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APPLE VALUE CHAIN STUDY AND ACTION PLAN

**AGRICULTURAL COMPETITIVENESS AND ENTERPRISE DEVELOPMENT
PROJECT (ACED)**



OCTOBER 2011

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APPLE VALUE CHAIN STUDY AND ACTION PLAN

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Contents

| | |
|--|-----------|
| SUMMARY | 6 |
| OBJECTIVE | 9 |
| 1 VALUE CHAIN STRUCTURE | 10 |
| 1.1 Overview of the value chain | 10 |
| 1.1.1 World apple production | 10 |
| 1.1.2 Key end markets and Moldova's share in these markets..... | 11 |
| 1.1.3 Market opportunities and key market requirements | 13 |
| 1.1.4 Other factors that determine competitive dynamics | 21 |
| 1.1.5 Production process and technologies..... | 23 |
| 1.1.6 Main channels to markets | 30 |
| 1.2 Analysis of value added | 33 |
| 1.3 Productivity analysis..... | 34 |
| 1.3.1 Production..... | 34 |
| 1.3.2 Post-harvest and sales..... | 37 |
| 2 LINKAGES AND RELATIONSHIPS WITHIN THE VALUE CHAIN | 38 |
| 2.1 Vertical linkages..... | 38 |
| 2.2 Horizontal linkages..... | 39 |
| 3 ACTION PLAN | 41 |
| 4 CAUSAL MODEL | 44 |
| ANNEX A: CROP BUDGETS FOR APPLES | 48 |
| A.1 Intensive orchard (12.5 ha, 2381 trees/ha)..... | 48 |
| A.2 Traditional orchard (20 ha, 833 trees/ha)..... | 48 |
| A.3 Comparative cumulative cash flow | 49 |
| ANNEX B: CIGAR BOX FOR AJC | 50 |
| ANNEX C: VALUE ADDED TABLES | 51 |
| C.1 Truck market channel..... | 51 |
| C.2 Direct trade channel | 52 |

List of tables and figures

| | |
|--|----|
| Table 1: World Apple Production (thousand tons)..... | 10 |
| Table 2: Fresh apples: per capita consumption by selected countries (kg) | 11 |
| Table 3: Major European Apple Importers in 2010 year (tons) | 12 |
| Table 4: Percent of Fruit Purchases by Retail Type and Year..... | 20 |
| Table 5: Share of supplying countries in the monthly Russian imports of apples | 21 |
| Table 6: Detections of quarantine pests by Rosselkhoznadzor in Moldovan products | 23 |
| Table 7: Size distribution of apple orchards planted in 2009 year | 25 |
| Table 8: Area of pome fruit orchards owned by agricultural enterprises and family farms..... | 25 |
| Table 9: Major Moldovan apple processors (tons)..... | 32 |
| Table 10: Export of apple juices from Moldova | 32 |
| Table 11: Costs and margins for the “truck market” channel..... | 34 |
| Table 12: Costs and margins for the “direct trade” channel..... | 34 |
| Table 13: Production productivity benchmarking (France vs. Moldova) | 35 |
| | |
| Figure 1: Structure of Moldovan fresh apple exports (thousand tons) | 12 |
| Figure 2: Volume and structure of the Russian market (tons)..... | 13 |
| Figure 3: Imports of fresh apples to Russia by country, by volume in 2010..... | 13 |
| Figure 4: Market volume of apples, tons..... | 15 |
| Figure 5: Fresh apples imports in Romania in 2010 by volume..... | 15 |
| Figure 6: Apple monthly import price and minimum entry price fluctuation in 2010, euro/kg..... | 16 |
| Figure 7: Monthly import price fluctuation for fresh apples in Romania by country in 2010, €/ kg | 16 |
| Figure 8: Market volume of dessert apples, tons..... | 18 |
| Figure 9: Average wholesale price for fresh apples, € / 100 kg | 19 |
| Figure 10: Dynamics of the suppliers’ market share in the Romanian apple imports..... | 22 |
| Figure 11: Apple production & export (ths. tons) | 24 |
| Figure 12: Dynamics of new plantings (ha) | 24 |
| Figure 13: Top income-generating commodities in Moldova | 24 |
| Figure 14: Types of new apple plantings (2009)..... | 26 |
| Figure 15: Evolution and structure of cold storage capacity | 27 |
| Figure 16: Age-status relationship for existing cold storages | 28 |
| Figure 17: Seasonality of Moldovan apple exports (tons)..... | 28 |
| Figure 18: Apple shipments from Bodensee (by week, thousand tons) | 29 |
| Figure 19: Apple value chain map | 30 |
| Figure 20: Wholesale market price for apples in 2010 season (MDL)..... | 31 |
| Figure 21: AJC market price evolution (2003-2011) | 33 |

Acronym list

| | |
|-------|---|
| AAFA | Access to Agriculture Finance Activity |
| ACED | Agricultural Competitiveness and Enterprise Development Project |
| ACSA | National Agency for Rural Development |
| ADP | Agribusiness Development Project |
| AJC | Apple Juice Concentrate |
| BSP | Business Service Provider |
| CIS | Commonwealth of Independent States |
| EPPO | European and Mediterranean Plant Protection Organization |
| EU | European Union |
| FAO | Food and Agriculture Organization |
| GCCA | Global Cold Chain Alliance |
| GoM | Government of Moldova |
| HACCP | Hazard Analysis and Critical Control Points |
| HVA | High Value Agriculture |
| IDSP | Investment Development Service Provider |
| IFAD | International Fund for Agriculture Development |
| IPM | Integrated Pest Management |
| STTA | Short Term Technical Assistant |
| MAFI | Ministry of Agriculture and Food Industry |
| MCA | Millennium Challenge Account |
| MFA | Fruit Producers and Exporters Association “Moldova Fruct” |
| MRL | Maximum residue level |
| MIEPO | Moldovan Investment and Export Promotion Organization |
| NRA | National Refrigeration Association |
| SPS | Sanitary and Phytosanitary |
| USAID | United States Agency for International Development |
| VAT | Value-Added Tax |
| VC | Value Chain |
| VCSC | Value Chain Support Centre |
| WFLO | World Food Logistics Organization |
| WTO | World Trade Organization |

Summary

In the past, Moldova was one of the largest producers and processors of fruits in the former Soviet Union with most of the production exported to other Soviet republics. For this reason, Moldova was described as the “orchard” of the Soviet Union. Fruit production volumes hovered around 1 million tons. The collapse of the old system in the early 1990s brought with it the disruption of the existed state-controlled distribution chains and the rapid shrinking of apple production and processing. By the mid-1990s the need for structural changes became obvious as most collective farms were in a state of insolvency. The Russian economic crisis of 1998-99 created additional pressures to changes.

A major element of the agricultural system reforms was the land privatization process that took place between 1998 and 2000. More than 1 million residents became landowners. The adjustment process has been both difficult and lengthy with the private sector slowly evolving and learning how to operate in a market economy and how to produce and sell based on market demand. The rebound of the Moldovan apple sector began in 2000, driven by the increased demand from regional markets, mainly the Russian Federation, whose imports grew annually by an average of 20% during the last decade, going from 200 thousand tons in 2000 to 1,204 thousand tons (USD 1.7 billion at wholesale prices) in 2010.

Currently Moldova produces about 350 thousand tons of apples. FAO estimates the apples to be the third highest grossing product of the Moldovan agricultural sector (adjusted for the international commodity prices, the production value exceeded USD 87 million in 2009), surpassed only by grapes (wine and table) and cow’s milk. The main destination of the Moldovan apples is the fresh export market (180 thousand tons for export, or 51%, of which 93% represent exports to the Russian Federation), followed by processing (90 thousand tons, or 26%) and fresh local market (80 thousand tons, or 23%).

The predominant channel in the Moldovan apple sector involves the production of apples in a traditional, low-density orchard (less than 1,250 trees/ha), exported by the grower or a local trader/exporter to Russia during the harvesting season, or immediately after, without passing through the cold chain (only field packing), sold there through the truck markets (an open-air market where the products are sold from trucks) to small wholesalers distributing the fruit to the entire European part of Russia, the final consumer buying the fruit on the street or in an open-air market.

The growers that planted modern orchards are more inclined to avoid the risks of the truck market channel by working directly with the traders and larger Russian importers and wholesalers. Only a small quantity of the Moldovan apples reaches the shelves of the Russian retail chains through this channel. There have been attempts of some growers to establish direct links with the Russian retailers, but most attempts failed because of the inability to offer fruit graded or a longer-term supply of quality fruit.

The local market is served almost exclusively by the small and medium growers, with fruit of lower quality (not accepted in the export market) or fruit produced in small quantities that are difficult to aggregate into export deliveries (at least 20 tons, the capacity of a refrigerated truck). The modern retail formats have a very low share of this channel, the main place where the Moldovans buy apples being the open-air markets.

The main use of the apples sold to processors is the production of apple juice concentrate (AJC) that is exported mainly to EU. The historically very volatile AJC market prices, combined with the need to compete with the cheap Chinese AJC, leave little room for maneuver of the Moldovan apple processors when they set the processing apple prices (the raw material represents 2/3 of the variable production cost).

No farmer is growing apples for processing, because prices offered are much lower than those on the fresh market and are below the production costs.

If the current new planting level is maintained, the Ministry of Agriculture and Food Industry expects Moldova to double its apple production to 600-700 thousand tons towards 2015. To sell these apples profitably and successfully compete with the established suppliers (Poland, Italy) and the emerging players (Ukraine, Serbia), the Moldovan apple value chain entities have to deliver substantial improvements throughout the value chain to meet the end market requirements, as identified by ACED end market studies:

- Cost-competitive apples with good cosmetic appeal (appropriate size, attractive coloring, and absence of visual defects);
- Longer shelf-life and delivery sustainability (4-6 weeks);
- Size and color uniformity in the package;
- Easy handling package ensuring a good protection to the fruit;
- Guaranteed food safety & phytosanitary health.

Most of the improvements regarding the apple cosmetic appeal and the cost per kg can be achieved by the growers in their orchards by:

- Planting intensive orchards using modern varieties with improved coloring;
- Introduction of chemical thinning;
- Improved use of orchard irrigation;
- Improved plant nutrition, based on soil, water and plant-tissue analysis;
- Installation of anti-hail nets and frost protection systems in the orchard;
- Appropriate winter and summer pruning;
- Improved pest management;
- Implementation of appropriate harvesting tools;
- Improved human resource management (training of workers, process planning) and labor productivity.

ACED will contribute to attaining these improvements by implementing advanced practices and technologies in selected demonstration plots and organizing training sessions around these plots for interested farmers.

Longer shelf-life, delivery sustainability and fruit uniformity (size and color) can be achieved by better harvesting, handling and storage practices and investments in post-harvest infrastructure (cold stores, grading and packing equipment, refrigerated trailer transport). As in the case of apple production ACED will implement postharvest demonstration activities and will organize training sessions to disseminate best practices and technologies to current cold store operators and potential investors in new facilities.

Additionally ACED will support apple value chain entities in getting better access to long-term finance by linking them with equipment suppliers, investment development service providers and financial institutions, including those participating in the Compact AAFA. ACED will develop informational materials, organize study tours for financial institutions and offer additional technical assistance to them in order to improve banks' understanding of the HVA sector and its financial needs.

Food safety and phytosanitary health can be guaranteed only when farmers apply good agricultural practices (GAP) at all stages of production and postharvest handling, while the role of the Government is to build awareness about SPS issues and implement proactive sanitary and phytosanitary inspection and

testing system. ACED will promote the adoption of good agricultural practices through training seminars and will cost-share the assignments of local consultants for the farmers implementing the GLOBALGAP standard. The central phytosanitary laboratory will be equipped with modern equipment and the inspectors will receive adequate training based on EPPO standards and guidelines.

Taking into consideration continuous development and consolidation of the retail sector and increasing globalization in the world apple market, deeper cooperation among value chain entities is mandatory for the long-term sustainability of the Moldovan apple sector. ACED approach in building trust among value chain entities will focus on identifying clear opportunities for collaboration and cooperation among value chain entities and providing assistance to take advantage of these opportunities through joint action. Thus, joint efforts could help value chain actors to meet large supply contracts, make joint investment in postharvest infrastructure, taking advantage of the economy of scale, or implement transfer of technology activities.

Objective

This paper has been prepared to bring together the mass of information that has been gathered with respect to the apple value chain in Moldova, including information about various end markets, production technologies, post-harvest practices, investment needs, and relevant government policy and business practices. This information is carefully analyzed to provide a basis for developing a strategy and action plan that will be useful to the ACED team as it works with apple producers, input suppliers, traders and other participants to improve the efficiency and enhance the profitability of the value chain and its role as a driver of the Moldovan rural economy.

1 Value Chain Structure

1.1 Overview of the Value Chain

1.1.1 World Apple Production

The apple is the pomaceous fruit of the apple tree, species *Malus domestica* in the rose family (Rosaceae). It is one of the most widely cultivated tree fruits. Apples are often eaten raw. The whole fruit, including the skin, is suitable for human consumption. Apples can be canned or juiced. They are milled to produce apple cider (non-alcoholic, sweet cider), which is filtered for apple juice. The juice can be fermented to make hard cider, ciderkin, and vinegar. Through distillation, various alcoholic beverages can be produced, such as applejack, Calvados, and Apfelwein. Pectin and apple seed oil may also be produced. Apples are an important ingredient in many desserts, such as apple pie, apple crumble, apple crisp and apple cake. They are often eaten baked or stewed, and they can be dried and eaten or reconstituted (soaked in water, alcohol or some other liquid) for later use. Puréed apples are generally known as apple sauce. Apples are also made into apple butter and apple jelly. They are also used (cooked) in meat dishes.

The proverb "An apple a day keeps the doctor away", addressing the health effects of the fruit, dates from 19th century. Research suggests that apples may reduce the risk of colon cancer, prostate cancer and lung cancer. Compared to many other fruits and vegetables, apples contain relatively low amounts of vitamin C, but are a rich source of other antioxidant compounds. The fiber content, while less than in most other fruits, helps regulate bowel movements and may thus reduce the risk of colon cancer. They may also help with heart disease, weight loss, and controlling cholesterol. The fiber contained in apples reduces cholesterol by preventing reabsorption, and (like most fruits and vegetables) they are bulky for their caloric content.

Around 70 million tons of apples were grown worldwide in 2010, with a value of about \$15 billion. China produced about 42% of this total. The United States is the second leading producer, with more than 6.1% of world production. They are followed by the "two-million" group: Iran, Turkey, Poland and Italy. For comparison, Moldova produces annually 350-400 thousand tons. In the next 10 years, the world apple output is expected to increase by 26% to 88 million tons.

Table 1: World Apple Production (thousand tons)

| Year | 2000 | 2005 | 2010 | 2015 | 2020 |
|----------------------------------|---------------|---------------|---------------|---------------|---------------|
| Country or Region | Actual | Actual | Preliminary | Forecast | Forecast |
| Major Producing Countries | | | | | |
| France | 2.157 | 2.241 | 1.680 | 1.850 | 1.900 |
| Italy | 2.132 | 2.192 | 2.165 | 2.380 | 2.400 |
| Poland | 1.450 | 2.075 | 2.000 | 3.160 | 3.270 |
| Other Europe | 7.199 | 6.597 | 7.163 | 7.975 | 8.228 |
| Total Europe | 12.938 | 13.105 | 13.008 | 15.365 | 15.798 |
| United States | 4.682 | 4.409 | 4.270 | 4.750 | 5.000 |
| Total North America | 5.564 | 5.401 | 5.215 | 5.795 | 6.105 |
| China | 20.440 | 24.017 | 30.000 | 36.000 | 40.000 |
| Total Asia | 23.650 | 32.181 | 38.200 | 45.244 | 49.824 |
| South America | 2.792 | 3.457 | 3.535 | 3.910 | 4.130 |
| South Africa | 574 | 680 | 750 | 875 | 930 |
| Oceania | 941 | 851 | 785 | 830 | 875 |

| | | | | | |
|--|---------------|---------------|---------------|---------------|---------------|
| Total Southern Hemisphere | 4.307 | 4.988 | 5.070 | 5.615 | 5.935 |
| Russian Federation | 1.832 | 1.563 | 1.000 | 1.375 | 1.500 |
| Total Major Producing Countries | 48.291 | 57.238 | 62.493 | 73.394 | 79.162 |
| Other Producing Countries | 10.759 | 5.279 | 7.288 | 8.531 | 8.948 |
| WORLD TOTAL | 59.050 | 62.517 | 69.781 | 81.925 | 88.110 |

Source: Belrose Inc. World Apple Review 2010 & 2011

Worldwide, about 1/3 of apple production is processed and 2/3 are directed to the fresh market.

1.1.2 Key End Markets and Moldova's Share in These Markets

The world's largest apple producers are also its primary apple consumers and traders. Since the early 2000s, global per capita consumption has stabilized, but at a level slightly below that of the late 1990s (table 11). In 2007 the markets with the highest consumption per capita were Turkey, the EU, New Zealand, Canada, and China. Russia is one of the few markets to experience growth in per capita consumption. Significant variations in consumption occur in countries and between regions according to fruit availability (which depends on production levels) and changes in per capita income.

