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Sustainable Management of Biodiversity, South Caucasus

ASSESSMENT OF WHEAT, BARLEY AND EMMER WHEAT VALUE CHAINS IN ARMENIA

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INTERNATIONAL CENTER FOR AGRIBUSINESS RESEARCH AND EDUCATION

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Objective of the Study

According to the conventional interpretation, underdeveloped agricultural sector in Armenia has grounds to the structure of agriculture; agricultural land is fragmented into small land plots where effective farm management system is hard to adopt and economies of scale cannot be exploited. In addition, there are diverse issues and challenges associated with the basic infrastructure, skilled labor force, lack of capable scientific institutions, etc.

In fact, today's troubles are not simply the result of mismanaged privatization process, but the result of the entire transitional period, which still has not finished and hampered by a number of external factors, such as closed borders with neighboring Azerbaijan and Turkey. The former one, results in prioritizing and promoting grain, and in particularly wheat production by government, to address an issue of food security in case of emergencies and escalation of the conflict. Therefore, in an effort to pump up wheat sector, government implements a number of programs aiming to boost local production and increase efficiency. Some experts argue that this approach would work; others push on unsustainability of the program. In other words, they question feasibility of developing grain production in Armenia, since they consider that Armenia does not possess comparative advantage in grain, and particularly in wheat production, and therefore, needs to concentrate on more valuable crops, which can provide higher profit to farmers and organizations engaged in agriculture.

Ultimately, there is a lack of comprehensive study which can evaluate grain sector and sector related opportunities, to better understand, potential and existing challenges in the field.

This study investigates the current state and dynamics of wheat, barley and emmer wheat production and latest developments in Armenia. It aims to portray wheat, barley and emmer wheat production sector dynamics, including local production and trade, yield and sown areas by regions; identify the most widespread wheat, barley and emmer wheat local and imported varieties cultivated in Armenia and explain the reasons behind their popularity. Furthermore the study summarizes government programs and priorities in the field; identifies and evaluates the main seed production organizations and their activities. It defines the main challenges which hamper competitiveness and hinder development of the wheat, barley and emmer wheat entire value chains.

In particular the study focuses on local production and imported input supplies, the quality of soil and land, farming and cultivation methods as well as processing and marketing component, which although is not the primary focus, but important to better evaluate the sector.

Introduction

The grain sector is important for Armenia due to geopolitical situation; elimination of poverty and assurance of food security in case of emergencies, as well as to address stability of prices at local market. The grain price and supply fluctuations result in increase of prices, which directly impact on entire population and particularly poor segment, which can hardly sustain living. This urged government to prioritize grain production and development, and implement programs which aim at increasing production of grain and in particular wheat and barley in Armenia.

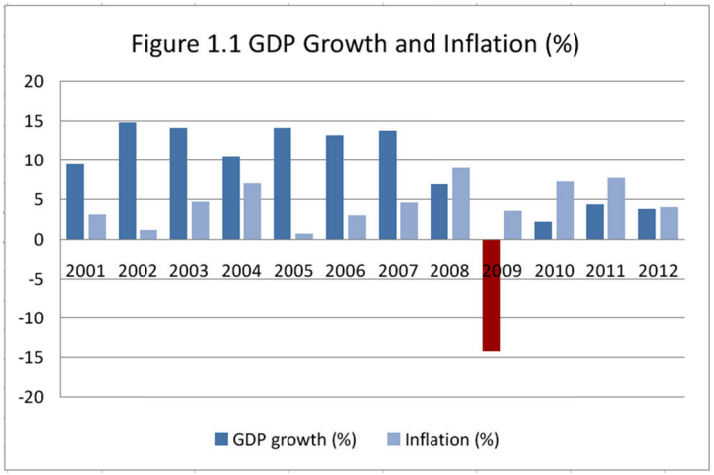
Although largest proportion of arable land in Armenia is devoted to grain production, the volumes are not sufficient to ensure food security, and it fluctuates from 30-40% of self-sufficiency level (NSS, 2011). Concurrently, wheat, barley and emmer wheat volumes, sown areas and yield fluctuate year by year, and there is no specific consistency and stable forecast which can be made, since there are a number of variables such as weather conditions, quality and availability of seeds and other input supplies. There are also several challenges at institutional level. State and private organizations which engaged in seed selection and production are not capable and require additional resources to be effective and to be capable to supply necessary amounts of elite and super elite seeds to the farmers. At the same time, high quality seed distribution mechanisms are not clear, and some experts point out to the problem of bias seed distribution in some communities of Armenia.

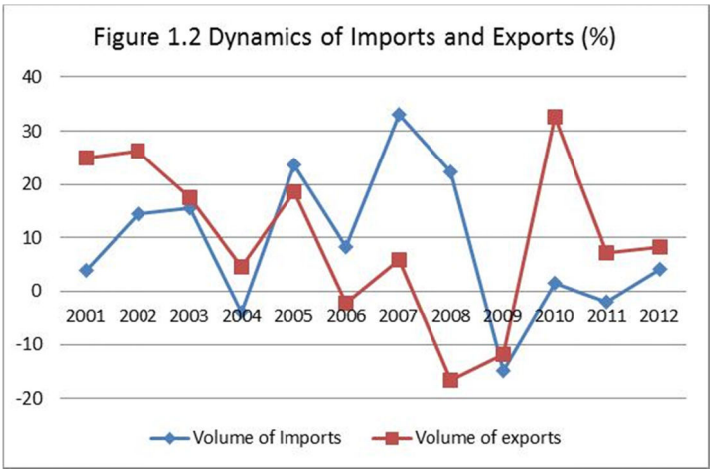
Ultimately, although there is some positive tendency in grain productivity and production volumes, the situation is not satisfactory and requires significant amount of work at every level of grain value chain, starting from seed production, appropriate land cultivation technologies and good agricultural practices, to the marketing and delivering the product to final target market and the consumer. According to some experts, grain production in Armenia cannot survive since there is a need for government subsidies; otherwise this branch is highly risky and not profitable.

1. Brief Macroeconomic Overview of Armenia

1.1 Outlines of Economic Performance after Independence

Since gaining independence, Armenian economy has been going through a transformation process from planned to market economy, which affected structure of GDP and in the first stage led to significant decrease of gross domestic product (GDP). The economy of the Soviet Armenia was largely industrial, focusing on production of chemicals, electronic products, machinery, processed food, synthetic rubber and textiles (US Department of State, 2011). Overall structure as well as performance of the economy had changed substantially after independence in 1991. The value chain disruption had resulted in dramatic decline in industrial output. Share of industry in GDP decreased from 49% in 1991 to 27% in 1993 (NSS, 2007). From 1990-1993 GDP had fallen by more than 60%. Along with a significant decrease of industrial output, share of agriculture increased from 25% in 1991 to more than 41% in 1994. Ultimately, exports of Armenia as a percentage of GDP had fallen from 41% to only 20% by 1997 (IMF, 2012). The dynamic of import and export is portrayed in the figure 1.2, where we can observe an increase of the percentage of the export volumes after 2009, which however although increases with a faster pace than the export, but still significantly lower than the import volumes. In other words, although import volumes significantly exceed export volumes, since 2008, export is increasing at a higher rate than imports.





Recovery had started after three years of recession. The average growth until 2000 constituted 5.5%, and accelerated from 2001-2007 by an average of 12.5% (The World Bank, 2011). This growth was associated with the first generation reforms, which targeted macroeconomic stability. Nevertheless, analysis of GDP structure, points out on some intrinsic data. At first, economic growth from 2001-2007 was largely associated with an increase of construction volumes, and increasing prices for the primary resources in international markets. Other branches of the economy although increased, but with relatively slower pace.

The situation became especially perilous in 2008 when economy was hardly hit by the global financial crisis. This has resulted in 14% GDP decline, which was linked to a sharp decrease of construction volumes, decline in the overall amount of remittances and diminishing prices of raw material on global markets (Civilitas Foundation, 2009). In 2010, the share of agriculture as the percentage of GDP constituted around 20%, industry 36% and services 44% (The World Bank, 2012). In 2011 Gross Agricultural Output comprised about 763,351 million AMD in current prices which makes 20.2% of GDP. With food industry it makes around 28.8% of the country's GDP in 2011 (NSS, 2012).

Remittances remain as the biggest sources of import financing and constituted about 1.5 billion USD in 2007, or 19% of GDP and 1.1 billion USD or 11.2% of GDP in 2011 (NSS and CBA, 2012). Nevertheless, a series of reforms including wage control elimination and privatization of land and small businesses contributed economic growth in Armenia after the collapse of Soviet Union. In the meantime, analysts recommend diversification of the economy, and investments into knowledge-based industries to sustain growth.

1.2 Geopolitical Situation and Natural Resources of Armenia

Armenia is located on the crossroad of Europe and Asia and borders with Georgia to the north, Azerbaijan to the east, Iran to the south and Turkey to the west. The borders between Armenia and Azerbaijan, and Armenia and Turkey are closed due to unresolved Nagorno Karabakh conflict. There were also some disruptions at the Armenia-Georgia border, because of tensions between Georgia and Russia. This border serves 70% of Armenian trade. Since country is landlocked, borders with Georgia and Iran are strategically important and vital for Armenia (Pope, 2008).

Armenia is rich for some metals and minerals, particularly copper, aluminium, zinc, gold, molybdenum and silver. There are also deposits of industrial minerals such as cement, clay and prelate (Levine & Wallace, 2000). In addition there are substantial deposits of pumice, marble, tufa, limestone, basalt and salt (KPMG, 2009). Export of these resources significantly contributes to gross domestic product. Meanwhile, there have been some investigations for energy resources, which however, have not shown any results yet. As of today, Armenia imports oil and gas, but availability of nuclear power station and several hydro power plants allow to supply 27% of overall annual energy consumption, as well as export to Georgia and Iran (US Department of State, 2011).

1.3 Diaspora and Investments

Armenia is a small but a global nation, having more people living aboard, than at home country. As of January 1, 2012 population of Armenia constitutes 3.1 million people at home and more than 6 million abroad. In addition Diaspora connected investments into Armenia

constitute 69% of foreign investments. For example most globally recognized brands such as Synopsis, HSBC, Coca-Cola, Marriott and KPMG entered Armenian market through involvement and in some cases participation of Diaspora (Hergnyan & Makaryan, 2006). The largest Diaspora investments come from Russia, which constitutes 29% of all investments, followed by US with 17%, Iran 14%, Belgium, Canada and UK. According to research conducted by EV consulting, most investment by Diaspora is driven by ethnic attachments, which constitutes 43% and 24% by family and friends altruism (Hergnyan & Makaryan, 2006). Despite investments, Diaspora organizations in countries such as United States, France, Russia and Canada influence provision of foreign aid to Armenia. Another source of support is individual remittances and donor transfers. Ultimately, Armenian Diaspora is also a market for locally produced products.

1.4 Infrastructure

Armenia faces a challenge of rapidly growing demand for roads, power and telecommunications. Meanwhile, due to relatively small size of the country, recent investments and donor programs in upgrading and improvement of infrastructure have helped to implement some essential projects. Among some largest schemes were road and irrigation infrastructure development programs financed and implemented through Millennium Challenge Program. The program, which was funded by the United States, aimed at upgrading and rehabilitating roads and improving water access through rehabilitation and construction of main canals, gravity schemes and pumping stations. These projects are amounted 67 million USD for roads, and 120 million USD for the modernization of irrigation system (MCA Armenia, 2012).

Some other donor organizations, foreign governments, private companies and Diaspora organizations have been constantly engaged in infrastructure improvement and modernization programs in Armenia. These types of programs resulted in improvement of the general level of physical infrastructure where Armenia outperforms several countries in second level of development and competitiveness.

Nonetheless, the agriculture related infrastructure is underdeveloped. The most rural roads have poor conditions; irrigation water is not available in many communities or irrigation system is old and needs modernization; the logistics system is poor, there are few warehouses, cold storages, slaughterhouses, sorting and grading capacities etc. This significantly impacts on efficiency of agricultural sector in Armenia.

