



Regional Office for Europe and Central Asia

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

FOOD LOSSES AND WASTE IN KAZAKHSTAN

Country Report

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1. SUMMARY

The study has been carried out in the framework of global, regional and country-level studies conducted by the Food and Agriculture Organization of the United Nations (FAO).

The objective of the study was to identify critical points and patterns of food losses and waste (FLW) along selected food supply chains in Kazakhstan, which have the largest impact on food security and food supply and the most economic importance, while also taking into consideration employment generation, contribution to foreign exchange, impact on smallholder producers, represents significant share in agricultural production of the country, involves processing and marketing activities.

The following priority groups and agri-food chains were analyzed:

- Cereals: wheat
- Oilseeds and pulses: sunflower seeds
- Roots and tubers: potatoes
- Meat: beef
- Milk: cow's milk

The five priority agri-food chains were analyzed to identify the critical losses at five points in each chain:

1. Agricultural production
2. Postharvest handling and storage
3. Processing and packaging
4. Distribution
5. Consumption at household level

The analysis was conducted through desk research of existing reports and materials, data and media sources, and through key informant interviews of stakeholders representing the private and public sector at each stage of the chain.

Based on the analysis and other available sources, the following values were found after overall assessment of food losses and waste for the mentioned commodity groups along the main points of the supply chain:

	<i>Agricultural production</i>	<i>Postharvest handling and storage</i>	<i>Processing and packaging</i>	<i>Distribution</i>	<i>Consumption at household level</i>
<i>Cereals (wheat)</i>	5-20%	5-10%	1-3%	1-2%	5-15%
<i>Oilseeds and pulses (sunflower)</i>	5-15%	5-10%	1-2%	1-2%	1-2%
<i>Roots and tubers (potatoes)</i>	10-20%	10-30%	3-5%	10-15%	5-15%
<i>Meat (beef)</i>	1-3%	3-5%	1-2%	1-2%	1-2%
<i>Milk (cow's milk)</i>	3-5%	5-10%	1-2%	5-10%	1-5%

The ranges represent averages for 'best' and 'worst' case scenarios. The agricultural production stage is one of the stages of the chain in which most losses occur. The products with the largest losses at this stage are potatoes, wheat and sunflower seeds, as they are field crops and depend to a large extent on the conditions during harvesting, the size of the producer, the type, condition and number of harvesting machines, crop varieties, means of transportation and the control of on-farm product flows.

Postharvest handling and storage stage is another stage at which significant losses occur. The products with the highest levels of waste are potatoes, wheat, sunflower seeds and milk. The main reasons for losses of potatoes and milk is inadequate storage conditions, while for wheat and sunflower seeds it is misinformation about quality by elevators and crushers. Other factors affecting the extent of losses are inadequate equipment for post-harvest handling, inadequate transportation methods, and the size of on-farm storage.

The processing and packaging stage experiences lower losses than the previous stages. This is mainly due to higher levels of mechanization. The highest losses at this stage were found in relation to potatoes, which may be explained by additional sorting during bagging.

The distribution stage also has lower level of losses, since in most cases it is a processed and packed product and it is controlled and accounted for by special staff. The highest levels of losses are observed with potatoes and milk caused by inadequate storage conditions and/or due to expiration.

The consumption stage has different values: the highest losses are found for wheat and potatoes. This is mainly explained by a much lower price for these products and less attention to the issue of losses and waste.

The main recommendations and policy proposals were about reducing the impact of the above-mentioned causes. They are divided into four sets of proposals.

1) Efficiency proposals.

This set includes proposals improving the overall efficiency of processes along the chains. Crop breeding research could be extended by more research towards new varieties which have less shattering, and more local varieties with different vegetation periods. Government regulation related to the involvement of inspection companies at the elevators during acceptance of the grain could support farmers to have fewer losses.

2) Financial proposals.

This set mainly includes improvement of access to new technologies, machinery and equipment that need investment, which is hard for producers without support programs. This includes loans and leasing of combines and harvesting equipment, cleaning and drying equipment, storage equipment, processing equipment, extension of budgets of support programs. Improvement of bureaucratic procedures at the agencies operating the government programs could improve access to such programs.

3) Management proposals.

This set includes proposals that affect management along the chains. At the production and post-harvest handling and storage stages cooperation among farmers could be beneficial for all parties.

This way costs and risks could be spread among the cooperative participants. Supporting the government in relation to initiatives in terms of financing, taxation and overall regulation could be a positive factor.

4) Other policy proposals.

This set includes proposals that were not mentioned in the previous sets. Adapting research and education towards agribusiness needs could bring positive results in the medium and long-term. Improvement of business climate in the country could make running the business easier and with less expenses and increase number of business entities. Improvement of rural infrastructure could attract more qualified workers to farms.

Losses and waste at every stage are always expressed in money for the business. No matter if it is a production or consumption stage, any losses mean a monetary loss. In the initial stages this could be explained as a loss of possible income, whereas the next stages are direct losses of money spent on the purchase of the products. The more expensive the products are (e.g. beef), the fewer losses and waste that are usually observed.

Most stakeholders along the food chains are aware of losses and they understand them and try to reduce them by applying various measures including investment in production, processing, storage and other technologies. Their aim is not to supply more food to food-deficit countries, but to reduce their own costs and increase income.

The amount of extra food (that could be) saved as a result of measures is not always enough to contribute to the world or regional food supply issue, because Kazakhstan is located far from main consumer-countries that have a food deficit.

2. INTRODUCTION

In 2010 and 2011 the Swedish Institute for Food and Biotechnology conducted a series of studies at the request of the Food and Agriculture Organization of the United Nations (FAO) on global food losses (one for high/medium-income countries and one for low income countries) in order to raise awareness on global food losses and waste, and on the impact of these on poverty and hunger in the world, as well as on climate change and on the use of natural resources.

