 2013, the Government of Armenia has adopted a greenhouse development concept note, which entails assistance to investors in receiving loans, preparation of better greenhouse agronomists and other specialists and improving greenhouse statistics system. This concept note aims at increasing local supply of non-seasonal vegetables as well as their export to international markets. In addition, the Government has established a council to support exporters in Armenia.

There are also a number of government benefits for the investors into agriculture and greenhouse sector in particular. After 2015, import of greenhouse construction and materials is VAT exempted. The Law of the Republic of Armenia on the Exemptions of the VAT payments for the products imported by the companies and sole proprietorships that are not subject of the excise duty, defines VAT exemptions for a number of imported products, including items that are used in greenhouse industry (greenhouse construction and greenhouse commodities production). In addition, section V of the Law of the Republic of Armenia on Value Added Tax provides information on VAT exemptions for a number of products, such as fertilizer, pesticides, agricultural plants, seeds, etc. In some cases, government also negotiates with banks and financial organizations to ensure low interest loans for greenhouse investors.
GEOGRAPHY, CLIMATE AND NATURAL RESOURCES

In addition to specific measures that are being implemented by the Government of Armenia, there are also so called “natural and geographic specific” benefits and advantages of investing in agriculture sector. Armenia is rich with clean water resources that are widely used for irrigation purposes. Favorable climate and particularly sunshine duration, solar radiation level makes Armenia an excellent location for agriculture production. These natural conditions can also be utilized to provide energy through alternative energy sources, including solar.

Armenia is located in the western part of Asia and occupies the north-eastern part of Armenian Plateau between Caucasus and Nearest Asia. It is a landlocked country bordering with Georgia and Azerbaijan on the north and east and Iran and Turkey on the south and west. The country’s area comprises 29,743 km², of which 68.9% is agricultural land. About 36.4% of terrain are mountains and 76.5% of territory is on the altitude of 1,000-2,500 m above sea level. The highest elevation of the country is the peak of Mount Aragats (4,090 m.), and lowest is area of Debed river canyon (375 m.). Armenia is abundant with water resources, Lake Sevan is considered the largest in Armenia, and Araks River is the longest. Renewable freshwater resources comprise 5,532.0 million m³. There are fresh water lakes and reservoirs, with about 40.0 billion m³ total volume. Nearly 95% of those waters is the share of one of the world’s highest mountainous lakes, Sevan (NSS 2015).

The overall river flow (originating within the country) has been estimated at 6.8 billion cubic meters. This is in part driven by the estimated 16.7 billion cubic meters of precipitation, with less than 10.8 billion cubic meters lost by evaporation. An available 1.19 billion cubic meters originates from outside the country via the transboundary Araks and Akhuryan Rivers. Groundwater contributes to estimated
4 billion cubic meters (World Bank Group 2014).

One of the main advantages of investing in greenhouses in Armenia is climate and weather. The former one is essential for greenhouse, and in turn sun intensity, sun radiation, and a number of sunny days during the year are critical indicators.

<table>
<thead>
<tr>
<th></th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Average number of sunny days during a year (days)</strong></td>
<td>299</td>
<td>282</td>
<td>302</td>
<td>307</td>
<td>304</td>
</tr>
<tr>
<td><strong>Average duration of sunshine (hours)</strong></td>
<td>2331</td>
<td>2025</td>
<td>2243</td>
<td>2286</td>
<td>2201</td>
</tr>
<tr>
<td><strong>Solar Radiation MJ/m²</strong></td>
<td>4301</td>
<td>4550</td>
<td>4893</td>
<td>4898</td>
<td>4773</td>
</tr>
</tbody>
</table>

Source: Hydrometeorology and Monitoring Service

In comparison to European countries, these indicators are much favorable in Armenia. The data in table above is provided by the World Resources Institute and demonstrates the global sunlight map, where Armenia is located under red color meaning high number of sunny days during the year. According to the data of the “Hydrometeorology and Monitoring Service” SNCO of the Ministry of Emergency Situations of Armenia, in 2014, 304 sunny days were registered in Armenia. Furthermore, duration of sun during the year constituted about 2,201 hours with average of 4,773 MJ/m² solar radiation. A table below presents information on critical indicators during last five years. This information is provided as an average for Armenia; however, it is different at regional level. Most of greenhouses are built in Ararat, Armavir and Kotayk regions, but there are many experts that consider Gegharkunik as one of the best locations.