1.5 Human Capital

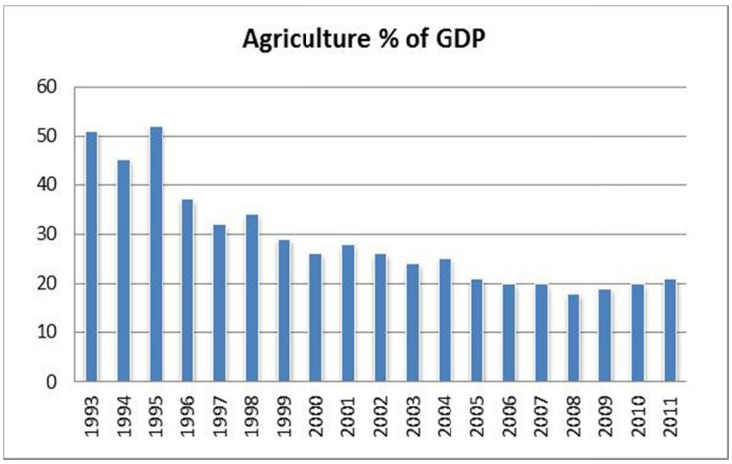
According to the Global Competitiveness Index, Armenia scores 2.8 out of 7, which implies that most talented and skilled people leave Armenia and search for work abroad (Schwab, 2010). Among some other significant challenges of the human resource development and educational system in Armenia, is primary education enrolment rate, quality

of overall education system, quality of management schools, Internet access in the schools, availability of research and training services and extent of staff training (Schwab, 2010).

In addition, there is a growing need for informal education, which can be improved by investment of local organizations into provision of trainings and professional development programs locally and abroad. Particularly, in terms of Armenia, which has limited natural resources, insufficient arable land and relative small population, it needs to build competitive advantage through investment in human capital development programs. These all factors directly influence on quality and productivity of labour. Therefore, it is crucial to assure improvement of human capital for cluster formation.

2. Brief Overview of Agriculture in Armenia

The transformation in agricultural land after collapse of the Soviet Union led to privatization in 1991-1992 where majority of agricultural land was distributed to the small peasant farms. This resulted in significant increase of share of agriculture in the structure of GDP. Meanwhile, after 1995 the share of agriculture has been decreasing and in 2011 constituted 20.2%. The impact of agriculture on the economy is significant, given that during last five years 60% of income of rural population, which constitutes 36% of total population, is provided through agriculture, and 61.6% of land area is agricultural. The majority of workers in the regions of Armenia engaged in self-employment of unpaid works, such as agriculture and subsistence farming (The World Bank, 2011). Agriculture is one of the most critical fields providing 44% of employed in the country. Nonetheless, according to the sample study of the National Statistics Service during 2001-2006 on actual employment in agriculture, the actual number of employed in agriculture constitutes about 24.3% or 240,000 people (NSS, 2006).



The main land users in Armenia are private farmers who produce over 98% of the gross agricultural output. These farmers possess 71.1% of privatized arable lands, 78.3% of perennial crop areas, and 48.4% of grasslands (Avetisyan, 2010). The agricultural land in Armenia is categorized in the following types; 21.3% arable land, 1.6% perennial grass, 6% plough-land, 52.6% pastures and 18.5% other (NSS, 2011).

There are three main agricultural production zones (Armenia has 9 agricultural zones) in Armenia; those are Ararat Valley (up to 1,200 meters above sea level), pre-mountain zone

(1,200-1,800 meters above sea level) and the mountain zone (higher than 1,800 meters above sea level) (Ministry of Agriculture, 2008). With a mostly mountainous terrain, arable land in 2012 amounted about 448,000 hectares (State Cadastre, 2012). Wheat sowing area in 2011 constituted 77.8 thousand, barley 68.3 thousand and emmer wheat 4.6 thousand hectares (see Table 3.1.1).

Furthermore, agricultural sector is important in terms of food security, which is essential in case of Armenia, which has two closed borders and there is possibility of escalation of Nagorno Karabakh conflict. Armenia possesses high level of self-sufficiency with potatoes, vegetables, fruits, milk, eggs and lower level with wheat, meat, pork (NSS, 2011). Over the period from 2004 till 2008, the average annual growth in agriculture was about 7.4%. This helped improve food self-sufficiency, which in 2008 increased up to 60% in the country. The local demand for plants, potatoes, main fruits, grapes, and veal is 98% satisfied by the local production, whereas the self-sufficiency level is quite low for wheat (40%), other grains (50-55%), poultry (15-17%), and pork (50-55%).

Hence, it should be mentioned that all these numbers just highlight again that agriculture is critical for Armenia. Specifically, improving agriculture could lead to poverty reduction, food security, increase in quality of life especially in rural areas, stability, and strategic improvement of the other sectors.

The volume of agricultural produce in 2011 was twice as larger than the same indicator in 2010. In particular, gross fruit production in 2011 was 234.6 thousand tons, which exceeds about 1.8 times the respective indicator of the previous year. About 16 thousand tons of fruits and vegetables were exported, which exceeds the indicator of the previous year by 30%.

According to the data of the NSS, the gross agricultural output in 2011 exceeded the previous year's indicator by 15.3 %, including the growth of crop production that made 28.7%. In the past, fruit growing was considered to be the most profitable sector in Armenia. Availability of land areas in different soil and climatic zones makes it possible to grow apricot, peach, prune, cherry, apple, pear, quince, walnut, peanut, fig, and pomegranate. About 70% of the country's fruit orchards are located on 400-to 1,000 meters, 4%-5% - 1,500-2,000 meters and 2.5% - 2,000 meters above sea level.

The main part of the produced crop is sold in the market, while processing companies were able to purchase 51,000 tonnes of vegetables and 14,100 tonnes of fruits in 2011, worth of 4.7 billion AMD (MoA, 2011). The stone fruits that are of priority significance for the processors (apricot, peach), are purchased from the same areas, Ararat and Armavir marzes (more than 70%). Pome fruits (e.g. apple) are purchased (more than 60% of the total) mostly from Kotayq and Aragatsotn marzes. Subtropical fruits (e.g. fig.) are purchased from Syuniq (Meghri area) and Tavush (Noyemberyan area) marzes.

The role of the processing industry is very important in the development of agriculture and in marketing of agricultural products. Currently, only 10-15 % of the existing capacity is used in the sector. The volume of usage varies from company to company and is between 3%-5% and 50%.

Agriculture has one of the lowest productivity levels, in contrast to other branches of the economy (EV Consulting, 2012). Although government has been undertaking a number of programs aiming to support agriculture, there are still several essential obstacles which hamper competitiveness and hinder development of the field. These challenges are seasonal production; inability to exploit economies of scale; and farms, which largely dominated by household economies where consumption, investment, work and social activities are undifferentiated and unspecialized. These challenges are complemented by the geopolitical situation of Armenia, primarily closed borders with eastern and northern neighbour countries; underdeveloped infrastructure in most rural areas; low quality input supplies; unsophisticated and small local market; low skilled human resources; high interest rates of agricultural loans, little investment into new technologies, other similar hurdles. In particular, the quality of input supplies and fertilizer is not satisfactory which affects the productivity of wheat and barley in all regions of Armenia.

Knowledge gaps on farm structures and demographics limit the most effective formulation and implementation of policy solutions. The last agricultural census in Armenia was conducted in 1920, and only a partial farm survey was conducted in 2008. There are no regular mechanisms of monitoring the structural changes in the farm sector. Also, data is missing to describe the demographic structure of farmers, and other socio-economic characteristics of farms and farmers (The World Bank, 2012). For policy analysis and other research work experts, academia or consultants have to rely on official statistics which in most cases provides contradictory information. Another approach is to collect primary information through surveys of the rural population, which is a very important, however not sufficient for covering this gap. An agricultural census in Armenia is urgently needed.

2.1 Impact of Global Financial Crisis on Agricultural Sector in Armenia

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The global financial crisis had significant impact on Armenian economy, in particular in construction, mining, tourism and agricultural spheres, however impact on agriculture was particularly concerning in terms of food security and poverty reduction reasons. The existing data describes this impact as devastating, since it led to increases of input prices; significant decrease of remittances led to decrease of income of population; government funds for agriculture also decreased; credit rates increased and procedures to get credit got stricter.

In particular, at the initial level of the agro-food chains (farmers) situation was the worst. Input prices increased (such as fertilizer, machinery, etc.) which translated into higher production costs for farm products. Hence, output prices ought to increase to account for the higher production costs. However, that's not the case and farmers had to even lower the product price to be able to sell it in the market. The reason was threefold. First, the level of remittances to Armenia decreased greatly which weakened the purchasing power of consumers (i.e. decrease in local demand for goods). Second, the export markets dried up and the processing firms were unable to sell their products. Therefore, the demand for agricultural products from farmers also declined. Third, government was lagging behind in

supporting farmers. The existing programs were very limited and not well-tailored. The entire agro-food supply chain has been affected (ICARE, 2009).

The agricultural gross production decreased by 5.1% in the first quarter of 2009 (relative to 2008 first quarter). For the same time period, economic loss in processing industry was about 5.7%, where the production of cognac and canned food nearly halved. Moreover, the ratio of agricultural food imports to exports increased to 5.9/1 in the first four month of 2009 (the ratios for 2007 and 2008 are 2.6/1 and 3.6/1, respectively). In other words, exports of agricultural food products declined by about 45% in 2009 (first four months) relative to 2008. The level of imports of agricultural food products did not decrease greatly (5.3%), but the fact that it decreased already indicated reduced purchasing power of population.

The financial and economic crisis affected the agriculture through the means of cultivation. For example, 25kg bag of fertilizer produced in Georgia in 2008 was 5500 AMD, and in 2009 it increased up to 7000 AMD. This was a 30% increase in fertilizer price over a year. The cultivated land for crops also decreased from 304,500 ha in 2008 to 298,000 ha in 2009. The situation was similar for the livestock sector. The overall number of livestock decreased by 7% or by 44,300 heads in 2009, among which cows decreased by 27,000, sheep and goats by 77,900 or 12%, and pigs by 1,900 or 2%. The main reason for this was the drop in feed production, particularly barley and wheat, increase in feed price, and decreased demand by processors (ICARE, 2009).

3. Grain Production and Industry Developments in Armenia

Armenia is a landlocked country, where key threats to food security stem from the unsettled conflict over Nagorno Karabakh; weak transportation links, which limits Armenia's access to international markets; domestic food supply scarcity particularly in case of emergencies; and large number of people living under poverty line. In addition, agricultural sector is not adequate to meet population needs, some strategic crops such as grain is far from reaching self-sufficiency level. Therefore, local production and supply of grain, and primarily wheat have been an ad hoc topic for the government, which has been developing a number of programs to support grain production in Armenia. This section of the report is an attempt to demonstrate and portray the recent tendencies in wheat, barley and emmer wheat production. It focuses on production, yield, sowing areas of grain in Armenia; observes recent trends in trade as well as attempts to evaluate impact of government programs on local production.

Grain is grown in many astonishing number of climatic geographic conditions, from 58 degree north to 40 degree south, at different sea level attitudes, in sub-tropical conditions, and semi-arid plains, in heavy rare rainfall areas. Therefore, literally grain can be adopted and grown in most of the sites in the world. The most tolerant and widely produced grain is wheat, which is the essential ingredient for the bread, the staple product (Atkin, 1992). Grain is important,

since it remains an important political issue, as a vital crop to satisfy essential human needs. However, there is a debate about economic benefits of grain, and in particularly wheat production in Armenia. Some argue that grain production is important in particularly for countries, with external risk of conflict escalation and blockade, such as Armenia. Therefore grain and in particularly wheat self-sufficiency is crucial. On the other hand, due to limited land resources, some argue that the land could be used for production of more valuable crops, where Armenia has comparative advantage and can compete on global marketplace. The food security issue indeed, complemented with the price and supply fluctuation at domestic market, has solid grounds for government decision upon promoting development of the field, mainly through increasing efficiency and extending lands under wheat production.