Table 2: Fresh apples: per capita consumption by selected countries (kg)

| Country | 1997-99 | 2001-03 | 2004-06 | 2007 |
|--|--------------|--------------|--------------|--------------|
| Austria | 24.03 | 24.04 | 25.04 | 25.23 |
| Belgium | 20.09 | 17.58 | 17.76 | 18.27 |
| Bulgaria | 7.14 | 3.61 | 4.16 | 4.31 |
| Denmark | 20.28 | 19.99 | 19.81 | 19.60 |
| France | 16.74 | 16.50 | 15.23 | 16.12 |
| Germany | 19.98 | 18.50 | 18.93 | 19.35 |
| Hungary | 17.77 | 14.11 | 17.71 | 15.42 |
| Italy | 22.67 | 19.89 | 17.67 | 16.68 |
| Netherlands | 20.16 | 20.12 | 20.66 | 20.38 |
| Poland | 14.74 | 14.42 | 13.27 | 8.06 |
| Romania | 16.00 | 14.24 | 16.86 | 13.32 |
| Slovakia | 13.62 | 7.64 | 12.21 | 10.52 |
| United Kingdom | 10.15 | 9.35 | 10.06 | 10.14 |
| Selected EU countries (average) | 17.18 | 15.38 | 16.11 | 15.18 |
| Canada | 12.18 | 11.41 | 12.91 | 12.56 |
| Mexico | 5.48 | 5.41 | 6.46 | 6.27 |
| United States ^a | 8.59 | 7.22 | 7.60 | 7.53 |
| North America (average) | 8.75 | 8.01 | 8.99 | 8.79 |
| China | 14.43 | 12.86 | 13.10 | 11.28 |
| Japan | 6.00 | 5.82 | 5.10 | 5.48 |
| Taiwan | 6.88 | 5.53 | 6.08 | 6.06 |
| Turkey | 36.71 | 32.43 | 28.70 | 31.68 |
| Asia (average) | 14.56 | 13.07 | 13.07 | 11.69 |
| Argentina | 9.05 | 8.51 | 5.27 | 4.40 |
| Australia | 8.41 | 6.54 | 7.14 | 7.38 |
| Brazil | 4.71 | 4.72 | 4.28 | 4.64 |
| Chile | 6.46 | 7.30 | 7.19 | 9.58 |
| New Zealand | 21.24 | 16.58 | 14.33 | 14.57 |
| South Africa | 4.49 | 3.83 | 3.68 | 4.11 |
| Southern Hemisphere (average) | 5.67 | 5.48 | 4.78 | 5.10 |
| Russia | 4.54 | 6.05 | 6.79 | 8.11 |
| All 27 countries listed above | 13.80 | 12.38 | 12.52 | 12.26 |

Source: Belrose, Inc., World Apple Review 2008

The international trade in fresh apples was estimated at 6.2 million tons (more than 9% of world production). The biggest importer of fresh apples is the Russian Federation (1.2 million tons, 20% of world imports), followed by Germany (10%), United Kingdom (7%), Egypt (4%) and Mexico (4%).

Russia is the only big apple importer experiencing strong, continuous growth of imported volumes. During last 10 years, imports grew annually by an average of 20%, going from 200 thousand tons in 2000 to 1,204 thousand tons in 2010.

Table 3: Major European apple importers in 2010 (tons)

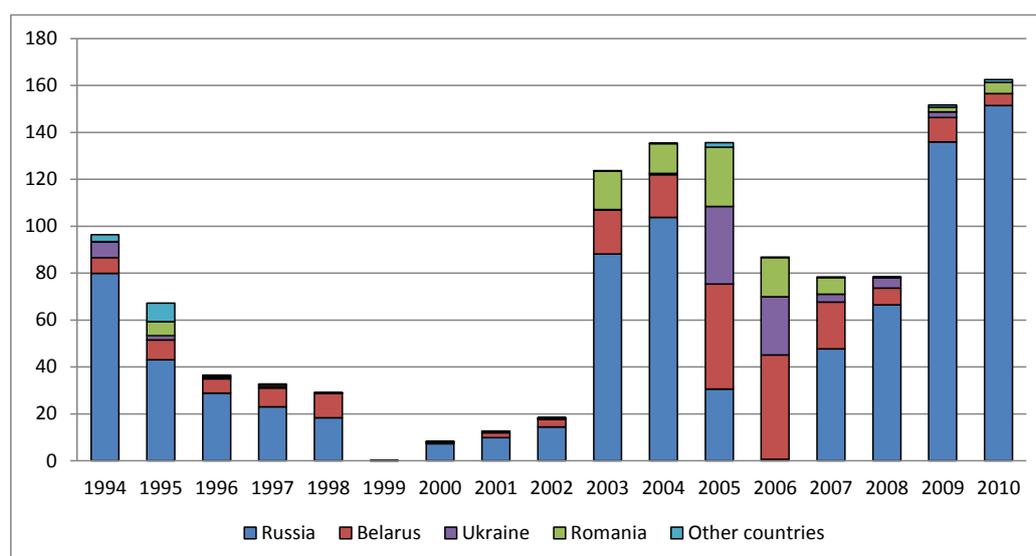
| Rank | Importer | Total Volume | Imports from Moldova | Share of Moldova |
|------|--------------------|--------------|----------------------|------------------|
| 1 | Russian Federation | 1,204,175 | 151,402 | 13% |
| 2 | Germany | 621,501 | | |
| 3 | United Kingdom | 457,425 | | |
| 4 | Ukraine | 203,061 | 30 | 0% |
| 5 | France | 168,200 | | |
| 6 | Belgium | 146,502 | | |
| 7 | Sweden | 84,413 | | |
| 8 | Czech Rep. | 81,058 | | |
| 9 | Denmark | 76,690 | | |
| 10 | Austria | 73,375 | | |
| 11 | Belarus | 60,324 | 5,100 | 8% |
| 12 | Slovakia | 53,558 | | |
| 19 | Romania | 36,981 | | |

Source: UN Comtrade, Eurostat Comext

Historically, the Russian Federation has been the main export market for the Moldovan fresh apples. In 2010 the exports to Russia represented 93% of total exports. Belarus is the only other permanent market for the Moldovan fresh apples (3-5% of total exports). Throughout the last decade, there were periods when other markets had an important share in the Moldovan exports:

- Romania in 2003-2006 took 10-20% of the Moldovan apple exports, but after this country joined EU in 2007 and adopted the EU customs tariffs, the Moldovan exports stopped (for more details, see *Chapter 1.1.3.2* on the Romanian market);
- Ukraine had a share of 25-35% in 2005-2006, when the imports of the Moldovan fresh produce were banned in the Russian Federation. It is safe to assume that most of the apples were not consumed in Ukraine, but rather re-exported to Russia, to circumvent the ban.

Figure 1: Structure of the Moldovan fresh apple exports (thousand tons)



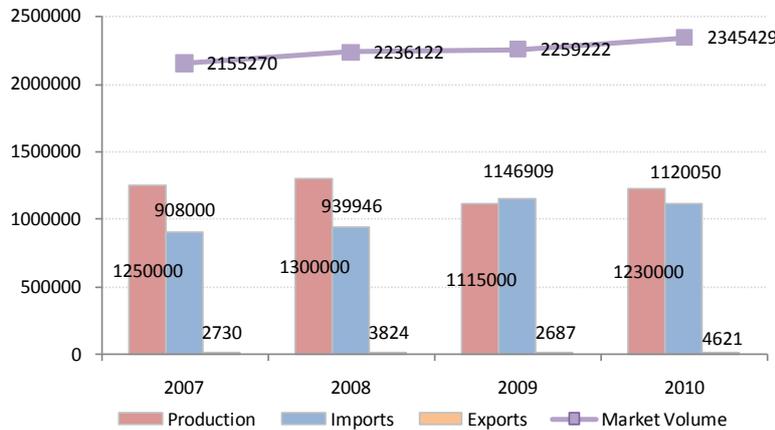
Source: UN Comtrade

1.1.3 Market Opportunities and Key Market Requirements

1.1.3.1 Russia

The fresh apple market in Russia reached 2,345 thousand tons in 2010. The market is shared almost equally by the local production and imports.

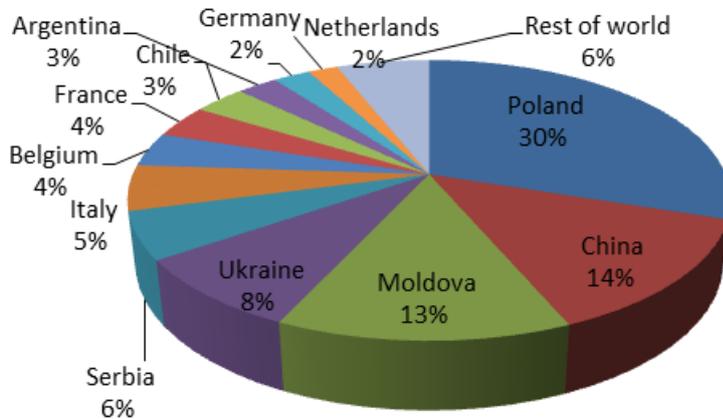
Figure 2: Volume and structure of the Russian market (tons)



Source: United States Department of Agriculture, FAS Production, Supply and Distribution Data Base

Poland is traditionally the biggest supplier to the Russian market and China is the second one supplying apples to the Asian part of Russia.

Figure 3: Imports of fresh apples to Russia by country, by volume in 2010



Source: Global Trade Atlas

The market share of the Moldovan apples has been constantly growing since the import ban of 2006, increasing from 5% in 2007 to 13% in 2010. Last year was also a good year for the Ukrainian producers, who doubled their exports to the Russian market. Serbia has also doubled its exports to Russia reaching a 6% market share in 2010. Export volumes from Italy, France and Belgium during the last 5 years were up as well, keeping pace with the growth of the market. Chile had a relatively stable share of 3-4% of the market. The share of Argentina dropped from 10% in 2005 to 3% in 2010.

The average wholesale price for apples in Russia during the last two years was relatively stable within the range of €1-1.20/kg, with a small spike in August. An explanation for the absence of price premiums in

the off-season (winter and spring months) is arrival of high quality fruit from the Southern Hemisphere (Chile and Argentina) during that period.

The Russian market is really divided into two distinct segments, although there is always some crossover when there is an imbalance between supply and demand. The lower to middle segments of the market, where the majority of the apple business is done, is served by Poland, Moldova, Ukraine, Serbia and China (for selected Eastern parts). For the higher end niche market segment, where big fruit and specialty varieties are sold in fancy packaging, competition is strong among suppliers from Holland, Italy, Belgium, Argentina, Chile and Spain.

The mainstream market (low-mid priced) is extremely competitive. Serbia has done a great job over the course of the last few years in providing quality produce and building its image, which allowed it to increase its prices and expand its presence in the Russian market. Poland continues to have a very good reputation in the market. Ukraine is also moving ahead and gaining good recognition in supplying consistent fruit in the market. What happens in these three countries can seriously affect Moldovan apple exports, especially considering the fact that Ukraine planted large areas to new orchards during the last several years.

Moldovan fruit has a good reputation with many but lacks the cosmetic appeal and size consistency of other suppliers. The overall organoleptic qualities of the Moldovan fruit are often preferred over the fruit from Poland and Serbia, but the eye appeal and overall pack out is not as good. One cannot emphasize enough how important it is to have cosmetically appealing fruit as people “eat with their eyes”.

There are freight cost variances between the major exporters of apples to Russia with Serbia being the most expensive (€3,100) per truck load and Poland being the least (€2,150 with Moldova in the middle (€2,800). While this cost difference is not a determining factor on the final price, it is an important factor in determining profitability of the business, especially in the mainstream market (low-mid priced). Generally the Serbian and Polish fruit sells for a small premium (10%) higher compared to the Moldovan and Ukrainian fruit based on consistent sizing, eye appeal and attractive full pack out of the box.

The size uniformity of the fruit is very important. Fruits of 65-70mm are generally preferred for the retail trade and HoReCa. Larger fruits (85-90mm) are sold in retail at a premium but this is a niche product. Within the HoReCa market there is also demand for smaller fruit (+/- 60mm) for schools, hospitals, airlines, military and other similar institutions.

There is no real importance given to the type and material of packaging, as long as it provides protection to the fruit and prevents damage.

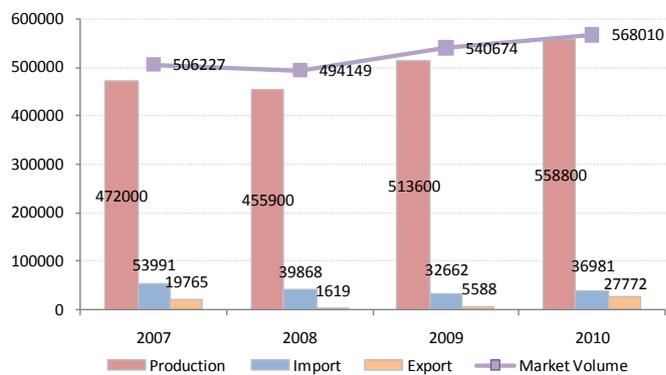
Traditional varieties, such as Golden Delicious, Idared, Simirenko and Red Delicious continue being popular and will maintain the biggest share in the future. In addition some new varieties like Gala, Champion, and Gloster are slowly gaining in popularity. The majority of suppliers shipping the more expensive varieties to supermarkets have increased their market share and volumes during the last 2-3 years. This will continue, as consumers prefer buying more and more produce in supermarkets, which now account for more than 50% of overall fruit sales in big cities. This is an important aspect to be considered, as the open market segment where Moldovan fruits are usually sold will shrink in Russia.

In order to be competitive, Moldovan producers need to meet the quality requirements of the retail sector where the major growth is expected and, in the nearest future, to consolidate their efforts to adapt their products and overall marketing strategy to this changing market environment.

1.1.3.2 Romania

During last four years, apple consumption in Romania increased by 12%, from 506 to 568 thousand tons.

Figure 4: Market volume of apples, tons

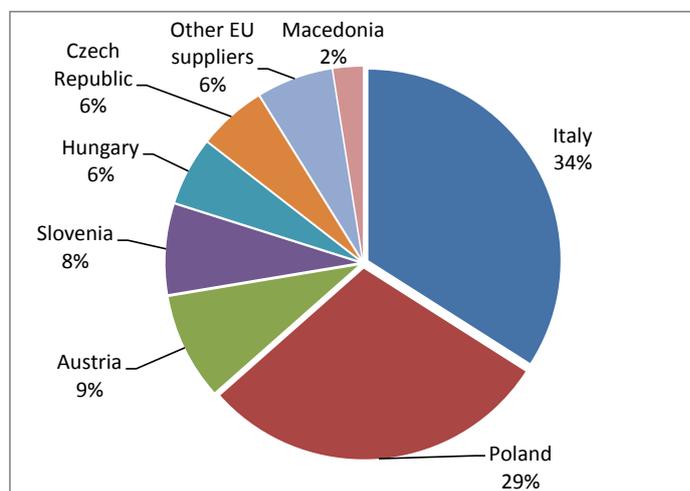


Source: Eurostat Data Base

During the same period, the overall production of fresh apples in Romania increased by 18% from 472 to 558 thousand tons. Overall imports of apples in 2010 (37,000 tons) were up 13.2% compared to 2009 but down 7.2% from 2008.

Apples are consumed all year round and the competition is very intense stemming mainly from the vast production from local producers. Imported apples are shipped from Italy, Poland, Austria, Slovenia, Hungary, and Czech Republic and, to a significantly smaller extent in the winter months, from the Southern Hemisphere – mostly Argentina and Chile. Moldova’s share of imports dropped from 24% in 2005 to 0% in 2007 (year of Romania accession to EU) and have never recovered.

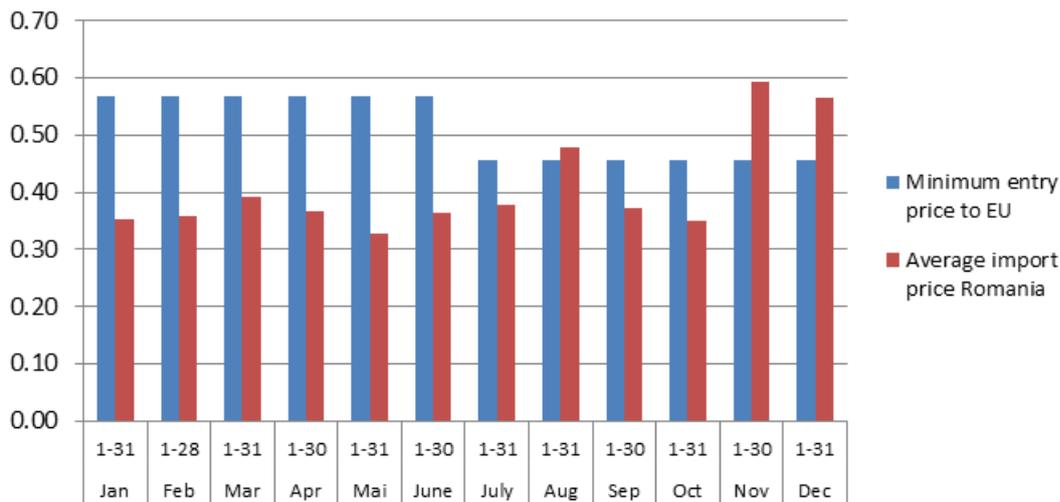
Figure 5: Fresh apples imports in Romania in 2010 by volume



Source: UN Comtrade

Moldovan fresh produce, including apples, benefit from the Asymmetric Trade Preferences when exported to EU and 0% of “ad valorem” import duty is applied. In order to benefit from these Preferences, the import price needs to be no less than the stipulated “minimum entry price” (MEP) for the specific period. This system protects the EU producers from low market prices. For most of the year it is a significant barrier preventing the Moldovan apples from entering EU markets since intra-European shipments are not affected by this restriction. The monthly fluctuation of the average import prices (AIP) to Romania in comparison with the minimum entry price (MEP) is presented in Figure 6 below.