The results of the studies suggested that roughly one-third of food produced for human consumption globally is lost or wasted, which amounts to about 1.3 billion tonnes per year. This inevitably also means that huge amounts of the resources used in food production are used in vain, and that the greenhouse gas emissions caused by production of food that gets lost or wasted are also emissions in vain.

The studies also underlined that food is lost or wasted throughout the supply chain, from initial agricultural production down to final household consumption. In medium- and high-income countries food is to a significant extent wasted at the consumption stage, meaning that it is discarded even if it is still suitable for human consumption. Significant losses also occur early in the food supply chains in industrialized regions. In low-income countries food is lost mostly during the early and middle stages of the food supply chain; much less food is wasted at consumer level.

The study also revealed the lack of monitoring and reporting of food losses and waste and the major data gaps in knowledge of global food loss and waste. It therefore urged further research in the area to provide the grounds for informed and coordinated decision making on actions and policy proposals aimed at reducing losses and waste throughout supply chains (Themen, 2013)

2.1 Concept

The FAO Regional Conference for Europe (ERC) 2014 requested that FAO take the lead in sharing knowledge, information and best practices to reduce food losses and waste, and endorsed that FAO should continue to address gaps in availability of data and statistics on food losses and waste, including at small-scale farm level in the countries of the Region. It should also assist member countries in developing capacities for value chain analysis with particular attention on food losses and waste. As a part of that process FAO Regional Officer for Europe and Central Asia is – within the Strategic Objective 4 – continuing to collect information and analyze the causes of food losses and waste in the countries of the Region (FAO, 2014).

2.2 Objectives

The objective of the study is to identify critical points and patterns of food losses and waste (FLW) along selected food supply chains in Kazakhstan, which have the largest impact on food security and food supply in the country. It will provide overall assessment of FLW and its impact on food security and food supply, as well as identification of main technical, economic and policy related causes for FLW along selected agri-food chains (FAO, 2014).

2.3 Methodology

The methodology developed by FAO was used in the analysis:

- At the beginning of the study, an introductory overview of volumes produced for each commodity group (cereals, roots and tubers, oilseeds and pulses, fruits and vegetables, meat, fish and seafood, milk and eggs) was prepared. Within the relevant commodity groups two to three most important products with the largest economic importance, also taking into consideration employment generation, contribution to foreign exchange, largest impact on smallholder producers, represents significant share in agricultural production of the country/region, involves processing and marketing activities were identified and described.
- After that, five priority agri-food chains for detailed Critical Loss Point analysis based on their economic importance, employment generation, contribution to foreign exchange, contribution to food security were identified. Prioritization was validated by key informant interviews on the magnitude of FLW with the representatives of the Government, inter-professional organizations and agri-food industry leaders.
- A brief description of priority agri-food chains was done: chain components, agents and organizations, description of the chain maps and flows, components that will be analyzed in-depth.
- Critical Loss Points (CLP) have been identified. These are the points in the agri-food chains where FLW are of the highest magnitude, have the highest impact on food security, and the highest effect on the economic result of the FSC. The assessment of the magnitude of FLW is based on available reports and studies and key informant interviews with the representatives and stakeholders in analyzed agri-food chains. FLW on the CLPs with the highest magnitude is analyzed and documented. Food losses are taken into consideration both in terms of quality and quantity.
- Based on the analysis and other available sources, overall assessment of food losses and waste for all commodity groups along the main points of the supply chain: agricultural production, postharvest handling and storage, processing and packaging, distribution (retailers and supermarket), and consumption are presented. The assessment is compliant with the assumptions on country specific weight percentages of FLW, and summarized is the respective table in Chapter 4.
- Analysis of factors that have an impact on the magnitude of FLW which included: resources and technologies, management-marketing-product development, market structure and governance structure including value chain coordination-supply-logistics, trade and taxation policies, food safety and quality standards, research development and innovation, programmes and special policies for analyzed agri-food chains.
- Analysis of government programs affecting agribusiness and its efficiency.
- Development of recommendations on actions and policy proposals in order to reduce effect of factors negatively impacting magnitude of FLW.

2.4 Sources and type of information

The main sources of information used in the preparation of the current study are:

- Previous research
- Statistical databases (local, international)
- Stakeholders involved in the priority agri-food chains
- Mass-media
- Government programs

More details on the sources of information are presented in the References section.

2.5 Structure of the document

The document consists of 7 sections.

The first and second sections are the Summary and Introduction. The seventh section is References.

The third section contains an overview of volumes produced for each commodity group (cereals, roots and tubers, oilseeds and pulses, fruits and vegetables, meat, fish and seafood, milk and eggs). Within the relevant commodity groups one or two of the most important products with the largest economic importance, also taking into consideration employment generation, contribution to foreign exchange, largest impact on smallholder producers, represents significant share in agricultural production of the country/region, involves processing and marketing activities were identified and described.

The fourth part identifies priority agri-food chains for in-depth analysis, describes them and assesses and characterizes food losses and waste. In the end, based on the analysis and other available sources, there is an overall assessment of food losses and waste for all commodity groups along the main points of the supply chain: agricultural production, postharvest handling and storage, processing and packaging, distribution (retailers and supermarket), and consumption.

The fifth section analyzes factors that have an impact on the magnitude of food losses and waste along the agri-food chains.

The sixth part contains a brief description of current government programs supporting agriculture and recommendations for influencing the negative factors affecting FLW.