From 1991-1996 Armenia suffered from the consequences of devastating earthquake (1988) and violent conflict with Azerbaijan; in times of transition from planned to market economy. This of course affected the structure and productivity of agricultural sector. In particular, temporary blockade urged the state to rely on its own supplies of essential food, which pushed a large number of farmers to use their small land plots for grain cultivation and production. This also led to substantial destruction of grape orchards, restrictions on technical crop production, and triggered expansion of grain sowing area from 138.2 thousand hectares in 1990, to 209.6 thousand hectares in 2005 (Avetisyan, 2010). Although decreased since 2005, grain production occupied about 160 thousand hectares in 2010 and 2011 and increased again to more than 171 hectares in 2012 (NSS, 2012). In fact, according to the Millennium Challenge Account Armenia sub-sector of agriculture provides the lowest per hectare income for farmers (Avetisyan, 2010).

Since local production of grain is not adequate, Armenia is importing wheat from neighboring countries, in particularly Russia, Kazakhstan, and Ukraine. This helps stabilize wheat and flour prices in Armenia and supply necessary amounts to population and processors. Nevertheless, another challenge in terms of importing grain is periodical global deficit of wheat. An example of this was wheat deficit in 2011 and current decrease of wheat and other grain supplies from United States, Russia etc., which will impact global prices for the futures for the selected products and therefore negatively impact domestic market as well.

Ultimately, all these developments lead to concerns about food security in Armenia and urge government to undertake variety of programs to support this field of agriculture. Currently, government programs are largely targeted to supply farmers with the elite and super elite seeds, as well as provide other necessary inputs which will support expansion of sown areas and increase production volumes of grain in Armenia. Some experts state that to ensure fruitful autumn wheat harvest, it is necessary to select appropriate intensive sorts of wheat and ensure that farms have access to efficient agricultural machinery, plant protection measures, fertilizer, irrigation etc. Therefore, although supply of high quality seeds is critical at the moment, the further cultivation technologies as well as input supplies and proper knowledge are necessary to ensure good harvest, increased yield and production volumes.

3.1 Grain Production

Domestic wheat production suffers from mountainous terrain, dry and variable weather condition; in addition, land appropriate for wheat production is limited. Per capita agricultural land in Armenia constitutes 0.65 ha, and only 0.14 ha arable land. Therefore, efficient use of the land resources is critical for Armenia. Nonetheless, due to a number of challenges and variety of reasons, about 33% of arable land or roughly 150,000 hectares were not cultivated in 2010 (MoA, 2010). In 2011, this number increased to 165.6 thousand hectares, out of total 450 thousand hectares (Agrolratu, 2012).

Grain production occupies largest areas of crops and has a significant importance for Armenia. In 2011, 77.8 thousand hectares of land was devoted to wheat production and 68.3 thousand hectares for barley production (NSS, 2012). This recedes to wheat sowing areas in 2010 by 9.8 thousand hectares and exceeds barley sowing areas by 7.1 thousand hectares respectively. However, production volumes of both cereals have increased, due to higher yield.

Armenia has some success at achieving higher wheat productivity in 2011. At first, the wheat yield reflects the long term efforts of seed quality improvement and wheat production productivity program in Armenia, supported by the government.

The program on “Wheat Seed Production Development Plan 2010-2014 for the Republic of Armenia” aims at increasing production of grain and ensuring raise of self-sufficiency level through increasing productivity of grain production in Armenia. It intends to increase planting areas to 200 thousand hectares by 2014 and increase wheat self-sufficiency level to 50-55% by 2016. Ministry of Agriculture prepared a program to support production of super elite and elite seeds, which provide higher yield and will have a great impact on wheat production. The program was submitted for the government approval (Agrolratu, 2012).

Nevertheless, current government agencies and private institutions which are engaged in seed selection and production are not capable to produce enough elite seed to supply farmers and wheat producer organizations. In addition, different stakeholders point out diverse challenges which results in lower productivity.

Although there is some positive impact of the government programs, the problem of input supplies quality, such as seeds and fertilizer and insufficient plant protection measures result in fluctuating yield and production volumes. The barley and wheat yield per hectare have increased to 2.9 tons per hectare in 2011 in contrast to average 2.1 ton/ha 2005-2010 (see Tables 3.1.1, 3.1.2). Although increased, it is only 0.3% higher than the yield in 2007.

Table 3.1.1. Wheat, barley and emmer wheat sown areas, production and yield.

Areas of major crops, 1000 ha							
	2005	2006	2007	2008	2009	2010	2011
Wheat	132	107.7	99.3	93.1	91.9	87.6	77.8
Barley	66.6	63.7	65.9	66.6	68.7	61.2	68.3
Emmer wheat	5.1	5.6	4.4	5.8	5,3	4,2	4.6
Yield of major crops, t/ha							
Wheat	2.02	1.5	2.6	2.4	2.2	2.1	2.8
Barley	1.7	2.6	2.5	2.3	2.2	2	2.6
Emmer wheat	1.45	0,69	2,13	1,84	1,59	1,11	2.05
Production of major crops, 1000 tonnes							
Wheat	258.4	146.5	254.2	225.7	198.1	183.5	224.1
Barley	110.8	49.5	162.6	149.1	145.1	118.6	178
Emmer wheat	7.3	3.2	9.5	10.7	8.4	4.2	9.5

Source: NSS, 2011 yearbook, agriculture.

According to some experts, many farmers were provided with low yield and low quality seeds, while better seeds were provided to the people who have some connections in respective government institutions. As for 2012, weather has influenced grain production in several parts of Armenia, in some cases inconsistent distribution of precipitation in some regions, or lack of precipitation in others had negatively influenced autumn sown wheat. At the same time wheat harvest was also affected by lower than usual temperature.

The Tables 3.1.1 and 3.1.2 demonstrate some intrinsic data on production, sowing areas and yield of wheat, barley and emmer wheat in Armenia. In portrays that despite the fact that sown area of wheat has decreased in 2011; the average yield has increased and resulted in increase of production volumes by around 22%. Therefore, in general, efficiency of wheat production in Armenia has increased in 2011. In contrast, these data reveal that emmer wheat yield has decreased in 2010, in comparison with 2007-2009 which is mainly due to the unfavorable weather conditions farmers experienced in 2010 above all previously mentioned constraints but later was improved in 2011.

In 2012 about 92,000 hectares of autumn wheat and 3,500 hectares of autumn barley were sown which shows that about 19,445 hectares more were sown in autumn compared to 2011. Spring wheat and barley sown area figures are respectively 3,412 ha and 61,928 ha or a total of 4,328 ha less than in 2011 (NSS, 2012). These figures allow to note that overall about 15,000 more hectares of wheat and barley were sown in 2012 and considering the existing yield levels and hoping for normal weather conditions the harvest volumes in 2013 will be very promising.

Emmer wheat sown areas in 2012 were increased by a record number: almost 40% compared to 2011 level and comprised about 6,420 hectares. This shows that farmers' interest in cultivating other grain varieties is increasing.

Table 3.1.2 Wheat and barley sown areas and yield in 2009-2011.

	area/ha			yield/ha		
	2009	2010	2011	2009	2010	2011
Spring wheat	6843	5,862	4,359	2,3	2.2	2.8
Autumn wheat	85,041	81,723	73,478	2.2	2.1	2,8
Spring barley	65,907	57,503	65,309	2.2	2	2.6
Autumn barley	2,666	3,657	2,577	1.8	1	2,3

Source: NSS, 2011 yearbook, agriculture.

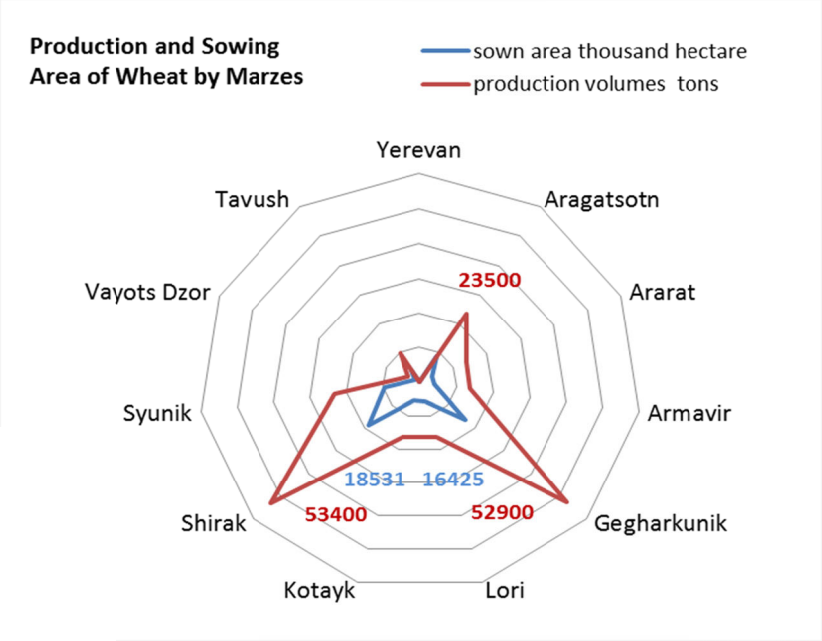
The barley yield has increased by 0.6% and constituted 2.6 tons per hectare in 2011, which production volumes increased from 118.6 thousand tons in 2010 to 178 in 2011. Again, this does not mean that wheat and barley harvest will be necessary higher this year, since there are several factors affecting on this sector.

Table 3.1.3 Wheat and barley production volumes in 2009-2011.

	production/ton		
	2009	2010	2011
Spring wheat	15,456	12,483	12,130
Autumn wheat	182,625	170,980	211,951
Spring barley	140,553	114,946	172,375
Autumn barley	4,588	3,628	58,509

Source: NSS, 2011.

As we can see in the tables above, the wheat and barley production volumes, sown areas and yield is always fluctuating. As show in the Table 3.1.2, wheat is largely sown in autumn and barley in the spring. The emmer wheat is mostly sown in spring. The main marzes which produces emmer wheat is Kotayk and Syunik, which produces more than 85% of total emmer wheat in Armenia. In case with spring barley production, Shirak, Gegharkunik and Aragatsotn marzes are the leading producers (see Tables 3.1.4, 3.1.5, 3.1.6). These three marzes produce around 88% of total spring sowing barley in Armenia. The wheat yield is highest in Ararat, Armavir and Gegharkunik marzes.



However in terms of wheat sown areas, the largest is Shirak, Gegharkunik, Syunik and Aragatsotn marzes. The former two are also the largest producers in terms of gross harvest. “Sustainable Rural and

Agricultural Development Strategy for the Republic of Armenia 2010-2020" defines and suggest that in the long term perspective the grain production should be entirely shifted to Gegharkunik, Lori, Kotayk, Shirak, Syunik marzes, (GoA, 2011).

While valleys and pre-mountain zones are recommended to specialize in more high value crop production. Existing quantities of grain and in particular wheat do not satisfy global normative levels of wheat reserves, where the self-sufficiency level for wheat in Armenia is around 40% while world standards require 75% (ICARE, 2009).

Table 3.1.4 Wheat sown area by marzes and Yerevan community (hectare).

	2007	2008	2009	2010	2011
Yerevan	257	290	250	123	50
Aragatsotn	10716	8684	9113	8602	8858
Ararat	5353	4290	4136	3895	3599
Armavir	7161	6469	6694	5255	4067
Gegharkunik	16557	18065	15949	21981	16425
Lori	9670	8023	7231	6498	5838
Kotayk	8132	7610	6907	5067	5386
Shirak	23496	21801	21847	19081	18531
Syunik	13324	12924	14756	11436	9629
Vayots Dzor	1065	1470	1812	1516	1416
Tavush	3498	3490	3189	4131	4038

Source: NSS, 2012, Food security and poverty. Availability of food.

Table 3.1.5 Wheat production volumes by marzes (thousand tons).

	2007	2008	2009	2010	2011
Yerevan	0.9	1	6	0.3	0.2
Aragatsotn	27.4	19.3	20.7	17.1	23.5
Ararat	21.7	15.9	15.6	12.9	13.9
Armavir	22.2	22	22.4	14.1	13.6
Gegharkunik	46.5	50.4	4.6	55.7	52.9
Lori	21.2	14.7	11.8	10.7	16.4
Kotayk	25.1	14.7	11.8	10.7	16.4
Shirak	61.8	52.8	44.4	48.7	53.4
Syunik	30.2	29.7	19.9	9.8	23.3
Vayots Dzor	1.4	2.3	3	2.5	3.5
Tavush	5.4	6	5.9	4.5	9.9

Source: NSS, 2012, Food security and poverty. Availability of food.