**TRADE AND FREE TRADE AGREEMENTS**

Geographical advantages of Armenia are not limited to excellent climate conditions, weather and availability of agricultural resources; location is beneficial also from the perspective of trade. Armenia is located in the crossroad of Europe and Asia and benefits from preferential trade regimes. Being a member of WTO, Armenia has undertaken efforts to liberalize trade and minimize trade impediments. It has joined Eurasian Economic Union in 2015 which has created an excellent opportunity for domestic producers to access markets of Russia, Belarus, Kazakhstan and Kyrgyzstan. Furthermore, EEU negotiates free trade agreements with a number of countries such as Vietnam, China, Israel, Iran and others. Armenia also benefits from preferential GSP plus trade regime with EU
and the United States that facilitates exports of Armenian local produce to selected states. Ultimately, Armenia maintains free trade agreements with Georgia and CIS countries. Investors should also diversify and consider other regional markets such as Gulf Countries and some Asian emerging states. In addition, non-conventional production such as organic tomato can also compete on European Markets. Therefore, a producer should plan market penetration, based on thorough selection of target markets, including implementing geographic segmentation, as well as segmentations based on demographics and other variables.

Due to global economic slowdown, demand for non-seasonal vegetables has slightly decreased; however, recovery will lead to quick restoration and increase in demand due to increasing disposable income of population.

**TYPES OF GREENHOUSES**

Application of modern technologies has significantly improved yields, and technologies such as hydroponic, used for tomatoes and other crops, have received the most attention for business applications. Greenhouse building costs can vary, depending on materials and equipment used. In Armenia, there is wide range of operating greenhouses, starting with the small scale tunnel plastic models to modern glass greenhouses, where yields are usually higher with a better quality control system.

There are number of greenhouse types that can be considers by small and large producers and that can range from stand-alone structures to a large gutter connected greenhouses. The technologies are critical for productivity, and may vary significantly in terms of the cost. The main types of greenhouses are presented in the next figure. These greenhouses can be categorized in accordance with the materials that greenhouse is made: glass, acrylic, polycarbonate, fiber reinforced polyester, polyester film (Worley 2015). Greenhouses can also be categorized by style. The Dutch Greenhouse is mainly built from the glass or the float glass, which is transparent glass with a high light admittance that allows higher penetration of light. The average life of this type of greenhouse is 15 years. In general there is an assumption that 1% of additional light increases the potential production by 1%, therefore, there is a significant importance of light penetration. In this perspective glass has advantage over plastic because of higher sun transition. The second type of glass greenhouse is the most
popular type of commercial greenhouse and one which is mostly used in Armenia, the Venlo. This type of greenhouse can be adapted to a variety of conditions and circumstances, such as snow, sand and dust, high and low temperature and high humidity levels as well as can provide high level of transmission of light. This type is used for vegetable and flower production. Finally, Wide Span Greenhouses that although used in commercial production, are usually for pot plant nurseries and research greenhouses. Advantage of this type is the larger internal space and high ventilation capacity. Similar to Venlo, it has durable construction to hold snow loads and severe winds (Dutch Greenhouses 2016).

TECHNOLOGIES AND RECENT DEVELOPMENTS

Many modern greenhouses automatically maintain temperature, lighting, humidity and CO₂ in accordance with the specific needs for a specific crop. Based on the location of the greenhouse, an investor should consider application of cooling system. However, heating is the critical element of greenhouse and there are number of sources of energy that can be considered nowadays. Traditionally greenhouse heating is performed through gas fired boiler. Due to development of alternative energy sources, in particularly in locations with vast number of sunny days, such as Armenia, investors should consider using solar energy panels and other measures. Application of solar system increases initial investments; however, it also lowers operational costs of production and ensures diversification of energy sources. There are numerous opportunities in the form of grants that can fund fully or partly installation of such a system. According to International Energy Agency, the cost of energy from the renewable sources such as solar and wind has been decreasing during the last five years (Patel 2015). According to some estimates, the total solar capacity potential in Armenia constitutes from 1,700 to 2,300 MW, and there is about 80% of average illuminance. Furthermore, there is also a great potential to generate wind energy to around 10,000 MW (Vorotnikov, 2013).

Due to fluctuations in weather conditions as well as because of hot climate in summer, many greenhouses use cooling systems. One of the techniques for cooling during high temperature is evaporative cooling as well as a shade cloth, which is used to cover the top of the greenhouse.
Another important technological solution in modern greenhouse industry is the shading system. This system is installed based on geographical location, and usage of light with the specific crop.