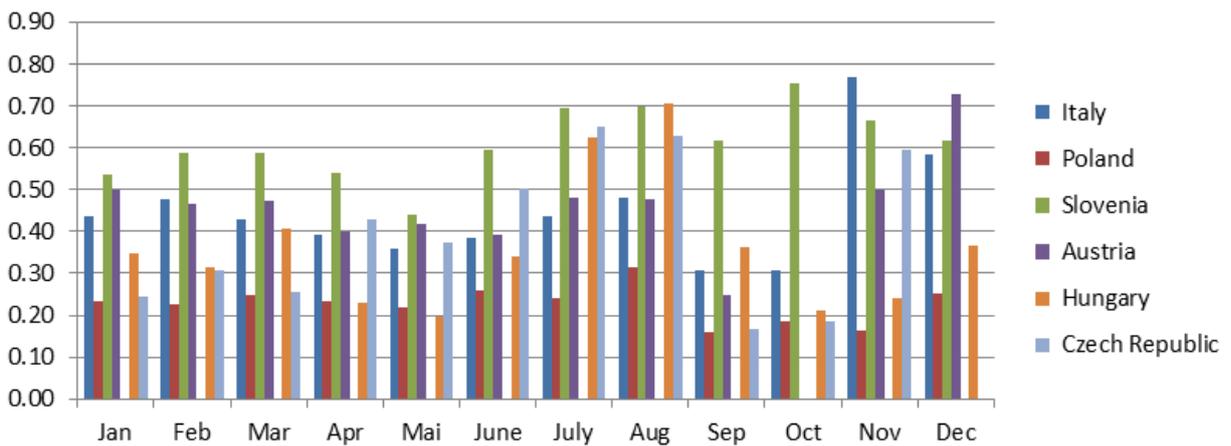
Figure 6: Apple monthly import price and minimum entry price fluctuation in 2010, euro/kg



Source: Global Trade Atlas

In establishing a pricing strategy to go to market both the MEP must be considered and the pricing of the competitive supply countries to best determine the price range that is needed to effectively market the fruit in Romania. The MEP varies from €0.457 to €0.568 per kg during a year. As it is shown on the figure above, the MEP is much higher than the average import price (AIP) from January through June. The main countries supplying apples to Romania in that period are Italy (€0.36 – €0.48/kg) and Poland (€0.23 – €0.26 /kg). The high MEP of €0.568 /kg blocks Moldovan apple imports since the quality and perception of Moldovan apples cannot be compared to the Italian ones, which are being sold below the MEP, as are the Polish apples.

Figure 7: Monthly import price fluctuation for fresh apples in Romania by country in 2010, €/ kg



Source: Global Trade Atlas

In the months of November and December there is theoretically a potential for Moldovan apples to be shipped from cold storages into the Romanian market since the AIP is higher than MEP as Romanian local supply decreases due to lack of cold storage facilities. The main competitors in this period are Italy, Slovenia and Hungary. The Italian and Slovenian apples were imported within the price range of €0.58-0.67 /kg, while the Hungarian shippers were selling lesser quality apples at €0.24 – 0.37 /kg (still below MEP). In order to effectively compete in Romania, the Moldovan apples need to be in line with the quality standards of Italy and Slovenia.

All sizes and mixed sizes can be sold, at a price, but the general preference is for boxes of 70-75 mm apples with little variation. Small fruit, 60-70mm, can also be sold, though at a lower price, which is often critical with HoReCa and school programs. The larger fruit, 80-90 mm, is the more premium pack size fruit that used to be more in demand, but that trend is diminishing.

The sizing variance for Extra, Class I, and Class II fruit packed in rows or layers should not exceed 5 mm for most varieties. There are some varieties, like Bramley, Triomphe de Kiel and Horneburger, where the tolerance can be as much as 10 mm.

Grading is important for adding value to the product. When the grading is mixed, the buyer will only pay the market price for the smallest size apple which may be priced considerably lower than the average price. There are three grades used for apples, based on the Marketing Standards for Apples, approved by EU.

Idared and Golden, which are very commonly produced in Moldova and are mainstream varieties, have the largest presence on the market. There have been numerous comments made that the average consumer really does not know varieties except for these two and varieties are not that important as compared to the color. The green shade of the Golden variety is widely accepted and even preferred by some consumers. It is also worth noting that red apples are in greater demand in the latter part of the year. Starting in the New Year the Golden and Green apples are in great demand as well.

Packaging for apples is something that varies from packer to packer but all types of packaging are acceptable as long as the fruits can be stored and transported well. Boxes can have plastic layer with cells (cups) for individual fruit or can be packed in bulk. Wooden boxes are acceptable as are open carton boxes and telescopic carton boxes, though the latter are not favored because the fruit cannot be seen without opening the box. Open carton boxes (12 kg) are currently favored in this market.

Moldovan exporters to Romania must consider that minimum labeling of the boxes is required specifying the packer, origin, nature of product, sizing and classification as required. The label for retail contains the following information: name of distributor, name of packer, product name, origin, quality, weight and price (added by supermarket).

As a rule buyers would want apples shipped on pallets, with corner posts, but floor load is not a deal breaker as long as the product arrives in good condition.

Actually there appears to be no serious demand for organic or “bio” apples in Romania and there are only very small niches for these fruits. A very large percent of the market wants economical/cheap apples that eat “okay” where overall taste is not that important but the color is and overall value perception dictates the sale. There are also consumers willing to pay a premium for larger size fruit that is more cosmetically appealing, but this segment still remains very small.

1.1.3.3 Germany

Germany, with its 82 million people (or 16 percent of the EU 27 population) has the largest economy in Europe and is a leading European market for foods and beverages. In 2009, retail food sales in Germany totaled € 139 billion (approx. \$ 194 billion).

Germany is the 6th largest fruit producer in the EU-27, but it is an even bigger consumer, ranking first in fruit consumption. In recent years, German annual consumption of fruits was 10.3 million tons, including frozen and canned fruits on a fresh weight basis. Germans tend to consume most of their fruit fresh. In

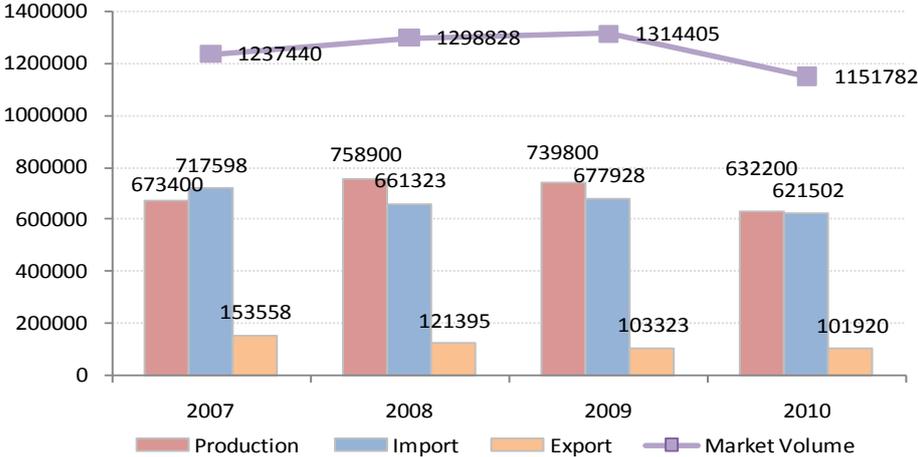
2008, 67,200 tons of frozen fruits and 514,360 tons of canned fruits were consumed in Germany, with the remainder either consumed fresh or used at home for baking.

The top five favorite fruits consumed in Germany are apples, bananas, grapes, oranges, and peaches.

Germany’s position as the largest EU-27 consumer of fruits results from the size of its population rather than high per capita consumption. On a per capita basis, fruit consumption in Germany is still far behind other EU countries. In addition, per capita consumption of fruits has been declining since 2005, aggravated by stiff competition from sweets and other snacks. However, efforts by the German government to improve the consumption of fresh fruits and vegetables, concerns about obesity, aging, and a greater overall interest by Germans in a healthier lifestyle should increase per capita consumption of fresh fruits and vegetables over the long run¹.

Germany is the second largest apple importer in the world after Russia. However, the consumption of fresh apples declined in Germany by 7.4% over the last 4 years, from 1237.4 thousand tons in 2007 to 1151.8 thousand tons in 2010, a fact that could be traced to behavioral changes of the consumers due to economic crisis. As a consequence, the imports of fresh apples diminished by 15.5% from 717.6 thousand tons in 2007 to 621.5 thousand tons in 2010.

Figure 8: Market volume of dessert apples, tons

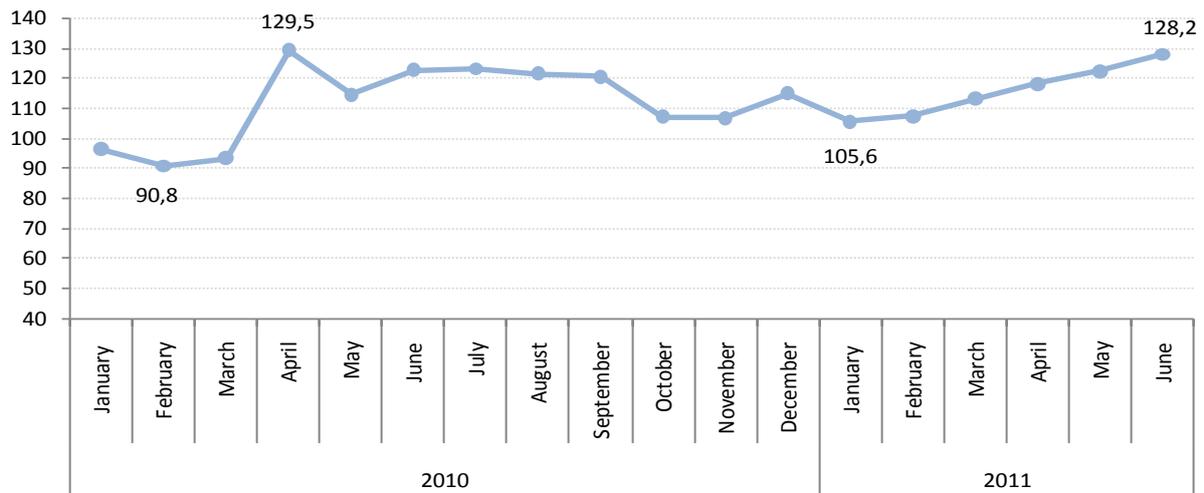


Source: Eurostat

The wholesale prices of apples vary slightly during the year: prices are lower in the season and higher in off season period. The recent peak of wholesale prices was recorded in April 2010, when apples were €1,295/kg.

¹ “GAIN Report – GM1006 – Product Brief Fruits Germany”, Sabine M. Lieberz / USDA Foreign Agricultural Service

Figure 9: Average wholesale price for fresh apples, € / 100 kg



Source: German Federal Agency for Agriculture and Food (Bundesanstalt für Landwirtschaft und Ernährung)

German wholesale companies import most of the fruit and then distribute it to wholesale markets or retail chains. Small green grocers, including the popular Turkish green grocers, buy their produce from wholesale markets. Retail chains very rarely import themselves. In 2007, the biggest wholesalers were: Cobana Fruchtring/Hamburg, Atlanta/Bremen, Edeka Fruchtkontor/Hamburg, Bocchi-Univeg/Bremen, van Wylick/Dusseldorf, Dole fresh fruit Europe/Hamburg, and Duerbeck/Frankfurt. Taking into account the relations on the German market it is highly recommended to work with importers, as these companies have a lot of experience with import certificates, labeling and other import requirements.

The system of minimum entry price (MEP) is also applicable in Germany as an EU member and it is similar to the Romanian one described above.

Germany is a very price sensitive market. Therefore, exports to Germany will be difficult during the peak of the local season when prices are low and tariffs are high. However, opportunities do exist off-season or at the beginning or end of season. German consumers are accustomed to buying seasonally and favor local production. However, this is changing. With people being more and more detached from agriculture and fading knowledge about seasonality, this tendency is eroding and some retail markets take pride in stocking produce year round. German consumers are now able to find fresh produce year-round, albeit for higher prices during the off-season.

The trend among German consumers is a tendency to buy at no-frill discount stores. From 1999 to 2007 discounters were able to increase their market share (on a volume basis) for fruits from 38 to 53 percent at the expense of all other retail forms. From 2008 to 2010 the share remained stagnant at 54 percent. This is a sign of the extreme price sensitivity of German consumers prevalent in almost all areas but especially developed when it comes to food. In 2009/10, Edeka Group, with 26 percent of fresh fruit sales in Germany, had the largest percentage among German retailers. With 24 percent and 15 percent, respectively, Aldi and the Rewe Group had the second and third highest percentage of fresh fruit sales in Germany.

Table 4: Percent of Fruit Purchases by Retail Type and Year

| | 2006/07 | 2007/08 | 2008/09 | 2009/10 |
|--------------------------------------|---------|---------|---------|---------|
| Discounter ² | 53 | 54 | 54 | 54 |
| Supermarkets ³ | 20 | 19 | 19 | 20 |
| Hypermarkets ⁴ | 15 | 15 | 15 | 15 |
| Roadside stands and specialty stores | 8 | 8 | 7 | 6 |
| Farm gate sales | 2 | 2 | 2 | 2 |
| Other | 3 | 3 | 3 | 3 |

Source: *Fruchthandel Directory 2011 based on GFK*

Food safety and environmental concerns are major issues in Germany. The public reacts strongly to food scandals that involve high levels of pesticides or contaminants and stops buying products associated with such scandals. As result, the retailers and other supply chain entities developed private standards (GlobalGAP, QS) that establish specific requirements against which supply chain actors are regularly audited. Certified compliance with these standards is a requirement for any Moldovan apple grower/exporter in order to get the products on the shelves of most German retailers.

Many Germans attempt to protect the environment via consumer choice. As a result, consumption of organic products is rising steadily in Germany. Conventional products that convey a natural image are also viewed positively. For example, these consumers prefer to buy fruits loose rather than prepackaged, partly to avoid excess packaging material. Some consumers even resist fruits labeled with a plastic PLU code sticker. However, the share of prepackaged fruits especially in the convenience and the discount segment is increasing.

1.1.3.4 General conclusions regarding the market requirements

Concluding the findings regarding the requirements of Russian, Romanian and German markets as targeted ones for Moldovan apples we can outline the following common aspects:

- Fruit must be graded by size and color. Generally the consumers prefer sizes over 65 mm. Sizing is crucial and the tolerance for variance is low specifically when working with retail chains where the real growth in the market is taking place. Size uniformity is less important for open markets;
- Cosmetic appearance is important. No visual defects (scabs, bruises, harvest damage) should be present when delivering produce to retail chains. Fruits must be clean;
- Packaging should protect the quality of produce during transportation and storage. Even if wholesale buyers as a rule do not insist on any material to be used for packaging, well designed open cardboard boxes are generally preferred;
- Compliance to pesticide MRLs is mandatory for all target markets. Certification to food safety standards (GlobalGAP, QS) is a strict requirement for key segments of the German market (such as retail channel);
- Demand for organic apples is insignificant in Russia and Romania and still is not important in Germany, even though consumption of organic products is rising steadily in Germany;

² Discounter - no frill stores with a limited selection of items, also characterized by generally lower prices than at traditional supermarkets.

³ Supermarket – retail store with less than 5000 square meters.

⁴ Hypermarkets – retail stores with more than 5000 square meters.

- Delivery sustainability of 4-6 weeks is important and a longer period throughout the year is an advantage. Time of delivery should not exceed 4-5 days from the day of order;
- In a majority of cases direct relations with retail chains involves payment 30-40 days after delivery (the standard practice for Moldovan apple sector being payment at delivery).

1.1.4 Other factors that determine competitive dynamics

1.1.4.1 Trade regimes

Russian Federation

The Russian Federation charges 0% customs duties for the fresh apples originating from Serbia and CIS countries (including Moldova, Ukraine and Azerbaijan), under the bilateral free trade agreements. At the same time, all apples originating in the EU are taxed EUR 0.20 /kg if they are exported before December 31 and EUR 0.10 /kg for the rest of the season. These taxes are especially felt in the low-mid market segment, where price is an important factor. Because of the higher tax before December 31, Poland is postponing its shipments till the second part of the marketing season, leaving the August-December window to Moldova, Azerbaijan and, to lesser extent, Ukraine and Serbia. The exports of higher-quality (and price) suppliers are less impacted by the customs duties (for example, all other EU countries).

Table 5: Share of supplying countries in the monthly Russian imports of apples

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Poland | 45% | 53% | 55% | 51% | 50% | 32% | 10% | 5% | 2% | 3% | 6% | 8% |
| China | 19% | 22% | 17% | 13% | 14% | 11% | 17% | 22% | 23% | 18% | 15% | 13% |
| EU (excl. Poland) | 18% | 12% | 14% | 12% | 20% | 33% | 32% | 11% | 9% | 9% | 9% | 12% |
| Southern Hemisphere | 1% | 0% | 5% | 19% | 13% | 24% | 35% | 3% | 0% | 0% | 0% | 0% |
| Moldova | 5% | 4% | 4% | 2% | 1% | 0% | 5% | 51% | 36% | 35% | 33% | 20% |
| Azerbaijan | 4% | 3% | 1% | 0% | 0% | 0% | 0% | 3% | 25% | 27% | 22% | 16% |
| Ukraine | 7% | 6% | 5% | 3% | 2% | 1% | 0% | 1% | 2% | 3% | 7% | 18% |
| Serbia | 1% | 1% | 0% | 1% | 1% | 0% | 0% | 3% | 4% | 5% | 7% | 12% |

Source: Own calculations based on data from the "Tamozhnya" ("Customs") Information Retrieval System.