3. COMMODITY GROUPS WITH THE LARGEST IMPACT ON FOOD SECURITY AND FOOD SUPPLY ON DOMESTIC AND INTERNATIONAL MARKETS

The following commodity groups are presented in the report:

- Cereals
- Roots and tubers
- Oilseeds and pulses
- Fruits and vegetables
- Meat
- Fish and seafood
- Milk
- Eggs

3.1 Cereals

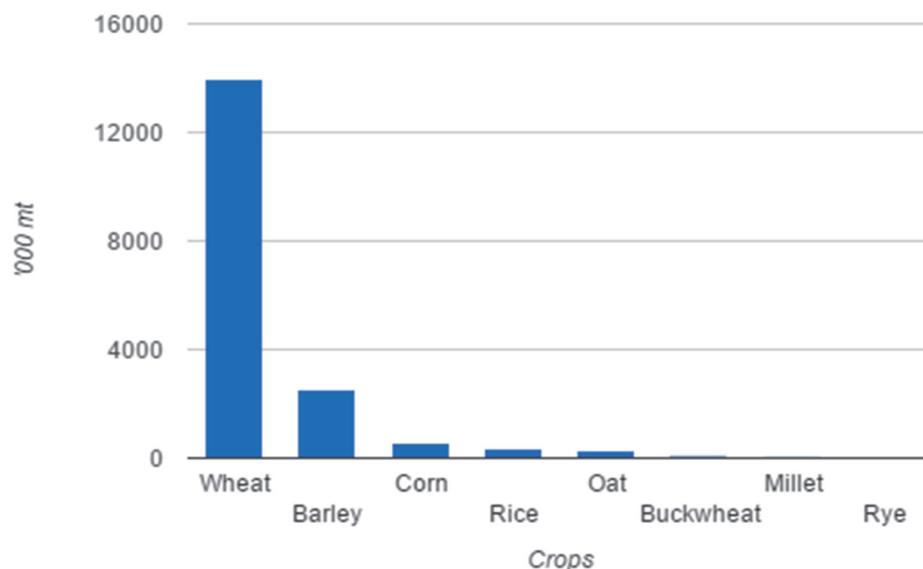
Cereals produced in Kazakhstan include:

- Wheat
- Barley
- Oat
- Corn / Maize
- Rice
- Rye
- Buckwheat
- Millet

Production of these cereals in 2013 is shown in Figure 3.1. As this figure shows, main cereal crop grown in Kazakhstan is Wheat. Its share among indicated crops equals to 78 percent. Other crops, produced in significant quantities are barley (14 percent), corn (3 percent), rice (2 percent) and oat (2 percent). Other crops have a share less than 1 percent each.

Within the cereals group, wheat and barley are of the greatest economic importance in terms of employment generation, contribution to foreign exchange, impact on smallholder producers, share in agricultural production of the country and involving processing and marketing activities. These two products will be described below.

Figure 3.1. Cereals production in Kazakhstan in 2013 (Source: Committee for Statistics)



3.1.1. Wheat

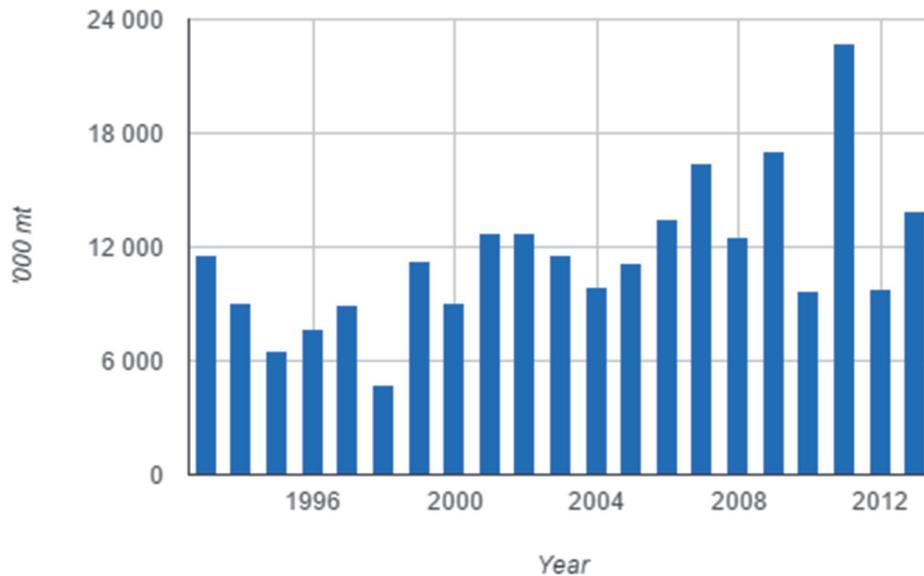
Based on the information in the table, wheat was the cereal with the largest production in Kazakhstan in 2013. It is mainly grown for exports and flour production, which is also mainly exported. Domestically, wheat flour is used to produce bread, bakery products and pasta.

Production performance

Figure 3.2. shows wheat production quantities from 1990 to 2013. The evolution of wheat production can be explained along with the evolution of economic situation in Kazakhstan. Since the collapse of the Soviet Union, production activity in the country – including wheat – was decreasing until the late 1990s, after which production started to recover. This can be seen on the figure, showing that wheat production fell from 11,585,000 tonnes in 1993 to 4,746,000 tonnes in 1998 (-59 percent). Another characteristic is a harvested area, which fell from 12.6 m ha in 1993 down to 9.1 m ha in 1998 (-28 percent).

1999 can be seen as the turning point for wheat production in Kazakhstan. Although the harvested area was even smaller (8.7 m ha), the crop was larger (11.241 m tonnes) due to higher yield, which was caused by favorable weather conditions that year.

Figure 3.2. Wheat production in Kazakhstan from 1990 to 2013, thousand mt
(Source: FAOSTAT)



Due to a successful season in 1999-2000, the area planted with wheat stopped contracting and grew until 2013 (with a couple of exceptional years): from 8.7 m ha up to 13.0 m ha in 2013.