Furthermore, most of modern greenhouses are using not the soil but rather the hydroponic method of growing vegetables. This includes application of NFT, Ebb and Flow.

Usually the system is operating through combination of horizontal and vertical screening. Simply said, the system is reducing light, creating darkness in accordance with the climate and according to the specific needs of a crop.

**TOMATO PRODUCTION AND POST HARVESTING**

There is a large number of tomato varieties available on domestic and international markets. In Armenia, most of seeds are imported, however small greenhouses cultivate traditional Armenian varieties that have better taste and flavor, but have low yield and are difficult to transport. This is important to note, since local varieties are mostly cultivated in open fields and mainly marketed locally or processed into a value added products. In the meantime, there is a large number of special varieties typical for greenhouses. The Netherlands is one of the largest tomato seeds producers which focuses on hybrid indeterminate varieties. Currently, seeds are available in specialty stores, or alternatively purchased directly from producers. In order to import seeds, companies should follow phytosanitary regulations of the Republic of Armenia.

There are a number of characteristics that need to be considered while selecting specific variety: size of fruit, resistance to disease, cracking of the fruit, yield uniformity of fruit size on technical side, and of course yield, demand and market price of a specific variety. At the moment the most popular varieties cultivated in greenhouses in Armenia are Makita, Cinto,
Belfast, Big Beef, Calipso, Tiguano, Ardales, Vesivious, Garinsha, Viali, etc. Some of these varieties are portrayed in the figure above; however, there are many others cultivated in Armenia and elsewhere.

Although per capita demand for tomatoes is increasing locally, most large greenhouses are focusing their efforts on export markets. The main market for Armenian agricultural produce and in particularly tomatoes is the Russian Federation and, after joining the Eurasian Economic Union, tomato export to the Russia has increased significantly. Of course, this is also associated with the sanctions over traditional tomato suppliers to Russia, such as EU and European Union. Nevertheless, Armenian agricultural produce has been very popular since the Soviet times. Therefore, consumers in Russia and CIS countries prefer Armenian agricultural products due to quality features, such as taste, flavor, etc. This is important, since an investor can focus on creating specific communication strategy, which will clearly deliver proper message to consumers. From the technical perspective, harvested tomatoes should be taken to the packing area after picking and then should be cleaned, graded, and packaged into respective boxes. In addition, some greenhouses also use
waxing technology, which is applied to the fruit to enhance appearance and extend shelf life. Before packaging, all products are sorted and graded by many categories, including size, color, shape, etc. According to North American classification, the following size categories are used, for the small size: 5.40 cm - 5.72 cm; medium: 5.79 cm - 6.35 cm; large: 6.43 cm - 7.30 cm, extra-large: 7.30 cm. Usually packaging for the local market can be different, that that for the export. The packaging for export is made of sturdy materials, and is well ventilated (National Agricultural Research Institute of New Guyana 2003).

MARKETING

Greenhouse industry and greenhouse tomato production have been one of growing investment subjects in the agricultural sector of Armenia. Armenia and the region have favorable climate and weather conditions which enable production of high quality tomatoes in greenhouses. It is also reflected in the regional statistics, since the region is considered to be one of largest tomato producing areas, where Turkey and Iran lead in top ten global producer’s index. In particular, Turkey used to be the largest supplier of fresh tomatoes to Russian market and in 2015 360,000 tons of tomatoes were exported (Interfax 2015). The other top tomato exporting countries to Russia are China, Morocco, Armenia, Azerbaijan and Belarus.

Due to embargo for agricultural products from Turkey to Russian Federation and increasing production of greenhouse tomatoes in Armenia, export of tomatoes has reached record quantities in the first quarter of 2016. According to the Armenian National Statistics Service, tomato production in Armenia is demonstrating stable growth tendency. This trend is mainly associated with recent investments into greenhouses. Since 2013 tomato production has been increasing by average of 8 percent a year and reached total production of 319,038 thousand tons in 2015.

According to the FAO data, Armenia is positioned 48th in the global tomato production index, but it has enormous potential for non-seasonal tomato production. Due to improving technologies and regional economic integration processes, export of tomatoes from Armenia has increased by 574% in comparison with the same period of 2014. The main export destinations are Russia and Georgia. Export to Russia has increased as a result of sanctions that the Russian government
imposed on European states and Turkey, that were previously supplying the major share of tomatoes to the Russian market.