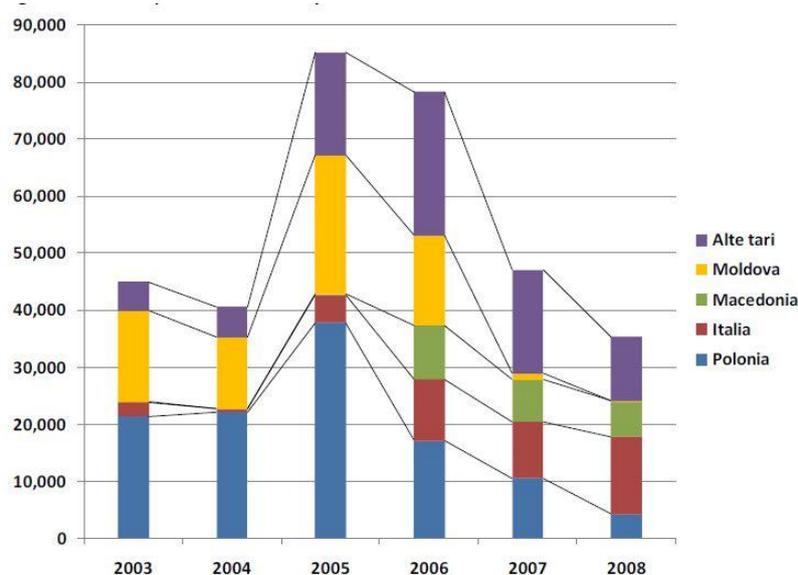
The Moldovan competitive "tax" advantage will almost surely change after accession of the Russian Federation to WTO. As part of bilateral negotiations with USA, Russia agreed to lower its specific tariff rate for apples by 70 to 85 percent within 5 years after WTO accession⁵. This will reduce the costs of US and EU apples by EUR 0.08-0.16 /kg.

European Union

The trade regime of the European Union has a similar type of market distortion. Moldova used to be a major exporter of apples to Romania. Since Romania joined the EU in 2007 and adopted the "minimum entry price" mechanism, Moldova, a low-price supplier, has been squeezed-out of the market by the EU suppliers that are not subject to the "minimum entry price" mechanism.

⁵ USRCCNE, Results of Bilateral Negotiations and Russia's Accession to the WTO (<http://www.usrcne.org/news2.phtml?m=266>)

Figure 10: Dynamics of the suppliers' market share in the Romanian apple imports



Source: UN Comtrade

1.1.4.2 Sanitary and Phytosanitary Issues

During the last few years, the Russian Federation has imposed a series of bans on the grounds of non-compliance of the exporting country with their sanitary and phytosanitary regulations, although many observers noted that they “coincided” with periods of political tensions between Russia and the banned countries. Moldovan fresh produce exports (including apples) were banned from May 2005 till March 2007, while Poland exports were banned in 2008-2009. Although much of the fruit from the banned countries reached the target market through third countries (Lithuania, Belarus and Ukraine), the bans increased the costs of export logistics and decreased the farmers' incomes.

After the ban was lifted, the Russian Federal Service for Veterinary and Phytosanitary Surveillance (Rosselkhozadzor) notified the Moldovan authorities about cases when Moldovan apples had exceeded the Russian MRLs (Maximum Residue Levels) for several active ingredients (chlorpyrifos, dimethoate, cypermethrin, benomyl, and carbendazim). Considering that currently all batches of apples for the Russian market pass the mandatory residue check by Moldovan authorities, the detected cases of non-compliance show the need for improvement at grower level (pesticide storage and application, observance of prescribed waiting periods, etc.) and more effective Government supervision (monitoring plans, communication of differences between Moldova, EU and Russia MRLs, improved laboratory equipment and sampling practices).

In addition to pesticide residues, another issue that should be tackled is phytosanitary control, in order to avoid and/or reduce negative impact for growers and to avoid potential bans on export markets. The importance of this issue is increasing as more and more seedlings are imported when local nurseries don't have the appropriate varieties or the desired seedling quality. Last year, Rosselkhozadzor detected two quarantine pests in Moldovan apples (*Grapholita molesta* & *Quadraspidiotus perniciosus*). The additional pests detected in 2011 (*Ambrosia artemisiifolia*, *Pseudaulacaspis pentagona* and *Phomopsis helianthi*) are not related to apple growing, but the growing trend in the number of detected quarantine pests shows the need to improve the Moldovan phytosanitary system (improved laboratory equipment and practices, orchard monitoring, improved customs practices).

Table 6: Detections of quarantine pests by Rosselkhoz nadzor in Moldovan products

| | 2008 | 2009 | 2010 | 2011 9 months |
|-----------------------------------|------|------|------|------------------|
| Number of quarantine pests | 1 | 2 | 2 | 5 |
| Number of detections | 38 | 54 | 14 | 36 |

Source: Всероссийский центр карантина растений (http://www.vniikr.ru/Reports_diagn.html)

These SPS issues led to the signing of a Memorandum on the safety of the products of plant origin between Russia and Moldova on October 2, 2008 and a Supplement on June 23, 2009 that introduced the mechanism of an approved exporters' list⁶. In 2011 Moldovan authorities have formalized the process of list development and maintenance⁷. Currently the list includes 175 entities (producers-exporters and traders-exporters), but offers little or no guarantee of SPS compliance because of earlier-mentioned deficiencies in the phytosanitary and pesticide residue monitoring systems.

1.1.4.3 State subsidies

Government subsidies can significantly alter the competitive position of players on the fresh produce international markets. Although the Moldovan apple sector also receives Government subsidies for planting new orchards and investments in post-harvest infrastructure, their level is significantly lower than in neighboring countries.

Growers and producer organizations from EU countries (including Poland and Romania) can obtain significant aid from EU funds under EU Common Market Organization for Fruits and Vegetables (CMO). They may be reimbursed 75% of incurred investment costs to cover a part of the eligible investment costs associated with collection, storage, warehousing or preparing fruit and vegetables for sale. For example, the Moldovan entities can get a 40% subsidy for post-harvest investments, although the list of eligible items is limited and the payments are made with great delays (up to 1 year or more).

In Ukraine, the government imposes a 1% sales tax on alcoholic beverages and beer (in August 2011 it was increased to 1.5%) that is used to subsidize the development of the viticulture and fruit growing (new plantations and post-harvest infrastructure). Overall, the average subsidy is 50% of investments⁸. For example, in 2010 the average subsidy for an orchard was almost USD 7,000/ha, while in Moldova it represented just USD 1,250/ha.

1.1.5 Production process and technologies

1.1.5.1 Production activities

In the past, Moldova was one of the largest producers and processors of fruits in the former Soviet Union with most of the production exported to other Soviet republics. For this reason, Moldova was described as the "orchard" of the Soviet Union. Fruit production volumes hovered around 1 million tons.

The collapse of the old system in the early 1990s brought with it the disruption of the existing state-controlled distribution chains and the rapid shrinking of apple production and processing. By the mid-1990s the need for structural changes became obvious as most collective farms were in a state of insolvency. The Russian economic crisis of 1998-99 created additional pressures to change.

⁶ List of exporters of products of plant origin from Moldova to the Russian Federation (http://www.fsvps.ru/fsvps-docs/ru/importExport/moldova/files/moldova_export.pdf)

⁷ Minister of Agriculture and Food Processing Order 127 (<http://maia.gov.md/doc.php?l=ro&idc=47&id=14475>)

⁸ Ukrainian Governmental Portal (http://www.kmu.gov.ua/control/publish/article?art_id=244246495)

A major element of agricultural system reforms was the land privatization process that took place between 1998 and 2000. More than 1 million residents became landowners. The continuing adjustment process has been both difficult and lengthy with the private sector slowly evolving and learning how to operate in a market economy and how to produce and sell based on market demand. The rebound of the Moldovan apple sector began in 2000, driven by increased demand from regional markets, mainly Russia.

Figure 11: Apple production & export (ths tons)

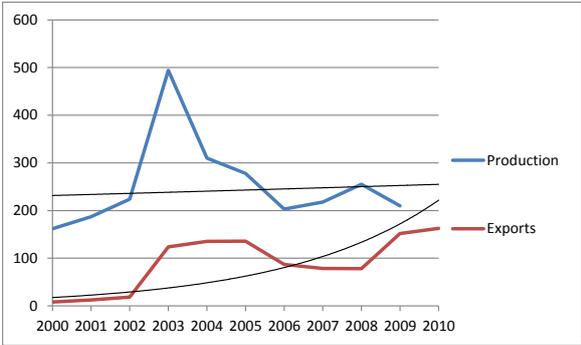
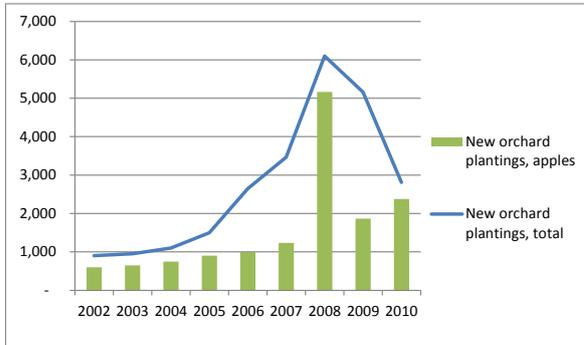


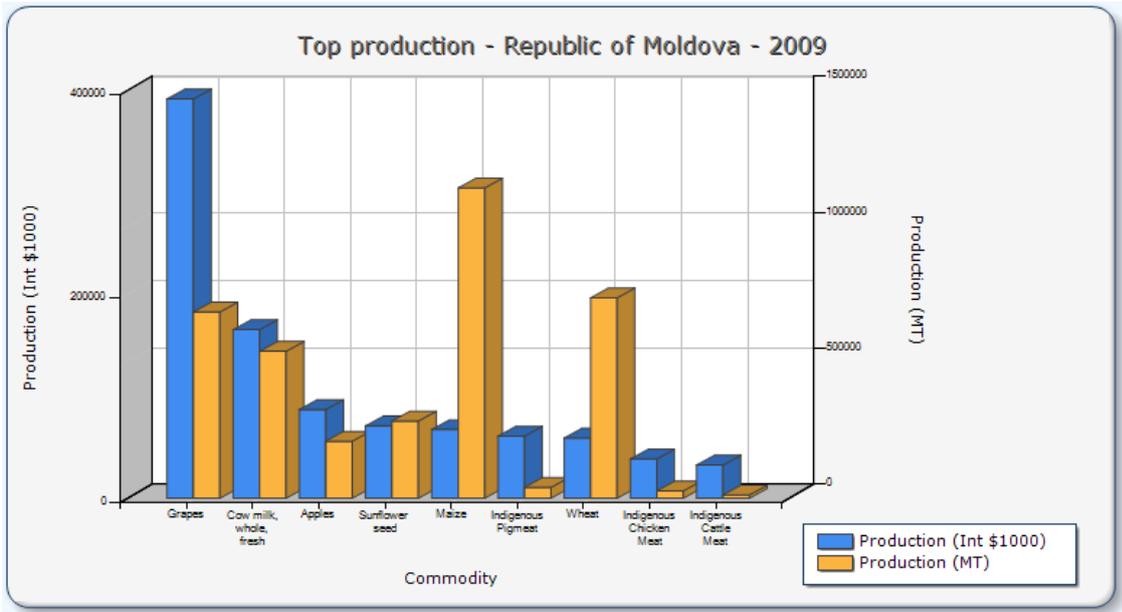
Figure 12: Dynamics of new plantings (ha)



Source: National Bureau of Statistics, UN Comtrade, own calculations based on data from MAFI

The growth of production is lagging behind that of exports because of the particularities of the production process: it takes several years for a new apple orchard to start bearing fruit in commercial quantities. If the current new planting level is maintained, towards 2015 year Moldova could double its apple production to 600-700 thousand tons⁹. Even at the current production level, FAO estimates the apples to be the third highest grossing product of the Moldovan agricultural sector (adjusted for international commodity prices, the production value exceeded 87 million USD in 2009), surpassed only by grapes and cows’ milk.

Figure 13: Top income-generating commodities in Moldova



Source: FAOstat (<http://faostat.fao.org/DesktopDefault.aspx?PageID=339&lang=en&country=146>)

⁹ Table 2 “Estimation of fruit harvest through 2015 year” in MAFI Program to Revitalize Post-Harvest Handling System for Fresh Fruits, Table Grapes and Vegetables (<http://cnfa.md/report/875/index.html>)

Data from the State subsidy scheme for planting new orchards gives the best indication of the size distribution at the grower level. From the total of 163 growers that planted new orchards in 2009 year, 60% have established orchards with area below 10 ha. However, from the total area point of view, most orchards fall in the range of 10-50 ha. A thorough statistical analysis (not included in the report) revealed a low correlation between orchard size and orchard density.

Table 7: Size distribution of apple orchards planted in 2009 year

| Orchard size (ha) | # | % share | Total area | % share |
|-------------------|------------|---------|-------------|---------|
| <5 | 59 | 36% | 160 | 9% |
| 5-10 | 40 | 25% | 281 | 15% |
| 10-20 | 35 | 21% | 459 | 25% |
| 20-50 | 25 | 15% | 670 | 36% |
| >50 | 4 | 2% | 298 | 16% |
| | 163 | | 1868 | |

Source: Own calculations based on data from MAFI for 2009 year

There are apple orchards in all raions of the country, but they are predominantly located in the Northern part of Moldova: from top-10 apple producing raions, only one is from the Central region of Moldova.

Table 8: Area of pome fruit orchards owned by agricultural enterprises and family farms

| District | Region | Area | Share |
|------------------------|--------|---------------|-------------|
| Soroca | North | 3,408 | 11% |
| Dondușeni | North | 2,185 | 7% |
| Briceni | North | 2,182 | 7% |
| Ocnîța | North | 2,173 | 7% |
| Florești | North | 1,935 | 6% |
| Riscani | North | 1,725 | 5% |
| Singerei | North | 1,562 | 5% |
| Orhei | Center | 1,469 | 5% |
| Edinet | North | 1,462 | 5% |
| Glodeni | North | 1,354 | 4% |
| Other districts | | 19,455 | 39% |
| TOTAL | | 32,139 | 100% |

Source: National Bureau of Statistics (<http://www.statistica.md/pageview.php?l=ro&idc=315&id=2279>)

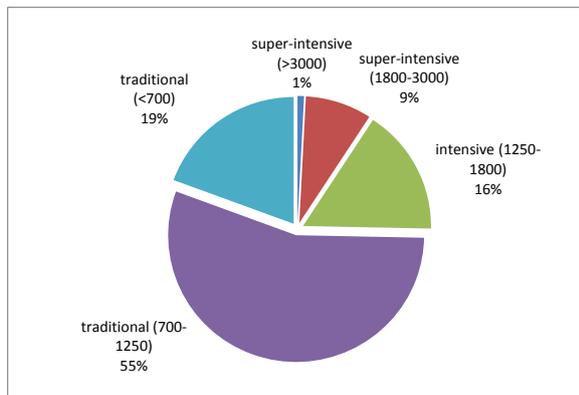
There are 56 apple varieties included in the main list of the State Register of Plant Varieties for 2011 year and an additional 32 in the list of varieties still under testing. The main summer variety is Slava Peremozhtsyam, the most planted winter varieties being Idared, Reinette Simirenko, Golden Delicious, and Red Delicious group. However, as growers adjust to ever-changing market demands and modern varieties become available (mainly by sourcing seedlings from Poland and Italy), there is an increased area planted with the so called “world’s new majors” (Gala, Jonagold, and, to a lesser extent, Fuji).

The incentives offered by increased export demand lead to the adoption by some growers of the intensive production technologies using dwarf apple trees. Dwarfs are created by grafting a standard fruit-bearing apple tree variety onto a root system (rootstock) that has been selected for its dwarfing characteristics. Compared to standard-sized apple trees (MM106 rootstock, 4x3 spacing in the orchard), dwarfs (M9 dwarfing rootstock, 2-years old seedling, 3.5x1.2 spacing in the orchard) have four advantages: (1) a shorter time period before reaching full production, (2) higher tree density and yields per hectare, (3)

faster and less expensive pruning, thinning, fruit harvesting, and (4) better quality. Dwarfs become fully productive much more rapidly, often in three to four years; standard apple trees generally take seven or eight years. The shorter production time allows growers to respond to changing consumer preferences more quickly. Dwarfs are also much smaller in size, allowing growers to plant higher-density orchards without limiting sunlight and to minimize their land and irrigation use while maintaining production levels. Dwarfs increase yields because the center branches of dwarf varieties are not shaded from the sun and can therefore produce more fruit, relative to their size. The trees' reduced size makes tree care and the fruit harvest less labor-intensive. Fruit quality is improved with dwarfs (increased fruit size, more intense coloration, higher uniformity of sizes and coloration), which translates in potentially higher prices. The net result is higher profitability: based on our calculations, excluding State subsidies, an intensive orchard can achieve an internal rate of return of 15%, while a traditional one – just 7% (see *Annex A: Crop budgets for apples*).

Despite obvious advantages of the intensive technologies, most of new apple plantings are still done in the traditional way. For example, in 2009 year, 75% of new plantings had a density below 1250 trees/ha. ¾ of new apple orchards were planted on MM106 rootstock, 18% - on M26 and only 6% on M9.

Figure 14: Types of new apple plantings (2009)



Source: Own calculations based on data from MAFI

The transition to intensive technologies is hampered by a series of constraints:

1. Access to long-term finance
 - Planting of an intensive orchard requires heavy investments in the year of planting (in most cases this implies the need to obtain a bank loan), while the investments in a traditional orchard occur in several years until fruit bearing and can be more easily financed through the positive cash flow from existing operations. Obtaining a bank loan is difficult because banks have limited access to long-term resources, have high collateral requirements and put a low value on the land and existing orchards when put as collateral.
 - Additionally, a series of macroeconomic policies weren't really encouraging investments – the nominal interest rates are relatively high (13-16% in 2011 and 18-25% just a couple of years ago), and the national currency (MDL) is appreciating in real terms versus USD and EUR (the main currencies for export transactions).
2. Access to water
 - As opposed to traditional orchards, those on dwarf rootstocks require irrigation.

- Many farmers own land plots that have no access to water from lakes, while the poor state of central irrigation systems in Moldova is well documented¹⁰.
3. Limited understanding and knowledge of intensive production technologies
- The Soviet Union left a pretty well educated cadre of agronomists that are comfortable working in traditional orchards, while the intensive technologies were introduced in Moldova just recently (M9 rootstock in 1998 and 2-year knip-baum seedlings in 2006) and there is limited experience and availability of support from local experts and consultants on the specifics approaches required, such as planting, pruning, branch binding, thinning, plant nutrition and irrigation.