Volatility in production can be explained by volatility in yields. The latter is affected by growing conditions and especially by the amount of rainfall during the vegetation period of the crop. In some years rainfall was good, but the harvesting conditions were hard; i.e. rain, snow and cold weather in autumn, which did not allow the crop to be harvested on time, which lead to in-field losses.

Other factors affecting the sowing/harvesting area and production quantity are wheat prices and crop prices in general. Due to the fact that the Kazakhstan wheat market is strongly impacted by the Russian and Ukrainian markets, wheat prices have been very volatile in recent years. If one or both countries have a large crop, then it is a bearish factor for the local market: prices go down and logistics to the world market becomes more difficult. Due to this, growers have been paying more attention to alternatives to wheat, which lead either to reduction of wheat area or its lower growing rate. Crop diversification evolution will be described below in the relevant parts of the report.

Domestic consumption

Wheat after production is usually used for:

- Processing: Wheat Flour production
- Seed use
- Feed use
- Export

Unfortunately, there is no detailed official statistical data on wheat use in the country. There is only the following from Statistical Committee:

- Grain use in total
- Use of wheat with breakdown to domestic consumption and export

FAOSTAT uses an indicator called “Wheat and products” and has several indicators in the utilization.

USDA PSD service has indicator “Wheat”, but it is also an aggregated indicator, which includes wheat grain + flour + pasta products.

Only the Committee of State Revenues (former Committee of Customs Control) has exact data on export of wheat only.

What is available from various sources is shown below with some commentaries (Figures 3.3 to 3.6.):

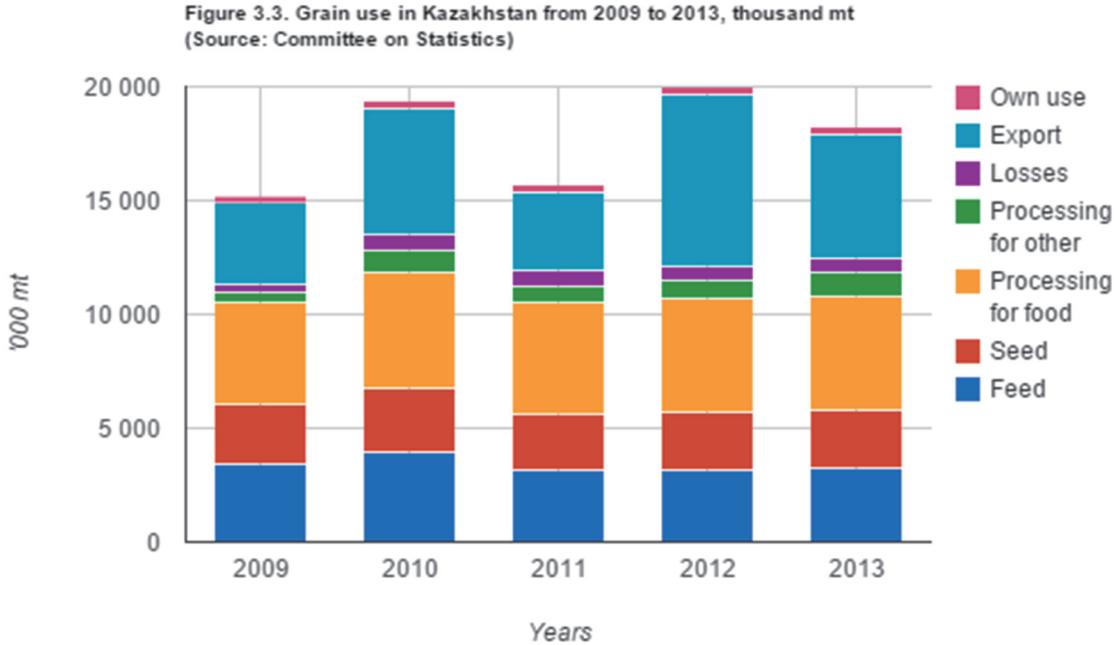


Figure 3.3. shows that the main uses are export (30 percent in 2013), processing for food (27 percent), feed (18 percent) and seed (14 percent). The large share of feed use can be explained by the use of barley and corn for feed purposes. Wheat is not normally used for feed.

Figure 3.4. shows the rough distribution of wheat use in the country into export and domestic consumption. Domestic consumption looks more stable than export dynamics. As in any balance, domestic use is more stable due to less variable sowing areas (use for seeds) and relatively less fluctuating consumption and lower elasticity compared to export quantities (processing for food). Whereas exports, which are usually acknowledged as extra quantity or surplus which was not utilized in the country, is more dependent on production volume and the world market situation (competition with other suppliers).