**Branding and Target Markets:** Marketing of tomatoes may seem very straightforward, however, there are many tools and techniques investors can apply in marketing tomatoes or tomato made products. Since this guide is about tomato production in greenhouses, we will not cover processing but rather marketing of fresh non seasonal tomatoes at domestic and export markets. There are basically two best known strategies for products - low cost and differentiation or in some cases a combination of both. If tomato yields are high and can compete with prices offered by the most efficient producers at domestic market or within the same export markets, then investor can consider competing at low price strategy, which covers larger market segment at domestic and traditional export markets. This strategy is usually applied by companies that exploit economies of scale or can ensure low cost of production. Alternately, an investor can think of a special characteristic that will position product differently from other producers; a special variety of tomato; or feature such as organic tomato, or maybe differentiating packaging and labeling to position its products for a different market segment that have ability and willingness to pay higher prices for that specific feature. This may also consider production of a specific variety of tomato that, regardless of having better taste and flavor, may have lower yields.

When discussing prices, it is important to mention that tomato prices are fluctuating significantly during the year due to harvest of field tomatoes. These tomatoes usually have lower cost of production and in some cases better taste and flavor. To avoid direct competition with those, the greenhouse producer needs to consider the timing of production. This means that the tomato seedlings can be planted at the time when the field tomatoes are coming to the market. By the time the tomato season is over, the greenhouse crop will be supplied to the market.

For a strategy to be effectively positioned, a company should communicate a respective message and build customer relations. Effective marketing also requires careful selection of distribution channels. Usually cheap tomatoes are marketed at local farmers markets or supermarket chains that target all consumers, while higher priced tomatoes should be distributed through high end supermarket chains such as SAS supermarket and Parma chains in Armenia,
mainly in the capital Yerevan or Globus Gourmet and Azbuka Vkusa (“Alphabet of Taste”) in Moscow. Therefore, the differentiation relates not only to the product feature and pricing but also distribution channels. Large greenhouses can also consider creating own brand for their products. Since Armenian agricultural products have good reputation at CIS and EEU markets, a company may focus on brand name that is associated with Armenia. Due to the fact that consumers make their decisions that are sometimes rational and sometimes emotional, a company should therefore target both in their strategy.

Domestic market is small in comparison with export opportunities in the region, and therefore, many larger greenhouses focus on export. During last five years the main export destinations for the Armenian tomatoes were Russian Federation and Republic of Georgia. Armenia is a member of Eurasian Economic Union and therefore, tomatoes are exported to Russia with no tariffs or custom payments. Furthermore, although Georgia is not a member of EEU, but there is existing trade agreement between Armenia and Georgia, which eliminates the export duties as well. Therefore, even after removing food embargo from EU and other states that have been traditionally supplying the Russian market, Armenia will still benefit as a member of EEU. In addition to traditional markets for Armenian agricultural produce, there are other export opportunities, in particular to markers of Middle East countries.

There are many factors that investor should take into consideration while constructing a greenhouse and considering supplies to domestic and export markets. These factors include quality, price, reliability of supply, quantity, transportation, etc.

**TOMATO PRICES IN ARMENIA AND EEU**

Tomato prices have seasonal fluctuation patterns; decreasing when open field tomatoes are available and increasing during the period from September to April, when most of tomatoes on the market are supplied from greenhouses. In 2015, the average producer price of tomato in Armenia has registered the lowest quote of 142.3 US dollars/ton in August and reached the highest price of 1,898.4 USD/ton in April.

Similar dynamics have been registered in consumer prices of tomatoes, the lowest
price of 0.5 USD/kg in August and 2.7 USD/kg in April. This information is critical for investors to consider their production cycles and ensure that a product is available during the high price season. Although these prices are different from year to year, however general tendency and market dynamics are usually following this pattern.

We can also observe similar situation with the price dynamics in Eurasian Economic Union member countries. This section will provide most recent data on tomato prices in the Russian Federation, Belarus and Kazakhstan.

Charts in this section are demonstrating dynamics of producer and consumer prices in the Eurasian Economic Union.

As it is portrayed, producer prices in general are the highest in the Russian Federation, followed by Belarus. In both countries we can observe significant fluctuations of prices between the season, meaning time of a year when open field tomatoes are available, and non-season, when the only available option is the greenhouse production. In Kazakhstan these fluctuations are much smoother.