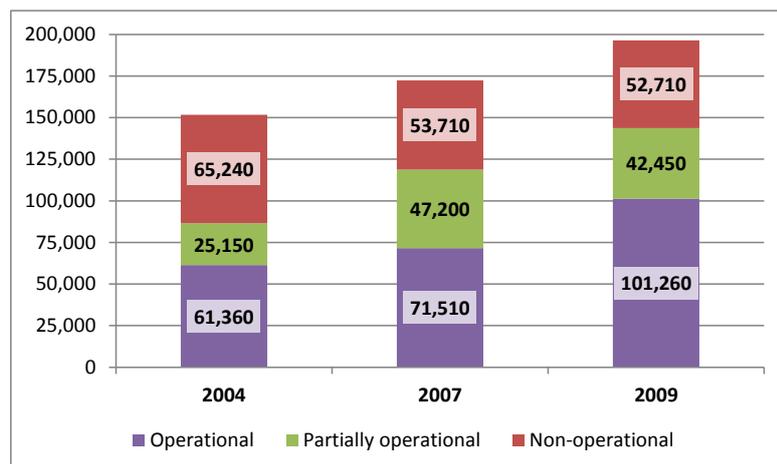
Many observers noted that the State subsidies for new plantings (15,000 lei/ha, irrespective of tree density) didn't contribute to promotion of intensive technologies: the subsidy exceeded the cost of seedlings for a traditional orchard, while covering just 15% of seedlings' costs for an intensive orchard. Considering that the availability of financial resources is a major constraint, it is easy to conclude that the subsidies provided a misleading message and wrong incentives to growers. Only in 2011, the Government adjusted the subsidy criteria by increasing the support to intensive and super-intensive plantings and imposing a minimum tree density to be eligible for State support.

1.1.5.2 Post-harvest infrastructure

Appropriate post-harvest infrastructure is required to meet the market requirements regarding supply continuity and grading. Additionally, the availability of cold storage allows the postponement of sales when market prices are low.

USAID-funded Agribusiness Development Project carried out two inventories of fruit, grape and vegetable cold storages (end of 2004 and 2007), with an update available from the Ministry of Agriculture as of December 2009. Overall, there are more than 220 cold storages with a total capacity of 197 thousand MT, which is higher by 29% compared to the end of 2004 (152 thousand MT).

Figure 15: Evolution and structure of cold storage capacity



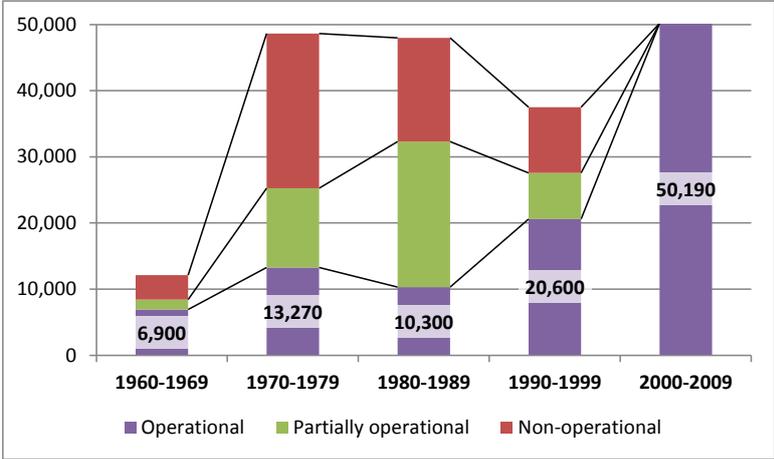
Source: MAFI, ADP (<http://cnfa.md/report/847/index.html>)

Despite the modest positive increase of the total capacity, a significant increase in the operational cold storage capacity was identified (+65%). This increase was largely the result of the construction of 45 new

¹⁰ GoM and MCA, Sector Analysis Report (2007), <http://www.mca.gov.md/file/SA%20Report%20Final%20ENG.pdf>

cold storage facilities in 2005-2009 years. In 2004-2007 there was an active upgrading of older cold storages by installing new refrigeration equipment and repairing insulation (as shown by the decrease of the capacity of non-functional cold storages), but later the process slowed down: it is safe to assume that most remaining non-functional cold storages represent old buildings, whose upgrading is not feasible and should be discarded from further analysis.

Figure 16: Age-status relationship for existing cold storages

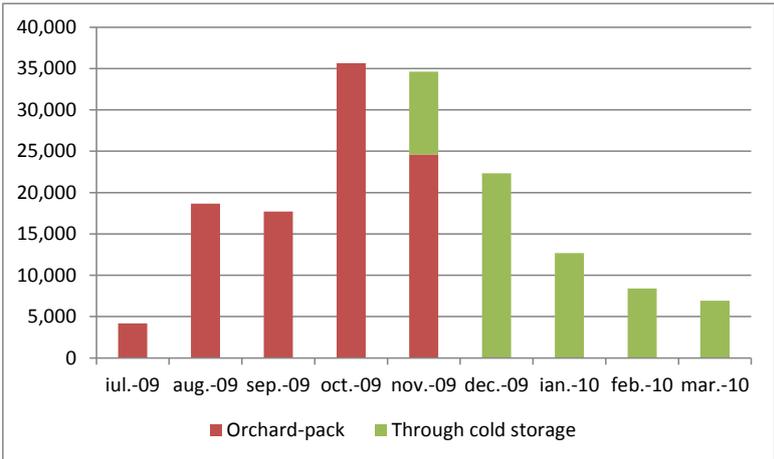


Source: MAFI, ADP (<http://cnfa.md/report/847/index.html>)

About 45% of cold storage facilities are located in the center of the country and are used to store both apples and table grapes; 35% are located in the north (used almost exclusively to store apples) and 20% in the south (mostly for table grapes, but also limited quantities of apples).

The existing cold storage capacity is not able to meet the market demand for supply continuity. Most of the apples are packed in the field (no grading possible) and loaded into trucks without passing through the cold chain. Only 1/3 of exported apples go through cold storage (exported in November and later).

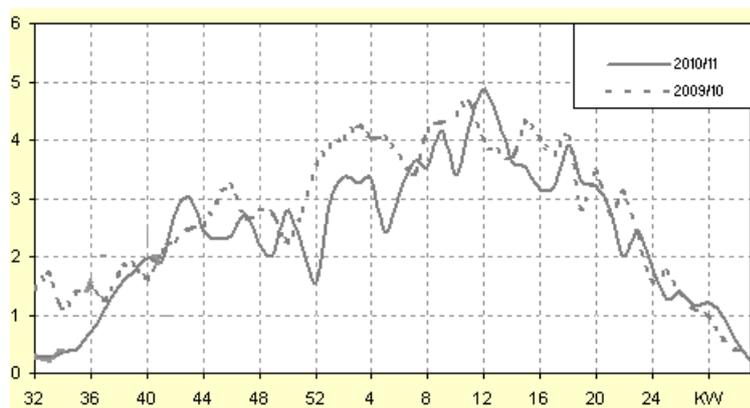
Figure 17: Seasonality of Moldovan apple exports (tons)



Source: Own calculations based on data from ИПС "Таможня"

For comparison, most of the apple shipments from the German region of Bodensee are done from cold storages, after the month of November, and for a much longer period (including summer months).

Figure 18: Apple shipments from Bodensee (by week, thousand tons)



Source: Landesstelle für landwirtschaftliche Marktkunde, Schwäbisch Gmünd

There are just five grading lines in the whole country, so the vast majority of the fruit grading is done manually. Under such circumstances, grading tolerances required by most importers can't be maintained (the typical situation is division of apples in two grade categories: 65- and 65+).

A large number of the cold storage facilities do not have suitable access roads and they lack continuous water supply and sewage systems, which are essential for meeting prevailing EU food safety standards. Only five cold storage units have certified food safety management systems (HACCP or ISO 22000) and only five producers with cold storages have GlobalGAP certificates.

A negative aspect that must be addressed, even in regard to new cold storage facilities, is the unjustified attempt to minimize investment costs. Examples include the exclusion of grading areas and equipment, insufficient thermal insulation and hydro insulation, doors that do not ensure chamber air tightness, lack of humidifiers, and sometimes the refrigeration units do not have sufficient cooling capacity. These initial cost reduction decisions lead to the inability to grade the fruit appropriately, to maintain optimum temperature and relative humidity regimes, and they lead to increase electric energy costs.

ACED's review of post-harvest infrastructure and practices¹¹ identified frequent issues with product quality that are related to harvest and post-harvest process management, rather than capacity or quality of post-harvest infrastructure. Significant improvements could be achieved without big investments by proper determination of fruit maturity, proper scheduling of harvest operations, implementing quality-based picker remuneration systems, and rapid fruit movement into cold rooms.

The major issues that limit the development of the post-harvest infrastructure are related to:

1. Access to long-term finance
2. Limited ability of local industrial designers and equipment suppliers to design and build appropriate post-harvest facilities, especially regarding grading and packing areas
3. Economies of scale required to justify the investment in apple grading lines (a 3 MT/h grading line costing \$150,000 will handle all the fruit of a typical 600 MT apple cold storage in just 1 month)
4. Land legislation of Moldova
 - When initiating the design of the cold storage, the growers have difficulties in obtaining all required permits because of some old terminology and inconsistencies in the Land

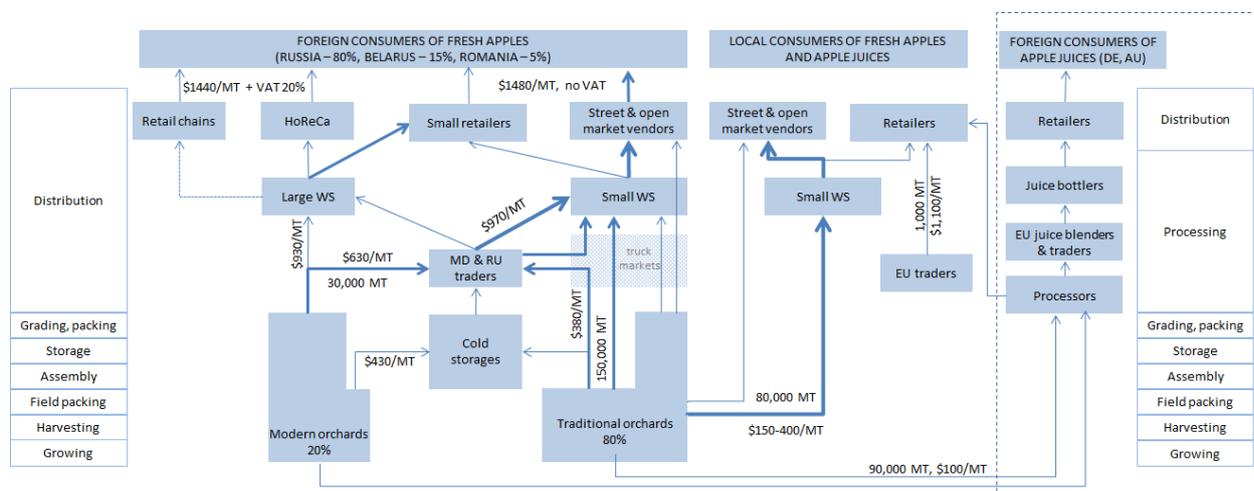
¹¹ Global Cold Chain Alliance report "Technical Input for Improved Cold Store Operations in the Republic of Moldova" (2011)

Code¹² (dated from 1991), namely the legal definition of “agricultural land”. Some local authorities do not issue the construction permit because they require growers to change the legal status of the land from agricultural to industrial (which requires a special Government Decision and is a costly procedure), while others give a different interpretation of the Article 36, thus authorizing constructions with changing the land legal status.

1.1.6 Main channels to markets

Currently Moldova produces about 350 thousand tons of apples; their main destination is the fresh export market (180 thousand tons for export, or 51%), followed by processing (90 thousand tons, or 26%) and fresh local market (80 thousand tons, or 23%).

Figure 19: Apple value chain map



1.1.6.1 Fresh export channels

Currently, the predominant channel in the Moldovan apple sector involves the production of apples in a traditional, low-density orchard, export by the grower or a local trader/exporter to Russia during the harvesting season, or immediately after, without passing through the cold chain (only field packing), sold there through the truck markets to small wholesalers distributing the fruit to the entire European part of Russia, with the final consumer buying the fruit on the street or open market. This channel is estimated at 150 thousand tons.

The growers that planted modern orchards are more inclined to avoid the risks of the truck market channel (see Section 1.1.3.1 above), by working directly with the traders and larger Russian importers and wholesalers. Only through this channel, a small quantity of Moldovan apples reaches the shelves of the Russian retail chains. There have been attempts by some growers to establish direct links with the Russian retailers, but most attempts failed because of inability to offer graded fruit or a longer-term supply of quality fruit. Overall, this channel is estimated at 30 thousand tons.

In the early 2000s, the “independent” cold storages (those not integrated into production) were a major element of the value chain. However, their role is diminishing (sometimes reducing itself to renting cold storage rooms to other value chain participants) because growers are increasingly investing in their own cold storage facilities. Owning a cold storage allows the grower to benefit from higher off-season prices,

¹² Land Code of the Republic of Moldova (<http://lex.justice.md/index.php?action=view&view=doc&lang=1&id=313324>)

protects the grower from the risks of price fluctuations during the harvesting season, and enables the grower to offer a longer-term supply. Without the pressure to sell the fruit during the harvesting season, the grower with a cold storage facility has enough time to grade fruit appropriately. It is worth to note that the integration of the cold storage and production is more frequent in the “direct trade” channel versus the “truck market” channel. Overall, not more than 35% of Moldovan apples pass through the cold chain.

The grading of fruits is done manually in almost all cases: there are just 4 apple grading lines installed in the whole country, a minuscule number in comparison with more than 120 cold storages serving the Moldovan apple sector.

In the vast majority of cases, the growers are building cold storages based on their own production volumes and are not buying fruit from others or providing storage on a tolling basis. It is only the “independent” cold storages that aggregate the fruit in one place from several growers, by buying the fruit, or renting the cold storage rooms to the growers or traders.

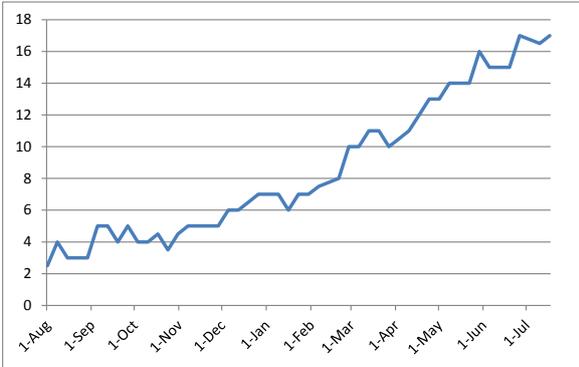
Traders, local or foreign, play an increasing role in the Moldovan apple value chain. Most of these companies were established in late 1990s and have their “roots” in the logistics sector, owning refrigerated and non-refrigerated trucks and providing international transportation services to regional countries (one of their main businesses was loading fresh produce in Turkey or Greece and moving it to Russia). With increased understanding of the market rules, players and channels, several companies have transformed fresh export into their main business activity. They have a stable customer base in Russia and their main challenge is to find the right product: of right quality and at right price.

1.1.6.2 Fresh local market channel

The local market is served almost exclusively by the small growers, with fruit of lower quality (not accepted on the export market) or fruit produced in small quantities that are difficult to aggregate into export deliveries (at least 20 tons, the capacity of a refrigerated truck). The modern retail formats have a very low share of this channel, the main place where Moldovans buy apples being the open markets.

It is both the poor post-harvest management leading to relatively high loss rate and the lack of cold storages (especially at the small farmer level that serves the local market) leading to scarce supply after November that determine high market prices in the off-season. Even so, the small market volume makes the local market unattractive to medium and large growers. The local supply of apples is exhausted in May, and the limited quantities still sold on the local market are imported fruits.

Figure 20: Wholesale market price for apples in 2010 season (MDL)



Source: Agravista monitoring of Chisinau wholesale market (www.agravista.md)

1.1.6.3 Processing channel

The apple processing industry is mainly represented by the three largest Moldovan canneries: Natur-Bravo, Alfa-Nistru and Orhei-Vit. As a group, they buy annually 70-80 thousand tons, or more than 80% of apples for processing.

Table 9: Major Moldovan apple processors (tons)

| Rank | Processor | Total Volume |
|---------------|--|-----------------|
| 1 | Natur-Bravo (Cupcini, Floresti, Ungheni) | 35,800 |
| 2 | Alfa-Nistru (Soroca) | 23,786 |
| 3 | Orhei-Vit | 19,959 |
| | Others | 11,000 |
| TOTAL: | | ~ 90,000 |

Source: Own calculations based on data from MAFI

The canneries use apples mainly to produce apple juice concentrate (AJC), with only a small portion going to single-strength juice, purees and jams. Most of AJC is exported to EU apple juice traders that usually perform the product fine-tuning and blend several batches to get the right mix of acidity and color. The resulting product is sold to juice bottlers located across Europe.