Table 3.1.6 Wheat yield by marzes (ton/hectare).

	2007	2008	2009	2010	2011
Yerevan	0.2	3.2	2.2	2.3	3.5
Aragatsotn	23.5	2.2	2.3	2	2.7
Ararat	13.9	3.7	3.8	3.3	3.8
Armavir	13.6	3.4	3.4	2.7	3.3
Gegharkunik	52.9	2.8	2.7	2.5	3.2
Lori	16.4	1.9	1.7	1.6	2.8
Kotayk	16.4	1.6	1.5	1.4	2.5
Shirak	53.4	2.4	2.3	2.6	2.9
Syunik	23.3	2.3	1.4	0.9	2.4
Vayots Dzor	3.5	1.6	1.7	1.6	2.5
Tavush	9.9	1.7	1.9	1.3	2.6

Source: NSS, 2012, Food security and poverty. Availability of food.

3.2 Grain Imports

Wheat is one of the most important food crops in Armenia; however wheat production in Armenia is fluctuating over the years due to several factors explained in the report. Therefore, Armenia has to rely on imports of more than 60% percent of wheat for its domestic wheat use. In addition, increase of wheat imports also dampens domestic prices, since local farmers are not able to exploit economies of scale and therefore face increased competition from foreign producers. Table below illustrates top ten grain supplying countries to Armenia, where top three, the Russian Federation, Kazakhstan and Ukraine are the largest. In 2011 Armenia purchased 215,682 tons of cereals from Russia (mostly wheat), 84,262 tons from Kazakhstan and 94,014 tons from Ukraine.

Table 3.2.1 Top ten cereal supplying countries to Armenia, 2011.

Country	Quantity (ton)
Russian Federation	215,682.9
Kazakhstan	84,262.3
Ukraine	94,014.3
Hungary	19,727.5
Iran	4,359.2
Romania	3,176.9
Bulgaria	3,131.0

France	3,018.8
Pakistan	2,704.4
Vietnam	1,050.0
Total of 10	431,127.3
Total imports (Cereals)	**437,285.6**

Source: NSS, 2011. Foreign trade of Republic of Armenia.

Due to suspending relations with the Hungary, it is possible that next year, Armenia will not buy wheat from Hungary. The former one supplied 19,727 tons of wheat and barley in 2011. Table 3.2.2 and 3.2.3 illustrate grain imports in quantities and values from 2005-2011.
In the meantime, depending on imports for Armenia is risk bearing not only in terms of food security but also in terms of global supplies deficit. According to the FAO, due to unfavourable weather conditions large number of cereal producing regions expects lower harvest than expected.

Table 3.2.2 Wheat and Barley Imports 2005-2011 (tons)

	Quantity in tons						
Products	2005	2006	2007	2008	2009	2010	2011
Wheat	319087.1	305513.1	421184.9	297735.5	376825.8	344660.4	356038.3
Barley	-	-	-	-	-	28517	19013.5

Source: www.customs.am

This will impact the global supplies and may drive wheat prices up. The wheat production is expected to be 663 million tons, which is 5% lower than in 2011 (FAO, 2012).

Table 3.2.3 Wheat and Barley Imports 2005-2011 (thousand USD)

	Value in thousand USD						
Products	2005	2006	2007	2008	2009	2010	2011
Wheat	47890.3	51606.3	83958.6	88653.8	94195.1	87876.2	90407.5
Barley	-	-	-	-	-	3191.2	3793.5

Source: www.customs.am

In the first nine months of 2012 Armenia already imported about 390 thousand tons of wheat paying around 100 million USD (www.customs.am). The reported customs value on average comprises about $256 per ton (transportation costs not included). Of the imported amount about 353 thousand tons came from Russia and about 33 thousand from Kazakhstan. Despite of lower wheat production volumes in Russia in 2012 as well as having a strict exporting limitations Russia still exported about 353 thousand tons of wheat to Armenia. Surprisingly in the same period of 2011 Armenia imported about 59 thousand tons of wheat from Ukraine but

only 4.8 thousand tons during the first 9 months of 2012. Based on experts' views Ukrainian wheat is comparably cheaper than Kazakh wheat. Based on 2011 data the price of Ukrainian wheat in Odessa and Sevastopol ports was $320 per ton which was becoming about $340-345 reaching to Poti (Georgia). In turn the price of Kazakh wheat comprised about $380 per tons reaching to Poti port. Armenian importers should definitely pay extra fees for loading and downloading the ships, transportation to Yerevan, taxes, etc.

Before the Embargo in 2010, Armenia was buying Russian wheat at $170 per ton which getting to Poti was becoming about $190-195. This situation was disrupted because of the Embargo and Armenia started to import Kazakh wheat paying roughly twice the price. Embargo was lifted in 2011 and Armenia as of January 25, 2011 again was buying the Russian wheat with the same conditions: $170 per ton (www.news.am). However, in 2012 the wheat prices were sharply fluctuating and for example in June 2012 the fourth-grade milling wheat price was $219 per ton in the Black Sea ports and skyrocketed to $276 just within a week. This was considered to be the first price hike since 2010 embargo. The price was stabilized in August and September in the range of $240 due to optimistic harvest forecast. But later, starting from October the wheat price registered another price hike due to pessimistic forecasts and more recent statistics on wheat harvest (www.ikar.ru).

3.3 Grain Varieties and Seed Producing Institutions

The main reason for wheat selection process is to increase yields; therefore, most research works are targeted to ensure high productivity of seeds. There are a number of organizations which work in the field of seed production. These institutions led to development of local sorts such as Armyanka 60 (1949), Artashati 42 (1949), Eghvardi 4 (1952), Leninakani 3 (1952), Lernahin 22 (1952) and Leninakani 216 (1957), Norkunduk (1957), Almargarit (1960), Vardenik (1962), Eritrileykon (1964), Erinaceum 36 (1971), Kangun (1960), Shiraki 1 (1980), Shiraki 2 (1990), Armyanka 60 (1987), Voskehask (1994), Akhtamar (1994), Nairi 68 (2000) and Ani (2003). The best local sorts are Armyanka 60, Nairi 68 and Akhtamar, which were produced by Scientific Centre of Agriculture. The emmer wheat popular sorts are Sisiani 55, Shushii 20, and Shaghati 12. In 2011, the following sorts of wheat and barley are registered in the state registry and allowed for production (see Table 3.3.1).

Climate and soil diversity enable cultivation of variety of crops in Armenia. According to the Seed Agency of the Ministry of Agriculture, there are 26 wheat, 17 barley and 3 emmer wheat registered varieties. The indigenous varieties as well as sorts which were locally produced by seed producing organizations are kept in "gene fund (Genofond in Armenian)", the newer variety collection is kept at "gene bank (Genobank)".

Table 3.3.1 Registered local and imported sorts of wheat and barley in Armenia in 2011.

Name of the sort	Registry year	Country of origin
Winter wheat		
Promontori	2009	United States
Dzager	2009	United States
Akhtamar	1994	Armenia
Armyanka 60	1987	Armenia
Bezostaya 1	1959	Russia
Brigantina	1986	Ukraine
Mironovskaya 808	1963	Ukraine
Voskehask	1994	Armenia
Nairi 68	2000	Armenia
Mirleben	2000	Ukraine
W 301	2001	United States
Veston	2001	United States
Stevens	2001	United States
Leninakani 5	2002	Armenia
Ani 326	2004	Armenia
Eltan	2004	United States
Nirsa	2005	Armenia
Armmis	2007	Armenia
Victoria	2008	Armenia
Merdzavani 149	2008	Armenia
Lalvari 10	2008	Armenia
Makar	2009	Armenia
Spring wheat		
Shiraki 1	1975	Armenia
Shiraki 2	1992	Armenia
Ani	2002	Armenia
Gohar	2008	Armenia
Winter barley		
Utik	2000	Armenia
Ararati 7	1983	Armenia
Mush	1994	Armenia
Start	1984	Russia
Sasun	2004	Armenia
Utik 2	2008	Armenia

Sevan	2008	Armenia
Spring barley		
Cascade 7	1984	Armenia
Nutans local	1984	Armenia
Nutans 115	1963	Armenia
Tan 1	1990	Russia
Mamlyuk	2000	Russia
Gyumri	2002	Armenia
Zernogradski 584	2004	Russia
Karchahasak		Armenia
Spitakahask		Armenia
Arevik	2002	Armenia

Source: MoA, 2012.

In the meantime, there are varieties which are not officially registered, but produced in Armenia (MoA, 2008). There are 13 species and about 360 varieties of wheat, more than 20 local varieties of wheat were cultivated in Armenia before 1950, nonetheless, only 2-3 local varieties are produced now, the others are not cultivated due to low productivity. Indigenous varieties such as “Spitakahat”, “Galgalos”, “Deghnazard”, “Tavtukhi” known for their draught-resistance; “Deghnazarda”, “Grnani” for their resistance to fungus related diseases; “Giulgan”, “Alti-aghaj” for cold resistance, etc. “Nutans”, a local variety of barley still cultivated, presents characteristics of drought resistance and adaptability to poor soil conditions. Most local varieties are on the edge of extinction and are almost not preserved in seed collections (MoA, 2008).

Therefore, one of the essential obstacles which significantly impact on production of grain is input supplies. During Soviet times, more than thirty specialized state organization were engaged in seed production in Armenia. Currently, there are only two state organizations. These are “The Selection Station of Gyumri” and “The Scientific Center of Agriculture”, which do not possess necessary machinery and equipment and have an urgent need for land and irrigation system modernization. The research department of the Gyumri Seed Selection Station is currently experimenting 350 wheat and 630 barley samples. The samples which were brought in 2007-2009 provide 4.1-5 tonnes yield per hectare; Nirsa and Leninakani 5.5-6 tonnes per hectare (Avetisyan, 2010). In addition, there are a number of private organizations, such as “Syunik Seed Producers” legal entity union, “Armenian Technology Group” (ATG) foundation and “Seed Producers’ Support Union” that produce seeds, nonetheless these organizations do not meet existing demand in Armenia and there are also several quality related issues. According to the Annual Report of the ATG, 60% of wheat seeds sown in Armenia are introduced by ATG Seed Multiplication Project. This project worked with 302 communities in Armenia and represents network of 5,259 grain producers (ATG, 2010).

Another significant player in terms of seed selection and seed production is Scientific Center of Agriculture (SCA). The centre is specialized in variety of spheres such as seed selection, seed production, agro-ecology, agro chemistry etc. The work is largely implemented in

Echmiatsin and Merdzavan experimental bases and financed through the Ministry of Agriculture. The center is intensely engaged in spring seed selection, which resulting in creating new sorts of high yield autumn barley, Ararati 7, Mush, Utik, Sasun, and Sevan. The center implements collaborative projects with the Armenian National Agrarian University (ANAU), ICARDA and CIMMYT. In the framework of cooperation from 1997-2012, the center received and experimented 8,660 sorts of autumn wheat, which resulted in adopting 4 sorts for local production. These sorts are Armsim, Armik, Van and Aray.

According to the administration of the center, one of the most urgent problems is to endure production of these seeds in Armenia. The volumes of seeds are not enough, and few farmers and organizations are engaged in normal seed production. The most urgent problem of the center is that the center lacks agricultural machinery, has old and deteriorated irrigation system and there is a lack of laboratory equipment. This limits the work and capacity of the organization. In addition, there is a lack of capable personnel. The average salary in the center is ranged from 35,000-50,000 AMD per month, and therefore, young specialists are not motivated to work at the center. In the long run perspective this can become a serious challenge for the center.