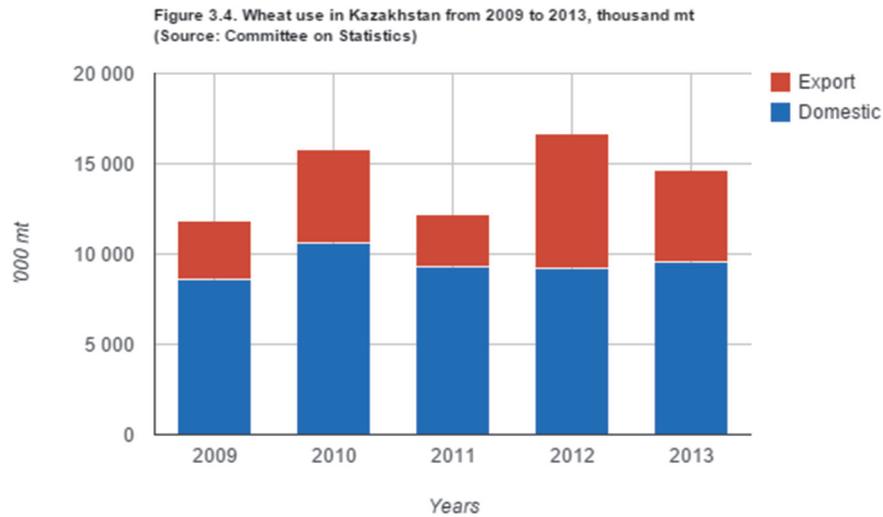


Figure 3.5. shows wheat and wheat product use based on data from FAOSTAT data. According to classifications in FAOSTAT, the numbers include “Default composition: 15 Wheat, 16 Flour, wheat, 18 Macaroni, 20 Bread, 21 Bulgur, 22 Pastry, 23 Starch, wheat, 41 Cereals, breakfast, 110 Wafers; nutrient data only: 17 Bran, wheat, 19 Germ, wheat, 24 Gluten, wheat, 114 Mixes and dough, 115 Food preparations, flour, malt extract”. According to this Figure, main uses of Wheat and products are export (38 percent in 2011), feed (19 percent), seed (18 percent) and food (11 percent). Other uses account for less than 10 percent.

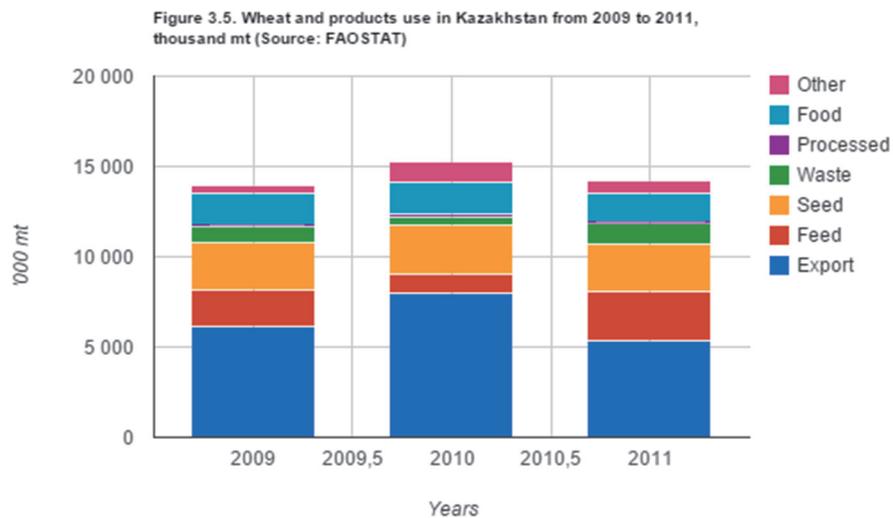
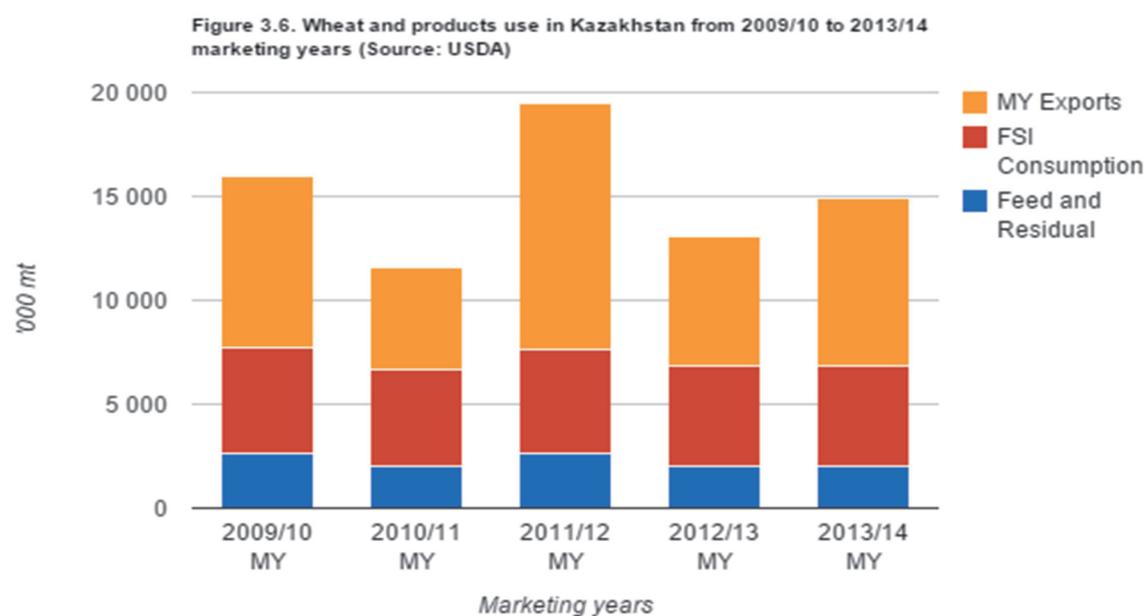


Figure 3.6. shows numbers based on USDA data. Wheat and wheat products includes wheat grain, flour and pasta products. MY Exports means export quantities during the local reporting year. FSI Consumption includes food, seed and industrial use.



As all sources show, despite differences in approaches and values, the main wheat uses in Kazakhstan are export, processing for food (i.e. Flour) and seed. Finally, it should be noted that the values of indicators from different sources did not match. This is probably something that should be addressed by the Ministry of Agriculture so as to achieve a properly operating data collection system.

Production value

The Committee on Statistics did not provide production values for wheat separately in open access. It provided only aggregated values for grains and pulses.

FAOSTAT provided calculated data on values of wheat production in Kazakhstan for 2008-2012. As shown in Figure 3.7, the value of wheat production varied significantly. The main factors affecting the values were quantity of production, prices during the year, and exchange rate (for example 2010 and 2011 look very different). Production quantities were 9.6 million tonnes in 2010 and 22.7 million tonnes.