One observation that can be made for all countries in this group is that tomato prices are reaching their minimum when open field tomatoes are available during the summer time, since the cost of production is smaller, and there are no large investments into the production.

Starting from September, prices demonstrate growth in Armenia, Russia and Kazakhstan, except Belarus when in 2015 the prices decreased during the period of October to December and reached their maximum in April. Although producer prices are demonstrating vivid difference in selected countries, situation differs in consumer prices, which are demonstrating pretty much the same pattern in all selected countries, recording the lowest prices during the open field tomato production season and increasing up to April. Therefore, having this information and following market dynamics, greenhouse owner should ensure that the production cycle in greenhouse
follows the pricing logic. An agronomist should plan production cycle in the way to ensure harvest during the high price season.

**Russian Federation**

In accordance with this data, the highest tomato producer and consumer prices have been registered in Russia. As it can be observed in the chart on the next page, the price for tomatoes is starting to increase from September and is reaching its peak in April in Russia. The interesting observation though portrays that in August producers’ prices are very close to consumer prices, meaning that open field tomato producers are facing serious challenges as price of tomato is reaching the lowest level.

Both charts also demonstrate that producer and consumer prices are slightly higher in the Russian market. Therefore, local producers can compete on Russian market, and that is the reason for consistent increase of export of tomatoes from Armenia to Russia. Armenian producers can also benefit from higher prices in case of proper positioning of product. This usually requires long term contracting relations with stable and regular supplies to a wholesale or retail outlets.

**Prices, USD/ton**

Source: *Federal State Statistics Service (Rosstat)*

Average producers’ price of tomato in Russia constituted around 867.7 USD/ton, while consumer prices were 0.9 USD/kg, these numbers are very close and therefore, this season is not the best time to supply tomatoes.
POSSIBLE RISKS AND MITIGATION STRATEGIES

Macroeconomic Risks: If a greenhouse is producing traditional types of tomatoes using conventional methods, then the most promising markets are Eurasian Economic Union member states and mainly Russia, which has been a traditional market for most of domestic agriculture products. In general, mainly Turkey, as well as EU member states have been the main supplier of tomatoes to the Russian Federation. However, due to sanctions at the moment there is a large unmet demand, which is indeed temporary and can be eliminated at any time, due to political developments. Furthermore, sanctions have also contributed to import substitution policy, and promotion of local production of most of agricultural products. This could be a risk to consider as well. On the other hand, EEU is actively working in signing free trade and economic cooperation agreements with many states, which will result in facilitated access to new markets and therefore can create new opportunities for tomato producers. In addition, since sanctions toward Turkey may have longer implication, that could be a good timing for the greenhouse producers to solidify their positions in the Russian market.

Strategic Risks: Currently all market and industry information for tomato greenhouse production has been collected. However, if the greenhouse diversifies production varieties and expands into production of other vegetables, there will be need for additional market assessment. Constant developments of new technologies require
in-depth research for conducting cost-benefit analysis and identifying feasibility of adoption of those technologies.

**Legal/regulatory risks:** Agricultural production in Armenia is highly subsidized: irrigation water, fertilizers, seeds, diesel fuel, and interest rates on agricultural loans are subsidized. In addition, currently agricultural producers are exempt of the profit tax, and in case of exporting the production, do not pay Value Added Tax. No business can account for continuous support to the sector, however in the strategy of agriculture and rural development for 2015-2025, the sector continues to be of high importance in terms of the need for support. In addition, if the company operating in the field also has high export volumes, it may get additional benefits of reduced income tax. The income tax of exporters is reduced 10 times if the export volumes are over $105 million, and 4 times if the export volumes range from $84 million to $105 mln.

**Market risks:** The recent embargo placed by the Russian Federation on agriculture imports from the number of countries created short term difficulties for perishable primary goods producers. This situation suggests the need to decrease dependency on one single market. The location of Armenia is very favorable for exploring opportunities of exporting agricultural commodities to Middle East countries.
POSSIBLE INVESTMENT FOR TOMATO GREENHOUSE

Size of investment

For constructing a 6 ha high-tech greenhouse for tomato production, total of $8,631,135 is needed as an initial investment. This amount includes acquisition of land, construction of Venlo type greenhouse for cultivating tomato and initial cash for covering operational expenses in the first year. According to Growtech Holand Company (the Netherlands) the cost of constructing Venlo type greenhouse with 6 ha of total area will be approximately $8,276,919, which includes construction of greenhouse, computer control system, heating system, irrigation system (hydroponics), cold storage for tomato, necessary equipment, etc. (Growtech Holand).