3.4 Government Programs and Legislation

Ministry of Agriculture of the Republic of Armenia has been undertaking several programs aiming to assure food security, increase agricultural production and efficiency. Among these programs the “Wheat Seed Production Development Plan 2010-2014 for the Republic of Armenia” is targeted at improving productivity of grain production in Armenia. In particular the program is concerned with increasing self-sufficiency of wheat in Armenia, which level is not satisfactory, and existing production constitutes only 37% of self-sufficiency level. On the other hand, the program also aims to sustain agrobiodiversity, which impacts the future of agriculture development. In the framework of the program, Government obtains 950 tons of foreign and 500 tons of local high reproductive grain seeds in the first, 800 and 900 tons in the second, 600 and 1500 in the third, 450 and 1950 tons in the fourth and 3300 local seeds in the fifth year. Then these seeds will be provided to the farmers, who own or rent at least three hectares of land (later, during implementation it became 7 hectares). In the framework of the program, respective seed agencies will continue cooperation with world famous selection stations such as ICARDA and CIMMYT, with organizations from Russian Federation and Ukraine. These organizations are providing Armenia with seeds, which are tested on adaptability and productivity, and in case of positive results, will be used in Armenia.

In terms of grain productivity, essential challenge is the lack or limited supply of high quality seeds, but it is also complemented by limited amounts of diesel fuel, fertilizer and plant protection supplies. In addition, the cost of production is increasing, and therefore, it becomes less attractive for farmers, who either switch to production of other high value crops or leaving the village and moving to cities (MoA, 2008). At institutional level, there is a need to support seed production facilities. The Selection Station of Gyumri, for example, needs additional

150-200 hectares, agricultural machinery, and modern irrigation system. Scientific Center for Agriculture needs agricultural machinery, laboratory equipment and upgrade of the irrigation system.

Aforementioned programs are basically stemmed from Sustainable Rural and Agricultural Development Strategy for the Republic of Armenia 2010-2020. The strategy elaborates on main directions of Government in rural and agricultural development for 2010-2020 period. The action plan of the strategy points out on current and projected specialization of the marzes by agricultural production. In the long term perspective it suggests that grain should be primarily produced in Gegharkunik, Lori, Kotayk, Shirak, Syunik marzes. Similar to “Wheat Seed Production Development Plan 2010-2014 for the Republic of Armenia” program, this strategy entails significant works in high quality seed production as well as seed quality monitoring assistance. The program aims to increase grain production area to 190,000 hectares by 2020, and increase grain production to 665,000 tons by the same year.

Furthermore, in June 2012, in the framework of The Main Directions of State Assistance to Agriculture in 2013 program, government has defined the main priorities, among which government will import high yield spring barley seeds. This program will be financed through the funds of Japanese Government, and aims to increase supplies of local animal feed. The program entails provision of these seeds to the farmers who own more than 0.3 hectare arable land. Among other related directions of the program is the provision of fertilizer and diesel fuel (Agrolratu, 2012).

According to the government sources, in 2012, Government of Armenia has satisfied seed demand from marzes, and also provided 25 thousand tons of fertilizer, 9.7 thousand tons of diesel fuels for lower than market price (Agrolratu, 2012). Nevertheless, the grain yield in the Republic of Armenia in 2012 is going to be lower than previous year, which according to the experts of Ministry of Agriculture is not linked with the quality of imported seed, but is a result of weather conditions, which also affected on wheat yield in Russia, Ukraine, Kazakhstan, US and Canada. Despite the lower yield, the gross production of grain in 2012 in the Republic of Armenia is going to exceed volumes of 2011 (Agrolratu, 2012).

The seed production and trade is regulated by a number of legislative acts, and major legislations are The Law on Seeds, The Seed Import Procedure, Government Decision on Crop Seed Imports and Exports in the Republic of Armenia. The Law on Seeds is regulating seed production, reproduction, certification, transportation, storing, selling and usage. The law defines a list of permissible sorts, which have undergone through state testing and registered in the list of permissible sorts. This list is published at least once a year, by a respective agency. The seed quality is described by its belonging, sort clarity, reproduction, which is determined through field studies and laboratory tests (see Law on Seeds of the Republic of Armenia).

Armenia is importing large amount of seeds, which is regulated by the Law on Seeds and Government decision on crop seed imports and exports in the Republic of Armenia. It states that only permitted seeds, which are appropriately packaged, and have quality and phytosanitarian certificates given by the respective body of the exporting country. Sample of

the seeds are taken for laboratory and on field testing. The import of seeds is permitted if, they intended for scientific or sort testing and experimenting or registered in the list of permitted sorts. Some seeds of soft wheat and barley are exempted from value added tax (see Government decision on crop seed imports and exports).

3.5 Description of the Local Wheat and Barley Sorts

This section is an attempt to characterize and describe selected local wheat and barley sorts. The pictures below illustrate the sorts of the wheat, which followed by description and technical characteristics.

Armyanka 60 *Syunik* *Artsakh* *Armik* *Ani 326*

Armyanka 60: This sort was developed by the Agriculture and Plant Protection Scientific Center. It belongs to Albidum variety which is a complex hybrid of Lyutenstsents, Alborubum, Bezostaya 1 and Etitozeukon. Duration of vegetation is 245-250 days, and is winter sustainable. The average yield is 6.5-7.9 t/h. This sort should be sown in irrigated lands.

Syunik: This sort was developed by the Agriculture and Plant Protection Scientific Center and is registered in 2011. It belongs to Lyutenscens variety and is a hybridization of Mtskheti 1, Knjazhnya varieties. Average yield is 6.5-7 t/h. This sort is best to be sown in Ararat valley, and pre-mountainous zone.

Armik: This sort was developed by the Agriculture and Plant Protection Scientific Center and is registered in 2010. It belongs to Lyutenscens variety and is a hybridization of Prich and Karlik varieties. The average yield constitutes 6.5-7 t/h. This sort is best to be sown in Ararat valley, and pre-mountainous zone.

Ani 326: This sort was developed by the Agriculture and Plant Protection Scientific Center and is registered in 2004. It belongs to Grekum variety. It is a hybridization of Genia 226 and Armyanka 60 varieties. The average yield constitutes 6.5-7 t/h. This sort is best to be sown lower attitude zones in irrigated and non-irrigated lands.

Nairi 68: This sort was developed by the Agriculture and Plant Protection Scientific Center and is registered in 2000. It belongs to Lyutenscens 93 variety and is a product of free hybridization. Average yield is 7-7.5 t/h. This sort can be sown in all regions of Armenia, in irrigated and non-irrigated lands.

Van: This sort was developed by the Agriculture and Plant Protection Scientific Center and is registered in 2010. It belongs to Grekum variety. Average yield is 7.5-8 t/h. This sort is best to be sown at irrigated lands in Ararat valley and pre-mountainous zone.





Nairi 68 *Van* *Armsim* *Akhtamar* *Dvin*

Armsim: This sort was developed by the Agriculture and Plant Protection Scientific Center and is registered in 2007. It belongs to Grekum variety and is a product of free hybridization of 1413.1/MLT. Average yield is 7-7.5 t/h. This sort can be sown in all regions of Armenia, in irrigated and non-irrigated lands.

Akhtamar: This sort was developed by the Agriculture and Plant Protection Scientific Center and is registered in 1994. It belongs to Lyutenscens variety and is a hybridization of Prich and Karlik varieties. Average yield is 6.5-7 t/h. This sort is best to be sown in Ararat valley, and pre-mountainous zone.

Dvin: This sort was developed by the Agriculture and Plant Protection Scientific Center and is registered in 2011. It belongs to Eritrospermum variety. Average yield is 6.5-7 t/h. This sort is best to be sown in Ararat valley, and pre-mountainous zone.

4. An Overview of Wheat and Barley Production in the Region and Russia

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Having 95,412 hectares under wheat production, and 65,428 under barley production in 2012, Armenia is ahead of Georgia in the region; but recedes to other three neighboring countries Azerbaijan, Iran and Turkey. Similarly production volumes and seed production in Azerbaijan exceeds Armenia about five times in terms of barley and around seven times wheat; the other two states are among largest wheat producers in the world, when Turkey and Iran ranked 10 and 12 respectively. The major exporters of wheat are Argentina, Australia, Canada, the EU,

Kazakhstan, Russia, Ukraine and the United States. The major coarse grain exporters are Argentina, Australia, Brazil, Canada, the EU, Russia, Ukraine and the United States (FAO, 2012).

The average barley yield in Armenia and Azerbaijan in 2010 was alike; 1.93 tons per hectare. However wheat yield is higher in Armenia and in 2010 it constituted 2.1 t/ha in contrast to 1.9 t/ha in Azerbaijan. The barley and wheat yields in Georgia are significantly lower than in aforementioned states. Wheat yield in Iran is similar to Armenia, while barley yield is slightly higher. In Turkey barley and wheat yield is highest in the region, and constitutes around 2.4 tons per hectare for both crops. USDA forecasted wheat production in Turkey to reach 18.5 million tons, which is 9% increase in comparison with the 2011. The similar situation observed in barley production, which is 6.5 million tons, and increased by 10% in comparison with the previous year (USDA FAS, 2012).

Nevertheless, in contrast to neighboring countries, arable land in Armenia is limited and therefore, it is crucial to increase yield to sustain higher production of grains where there is still land available for extension of grain production. Increasing efficiency would be the primary factor which at first will sustain necessary amounts of grain, and what is the most important, will make this branch of agriculture profitable for farmers and agricultural commercial organizations.

The Russian Federation is one of the largest global grains producing country, which is also the largest exporter of wheat and wheat seeds to Armenia. Russia exported 215,682.9 tons of wheat in 2011 to Armenia. The land under wheat cultivation in Russia has changed insignificantly since 2000, and constituted 21,639,800 hectares, which is 1% higher than in 2000 (FAOSTAT, 2012). Meanwhile, in comparison with the previous two years, 2008-2009, the decrease was significant and constituted around 20%. In other word one fifth of the arable land which used to produce wheat is either switched under other crops or is not cultivated.

According to the Ministry of Agriculture of the Russian Federation (MARF) 80-85 million tons is forecasted in 2012, in contrast to 94.2 tons in 2011. In the beginning of the year, the Ministry forecasted 94 million tons. Many wheat analysts already started to cut their forecasts mainly due to unfavorable weather conditions and particularly drought (Interfax, 2012). Traditionally the higher yield was registered in the East-Caucasian region of Russia.

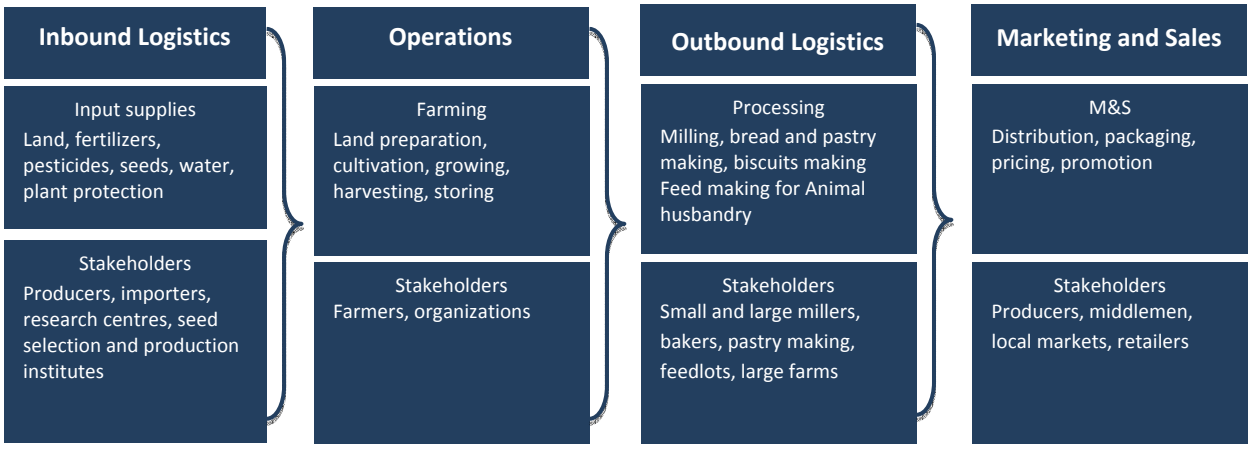
Since the wheat prices in Russia have been rising, the government undertook sales of the wheat stocks to moderate the effect of the poor harvest. The government sold 82,985 tons of grain from its stocks to help curb food inflation. However, prices are still rising. The prices in the last week of the October constituted 320USD per ton of third-grade wheat, and the fourth grade milling wheat was around 310USD (Business Recorder, 2012).