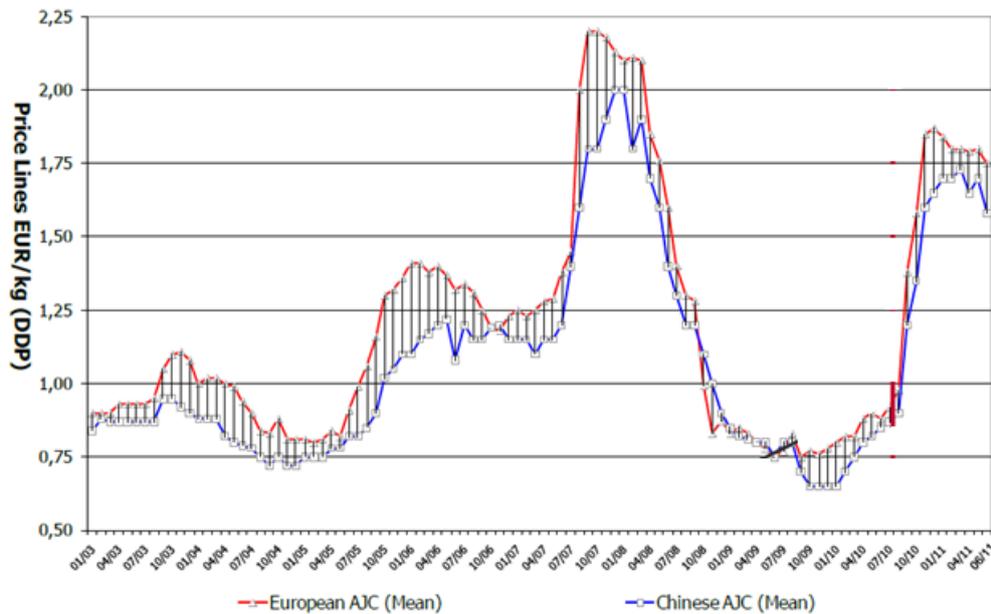
Table 10: Export of apple juices from Moldova

| | | 2006 | 2007 | 2008 | 2009 | 2010 |
|-----------------------------|-----------------|--------|--------|-------|--------|--------|
| Single-strength apple juice | Quantity (tons) | 1,264 | 2,361 | 1,459 | 965 | 1,454 |
| | Value (USD) | 0.7 | 1.4 | 1.0 | 0.6 | 0.9 |
| Apple juice concentrate | Quantity (tons) | 11,218 | 20,216 | 8,768 | 23,213 | 22,732 |
| | Value (USD) | 11.9 | 40.7 | 12.5 | 14.7 | 19.7 |

Source: UN Comtrade

The AJC market is dominated by China, which offers the cheapest product. The main European producer is Poland, followed by Hungary, Germany and Italy. For a long period of time, the Chinese AJC manufacturers used low-acidity apples (such as Fuji), resulting in low-acidity concentrates that had to be mixed with higher-acidity concentrates from other suppliers. However, as Chinese manufacturers diversified their variety mix, they can offer batches with various acidity ratios and the use of the acidity differential by European suppliers (including Moldova) for price bargaining has lost some of its strength.

Figure 21: AJC market price evolution (2003-2011)



The historically very volatile AJC market prices, combined with the need to compete with cheap Chinese AJC, leave little room for maneuver by the Moldovan apple processors when they set the processing apple prices (the raw material represents 2/3 of the variable production cost, see *Annex B: Cigar Box for AJC*). No farmer is growing apples for processing, because prices offered are much lower than those on the fresh market and are below the production costs. For example, in 2010 the canneries bought apples for up to USD 0.10 /kg, in comparison with the fresh market price of at least USD 0.40 /kg and the variable production costs of around 0.20 USD/kg.

The expected increase of the cold storage capacity and in the number of sorting and grading lines opens the possibility to use the lower-grade apples for the production of value-added products (apple slices, fresh juice, dried apples, etc.) that do not require the economies of scale imposed by AJC market. With a right business model, this can increase apple grower and packer incomes and create longer-term jobs for the seasonal workers.

1.2 Analysis of value added

As depicted in the value chain map (see *Figure 19*), there are several scenarios for Moldovan apples reaching the consumers in external markets (mainly Russia), with key variables being the type of orchard, use of cold chain, and marketing channel. In addition to that, Russia itself is supplied with apples from various countries, some of them being almost always present on the market, others having clear marketing windows. In contrast to this myriad of scenarios, the variations during the year of the wholesale price for apples in Russia are much smaller. The analysis of the value added through various channels brings to light some of the key explanations to these contrasting facts.

To examine the structure of the value added, the two most representative marketing channels were chosen:

1. The “truck market” channel includes a grower using traditional technologies, selling the apples during the harvesting season to a trader for USD 0.38/kg, including his margin of USD 0.10 /kg. The trader provides wooden packaging to the grower, then exports the packed apples to Russia

and sells them to small retailers and open-market vendors through a truck market (such as the Pokrovka market).

2. The “direct trade” channel starts with a grower that uses modern technologies and stores the apples in the own cold storage. The grower grades the fruit, buys the cardboard packaging and arranges the transportation of the goods to a distributor located in Russia, who pays him USD 0.96 /kg, including the grower’s gross profit margin of USD 0.40/kg. The distributor repacks the apples in retail packaging and ships them to a retail chain customer.

Despite such big differences in producer prices and margins, the fruit is bought by the final consumer at almost the same net price: USD 1.48/kg (see *Annex C: Value added tables* for the detailed breakdown of stages). To this price, the larger retailer has to add the VAT 18%, while the open-market vendor is not subject to this tax.

The much larger margin of the most advanced grower is only partially explained by the better yields and quality of the fruit; the use of cold storage allows him to avoid the pressure to sell the fruit during the harvest season and buys him time to properly grade the apples and to find the most appropriate packaging and transportation services. In contrast with the “advanced” grower, the traditional grower is under great pressure from traders to sell his fruit at lower prices (especially in the years with abundant supply), which reduces his margins (= cash flow), as well as his ability to invest in a cold storage facility.

Table 11: Costs and margins for the “truck market” channel

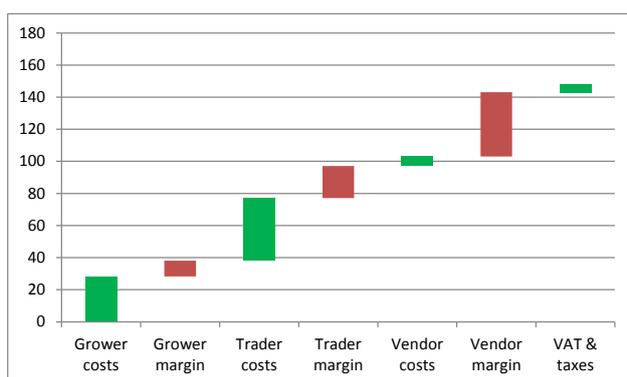
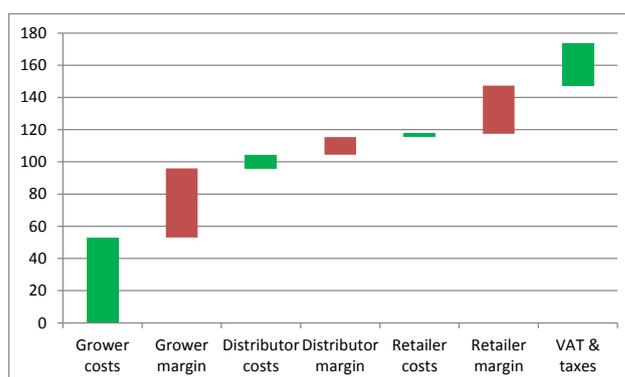


Table 12: Costs and margins for the “direct trade” channel



1.3 Productivity analysis

1.3.1 Production

The clear advantages of dwarf tree orchards were discussed above (see *Chapter 1.1.5 Production process and technologies* and *Annex A: Crop budgets for apples*). The same investment of 450,000 USD could be used to plant 20 ha of a traditional orchard or 12.5 ha of an intensive orchard, both yielding annually around 600 tons of fresh market apples¹³. However, the higher labor productivity, yield and fruit quality of the modern orchard makes it a much more attractive investment: it has an internal rate of return of 15%, versus 7% for a traditional orchard.

¹³ The establishment cost of this traditional orchard is significantly smaller (\$150,000), with the difference being required to maintain the orchard until its starts bearing fruit in years 5-6.

Traditional apple orchard (4x3) are no longer planted in the advanced apple producing countries, so reliable international benchmarking can be done only for the intensive orchards (3.5x1.2). A comparison with a typical apple orchard from France¹⁴ would reveal:

- The variable production costs per hectare are much bigger in France: USD 25,500 versus USD 10,700. Labor costs and related taxes represent the most important cost item (43% in France) and it is the difference between hourly rates (\$15 /hour versus \$1.6 /hour) that is the main reason for the difference in total variable costs;
- The physical labor productivity is significantly higher in France (equivalent to Moldovan workers spending more time to do the same or similar job), as the differential in costs (ranging from 2.8 to 6.9) is much lower than the hourly rate differential (9 times);
- The difference in physical labor productivity is lowest for harvesting operations, but there is a lot of evidence that fruit bruising is much more frequent in Moldova than France. When Moldovan companies tried to place emphasis of quality of the picking operations, the productivity was significantly reduced from the standard rate of 1 ton/day;
- The cost of material inputs is marginally higher in France, mainly due to replacement of some manual jobs with a chemical or mechanical alternative (for example, use of chemical thinning in France versus manual thinning in Moldova);
- Average yields are significantly higher in France (55 versus 37 tons/ha, a 50% differential);
- When this is factored in, the differential in unit costs is reduced to 1.6 times (\$0.46 versus \$0.29), the differential in labor costs explaining 72% of the overall difference (see *Table 13* below);
- Despite replacing some material inputs with manual operations, the Moldovan growers have a higher cost of orchard inputs per kg of output, reflecting the constraints of the input supply market, such as the long registration period for new agro-chemicals and lower competition among input suppliers;
- The sales prices are almost identical (around USD 0.60 /kg).

Table 13: Production productivity benchmarking (France vs. Moldova)

| Item | France | Moldova | Diff (FR vs. MD) | % Diff |
|-----------------------------------|------------------|------------------|------------------|-------------|
| Costs per hectare (USD/ha) | | | | |
| Materials | \$ 5,868 | \$ 4,445 | \$ 1,424 | 132% |
| Hail insurance | \$ 1,795 | \$ 1,009 | \$ 786 | 178% |
| Labor (production) | \$ 4,347 | \$ 1,554 | \$ 2,794 | 280% |
| Labor (harvesting) | \$ 3,311 | \$ 477 | \$ 2,835 | 695% |
| Total orchard costs | \$ 15,322 | \$ 7,484 | \$ 7,838 | 205% |
| Labor (grading & packing) | \$ 3,303 | \$ 750 | \$ 2,553 | 441% |
| Transport to cold storage | \$ 1,695 | \$ 300 | \$ 1,395 | 565% |
| Storage costs | \$ 5,220 | \$ 2,224 | \$ 2,997 | 235% |
| Total post-harvest costs | \$ 10,218 | \$ 3,273 | \$ 6,945 | 312% |
| TOTAL COSTS PER HA | \$ 25,540 | \$ 10,757 | \$ 14,783 | 237% |
| Yield (kg) | | | | |
| | 55,000 | 37,000 | \$24,407 | 149% |

¹⁴ Authors' calculations based on data from http://www.agri82.fr/images/stories/2010/arbo_2010/resultatsentreprises_pommes.pdf & <http://www.grab.fr/wp-content/uploads/2010/09/A08-PACA-16-Mod%C3%A8leIsafruit.pdf>

| Item | France | Moldova | Diff (FR vs. MD) | % Diff |
|--------------------------------------|----------------|----------------|------------------|-------------|
| Unit costs (USD/kg) | | | | |
| Materials | \$ 0.11 | \$ 0.12 | \$ (0.01) | 89% |
| Hail insurance | \$ 0.03 | \$ 0.03 | \$ 0.01 | 120% |
| Labor (production) | \$ 0.08 | \$ 0.04 | \$ 0.04 | 188% |
| Labor (harvesting) | \$ 0.06 | \$ 0.01 | \$ 0.05 | 467% |
| Total orchard costs | \$ 0.28 | \$ 0.20 | \$ 0.08 | 138% |
| Labor (grading & packing) | \$ 0.06 | \$ 0.02 | \$ 0.04 | 296% |
| Transport to cold storage | \$ 0.03 | \$ 0.01 | \$ 0.02 | 380% |
| Storage costs | \$ 0.09 | \$ 0.06 | \$ 0.03 | 158% |
| Total post-harvest costs | \$ 0.19 | \$ 0.09 | \$ 0.10 | 210% |
| TOTAL UNIT COSTS | \$ 0.46 | \$ 0.29 | \$ 0.17 | 160% |
| Unit cost | \$ 0.46 | \$ 0.29 | \$ 0.17 | 160% |
| <i>materials</i> | <i>\$ 0.27</i> | <i>\$ 0.22</i> | <i>\$ 0.05</i> | <i>123%</i> |
| <i>labor</i> | <i>\$ 0.20</i> | <i>\$ 0.08</i> | <i>\$ 0.12</i> | <i>265%</i> |
| Overall financial performance | | | | |
| Unit price (USD/kg) | \$ 0.57 | \$ 0.60 | \$ (0.03) | 95% |
| Sales (USD/ha) | \$ 31,322 | \$ 22,075 | \$ 9,247 | 142% |
| Costs (USD/ha) | \$ 25,540 | \$ 10,757 | \$ 14,783 | 237% |
| Margin (USD/ha) | \$ 5,782 | \$ 11,317 | \$ (5,536) | 51% |

Low labor costs (stemming from low wage per day) are an important source of the profitability for apple growers. At the same time, they are the main cause of rural poverty and labor migration, which leads to increased problems in recruiting workers for seasonal activities (such as harvesting). It is expected that the wages per day will increase in the long run and the industry has to find additional sources of improvement to compensate for it.

One of the main improvements leading to increased income is to achieve higher yields per ha of Extra and Class I fruit. This can be achieved by the transfer of proven technologies adopted by the advanced apple producing countries. The specific topics to consider are:

- Tree pruning and branch bending;
- Fruit thinning (chemical thinning, followed by hand thinning for fine-tuning);
- Soil and leaf analysis methodology (currently done only at planting stage);
- Integrated pest management, including use of weather stations, disease forecast models and non-pesticide methods (such as pheromone traps or biological pest control);
- Plant nutrition;
- Plant growth regulators to control shoot growth;
- Irrigation scheduling.

ACED demonstration activities could be carried out in the already established knip-baum (a two-year sapling with one-year crown) orchards in Cotiujeni, Colicauti, Edinet, Racovat and Domulgeni, with technical support from the foreign consultants active in the region (FruitConsult, Griba or Huber Vivai), involving local experts knowledgeable about local climatic and soil conditions.

1.3.2 Post-harvest and sales

As mentioned earlier, the Moldovan growers are building their own cold storage facilities to store their own crop. They are not providing storage services to other growers and are marketing the fruit individually. As result, the much more fragmented EU fruit production sector is much more consolidated when it comes to sales and can much better meet market requirements such as delivery sustainability (4-6 weeks) and product uniformity (size and color).

Compare the typical Moldovan situation (individual grower, apple production on 25 ha, yields of 37 tons/ha, apple harvest of 925 tons, sold from a 4-room, 600-ton cold storage, with no grading line) with a typical Italian counterpart:

EOFRUIT is an Italian producer marketing organization founded in 1959 and located in South Tyrol region. Its 330 members cultivate a total of 440 hectares (average plot - 1.3 ha), of which EOFRUIT produces an average of 24,600 tons of apples every year (average yield – 56 tons/ha), all of which are grown in accordance with the strict AGRIOS production regulations, and 85% of which conform to the GLOBALGAP standard.

EOFRUIT employs 60 staff, 16 of whom are full-time and 44 are employed on a seasonal basis in the packaging department. The co-operative's warehouse area covers 32,500 m². It houses the very latest technology, which includes a highly advanced sorting system with an automatic diameter reader and 8 packaging lines. EOFRUIT is also a market leader in storage technology: their cold storage consists of 55 CA (controlled atmosphere) storage rooms.

One can only guess why the big apple production sector is not preventing the South Tyrol region of Italy from being the country's leader in terms of GDP per capita (32,900 EUR in 2006)¹⁵.

¹⁵ Source: Eurostat,
<http://europa.eu/rapid/pressReleasesAction.do?reference=STAT/09/23&format=HTML&aged=0&language=EN&guiLanguage=en>

2 Linkages and relationships within the value chain

2.1 Vertical linkages

During the Soviet times, the entire fruit production and marketing sector was managed as a single, integrated firm. Of course, the kolkhozes, the consolidation units, and the logistics operators had a certain degree of freedom to decide on some issues, but the strategic decisions were made by higher, centralized authorities. After the collapse of the Soviet Union and privatization of land and marketing infrastructure (cold storages), all those links disappeared and a market type of value chain governance was established. The farmers were growing fruit on their own with almost no Government oversight or interventions. Export sales were done by the farmers themselves or intermediary companies with no or little experience in the field (frequently the basis for their involvement with export were some older connections/friends residing in Russia or Belarus); the marketing channels were very fragmented, mirroring the extreme fragmentation of the retail activity in these countries. Big margins, but also big losses due to buyer default were a norm.

As the industry grew (the main driver being the increased Russian imports), the roles and activities within the value chain also evolved. There is a continuous development of the modern retail sector in all Eastern Europe countries, with an increasing share of fresh produce being sold through these outlets. These retailers are increasingly developing their quality requirements (10 years ago there was no big emphasis on grading, while now it is a synonym for quality) and are increasingly imposing their requirements to all other value chain entities, including mode of tendering or procurement, terms of quality assessment, terms of payment, etc. Some retailers are limiting themselves to working with approved/listed distributors; others are actively establishing direct links with the growers or packers in order to streamline the process and reduce costs¹⁶.

The Moldovan apple sector has generally “refused” to work with the retail chains (frequently citing the long payment terms as a key barrier), while it is safe to assume that the lack of consistent supply and lack of grading equipment are even more important constraints. However, there are already a limited number of cases of deeper cooperation among Moldovan growers and Russian importers, when the Moldovan side upgraded the post-harvest processes specifically to support the importer’s ability to meet the requirements of retailers. Until now, this was limited to large growers only (>1000 tons), as they can offer a continuous supply of fruit.

For the rest of the sector, it is the traders that have an increased role in moving the product through the truck markets or smaller importers/distributors and passing the market information to the growers. As generally they have short-term relationships with the growers, usually the information they pass is related to cost competitiveness of various supplying countries, rather than more strategic information that can drive value chain upgrading in the right direction.