Feasibility of the project

The feasibility of the project is calculated for a full five-year period. An important assumption is that productivity will be low in the first years, but it will gradually increase up to the fourth year and become constant thereafter. According to the literature, 40-50 kg tomato can be harvested per square meter, which though is unrealistic to be assumed to get in the first two-three years. The target can be reached only after some period of time when productivity per square meter of greenhouse operated steadily increases (due to the learning curve effect) and specialists gain more expertise mastering all the nooks and crannies of the
technology. Thus, it is assumed that productivity will be stabilized at 45 kg per square meter starting from the fourth year.

In the initial year (Year 0), 5% of total yield (in December) can be sold, and the Company can generate small positive net income, which was neglected in calculation of project’s financial indicators (NPV, IRR, profitability index, payback period).

Project’s financial modeling was constructed considering the following assumptions:

- Total greenhouse area is 6 ha.
- Yield of tomato will increase year by year reaching its maximum level in Year 4 and stay constant thereafter (See Graph above).
- Total harvest will be exported to the Russian Federation.
- Producer prices in Russia were considered as selling price.
- According to Armenian law, there is no VAT on sales in case of export.
- During production process VAT on costs will be paid back by the Government.
- According to the Article 36 (point 1) of the Law on Profit Tax, there is no profit tax on agricultural production.
- There are property and land taxes in Armenia, however they were not considered in the model, as the tax is calculated based on the cadaster value of the land and property.
Therefore, in this stage the cadaster values are not calculated, but those are reflected in the property prices.

Marketing cost was not considered in the model as it was assumed that the Company will have established links in Russia and will do wholesaling.

All costs and prices were inflated by 4% (an average inflation rate in Armenia).

Depreciation was not included in the model, as there is no need of reduction of non-cash charges because there is no profit tax.

Competitive salaries were considered in the model. Fixed salary costs include salary of the director, chief accountant, assistant to chief accountant, chef agronomist, assistant of chief agronomist, computer system specialist, electrician-technician, supervisor, guard. Variable salary costs include salaries of seasonal workers.

20% discount rate (cost of capital) was applied in calculation of project’s Net Present Value (NPV). Should the company decide to use combination of debt and equity then weighted average cost of capital (WACC) can be lowered as in Armenia business loans are much lower than 20%. And even there are special rates offered by banks for financing greenhouses (e.g. Ameria Bank). In the financial model it has been considered that the greenhouse business will be financed via equity only and for cost of equity 20% figure is quite reasonable in Armenia.

Terminal value included in calculation of NPV was estimated taking into account the value of the land and greenhouse in the 5th year. It was assumed that the value of the land and greenhouse will decrease only by 20%.

All calculations and estimations are based on conservative approach.

Project’s projected financial statements for 5 year are presented in Appendix, which excludes revenue and costs of initial year (Year 0 – August-December). Apparently, during the whole projected period, generated net income is positive, which is though affected by the unlevered nature of financing and tax advantage in the agricultural sector.

Total production cost per kg of tomatoes is composed of seedling, heating, irrigation,
fertilizer, packaging, and transportation costs.

Heating cost comprises the largest proportion (about 40%) in total operating cost. Salary of seasonal workers (about 25%) and transportation costs (about 21%) have the next large portion in total operating costs (see graph below).

As tomatoes are highly seasonal, monthly prices and yields have erratic seasonal fluctuations. In some seasons of the year prices are equal to the costs of the products, which is a natural phenomenon, because in other seasons prices more than offset the loss incurred in other months (See Appendix).

Assessment of financial soundness of the project

Four profitability criteria are used to assess the financial soundness of the project, using a discount rate of 20%. By all of the criteria, the project is profitable (see graph presented below). NPV is about $4,569,101. IRR is greater than the discount rate (20%), which means that it increases the shareholders wealth; profitability index is also good, and overall, the initial investment amount is fully covered by annual cash flows in about 3 years.