Average prices were KZT 21 830 in 2010 and KZT 28 995 in 2011. Average exchange rates per 1 USD were KZT 147.35 in 2010 and KZT 146.62 in 2011.

Domestic market, exportable surplus or dependence on the international market

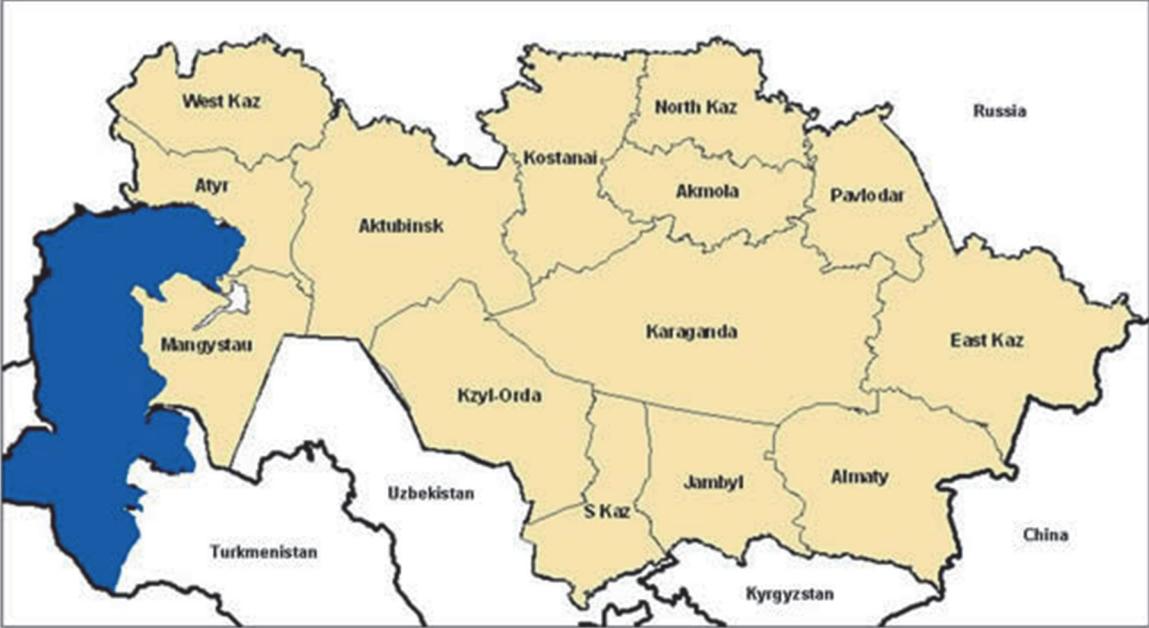
Wheat is a main agricultural export commodity in Kazakhstan. There is a production surplus, which is exported. The dynamics of wheat export activity is shown above in the Domestic Consumption section. According to Figure 3.4, over the last five years between 24 percent and 44 percent of produced wheat was exported as grain.

A large share of local use consists of processing for food (i.e. wheat flour). A large portion of wheat flour is normally exported. The share and size of wheat grain export mainly depends on crop size and the situation on the global wheat and wheat flour market.

Main productive regions

The main wheat producing region is North Kazakhstan. Three provinces, namely Akmola (27 percent in 2013), Kostanai (28 percent) and North-Kazakhstan (26 percent), are key growing provinces for wheat.

Figure 3.8. Map of Kazakhstan.



Source: USDA Foreign Agricultural Service.

Figure 3.9. Share of provinces in total wheat production in Kazakhstan in 2013, % (source: Committee on Statistics)

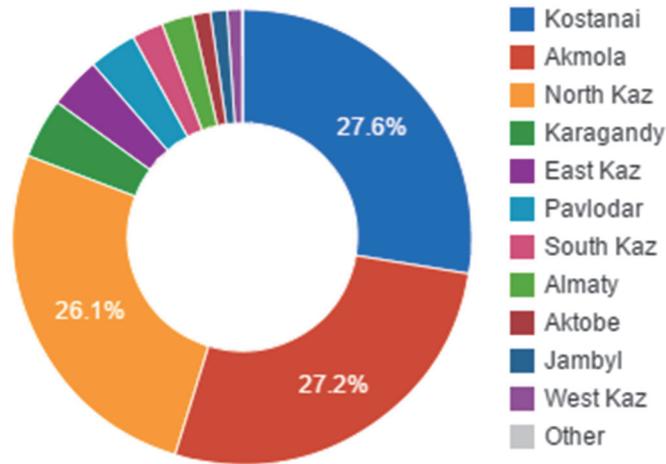
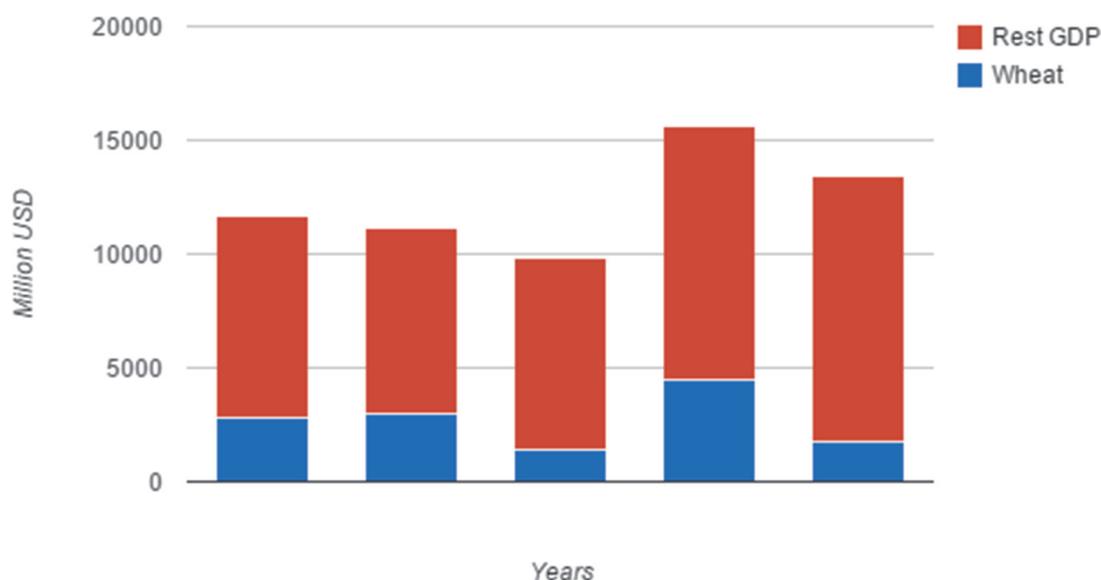