Lower production in Russia, Ukraine will also impact on Armenian market, at first some countries considering to limit their export volumes in 2012 and the global prices are going up. These both factors will have an impact on Armenia, since it is importing around 60% of its wheat needed.

5. Grain Value Chain Analysis

Although a large number of countries specialise in high value added industries and service provision to ensure economic growth and competitiveness on the global market, agricultural raw materials are critically important to the global security in terms of provision of necessary amounts of essential food to the population. In particular, vulnerable states, with high poverty levels and large proportion of hungry people, may result in violence and humanitarian disasters, which endanger global security and results in human sufferings in different parts of the world. In this context, the role of agricultural commodities and in particular global grain production is essential. Some states provide special conditions, subsidies or other measures to ensure self-sufficiency level. During recent few years the Armenian Government has also undertaken some measures to increase self-sufficiency level, to promote creation of competitive wheat production sector. Furthermore, food security is a national security priority, and Government has been undertaking a variety of programs targeting at ensuring grain self-sufficiency level.

The main purpose of this section is to analyse entire grain value chain, to understand the essential challenges that need to be addressed to improve yield, extend production and processing capacities of local farms and companies. The elements in this report aim at supporting policy makers, local stakeholders and other relating institutions to understand the existing challenges, priority directions; to decide upon investment into value chain and to develop a strategy on tackling these challenges.
The Diagram below highlights the main components of the value chain and the stakeholders involved in each component. A brief summary analysis is provided after describing each value chain component in the report.



5.1 Grain Value Chain Components

The significant part of grain for consumption is processed into flour, which further on processed into quite a lot of different products, and largely bread, which is stapled product. This makes grain production an important national security and food security component.

Hence, to understand entire grain value chain we must explore it at different levels, as portrayed in diagram above. At inbound logistics level we are focusing on input supplies, such as land, seeds, fertilizer, plant protection means, agricultural machinery and tools, labour, etc. These are necessary preconditions for an efficient grain production, where lack or low quality of each input impacts on the yield and the harvest and ultimately determines the level of profitability. Simultaneously, this is the most underdeveloped component of the chain.

The next level is operations, which basically a process of transforming these inputs into a product. These operations include but not limited to land preparation, cultivation, growing, harvest and storing. Appropriate execution of these operations together with good quality inputs can provide higher yield. Again, Armenian agriculture faces several human and technical challenges with regard to this component, which contributes to lower yields.

These two activities include a large number of stakeholders, such as producers and importers of the raw material, farmers and large agricultural enterprises, government and nongovernmental organizations and others. Therefore, at raw grain production level the quality of inputs and appropriate farming is fundamental. If it is complemented with the appropriate land use, high quality of inputs, on time and effective cultivation may attain higher self-sufficiency level and in the future produce surplus for the export markets.

The next level of the chain, are mostly organizations, which process the raw materials into semi-final or final products. Sophistication and size of these companies is important in terms of their requirements toward producing organizations. Although there are several problems existing in this component, the essential challenge is a lack of productive dialogue among them and primary producers. Ultimately, the processed product is delivered to the end users through different channels.

Grain value chain includes a number of actors and relations between these actors are crucial to understand problems and challenges in grain sector of Armenia. Collected data portrays that there are problems at every level, starting from quality and availability of inputs and concluding with the delivering product to the market. All these problems are discussed in this section through analysis of primary collected data.

5.2 Description of the Value Chain

As it was mentioned in the beginning of the report, one of the primary challenges hindering the competitiveness of the Armenian agriculture is a small and fragmented land plots, where effective production mechanism cannot be applied and therefore economies of scale cannot be exploited. Most of these small farms are subsistence farms, not commercial and they trade their products when have some surpluses, in particular during good harvests.

The quality of land is degraded in several communities which itself cannot produce and sustain good output. The wrong, not sustainable cultivation practices resulted that land in some places

is poor and overexploited. When it is complemented with low quality seeds and fertilizer and lack of necessary machinery the result is obviously low yield and poor harvest. Second, farmers are not using land appropriately, which results in change of physical and chemical composition of soil. The sowing is not always done in appropriate timing and appropriate techniques. Most of farmers are not well aware of grain sorts and they use reproductive seeds, and lose control over variety and quality of the seeds. This results in poor harvest and low quality raw product.

Furthermore this product is sold to the mills, bakeries and other processors, who do not have specific sort requirements, and check quality of seeds through only a simple glance look and in some cases, by viscidity and protein level. Nevertheless, most of them agree that some sorts are preferential for bread or other product production. However neither of surveyed processors/mills in Shirak and Syunik marzes applied this technique of selecting specific sorts in their production.

Ultimately, there is a lack of constructive dialogue between the producers and processors of wheat. Grain producing farmers produce in accordance with available inputs and processors accept that product if it complies with some basic norms. Furthermore if they complain about quality of the wheat for example, they agreed to return the product back. There is no control mechanism in place, and in some cases the problem arises when bread is already consumed and final consumer complains about its quality.

5.3 Inbound Logistics and Operations

There are two state seed producing organizations in Armenia, which work on development of the new grain varieties, as well as producing seeds for local production. In addition, there are a few private organizations and many seed producing farmers. These are the main providers of the seeds in Armenia, other than importing companies.

Most of these organizations have limited land, insufficient irrigation system, lack of agriculture machinery and skilled, qualified personnel. In general neither of them is using modern technologies and machinery. A few sections below are the summary of the organizations and their activities.

Seed Selection Station of Gyumri (SSSG) which was found in 1924 and aimed at obtaining and reproducing of selection varieties of crops for mountainous and pre-mountains zones in Armenia. According to the director of the center one of the critical components of their job is to understand which seeds should be used at specific locations in Armenia and to provide farmers with appropriate seeds which can provide high yield. Neither of the farmers or small organizations have capacity to produce elite and super elite seeds, which provide higher yield. According to the director of the centre they produce elite seeds at the station. Farmers on the other hand, argue that these are not elite, but the first reproduction seeds.

The director of the center mentioned that the Government program on import of elite and super elite seeds and provision to farmers is effective, but it also has an impact on the sale of the local seeds. For example this year they produced 872 tons of seeds, and still have 460 tons left in storage, because favorable conditions provided by Government urged many farmers to use imported seeds. By favorable condition it is meant that the Government provides seeds to the farmers through 1:2 ratios, which simply means that the farmer receives e.g. 100kg of seed this year for free, and have to return 200kg of same variety seed next year. Since farmers do not have to pay in cash this year, they can invest this money in buying inputs or for consumption.

The problem with the imported seed however, is the fact that they are not tested before dissemination and production, which may negatively impact on the long term grain production in Armenia. According to the director of the SSSG, these seeds should be tested through local seed selection and testing organizations before application, and then the ones which are tested and can be locally adopted should be distributed to farmers.

In general, director identified small and fragmented land plots as an essential challenge and considers cooperation to consolidate lands and apply modern cultivation methods. Furthermore, farmers cultivate different crops on their small plots which negatively impact on each other. According to the director, many farmers in the region are ready to create cooperatives; if there will be financial incentives. Simultaneously farmers should start from improving chemical and physical composition of land which has changed significantly, and results in lower productivity.

In terms of seed production, there are limited lands, lack of necessary machinery and human resources; the irrigation system is old and should be upgraded. Although government programs on seed import, fuel and fertilizer subsidies and provision of credit guarantee have positive impact, the credit rates should be lowered and payback periods extended, otherwise these resources are unreachable to small farms.

This year the center has tested 7 seed varieties, 4 local and 3 imported; Bezostaya 1, Leninakani 5, Krasnodari 99, Makar, Darinda, Nirsa and Daskanal sorts. The demand for Makar and Bezostaya 1 sorts was the highest this year. Makar provides in average 5.5 tons per hectare, and Bezostaya 1 from 4.5-6.5 tons per hectare. Although director mentioned that both sorts are local and Bezostaya 1 has been modified, literature indicates that Bezostaya 1 is a Russian sort. In addition to wheat the center produces barley seeds and currently has 200 tons in stock.

Another state organization which is engaged in seed selection, genetics and production is the **Scientific Center of Agriculture (SCA)**, which provides a number of analyses on soil physical and chemical composition and quality of wheat. The former one implies contamination of raw protein, viscidity, weight and fat in seeds. It also provides consulting on appropriate sowing periods, use of fertilizers, new sort application. Nevertheless, among the primary activities of the center is testing of seeds and selection of seeds for further production. The center cooperates with ICARDA, CIMMYT, ICRISAT and other organizations, and authored Ararati 7, Mush, Utiq, Sasun, Utiq 2 and Sevan varieties. The center has tested over 1600 varieties of

wheat and barley seeds and is closely cooperates with Syunik Seed Producers Union. The average price for super elite seeds is 230AMD per kg at the center.

According to the director of the Center, seeds which are produced by the center are of high quality, however many farmers are not practicing appropriate cultivation and farming techniques. These farmers are not starting sowing on time; do not fight against weed, which ultimately produces poor results. With regard to the seed imports, it is necessary to test imported seeds before dissemination to farmers, only after testing, those which can be adapted and distributed. An important point which director made is that most of the local sorts have foreign origin. Therefore, when people talk about local sorts, they are not indigenous to Armenia, but a result of cross breeding and selection activities. Some indigenous Armenian sorts are not used any more.

The main challenges of the center is the lack of modern agricultural machinery, necessity to upgrade irrigation system, lack of land, poor laboratory, low skilled human resources and finally high cost of seed import for testing reasons. If those problems are resolved, then the works of the center will be much more effective, more seed could be tested and better seeds produced for the farmers.

Syunik Seed Producers Union is a nongovernmental organization which is engaged in seed production, and cooperates with Lukianenko Institute in Ukraine, ATG, ICARDA and CIMMYT. The union owns 1000 ha land and authored 4 autumn wheat, 2 spring barley and 3 emmer wheat sorts. This union focuses on production of local varieties such as Akhtamar and Nairi 68, and also some Russian sorts. According to the leader of the Union, emmer wheat is mainly produced in Syunik and Kotayk marzes.

The low demand for local seeds in Syunik region is associated with the lower productivity of these seeds but in general farmers are not aware of local seeds. He mentioned that out of the local sorts Akhtamar sort provides high yield. He also pointed that mills do not pay attention on the sort of the grain, but prefer bigger and cleaner seeds. As of today, the bestseller seeds are Tanya, Nota and Badko (imported ones). Tanya can provide up to 6.2 tons per hectare in non-irrigated land. The Union sells seeds on average for 210 AMD per kg. In 2012, the Union has sold over 500 tons of wheat and emmer wheat seeds.

According to the leader of the Union, high quality seeds have to be complemented with the appropriate land preparation and cultivation, primarily sowing should be implemented in time, and on the right level of surface depth. According to his forecast, the harvest this year will be lower than in 2011, due to weather conditions, and wrong cultivation and farming practices. The main challenges of the Union are old agricultural machinery, which results in loss of 200-250 kg per hectare; outdated irrigation system; limited land.

A California based **Armenian Technology Group, Inc. (ATG)** which established a local **ATG Foundation** is another organization which engaged in seed import and production. According to their annual report, 60% of wheat seed sown in Armenia traces its roots to ATG Seed Multiplication Project. Their network of farmers includes 5,259 grain growers and extends to 302 villages. According to the director of the organization, Armenian sorts are not popular, and mostly foreign sorts of grain are cultivated. Stevens sort is widely cultivated in Ararat valley

and there is a high demand for it. Some organizations engaged in seed production sell the first reproduction seeds as elite seeds.

According to the leader of the organization the government program on elite and super elite seed import and dissemination to farmers has a number of shortcomings. First, some farmers cannot return the seeds after one year. As mentioned in the report, the farmers or an organization have to return based on 1:2 ratio and it turns out that some farmers are not able to return these seeds. Second, the seeds were provided with delays, which affected on cultivation timing. Third, the seeds were not tested and finally, the seed dissemination mechanisms are not fully developed. The same situation exists with seed selection and production institution, which provide good seeds to the large farmers. The average price for imported seeds is around 300 AMD, while locally produced seeds constitutes from 220-250 AMD per kg. In addition to seed problems, the cultivation process itself is expensive, which makes grain production not profitable. There is a significant lack of knowledge and necessity to apply new technologies.