Overall, the project is valuable in terms of developing the greenhouse industry, adopting new technology and generating attractive cash flows.
## APPENDIX

### Projected Income Statement

<table>
<thead>
<tr>
<th></th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Revenue, USD</strong></td>
<td>3,559,808.3</td>
<td>4,319,234.1</td>
<td>5,133,718.2</td>
<td>6,006,450.3</td>
<td>6,246,708.3</td>
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<tr>
<td><strong>Variable costs:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seedling Cost</td>
<td>16,268.6</td>
<td>16,919.4</td>
<td>17,596.2</td>
<td>18,300.0</td>
<td>19,032.0</td>
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<td>Fertilizer cost</td>
<td>9,469.7</td>
<td>9,848.4</td>
<td>10,242.4</td>
<td>10,652.1</td>
<td>11,078.2</td>
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<tr>
<td>Weeds/insects control cost</td>
<td>29,361.6</td>
<td>30,536.1</td>
<td>31,757.6</td>
<td>33,027.9</td>
<td>34,349.0</td>
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<tr>
<td>Irrigation cost</td>
<td>1,044.1</td>
<td>1,085.9</td>
<td>1,129.3</td>
<td>1,174.5</td>
<td>1,221.4</td>
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<tr>
<td>Heating cost</td>
<td>419,720.5</td>
<td>436,509.3</td>
<td>453,969.7</td>
<td>472,128.5</td>
<td>491,013.6</td>
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<tr>
<td>Pollination cost</td>
<td>26,029.8</td>
<td>27,071.0</td>
<td>28,153.9</td>
<td>29,280.0</td>
<td>30,451.2</td>
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<tr>
<td>Soil analysis cost</td>
<td>2,863.3</td>
<td>2,977.8</td>
<td>3,096.9</td>
<td>3,220.8</td>
<td>3,349.6</td>
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<tr>
<td>Transportation cost</td>
<td>205,920.0</td>
<td>249,849.6</td>
<td>296,964.1</td>
<td>347,448.0</td>
<td>361,345.9</td>
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<td>Packaging cost</td>
<td>45,552.2</td>
<td>47,374.3</td>
<td>49,269.3</td>
<td>51,240.0</td>
<td>53,289.6</td>
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<tr>
<td>Seasonal salary cost</td>
<td>247,478.6</td>
<td>257,377.7</td>
<td>267,672.8</td>
<td>278,379.7</td>
<td>289,514.9</td>
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<tr>
<td><strong>Total Variable costs</strong></td>
<td>1,003,708.4</td>
<td>1,079,549.5</td>
<td>1,159,852.0</td>
<td>1,244,851.4</td>
<td>1,294,645.5</td>
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<tr>
<td><strong>Gross Profit, USD</strong></td>
<td>2,556,099.9</td>
<td>3,239,684.6</td>
<td>3,973,866.2</td>
<td>4,761,598.9</td>
<td>4,952,062.8</td>
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<td><strong>Fixed costs:</strong></td>
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<td>Fixed salary</td>
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<td>145,861.3</td>
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<td>Maintenance cost</td>
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<td>8,927.7</td>
<td>8,927.7</td>
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<td>Office cost</td>
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<td>1,970.8</td>
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<td>2,131.6</td>
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<td><strong>Total fixed costs</strong></td>
<td>135,432.7</td>
<td>140,492.9</td>
<td>145,755.5</td>
<td>164,620.1</td>
<td>170,312.2</td>
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<tr>
<td><strong>EBIT</strong></td>
<td>2,420,667.3</td>
<td>3,099,191.7</td>
<td>3,828,110.7</td>
<td>4,596,978.7</td>
<td>4,781,750.7</td>
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<td>Interest</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<td><strong>EBT</strong></td>
<td>2,420,667.3</td>
<td>3,099,191.7</td>
<td>3,828,110.7</td>
<td>4,596,978.7</td>
<td>4,781,750.7</td>
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<tr>
<td>Tax</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Net income, USD</strong></td>
<td>2,420,667.3</td>
<td>3,099,191.7</td>
<td>3,828,110.7</td>
<td>4,596,978.7</td>
<td>4,781,750.7</td>
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### Discounted Cash Flows

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<tr>
<th>Y0</th>
<th>Y1</th>
<th>Y2</th>
<th>Y3</th>
<th>Y4</th>
<th>Y5</th>
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</thead>
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<td><strong>Net Cash Flows</strong></td>
<td>2,420,667</td>
<td>3,099,192</td>
<td>3,828,111</td>
<td>4,596,979</td>
<td>4,781,751</td>
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<tr>
<td><strong>Terminal Value</strong></td>
<td>6,660,908</td>
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<td><strong>Initial investment</strong></td>
<td>(8,631,135.09)</td>
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<td><strong>Discounted cash flows (20% discount rate)</strong></td>
<td>2,017,223</td>
<td>2,152,216</td>
<td>2,215,342</td>
<td>2,216,907</td>
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### Selling price of tomato