Figure 3.9. shows that these three provinces produced about 81 percent of the total wheat in Kazakhstan. They became the main producing areas in the mid-1950s when virgin lands were converted into croplands in order to provide enough wheat for the Soviet Union. The region is called the North Kazakhstan Steppe and is similar to the West Canadian Prairies – especially Saskatchewan province – in terms of soil types, rainfall, and other agro-ecological conditions.

Contribution to agricultural GDP

Wheat makes the largest contribution to agricultural GDP among all agri-products. Figure 3.10. shows the share of wheat in total GDP between 2008 and 2012. During these years, the share of wheat varied from 13 percent to 29 percent depending on the crop size, prices and exchange rate.

Figure 3.10. Share of wheat in agricultural GDP during 2008-2012 (Sources: Committee on Statistics, FAOSTAT, National Bank of Kazakhstan)



Wheat balance

Wheat balance is presented in Table 3.1. below.

On the supply side, the main source was production. On the use side, domestic use was larger than exports. This can be partly explained by processing of wheat into flour and export of the flour. More detailed explanation of wheat use is presented above in Domestic Consumption.

Large beginning and ending stocks could be explained by applying calendar years in building the balances. The crop is usually harvested at the end of the year (September-October) and sold mainly until the next spring. This is why December (ending stocks) and January (beginning stocks) have large numbers.

In terms of food security, Kazakhstan produces enough wheat for domestic consumption and contributes to food security of neighboring countries in Central Asia.

Table 3.1. Wheat balance in Kazakhstan between 2009 and 2013, thousand tonnes

	2009	2010	2011	2012	2013
SUPPLY:					
Beg. stocks	9 164	14 495	8 368	18 930	12 166
Production	17 052	9 638	22 732	9 841	13 941
Import	78	3	15	24	1
Total:	26 295	24 136	31 116	28 795	26 108
USE:					

Domestic use	8 571	10 657	9 295	9 245	9 523
Export	3 229	5 111	2 890	7 384	5 100
Ending stocks	14 495	8 368	18 930	12 166	11 485
Total:	26 295	24 136	31 116	28 795	26 108

Source: Committee on Statistics.

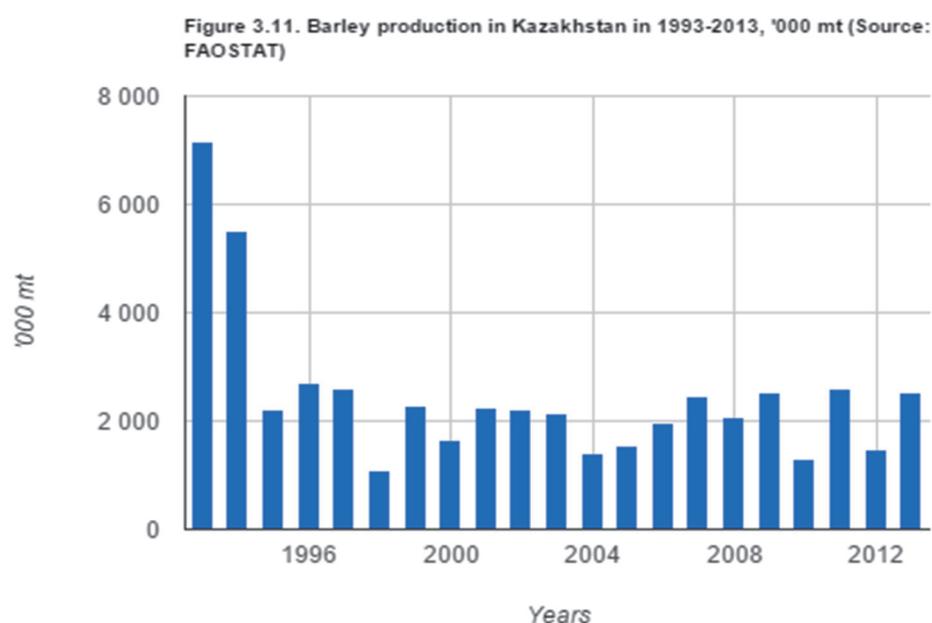
3.1.2. Barley

Barley is the second largest crop produced in Kazakhstan. It is mainly used for animal feed and exports.

Production performance

Figure 3.11. shows barley production quantities between 1993 and 2013. After the collapse of the Soviet Union, barley production dropped seriously due to less demand from the livestock sector. Nowadays it is still used in livestock, although to a lesser extent. It is considered one of top export cereal commodities. Details of consumption and export activities are provided below.