The director of the ATG Foundation also mentioned that there is a misuse of word and concept of farmer. Many refer to villagers as farmers, just because they have some land and engaged in some agricultural activities. However, farmers must have knowledge and apply good practices; this makes a difference between those two definitions. Unfortunately, most of the rural population are villagers, who do not possess necessary knowledge, which results in poor harvest and inefficient use of agricultural inputs.

Nevertheless, although most seeds are produced by the aforementioned organizations, there are many farmers in Armenia who produce seed for own production or sell it to other farmers. For instance there were about 150 seed producer farmers involved in the Government program from 57 communities.

We had a chance to talk to few farmers in Shirak marz, who mainly produce wheat seeds and autumn wheat. These farmers are producing seeds, because it provides higher profit margin. The primary seeds come from Seed Selection Station of Gyumri, and further farmers produce their own seeds. The most popular wheat and barley seeds in the region are Bezostaya 1, Krasnodari 99, Ptitnitskaya, Paradiz, and Eritros, Stevens for wheat and Nutans for barley. This year, many farmers cultivated Makar sort, which provided good yield last year.

According to the seed producers, the low popularity for local seeds is associated with the low yield. For example they tried Nairi 68, which yield for the second year was very poor. In contrast Bezostaya 1 can provide up to 5 tons per hectare in irrigated plots, and 2.5 at non-irrigated. This year, the harvest was good at locations which irrigated, and low at the others.

All three farmers that joined for discussion did not participate in government seed import program, since they believe that only tested seeds should be cultivated. However, the director of Agricultural Support Centre of the Shirak marz, pointed on two farms in Akhuryan, who got 7 tons of harvest due to cultivating imported seeds. He also mentioned that the government program has positive impact on the regions and the low harvest in many cases associated with the bad cultivation practices, which on one hand is human factor but also depends on availability of agricultural machinery and some basic inputs. On average 300-320kg seeds are

necessary to cultivate one hectare of wheat, and it also requires 250 kg of fertilizer. However there is a limited supply of fertilizers which was subsidized by the government this year.

According to the farmers, wheat and barley production is not profitable, and provides only 10 AMD profit per kilogram. One of the farmers mentioned that there is a need for government to provide information on demand and supply, so farmers can learn what to grow each year. Nevertheless, some calculations and estimations attached to this report indicates that wheat, emmer wheat and barley production has higher profitability than mentioned by farmers, which certainly depends on several factors, such as productivity, price at local and international markets, global production and trade dynamics. In addition, some of the farmers and villagers require that many functions should be implemented by the government. In particular this relates to input supply provision, sale of the products etc.

The similar picture was in Syunik marz, where meetings with different stakeholders were organized. It included farmers, processors and regional agricultural advisers and a set of primary challenges and dominant problems were identified. According to the regional agricultural advisers, the grain production in Syunik region has the following picture: wheat 65-70%, barley 15-20% and emmer wheat 10-15%. About 33% of total arable land in Syunik is not cultivated, which constitutes 17,000 ha out of 43,000 ha total. The main concern is a poor physical and chemical composition of soil complemented with lack of agricultural machinery, which impact on sowing periods and generates losses during the harvest. With regard to seeds, farmers and grain producers used to buy seeds from Seed Selection Station of Gyumri, but now many farmers obtain seeds through governmental program on imported elite and super elite seeds. Nevertheless, small farms obtain first reproduction seeds. The imported autumn wheat seeds for example, are intensive varieties and can sustain high yield. In the meantime the primary condition is that these seeds require intensive application of agricultural machinery, appropriate irrigation, fertilizers and control against weed. In this case the good harvest is certain. Farmers also complain that there are no specialized stores where they can buy fertilizer and other necessary inputs.

The most popular varieties in Syunik marz are autumn wheat varieties Krasnodari 99, Badko, Bezostaya 1. Last year several farmers cultivated Kolega variety, but the yield was about 1.5 tons per hectare. With regard to Krasnodari 99 and Bezostaya 1, the yield is 5.5 and 3 tons per hectare respectively. In contrast to farmers in Shirak marz, people sell their product to the local mill, which basically purchases all wheat produced in these communities. Last year the price per kilogram was 125 AMD, which increased to 150-160 AMD this year. A sample crop budget calculation for wheat is provided in the Annex 2. Based on this information the wheat farmer this year on average received about 50,500 AMD profit per hectare (rate of profitability about 50%). In this calculation the farm manager or farmer's own labour costs are not included.

In addition to wheat production, which is largest in this group, barley and emmer wheat is also produced in Syunik region. The most popular barley sort is Polidum, which provides 1.5-1.8 tons per hectare, but others are also cultivated such as Ararati 7, Mush, Cyclone. The barley is mainly purchased by pig farms, since it contains higher protein level. The average price for barley is 140-150 AMD per kilogram. A sample crop budget calculation for barley is

provided in the Annex 1. The calculation in Annex 1 show that the profitability of barley cultivation is comparably lower than that of wheat (28%).

Emmer wheat is largely cultivated in mountainous and undulating region in the world. It provides good yields on poor soils and resistant to fungal diseases. Furthermore emmer wheat contains high level of fiber, and is opulent with magnesium and vitamins (GFU, 2010). The two main regions of Armenia producing emmer wheat are Syunik and Kotayk.

Since Kotayk and Syunik regions are popular for emmer wheat production, an interview was conducted with a number of farmers who produce emmer wheat, as well as the directors of the RASC. According to the director of Kotayk RASC, the emmer wheat production is widespread in the region, in particularly Fantan, Hatis and Zar communities are specialized in emmer wheat cultivation. Similar to Syuinik region, the main types of emmer wheat which is grown in these communities are white and red.

The emmer wheat is mainly cultivated in non-irrigated conditions. The farmers buy local seed for about 150 AMD per kilogram, and use 200 kg per hectare. In case of favorable weather, farmers expect 1.5-2 tons of emmer wheat per hectare. According to the farmers and worker of RASC, the average retail price of emmer wheat in 2012 constituted about 400 AMD, and wholesale price 330 AMD per kg. The average yield in 2012 was about 1.8 tons per hectare which is higher than in 2011, which comprised 1.2 tons per hectare, and the price was 700 AMD per kg at retail level, and 550 AMD per kg at wholesale. The essential challenge for the emmer wheat producers in Kotayk is a market. Since there are a few local processing companies, farmers are looking for export opportunities. A few farmers exported small quantities this year.

The emmer wheat production is mostly differentiated by the color of the seed, and the name arises from this, red stem and white stem. The demand for emmer wheat is low, the product's price is sensitive and there are substitutes for poorer population, who according to farmers is mainly consumed by this segment of population. In Harzhis community, average yield for emmer wheat constitutes 3 tons per hectare. Most emmer wheat producers sow their own seeds and do not buy seeds from specialized institutions. Last year farmers in Harzhis sold their produce for 200 AMD per kg. A sample crop budget calculation for emmer wheat is provided in the Annex 3. Using the minimum wholesale price level in 2012: 300AMD per kilo, the emmer wheat profitability is rather surprising: about 200% (farm manager’s own labuor not considered). This is a very profitable and untapped sector. Although, maybe this is also another explanation of the 40% increase of the emmer wheat sown areas in 2012. So farmers are becoming very interested in cultivating emmer wheat.

Most of the farmers which were interviewed pointed out that they do not need advising, but would prefer tangible assistance, such as fertilizer and fuel, and agricultural machinery. Nevertheless, regional advisory service, mentioned that cultivation techniques and timing is often impaired and therefore advising is a necessary component in which farmers are not interested. A large farmer who cultivates around 600 hectare of wheat seeds mentioned that the main problem is overexploitation of soil. This farmer imports the seed himself (Tanya, Bezostaya 1 and Badko) and has average yield of 3.3 tons per hectare this year, in contrast to

2.3 tons per hectare last year. Another problem which was pointed by the farmer is small land plots, which makes farmer noncompetitive.

5.4 Analysis of Inbound Logistics and Operations

The data which was collected through in-depth interviews with the farmers and organizations engaged in seed and grain production in Armenia, identified several issues and challenges which hinder development of this field of agriculture. Wheat, barley and emmer wheat value chain has problems in each value chain component, however as inputs are the foundation for the production and therefore, it is a primary factor for further efficient production.

The primary problems in terms of input supply are the availability of high quality inputs. In general, many farmers complain about the quality of seeds and overexploitation of land, which is basic capital resource. Another problem is the insufficient amount of fertilizer and fuel which was subsidized by government. Furthermore some important fertilizers such as phosphoric, is not available, or available at high price, which farmers cannot afford. Head of Syunik regional agricultural support center mentioned that the use of phosphoric fertilizer ensures at least 30% higher yield.

Our analysis of the prices of fertilizers has shown that the price of ammonium nitrate fertilizer and other inputs were increasing. According to the NSS, the prices for the main types of fertilizer have increases in average by 30-40% since 2007, which increases cost of production of the grain. The price for irrigation water increased by 40% and herbicides by around 15% (NSS, 2011).

With regard to seed availability, most of seed production organizations and individuals have hundreds of tons in stock, however many farmers prefer imported varieties. Some argue that this is associated with higher productivity of these varieties; some refer to the favorable conditions provided through the Government program. In terms of local seed production capacities, the seed production organizations have limited land base, old irrigation systems, outdated agricultural machinery and low skilled labor force, which hinders their productivity, and impacts on the quality and quantity of seeds. As one of the producers mentioned, although local seed producing organizations sell elite and super elite seeds, these seeds are not what they labeled, since seed producing organizations do not have the capacity to produce them. Further laboratory analysis of seeds is needed to verify this information, since some of the seed producers mention that they produce elite seeds. Another issue is the lack of capable personnel in seed selection and research centers. The average salary in these centers is ranged from 35,000-50,000 AMD per month, and therefore, young specialists are not motivated to work based on that conditions.

While input supply quality and availability is crucial to develop grain production in Armenia, the farming practices and cultivation methods are the second, but not least important issue. Most seed producers point out on inappropriate cultivation practices, which results that neighboring farms can provide significantly different yields with the same seeds sown. This is associated

with a set of operation related problems. First, it is a human factor and each farmer has a specific relation and professionalism toward his/her own work. Timely land preparation is crucial to ensure better harvest. Simultaneously, due to lack of agricultural machinery and late supply of some crucial input supplies, many farmers cannot cultivate land properly, and this results in production losses. These losses are also associated with the post-harvest handling. Harvesting with the old machinery results in significant loses, lack of storing facilities limits flexibility of the farmers.

5.5 Grain Processing: Mills and Bakeries

In this section, we shift our emphasis on processing level, to understand impact of these organizations on local grain production and whether there is a sophisticated dialog among producers and processors.

One group of the most important processing organizations in this chain is flourmills, which process wheat into flour. Then the flour is processed into variety of products such as bread, pastries, etc. Therefore, it was important to understand what are the requirements and quality control measures used by flourmills and bakeries.

A number of meetings were conducted with wheat, emmer wheat and barley processing organizations, aiming at studying the demand side of the value chain and investigating the dynamics of grain market. The companies involved in this section were the flourmills, bakeries, poultries, packaging and marketing companies, which either process or consume wheat, emmer wheat and barley. An example of a consumer-company could be a poultry, which uses barley and wheat for the feed.

Mills are crucial stakeholders in the value chain, since they process wheat into flour which later is used by bakeries or final consumers.

Two flourmills were surveyed in Shirak and Syunik marzes, one in Artik and other in Goris. These mills do not buy wheat of specific variety, but buy different varieties and mix them together for further processing. In general they are aware of the main varieties grown in their communities, however, neither of them had any sort of specific requirements. As a result, the flour is made of different varieties and therefore quality differs depending on the quality and variety of the wheat supplied each time. Nevertheless, both mills have mentioned that they do some observations and analysis of the wheat before processing it. In particular gluten level and quality and protein is important. The minimal gluten level in wheat should be not lower than 18-19% otherwise it cannot be used for bread making. In most cases the wheat is checked through external observation, if the seed size is big and there is little waste inside, then the wheat is usually being processed. After processing the wheat into flour, a kilogram of wheat approximately yields about 700-750 grams of flour, 150-200 grams of husk and leftovers.