Currently there are no big differentials in the pricing levels of “truck market” channel and “retail chain” channel, mainly because of continuous growth of Russian imports (although the truck markets are losing

¹⁶ Such as the “Magnit” chain,
http://www.freshmarket.com.pl/pl/o_konferencji/aktualnosci?more=794425879

market share, the volume of transactions through them is not decreasing) and the incentive to avoid or reduce the tax burden when selling at the truck market. In the medium term, the situation for the truck markets will definitively worsen because of:

- Decreasing market share of this channel versus the modern retail formats;
- Authorities efforts to close these markets due to their negative impact on inner city infrastructure and the shady customs schemes practiced in these markets¹⁷.

The Moldovan apple sector has to put more efforts into establishing direct trade links with Russian importers, distributors and retail chains, in order to get better market information to maintain and strengthen its competitiveness in the regional export markets.

2.2 Horizontal linkages

Although the Moldovan apple growers are reluctant to do business together (joint sales or post-harvest investments), there intensity of cooperation and exchange of information is pretty strong, this flow being constantly supported by the agriculture development projects (funded by USAID, IFAD, World Bank, etc.).

The early adopters and promoters of intensive fruit production technologies were by Codru-ST LLC and Alfa-Nistru LLC, both of them being supported through USAID agriculture development projects. Most of growers that switched to intensive production technologies have visited at least once one of the first Moldovan orchards on M9 rootstock planted in 2000 year by Codru-ST LLC. The controlled atmosphere cold storage of the same company (built in 2002 with USAID support) even now serves as a benchmark for the new post-harvest investments. Codru-ST LLC was also the first local nursery to introduce 2-year knip-baum seedlings (through a joint venture with a Dutch nursery) and promoted the adoption of drip irrigation.

Another flow of knowledge and learning is coming from communication with the Polish apple sector: several “signature” orchards (mainly in the North) were established with Polish seedlings (such as Agrodenidan LLC or Victor Scutaru farming enterprise), the Moldovan growers tend to adopt the same set of equipment and implements as Polish do, and several apple cold storages and packinghouse were built by Polish companies.

The last wave of innovations (anti-hail systems, advanced orchard equipment) is closely related to the increased availability of Italian technologies through local dealers (Vitalitifruct-EXPO LLC and Samiral-Agro LLC).

The cooperation among leading growers became much more organized after five of them founded “Moldova Fruct” Fruit Producers’ and Exporters’ Association in 2006 year. Since then, the membership has expanded to 40+ members (growers, exporters, and input suppliers) including all companies mentioned above. The members regularly meet (usually once in two months, frequently in our of the member’s orchards) to discuss market development, production and post-harvest technologies, legislative initiatives, etc. The Association is at the early stages of development of its own consultancy department (currently it is done through a partnership with the experts from the Agrarian University). An example of fruitful cooperation within the Association is the initiation of official registration of several thinning agents by an Italian supplier, attracted to Moldova by the management of the Association.

¹⁷ “Clothing the Bear” and the Closing of Moscow’s Cherkizovsky Market, <http://jamestownfoundation.blogspot.com/2009/07/clothing-bear-and-closing-of-moscows.html>

Another association (the Fruit Producers' Association) was created with AGROinform support in 2007, possibly as a reaction to the perceived "elite-ness" of "Moldova Fruct" membership. This association has also an important number of members (several MFA members are also FPA members) and is involved by MAFI in the policy coordination processes in the same manner as MFA is.

There are several marketing cooperatives established by the Moldovan apple growers (Premium Fruct Coop established by some MFA members; three coops established with AGROinform support: Prim-Fruct, Orhei-Fruct and Edin Fruct Imex). So far, their impact on the sector was minimal, because of some deficiencies in the technical side (lack of common quality standards, lack of grading lines to assure shipment homogeneity), but mainly because of the "trust" factor.

3 Action Plan

| Market Requirements/ Critical Success Factors | Improvements needed | ACED interventions | Timing | Resources |
|---|--|---|--|--|
| 1. Cost-competitive apples with good cosmetic appeal (appropriate size, attractive coloring, absence of visual defects) | 1. Planting intensive orchards using modern varieties with improved coloring | 1. Develop a database of recommended apple production practices & technologies (including manufacturers and suppliers). Identify gaps between what's recommended and what's available in Moldova | November 2011 | ACED staff |
| | 2. Introduction of chemical thinning | 2. Update the existing guide on intensive apple production and its translation into Russian | December 2011 | ACED staff Local specialist |
| | 3. Improved use of orchard irrigation | 3. Link manufacturers of plant nutrition and thinning chemicals with the apple associations and Moldovan pesticide registration authorities | Start in January 2012 | ACED staff |
| | 4. Improved plant nutrition, based on soil, water and plant-tissue analysis | 4. Organize a "Modern apple production approaches and technologies" study tour to a leading apple production country (Italy, Poland) | April 2012 | International STTA |
| | 5. Installation of anti-hail nets and frost protection systems in the orchard | 5. Implement demonstration activities to showcase the best production practices and technologies, with focus on intensive orchard planting, fruit thinning, plant nutrition, irrigation, pest management, safe use of agro-chemicals, good agricultural practices (GlobalGAP to serve as a reference standard), organization of production and harvesting processes | Start in February 2012, follow-up in 2013 & 2014 | International STTA Local specialist Partner Business (apple grower) |
| | 6. Appropriate winter and summer pruning | 6. Organize training events around demonstration activities to disseminate the best practices and technologies in apple production | 5 events per season | Local subcontractor |
| | 7. Improved pest management | 7. Link local nurseries with international variety patent owners | February 2012 | ACED staff |
| | 8. Implementation of appropriate harvesting tools | 8. Establish a variety evaluation and demonstration plot, involving local nurseries, growers and researchers (public-private partnership) | April 2012 | Knip seedlings of 5 new varieties Local specialist Partner Business (apple nursery) |
| | 9. Improved human resource management (training of workers, process planning) and labor productivity | 9. Implement demonstration activities to showcase the best apple nursery practices and technologies, such a bed formation, irrigation, plant nutrition, grafting, testing for viruses | | Plants of M9-337 and B9 rootstocks International STTA Partner Business (apple nursery) |
| | | 10. Develop the "Apple seedling production guide" for local nurseries | August 2012 | Local specialist |
| | | 11. Develop the "Grower's guide to apple varieties", including availability at local nurseries | November 2012 | Local specialist |
| | | 12. Provide technical assistance to MAFI to develop and implement the new regulations for apple nursery activities, including upgrading of legal norms, standards and technical regulations for apple seedlings based on EPPO standards | February-May 2012 | International STTA |

| Market Requirements/ Critical Success Factors | Improvements needed | ACED interventions | Timing | Resources |
|--|--|--|--|--|
| 2. Longer shelf-life and delivery sustainability (4-6 weeks) | 1. Implementation of tools and techniques to achieve optimal harvest window 2. Adoption of pre-cooling (rapid start of the cold chain) 3. Building new cold storage facilities and expansion of existing facilities 4. Adoption of improved cold storage technologies | 1. Develop the “Investor’s Guide to Apple Cold Storage and Packing House Construction” | January-March 2012 | Local subcontractor |
| | | 2. Facilitate participation of Moldovan growers and exporters at key industry events to meet suppliers of post-harvest technologies | February 2012 (Fruit Logistica) November 2012 (Interpoma) | ACED staff |
| | | 3. Organize a study tour for growers and local cold storage technology suppliers to a country with developed apple post-harvest infrastructure (Italy, France, or Poland) | March 2012 | International STTA |
| | | 4. Organize a training and mentoring session for local cold storage designers regarding best practices in cold storage and packing house design (use of specialized software, facility layout, room and packing area temperature regimes, lighting of packing area, etc.) | October 2012 | International STTA |
| | | 5. Develop the “Apple harvesting and post-harvest management” guide | June-July 2012 | Local specialist |
| | | 6. Develop the “Banker’s guide to apple post-harvest infrastructure investments” (based on FAO & EBRD model) | March 2012 | Local subcontractor MCA/AAF |
| 3. Size and color uniformity in the package | 1. Installation of fruit grading equipment | 7. Organize a “Post-harvest infrastructure investments” local study tour for bankers | April 2012 | ACED staff MCA/AAF |
| | | 8. Link potential investors in apple post-harvest infrastructure with financial institutions, IDSPs, industrial designers and equipment suppliers. Provide mentoring and quality control | Start in November 2011 | ACED staff MCA/AAF |
| | | 9. Implement demonstration activities to showcase the best harvesting and post-harvest practices and technologies, including picking bags, harvesting trailers, impact recording devices, cold storage sanitation, quality monitoring tools (starch tests, color charts, penetrometers, refractometers), humidifiers, ethylene management solutions (ethylene scrubbers, DPA, SmartFresh), CA/ULO, energy efficiency, environmental issues (safe use of water, waste management, etc.) | Start in July 2012, follow-up in 2013 & 2014 | Local specialist Partner Businesses (cold stores) |
| | | 10. Organize training events around the demonstration activities to disseminate the best practices and technologies in harvesting and post-harvest handling, international quality standards | August & February of each season | ACED staff Local subcontractor |
| | | 1. Work with local cardboard manufacturers (KKI & SimcoEuro) to develop self-locking and machine-glued box designs (60x40 & 50x30, 1 layer & 2 layers, various heights & weights) | Start in November 2011 | ACED staff |
| 4. Easy handling package with good fruit protection | 1. Improved technical abilities of local cardboard manufacturers 2. Installation of open box forming equipment | 2. Implement new cardboard and fresh produce package tests at local cardboard manufacturers | May 2012 | Procurement of reference standards |
| | | 3. Carry out feasibility studies for box forming operations in key apple producing regions. Disseminate results and provide assistance to potential investors (business plans, loan brokerage, link with equipment suppliers and cardboard suppliers, etc.) | July 2012 | Local subcontractor |

| Market Requirements/ Critical Success Factors | Improvements needed | ACED interventions | Timing | Resources | |
|--|---|---|---|-----------------------------------|------------------------------------|
| 5. Guaranteed food safety & phytosanitary health | 1. Compliance of growers with good agricultural practices | 1. Develop the database of MRLs for Moldova and target export markets | March 2012 | ACED staff Local specialist | |
| | 2. Determination, continuous updating and dissemination to growers of target market MRLs by appropriate government institutions | 2. Through VCSC, provide technical assistance to value chain entities regarding implementation of GlobalGAP, QS, ISO 22000, ISO 9001 and HACCP requirements and subsequent certification | 2012-2013 | ACED staff Local subcontractor | |
| | 3. Improved government capacity to do sanitary and phytosanitary inspection and testing | 3. Procurement of equipment for the phytosanitary laboratory | | 2012 | International STTA |
| | | 4. Implement a training program for phytosanitary inspectors | | 2012-2013 | ACED staff International STTA |
| 6. Culture of quality and trust among value chain entities | 1. Deeper, formalized cooperation among value chain entities (sales, post-harvest investments, adoption of innovations, etc.) | 1. Link local growers and exporters with foreign distributors and retailers. Provide support & mentoring during the negotiations and deal implementation; disseminate lessons learnt | February 2012 (Fruit Logistica) Fall 2012 (World Food & IndAgra) | ACED staff | |
| | 2. Improved product quality uniformity among cooperating growers | 2. Carry out a demand assessment for apple storage, grading and packing services for smaller farmers in key apple producing regions. If positive, carry out feasibility studies | April 2012 | Local subcontractor | |
| | 3. Enhancement of managerial and marketing abilities of growers and traders | 3. Actively identify and provide technical support to cooperation initiatives/opportunities in the apple value chain, including market information, feasibility studies for post-harvest infrastructure, development of quality grades/standards, development of internal regulations | Start in November 2011 | ACED staff Local subcontractor | |
| | 4. Better communication to the target market of the implemented value chain upgrades & improvements | 4. With the local industry associations, develop a system of monitoring apple inventories in the cold stores. Explore the opportunities to expand the system into a joint marketing activity | | September 2012 | Local subcontractor |
| | | 5. Support the organization of the annual apple sector forum | | March 2012 | Partner Business (MFA) |
| | | 6. Organize country stands at the major trade fairs in the target markets | | 2013 | Local subcontractor MAFI, MIEPO |
| | | 7. Organize a “buyers’ mission” for foreign distributors and retailers interested in sourcing apples from Moldova | | 2013 | ACED staff |

4 Causal Model

| Market Requirements/ Critical Success Factors | ACED interventions | Outputs | Outcomes | Impacts |
|---|--|--|---|--|
| 1. Cost-competitive apples with good cosmetic appeal (appropriate size, attractive coloring, absence of visual defects) | 1. Develop an inventory of recommended apple production practices & technologies; identify potential suppliers | Inventory developed | 1. Growers adopting new production practices and technologies in the existing orchards (# of growers) 2. Growers planting new intensive orchards (# of growers, area of new orchards, value of investments) 3. GoM approves the new regulations and standards for nursery activities 4. Nurseries adopting new practices and technologies (# of “certified virus-free” apple seedling nurseries) Leading to 5. Better quality fruit with good cosmetic appeal (appropriate size, attractive coloring, absence of visual defects) 6. Higher yields 7. Higher share of Extra & Class I fruit in the total harvest volume Leading to 8. Increased competitiveness in the existing markets and market segments 9. Opportunities to diversify markets (export to EU) or enter new market segments (sales to modern retail formats) | 1. Increased grower and trader income due to higher farm-gate prices and bigger volumes available from Moldova 2. Increased grower income due to lower costs per kg of apples produced 3. Increased incomes for local nurseries 4. Reduced market risk profile for all value chain entities |
| | 2. Update the existing guide on intensive apple production | Guide updated # of copies distributed | | |
| | 3. Link manufacturers of plant nutrition and thinning chemicals with the apple associations and Moldovan pesticide registration authorities | # of new registered agrochemicals | | |
| | 4. Organize the “Modern apple production approaches and technologies” study tour to a leading apple production country | Study tour organized # of participants # of new production practices and technologies identified | | |
| | 5. Implement demonstration activities to showcase the best practices and technologies | # of new practices and technologies implemented | | |
| | 6. Organize training events around demonstration activities to disseminate the best practices and technologies in apple production | # of practices and technologies demonstrated # of farmers trained | | |
| | 7. Link local nurseries with international variety patent owners | # of nurseries assisted # of new apple varieties available | | |
| | 8. Establish a sustainable mechanism of new apple variety evaluation involving growers, nurseries and local researchers (public-private partnership) | Mechanism developed and implemented # of new apple varieties evaluated | | |
| | 9. Develop the “Apple seedling production guide” for local nurseries | Guide developed # of copies distributed | | |
| | 10. Develop the “Grower’s guide to apple varieties”, including availability at local nurseries | Guide developed # of copies distributed | | |
| | 11. Provide technical assistance to MAFI to develop and implement the new regulations for nursery activities | Draft of new regulations and standards developed | | |

| Market Requirements/ Critical Success Factors | ACED interventions | Outputs | Outcomes | Impacts |
|---|--|---|---|---|
| 2. Longer shelf life | 1. Develop the “Investor’s guide to apple cold storage and packinghouse construction” | Guide developed # of copies distributed | 1. Enterprises adopting new harvesting, cold storage and grading practices and technologies (# of enterprises) 2. Enterprises building new cold storage facilities or expanding the existing ones (new cold storage capacity, # and size of loans secured, # of post-harvest facilities built or upgraded, value of investments made) Leading to 3. Lower loss rates 4. Delivery sustainability (longer period of supply) 5. Higher quality (cosmetic appeal and uniformity) of the apples reaching retail shelves and consumers Leading to 6. Increased competitiveness of the existing markets and market segments 7. Opportunities to diversify markets (export to EU) or enter new market segments (sales to modern retail formats) | 1. Increased cold storage owner and trader income due to higher prices and bigger volumes available from Moldova in the off-season 2. Increased cold storage owner income due to lower storage costs per kg 3. Reduced market risk profile for all value chain entities |
| | 2. Link potential investors in apple post-harvest infrastructure with financial institutions, IDSPs, industrial designers and equipment suppliers. Provide mentoring and quality control | # of enterprises assisted | | |
| | 3. Develop the “Banker’s guide to apple post-harvest infrastructure investments” (based on FAO & EBRD model) | Guide developed # of copies distributed | | |
| | 4. Organize a “Post-harvest infrastructure investments” local study tour for bankers | Study tour organized # of participants | | |
| | 5. Facilitate participation of Moldovan growers and exporters at key industry events to meet suppliers of post-harvest technologies | # of participants # of new relevant post-harvest practices and technologies identified | | |
| | 6. Organize a study tour to a country with developed apple post-harvest infrastructure (Italy, France, or Poland) | # of participants # of new relevant post-harvest technologies and innovations identified | | |
| | 7. Develop the “Apple harvesting and post-harvest management” guide | Guide developed # of copies distributed | | |
| | 8. Implement demonstration activities to showcase the best harvesting and post-harvest practices and technologies | # of new post-harvest practices and technologies implemented at demonstration sites | | |
| | 9. Organize training events to disseminate the best practices in harvesting and post-harvest handling, international quality standards | # of post-harvest practices and technologies demonstrated # of enterprises trained | | |
| 3. Size and color uniformity in the package | | | | |