<table>
<thead>
<tr>
<th></th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
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</thead>
<tbody>
<tr>
<td>January</td>
<td>2307</td>
<td>2399</td>
<td>2495</td>
<td>2595</td>
<td>2699</td>
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<tr>
<td>February</td>
<td>2133</td>
<td>2218</td>
<td>2307</td>
<td>2399</td>
<td>2495</td>
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<tr>
<td>March</td>
<td>2480</td>
<td>2579</td>
<td>2682</td>
<td>2790</td>
<td>2901</td>
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<tr>
<td>April</td>
<td>2233</td>
<td>2323</td>
<td>2415</td>
<td>2512</td>
<td>2613</td>
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<td>May</td>
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<td>2286</td>
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<td>2472</td>
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<td>1221</td>
<td>1270</td>
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<td>1373</td>
<td>1428</td>
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<tr>
<td>July</td>
<td>1080</td>
<td>1124</td>
<td>1169</td>
<td>1215</td>
<td>1264</td>
</tr>
<tr>
<td>August</td>
<td>902</td>
<td>939</td>
<td>976</td>
<td>1015</td>
<td>1056</td>
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<td>591</td>
<td>614</td>
<td>639</td>
<td>665</td>
<td>691</td>
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<tr>
<td>October</td>
<td>1204</td>
<td>1253</td>
<td>1303</td>
<td>1355</td>
<td>1409</td>
</tr>
<tr>
<td>November</td>
<td>1164</td>
<td>1211</td>
<td>1259</td>
<td>1310</td>
<td>1362</td>
</tr>
<tr>
<td>December</td>
<td>1213</td>
<td>1262</td>
<td>1312</td>
<td>1365</td>
<td>1419</td>
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<tr>
<td>Average, USD/ton</td>
<td><strong>1561</strong></td>
<td><strong>1623</strong></td>
<td><strong>1688</strong></td>
<td><strong>1755</strong></td>
<td><strong>1826</strong></td>
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</table>

### Cost of producing tomato

<table>
<thead>
<tr>
<th></th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seedling Cost</td>
<td>9.0</td>
<td>8.1</td>
<td>7.3</td>
<td>6.8</td>
<td>7.0</td>
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<tr>
<td>Fertilizer cost</td>
<td>5.3</td>
<td>4.7</td>
<td>4.3</td>
<td>3.9</td>
<td>4.1</td>
</tr>
<tr>
<td>Weeds/ insects control cost</td>
<td>16.3</td>
<td>14.5</td>
<td>13.2</td>
<td>12.2</td>
<td>12.7</td>
</tr>
<tr>
<td>Irrigation cost</td>
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<td>0.5</td>
<td>0.5</td>
<td>0.4</td>
<td>0.5</td>
</tr>
<tr>
<td>Heating cost</td>
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<td>207.9</td>
<td>189.2</td>
<td>174.9</td>
<td>181.9</td>
</tr>
<tr>
<td>Pollination cost</td>
<td>14.5</td>
<td>12.9</td>
<td>11.7</td>
<td>10.8</td>
<td>11.3</td>
</tr>
<tr>
<td>Soil analysis cost</td>
<td>1.6</td>
<td>1.4</td>
<td>1.3</td>
<td>1.2</td>
<td>1.2</td>
</tr>
<tr>
<td>Transportation cost</td>
<td>114.4</td>
<td>119.0</td>
<td>123.7</td>
<td>128.7</td>
<td>133.8</td>
</tr>
<tr>
<td>Packaging cost</td>
<td>25.3</td>
<td>22.6</td>
<td>20.5</td>
<td>19.0</td>
<td>19.7</td>
</tr>
<tr>
<td>Seasonal salary cost</td>
<td>137.5</td>
<td>122.6</td>
<td>111.5</td>
<td>103.1</td>
<td>107.2</td>
</tr>
<tr>
<td>Total Cost, USD/ton</td>
<td>557.6</td>
<td>514.1</td>
<td>483.3</td>
<td>461.1</td>
<td>479.5</td>
</tr>
</tbody>
</table>
REFERENCE

6. Growtech Holand Company’s bid for construction of a modern greenhouse- requested by Armenian Harvest Promotion Center. https://issuu.com/ahpc/docs/armenia_-below_1.000_m._-gh_6_ha._-en_-final


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