Both mills purchase wheat from farmers and process but their main function is to provide milling services to the farmers and wheat producer organizations. The flourmill in Artik processes only local wheat, however it was mentioned that previously mostly imported wheat from Russia was processed and the quality was higher. With regard to the mill in Syunik marz, it processes on average 80-90% local wheat and 10-20% imported from Russia. Russian wheat is mixed to increase the quality of the flour. Nevertheless, there is no research done to portray which sort of wheat is better for making higher quality bread.

The bakeries buy flour without any requirement, and return it if the quality is low, mainly if gluten level is low. Only 20% of wheat is good, the rest has lower quality. The best is usually provided by the irrigated farms. The mill in Artik, explains that the wheat quality was higher this year, in contrast to the previous year.

The baking industry is the major client of the milling industry, which process flour into bread. Since bread is a part of the daily food diet of the entire population, then the bakeries are the critical part of the value chain. Two bakeries, one in Maralik of Shirak marz the other in Goris were visited, however neither of them were enthusiastic about wheat quality improvement program. In general they buy flour from the flourmills and then in case of bad or low quality they return it. The special case was Damaskos ltd., which produces “certified organic” bread from organic wheat. The primary suppliers of the bakery are Dimitrov and Argina communities. The only sort which they buy is the Umanka, which quality is not the best, but there are no alternatives. The bakery wants to try new sorts, but the problem is that there are no other organically certified wheat producers in Armenia. The company buys organic wheat for 200 AMD per kg, and although they tried to establish their own production of organic wheat, it failed due to several technical issues.

In general, the bakeries surveyed pay attention on sort (sort if this content is not related to the variety, but to differentiate between quality of flour, such as first sort) of the flour, which used to bake different kinds of bread. The most important criteria for these bakeries, is gluten level, which is necessary condition in bread baking. The other criteria and variety of sort is preferable, but not required. In terms of gluten, the Russian wheat flour is preferable since it contains higher level of gluten. The bakery in Maralik recognizes the quality of the flour after baking. If the bread is good and tasty then the flour was good. This is extreme measure, but according to the bakery personnel, most of bakeries do the same. One of the employees of the bakery recalls that several years ago, the flour which was supplied was marked with the sort of grain and some other data, nowadays no supplier provides such information. She also mentioned that Bezostaya 1 is good for bread, which has been used for several decades. In addition, the owner of the bakery mentioned that they trust the flourmill, which usually provides good quality flour. Ultimately, she mentioned that the variety does not matter, but good quality of the seeds matters. The largest mills, mostly process wheat imported from Russia.

5.6 Grain Processing: Processors, Poultries and Breweries

All large organizations dealing with grain processing or using grain for feeding reasons, are mentioning that there is a limited supply and lower quality of the local produce, which in many cases urge them to import wheat and barley from overseas. In terms of emmer wheat, local supplies and quality of the production is somehow satisfactory, however demand for it has been decreasing. As mentioned by the company, this is associated with the fact that the price for the emmer wheat made products have increased, and since the poorer segment of population is the main consumer of the product, some of them switched to cheaper substitute products.

Two organizations which were surveyed, Moya Semya and Maranik brands are the largest processors of emmer wheat in Armenia. Both organizations buy raw product from Kotayk marz, since according to them the emmer wheat which comes from there has higher quality in contrast to the one which is produced in Syunik. They mostly purchase emmer wheat from the higher attitude farms, which product has better taste and softness. However, as it was learnt from some farmers in Syunik, most of the product is sold to middlemen from Kotayk. Therefore, it is possible that companies actually buy emmer wheat which is produced not only in Kotayk marz, but also Syunik, which however supplied by the farmers and middlemen of Kotayk.

Maranik buys emmer wheat with no laboratory testing, but only through external observation of the product. Moya Semya does some basic analysis of the product, as well as organizes monitoring visits to the fields and farms. Both companies however, have necessary quantities supplied and there were no shortages so far. However, in case of improving the quality of the emmer wheat, it could be exported, at least to Diaspora communities, since the product is used to make traditional Armenian meals. Neither of the aforementioned companies had contracts with farmers, but work with few of them, who usually provide good quality products.

Some part of wheat and barley produced in Armenia is used for feeding purposes. In the framework of the research a meeting was organized at one of the largest poultries in Armenia, Arzni. The company is mainly importing grain from abroad, due to limited local supplies, better quality of the imported product and in some cases better price offers. As of today, the interviewed poultry imports around 90% of the grain for the feed, and only 10% purchased locally. The minimal amount of grain which is purchased by the single poultry constitutes about 600 tons per year.

In general the maximum percentage of the wheat ingredient in the feed should make more than 50%. Although the price of barley is lower and it is economically feasible, it should not constitute more than 20% of the feed. The wheat is preferable since it has higher protein level, which is good for the feed. In terms of gluten, it should be lower to make better feed. An approximate calculation at one of the poultries, estimated 80,000 tons of wheat which is used for the feed in poultries. In terms of breweries, they import processed barley for their production, but some of them are planning to start local production.

6. Conclusion

The primary engines behind the prioritizing grain and in particularly wheat production field in Armenia is the necessity to ensure food security; increasing prices of the grain in international markets; fluctuation of grain global supplies and availability of necessary resources to ensure domestic production. Nevertheless, although Government is implemented and implementing programs to promote domestic production of grain, and in particularly wheat, there are still a number of serious challenges which hamper development of this field.

The grain value chain analysis identified the most vulnerable components which are many, and require significant efforts by several stakeholders. Furthermore, some challenges are complex and require expensive solutions, which on one hand are vital for food security assurance, but on the other hand question the whole idea of effectiveness of grain production in Armenia. Taking into account the fact, that Armenia does not possess comparative advantage in wheat, emmer wheat and barley production, one should think about feasibility of developing this field of agriculture. Yet, some stakeholders jump into this field, without an adequate analysis of risks.

In reality, wheat, emmer wheat and barley industry suffers at each level of the value chain. Rather than attempting to intervene directly, Government needs to address underlying problems such as ensuring necessary infrastructure of local seed producing organizations, designing and enforcing legislation on seed import and testing, educating and retraining the workers, encouraging entrepreneurship, providing credits with plausible rates and payback periods. The Government must ensure legal framework toward targeted use of land resources ensuring food safety regulations and enforce their application. Finally, consolidation of land through some form of cooperation, or by attracting large investments, is necessary to improve efficiency of the sector. Having little land resources, efficiency would be the only factor which can significantly improve performance of the branch. On the other hand, works need to be done on training and improving capacities of farmers, on land preparation, cultivation and post-harvest handling.

The first set of the problem is overexploitation of land. The land is cultivated under the same crops and only single fertilizer used to enrich the soil in most communities. Most farmers complain about lack and insufficient levels of phosphoric and potash fertilizer. In addition, underdeveloped irrigation systems as well as the high cost of water is also problem in many communities, since the irrigated land provides higher yield and better quality product, these problems also need to be addressed.

The second set of the problems was availability and cost of the seeds. Although the entire picture is better now than it was before, which is reflected in increasing yield, the problem still exists. Capacity of the local seed producers is not satisfactory to produce high quality seeds, and import of seed without examination may lead to some serious problems in the future. Simultaneously the import of the seed should be gradually replaced by the local seed production, which is not possible at the moment, due to lack of human and technical capacity of these organizations. Ultimately, no work is done now to improve the situation and these institutions do not have funds to replace machinery or upgrade irrigation system. Therefore,

local seed production cannot develop, but is vital in terms of provision of locally produced high quality seeds.

Furthermore, the problem of inappropriate land cultivation exists almost in every community, which engaged in wheat, emmer wheat and barley production. The farmers complain about late supply of the seeds and some other inputs, which postpone cultivation, and results in poor harvest. This is also complemented with the lack or limited number of agricultural machinery units. Once production starts, there is a problem with irrigation in some communities. Finally, the post-harvest handling is also poor, since there are limited storing facilities or conditions of the storing facilities do not meet basic food safety requirements.

The problems also exist in terms of marketing and sales of the product. Due to the small size of the most farms, they do not have necessary negotiating capacities, logistics are complicated, and traders and middlemen mostly control the market.

Acronyms and abbreviations

AGBU	Armenian General Benevolent Union
ANAU	Armenian National Agricultural University
NSS	National Statistics Service of Armenia
ATG	Armenian Technology Group
CBA	Central Bank of Armenia
CIMMYT	International Maize and Wheat Improvement Center
CSRA	Custom Service of the Republic of Armenia
GCI	Global Competitiveness Index
GDP	Gross Domestic Product
FAO	Food and Agriculture Organization
ICARDA	International Center for Agricultural Research in the Dry Areas
ICARE	International Center for Agribusiness Research and Education
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IMF	International Monetary Fund
MoA	Ministry of Agriculture
PPSC	Plant Protection Scientific Centre
SCA	Scientific Centre of Agriculture
SFU	Syunik Farmer Union
SPSU	Seed Producers' Support Union
SSSG	Seed Selection Station of Gyumri
SSPU	Syunik Seed Producers' Union
WB	The World Bank

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Annexes

Annex 1: Cost of Production of Barley in Syunik Marz, 2012

Type of work	Measurement	Volume	Price per Unit	Total AMD
Sowing (machinery *)	hectare	1	22000	22000
Smoothing (machinery)	hectare	1	9000	9000
Seed	Unit	200	160	32000
Seeding (machinery)	hectare	1	9000	9000
Fertilizing	kilogram	200	120	24000
Fertilizing (machinery)	hectare	1	7000	7000
Weed protection means	hectare	1	7000	7000
Herbicides	kilogram		11000	11000
Harvesting (machinery)	hectare	1	18000	18000
Transportation cost			7000	7000
Land tax			8000	8000
Other expenses			10000	10000
Total				164000
Average yield**	Tons/hectare	1.5		
Cost of production (per ton)	Total expenses/average yield			109,333

** This activity is done with the agricultural machinery, and the cost includes cost of fuel*

*** The average yield of the past three years*

The calculation was provided by the Regional Agricultural Support Centre of Syunik Marz.

Annex 2: Cost of Production of Wheat in Syunik Marz, 2012

Type of work	Measurement	Volume	Price per Unit	Total AMD
Sowing (machinery *)	hectare	1	22000	22000
Smoothing (machinery)	hectare	1	9000	9000
Seed	unit	300	180	32000
Seeding (machinery)	hectare	1	9000	9000
Fertilizing	kilogram	250	120	24000
Fertilizing (machinery)	hectare	1	7000	7000
Weed protection means	hectare	1	7000	7000
Pest protection means	hectare	1	7000	7000
Herbicides	kilogram		11000	11000
Harvesting (machinery)	hectare	1	18000	18000
Transportation cost			7000	7000
Land tax			8000	8000
Other expenses			10000	10000
Total				199000
Average yield**	Tons/hectare	2		
Cost of production (per ton)	Total expenses/average yield			99,500

** This activity is done with the agricultural machinery, and the cost includes cost of fuel*

*** The average yield of the past three years*

The calculation is provided by the Regional Agricultural Support Centre of Syunik Marz.

Annex 3: Cost of Emmer Wheat Production in Syunik Marz, 2012

Type of work	Measurement	Volume	Price per Unit	Total
Sowing (machinery *)	hectare	1	27500	27500
Smoothing (machinery)	hectare	1	10000	10000
Seed	kilogram	200	150	30000
Seeding (machinery)	hectare	1	10000	10000
Fertilizing	pack	4	10000	40000
Weed protection means	hectare	1	7000	7000
Pest protection means	hectare	1	8000	8000
Herbicides	kilogram		20000	20000
Harvesting (machinery)	hectare	1	27500	27500
Transportation cost			8000	8000
Land tax			8000	8000
Other expenses			10000	10000
Total				206000
Average yield**	Tons/hectare	2		
Cost of production (ton)	Total expenses/average yield			103000

** This activity is done with the agricultural machinery, and the cost includes cost of fuel*

*** The average yield of the past three years*

The calculation is provided by the Regional Agricultural Support Centre of Syunik Marz.

Annex 4: The main problems identified in wheat, emmer wheat and barley value chain.