| Market Requirements/ Critical Success Factors | ACED interventions | Outputs | Outcomes | Impacts |
|---|---|--|--|---|
| 4. Easy handling package to protect the fruit | <ol style="list-style-type: none"> 1. Work with local cardboard manufacturers to develop self-locking and machine-glued box designs 2. Work with local corrugators to improve their cardboard and fresh produce package testing abilities 3. Assist potential investors in launching box forming operations in in key apple production regions | <p># of designs developed</p> <hr/> <p># of new test methods recommended</p> <hr/> <p>Feasibility studies completed for key apple production regions # of enterprises assisted</p> | <ol style="list-style-type: none"> 1. Increased availability of quality cardboard from local manufacturers 2. Increased availability of open boxes from local packaging manufacturers (# of box forming operations launched, # and size of loans secured) <p>Leading to</p> <ol style="list-style-type: none"> 3. Lower packaging costs 4. Better fruit protection (less bruising) 5. Easier handling 6. Better apple presentation & more appealing package | <ol style="list-style-type: none"> 1. Increased packer and trader incomes due to prices for packed apples, lower loss rates and lower handling costs 2. Increased incomes for local cardboard and packaging manufacturers |
| 5. Guaranteed food safety & phytosanitary health | <ol style="list-style-type: none"> 1. Develop the database of MRLs for Moldova and target export markets 2. Provide technical assistance through VCSC to growers for implementation of international quality and food safety standards and subsequent certification 3. Procurement of equipment for the phytosanitary laboratory 4. Implement a training program for phytosanitary inspectors | <p>Database developed</p> <hr/> <p># of enterprises assisted</p> <hr/> <p>Laboratory equipped</p> <hr/> <p># of inspectors trained</p> | <ol style="list-style-type: none"> 1. Growers adopting good agricultural practices (# of users accessing the MRL database, # of certified growers and producer organizations) 2. Government adopting a proactive approach to SPS issues <p>Leading to</p> <ol style="list-style-type: none"> 3. Apples complying to MRLs (# reported positive cases from the target market SPS authorities decreasing) <p>Leading to</p> <ol style="list-style-type: none"> 4. Safety of Moldovan apples for local and foreign consumers 5. Better image of Moldovan apples | <ol style="list-style-type: none"> 1. Reduced risk profile for all value chain entities (avoid losses associated with export bans) |

| Market Requirements/ Critical Success Factors | ACED interventions | Outputs | Outcomes | Impacts |
|--|--|---|---|---|
| 6. Culture of quality and trust among value chain entities | 1. Link local growers and exporters with foreign distributors and retailers. Provide support & mentoring during the negotiations and deal implementation; disseminate lessons learnt | # of growers and enterprises assisted Value of linkages | 1. Growers perform joint investments and sales (# of members, value of investments in joint infrastructure, value of joint sales) 2. Moldovan apples are exported to new markets (EU) 3. Value chain entities cooperate in “transfer of technology” or R&D activities | 1. Increased income at all nodes of the value chain due to better prices 2. Increased competitiveness and sustainability |
| | 2. Carry out a demand assessment for apple storage, grading and packing services in the apple producing regions. If positive, carry out a feasibility study | Studies performed for key apple regions | | |
| | 3. Actively identify and provide technical support to cooperation initiatives/opportunities in the apple value chain | # of organizations assisted | | |
| | 4. With the local industry associations, develop a system of monitoring apple inventories in the cold storages | Monitoring system implemented # of participating enterprises | Leading to 4. Smaller growers able to sell their apples through channels that were not accessible before because of supply sustainability issues | |
| | 5. Support the organization of industry events, including annual apple sector forum | # of events supported # of participants | 5. Better image of Moldovan apples among foreign buyers | |
| | 6. Organize country stands at the major trade fairs in the target markets | # of events supported # of participants | 6. The industry reaches economies of scale that were not possible at individual level | |
| | 7. Organize a “buyers’ mission” for foreign distributors and retailers interested in sourcing apples from Moldova | # of events supported # of buyers identified | | |

Annex A: Crop budgets for apples

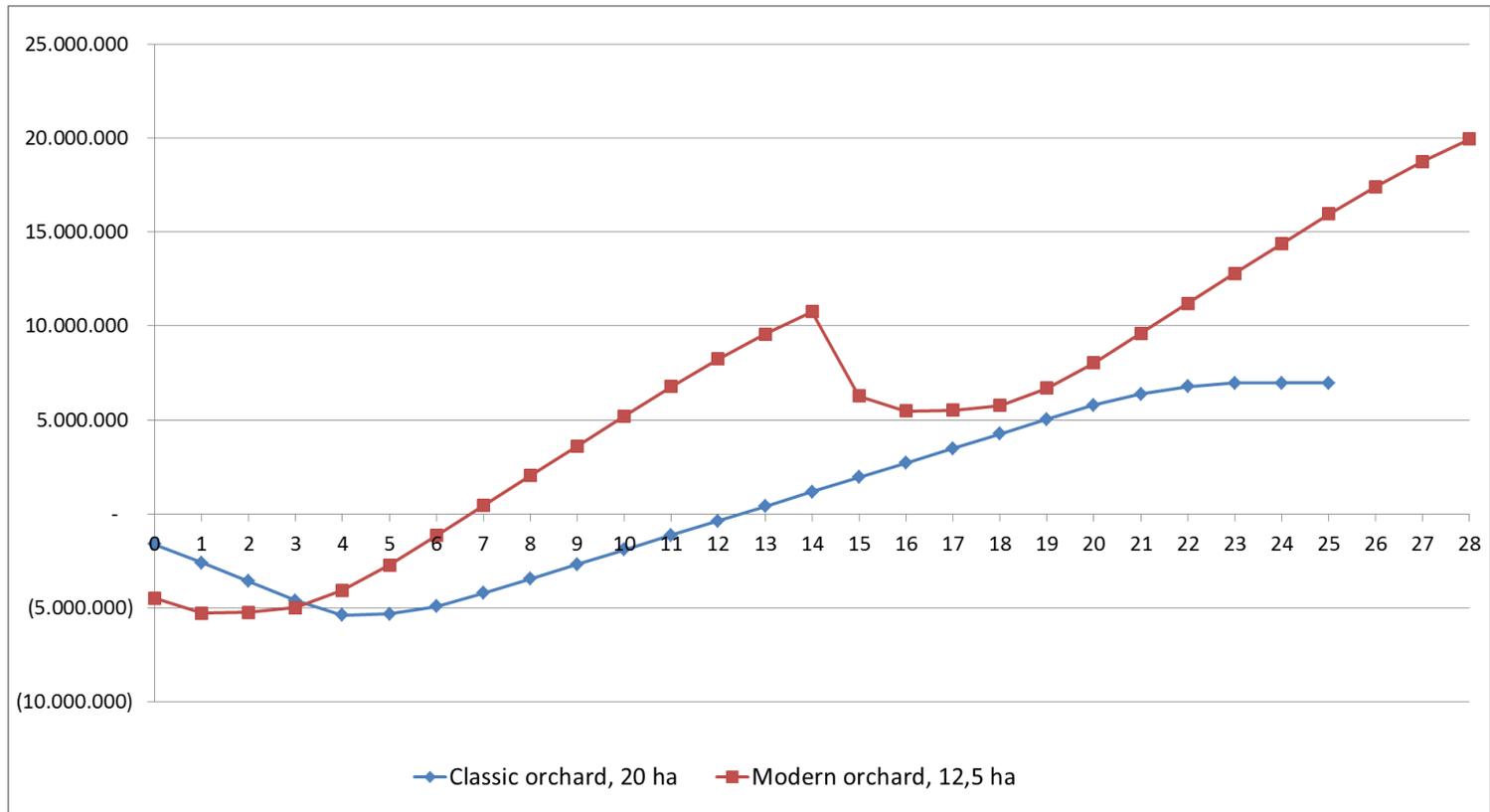
A.1 Intensive orchard (12.5 ha, 2381 trees/ha)

| | | Year 0 | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 | Year 7 | ... | Year 13 | Year 14 | Year 15 |
|----|---------------------------------|----------|----------|----------|----------|----------|----------|---------|---------|---------|-----------|-----------|-----------|
| 1. | Sales | 0 | 0 | 74.405 | 124.008 | 186.012 | 223.214 | 248.016 | 248.016 | 248.016 | 223.214 | 210.813 | 198.413 |
| | Total harvest | 0 | 0 | 178.571 | 297.619 | 446.429 | 535.714 | 595.238 | 595.238 | 595.238 | 535.714 | 505.952 | 476.190 |
| | Harvest / tree | 0 | 0 | 6 | 10 | 15 | 18 | 20 | 20 | 20 | 18 | 17 | 16 |
| 2. | Investment costs | 355.896 | 8.041 | 1.297 | 1.297 | 1.297 | 1.297 | 1.297 | 1.297 | 1.297 | 1.297 | 1.297 | 1.297 |
| 3. | Mechanized operations | 0 | 19.583 | 19.583 | 42.500 | 42.500 | 42.500 | 42.500 | 42.500 | 42.500 | 42.500 | 42.500 | 42.500 |
| 4 | Manual operations | 0 | 18.785 | 21.327 | 24.676 | 24.676 | 25.792 | 26.536 | 26.536 | 26.536 | 25.792 | 25.420 | 25.048 |
| 5 | Other expenses | 17.795 | 2.320 | 2.110 | 3.424 | 3.424 | 3.479 | 3.517 | 3.517 | 3.517 | 3.479 | 3.461 | 3.442 |
| 6 | Total production costs | 373.690 | 48.730 | 44.318 | 71.896 | 71.896 | 73.068 | 73.849 | 73.849 | 73.849 | 73.068 | 72.677 | 72.287 |
| 7 | Taxes & insurance | 156 | 5.228 | 9.635 | 13.019 | 16.119 | 18.281 | 19.722 | 19.722 | 19.722 | 18.281 | 17.560 | 16.840 |
| 8 | Net cash flow | -373.847 | -53.958 | 20.452 | 39.093 | 97.997 | 131.866 | 154.445 | 154.445 | 154.445 | 131.866 | 120.576 | 109.286 |
| 9 | Cumulative net cash flow | -373.847 | -427.805 | -407.353 | -368.260 | -270.264 | -138.398 | 16.047 | 170.492 | ... | 1.063.293 | 1.183.868 | 1.293.155 |

A.2 Traditional orchard (20 ha, 833 trees/ha)

| | | Year 0 | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | ... | Year 14 | ... | Year 23 | Year 24 | Year 25 |
|----|---------------------------------|----------|----------|----------|----------|----------|----------|---------|---------|---------|-----------|-----------|-----------|
| 1. | Sales | 0 | 0 | 0 | 0 | 68.750 | 156.250 | 225.000 | 225.000 | 187.500 | 168.750 | 150.000 | 150.000 |
| | Total harvest | 0 | 0 | 0 | 0 | 183.333 | 416.667 | 600.000 | 600.000 | 500.000 | 450.000 | 400.000 | 400.000 |
| | Harvest / tree | 0 | 0 | 0 | 0 | 11 | 25 | 36 | 36 | 30 | 27 | 24 | 24 |
| 2. | Investment costs | 127.650 | 5.380 | 214 | 214 | 214 | 214 | 214 | 214 | 214 | 214 | 214 | 214 |
| 3. | Mechanized operations | 0 | 28.000 | 28.000 | 31.333 | 64.667 | 64.667 | 64.667 | 64.667 | 64.667 | 64.667 | 64.667 | 64.667 |
| 4 | Manual operations | 0 | 21.781 | 23.604 | 24.906 | 31.104 | 36.625 | 38.917 | 38.917 | 37.667 | 37.042 | 36.417 | 36.417 |
| 5 | Other expenses | 6.383 | 2.758 | 2.591 | 2.823 | 4.799 | 5.075 | 5.190 | 5.190 | 5.127 | 5.096 | 5.065 | 5.065 |
| 6 | Total production costs | 134.033 | 57.920 | 54.409 | 59.276 | 100.784 | 106.580 | 108.987 | 108.987 | 107.674 | 107.018 | 106.362 | 106.362 |
| 7 | Taxes & insurance | 250 | 6.131 | 6.623 | 6.975 | 12.086 | 17.951 | 22.008 | 22.008 | 19.795 | 18.689 | 17.583 | 17.583 |
| 8 | Net cash flow | -134.283 | -64.050 | -61.032 | -66.250 | -44.119 | 31.718 | 94.006 | 94.006 | 60.031 | 43.043 | 26.056 | 26.056 |
| 9 | Cumulative net cash flow | -134.283 | -198.333 | -259.365 | -325.615 | -369.734 | -338.016 | ... | 468.398 | ... | 1.212.525 | 1.238.581 | 1.264.637 |

A.3 Comparative cumulative cash flow



Annex B: Cigar Box for AJC

| | USD per ton | | USD per year |
|---|-----------------|---|---------------------|
| Price (DDP Moscow) | 1,200 | Total Revenue | 3,663,200 |
| Import duties, 0% | 0 | Total Cost | 3,406,112 |
| VC4 Transport, sales commission 3% | 236 | Profit Before Tax | 257,088 |
| Price (EXW) | 964 | Profit % | 7% |
| Price (RM, delivered factory) | 90 | Asset value | 1,400,000 |
| Processing ratio | 6.00 | Depreciation % | 10.0% |
| Raw Material cost | 540 68% | FC1 | 140,000 35% |
| Other ingredients | 100 13% | Debt (40% of Asset value) | 560,000 |
| VC1 | 640 81% | Interest rate | 8% |
| Production cost per hour (steam, electricity) | 145 | FC2 | 44,800 11% |
| Production volume per hour (ton/hour) | 2.5 | Number of FTE employed | 50 |
| VC2 | 58 7% | Salaries permanent staff incl. social taxes | 150,000 38% |
| Cost of packing (aseptic bag + drum) | 20.2 | Other overhead, repairs, maintenance | 64,000 16% |
| Number of packs per ton | 4.5 | FC3 | 214,000 54% |
| VC3 | 92 12% | FC | 398,800 100% |
| Finished Goods losses % | 0.2% | FC % attributed to product | 100.0% |
| VC | 791 100% | FC (attributed to product) | 398,800 |
| Gross margin | 173 | Volume sold q (in ton) | 3,800 |
| Gross margin % | 18% | Contribution | 655,888 |
| FC / q | 105 12% | Break even volume (sales) | 2,311 |
| TC / q | 896 100% | Break even volume (raw material) | 22,800 |
| Profit / q | 68 | Output capacity per hour in ton | 15.0 |
| | | Operating hours per day | 22 |
| | | Working days per year | 90 |
| | | Max. output capacity per year | 29,700 |
| | | Capacity utilization % | 76.8% |

Benchmarks

- Apple juice concentrate in aseptic bags of 200 liters in steel drums.
- Price range: USD 750–1,500 C&F Rotterdam
- Variable costs: VC = USD 791 (88% of total cost)
- Fixed cost: FC = USD 400,000
- Break-even: Minimum sales volume = 2,300 tons; minimum raw material = 22,800 tons.
- Profitability: AJC gives low to moderate profitability to the processor. Capacity utilization (seasonal) must be over 75%. Profitability for 30,000 tons of apples into 3,800 tons AJC = 5–9%.
- Sensitivity: Gross margin = 18%. Risky: since the processing ratio is very high, the price of apples is crucial. A 12% increase in the price of apples will reduce the profit to zero.

Annex C: Value added tables

C.1 Truck market channel

| Value chain entity | Item | Value (US cents) | Share |
|--|-------------------------------------|---------------------|-------------|
| Traditional grower w/o cold storage | Materials | 11.0 | 29% |
| | Labor (production) | 8.3 | 22% |
| | Labor (harvesting) | 3.0 | 8% |
| | Other production costs | 6.1 | 16% |
| | Total production costs | 28.3 | |
| | Grower margin | 9.8 | 26% |
| | Grower sales price | 38.1 | 100% |
| Trader | Purchase price from grower | 38.1 | 39% |
| | Wooden crate (14 kg) | 4.2 | 4% |
| | International transport | 17.5 | 18% |
| | Broker commission | 4.0 | 4% |
| | VAT 18% of indicative price | 7.2 | 7% |
| | Truck market fee | 6.0 | 6% |
| | Total trader costs | 77.1 | |
| | Trader's margin | 20.0 | 21% |
| | Trader's sales price | 97.1 | 100% |
| Small retailer, open market vendor | Purchase price from trader | 97.1 | 68% |
| | Transport | 6.0 | 4% |
| | Total vendor's costs | 103.1 | |
| | Vendor's margin | 40.0 | 28% |
| | Vendor's sales price | 143.1 | 100% |
| | VAT 0% and other taxes | 5.0 | |
| | Final price for the consumer | 148.1 | |

C.2 *Direct trade channel*

| Value chain entity | Item | Value (US cents) | Share | |
|----------------------------------|--|----------------------------|-------|-----|
| Modern grower w/ cold storage | Materials | 7.3 | 8% | |
| | Labor (production) | 5.5 | 6% | |
| | Labor (harvesting) | 2.5 | 3% | |
| | Other production costs | 5.3 | 6% | |
| | Total production costs | 20.6 | | |
| | Grower margin for production | 21.8 | 23% | |
| | Grower's sales price from orchard | 42.4 | | |
| | Transport to cold storage | 0.8 | 1% | |
| | Storage costs | 6.8 | 7% | |
| | Labor (grading & packing) | 2.0 | 2% | |
| | Packed fruit costs | 52.0 | | |
| | Grower margin for storage | 16.0 | 17% | |
| | Grower's sales price from storage | 68.0 | | |
| | Cardboard box (14 kg) | 5.4 | 6% | |
| | International transport | 17.5 | 18% | |
| | Grower margin for logistics | 5.0 | 5% | |
| | Grower sales price (DDU) | 95.9 | | |
| | Distributor | Purchase price from grower | 95.9 | 83% |
| | | Broker commission | 1.5 | 1% |
| Handling & re-packing costs | | 7.0 | 6% | |
| Total distributor's costs | | 104.4 | | |
| Distributor's margin | | 11.0 | 10% | |
| Distributor's sales price | 115.4 | | | |
| Retail | Purchase price from trader | 115.4 | 78% | |
| | Handling costs | 2.0 | 1% | |
| | Total retailer's costs | 117.4 | | |
| | Retailer's margin | 30.0 | 20% | |
| Retailer's sales price | 147.4 | | | |
| | VAT 18% and other taxes | 26.5 | | |
| | Final price for the consumer | 173.9 | | |