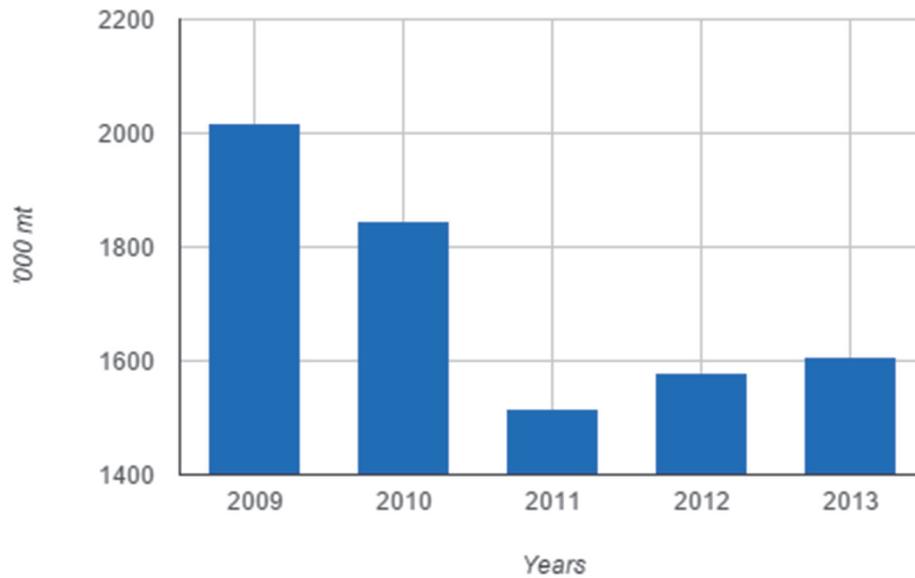
The evolution of barley production has similar characteristics to wheat and its history is also similar.



Domestic consumption

Domestic consumption is presented in Figure 3.12. The numbers mainly depend on crop size and export activity.

Figure 3.12. Barley domestic consumption in 2009-2013, '000 mt (Source: Committee on Statistics)



Production value

Figure 3.13. Value of barley production in 2008-2012, Million USD (Source: FAOSTAT)

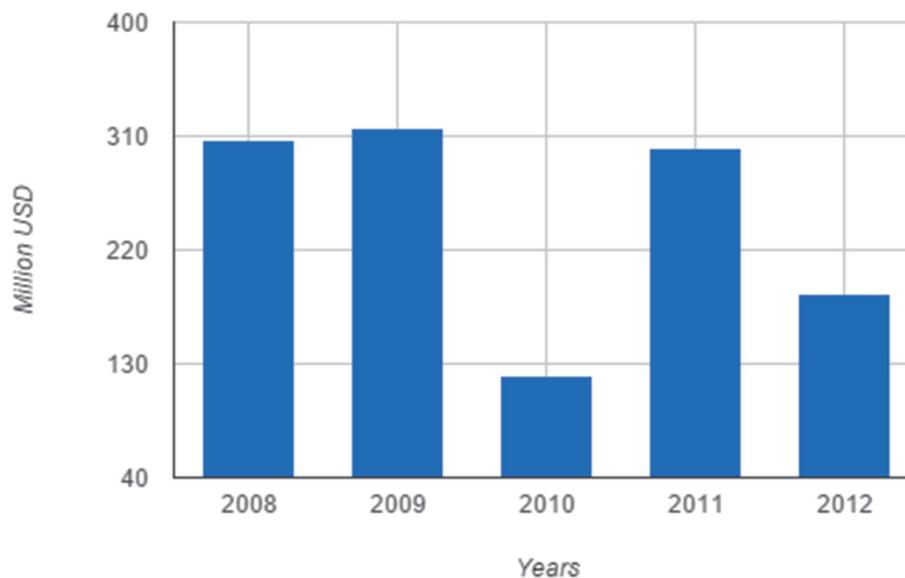


Figure 3.13. shows the value of barley produced between 2008 and 2012. The values are taken from FAOSTAT as calculated numbers. It was affected by crop size, market prices and current exchange rates.

Domestic market, exportable surplus or dependency on the international market

Barley production covers domestic needs and excess quantities are exported. Figure 3.14 shows export and import quantities over last several years. Foreign trade activity mainly depends on crop size, as well as demand and prices on the international barley market.

Figure 3.14. Barley Export and Import during 2009-2013, '000 mt (Source: Committee on Statistics)

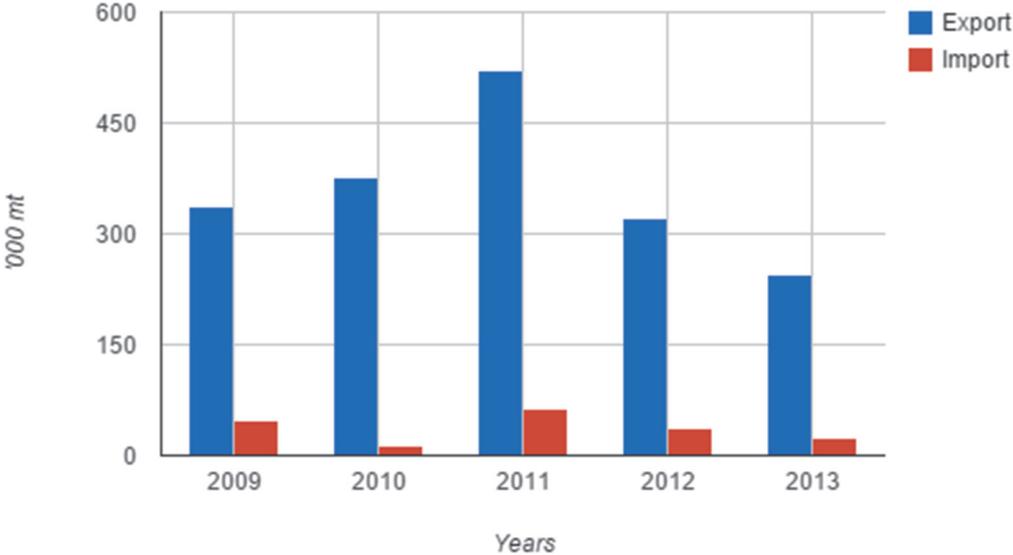
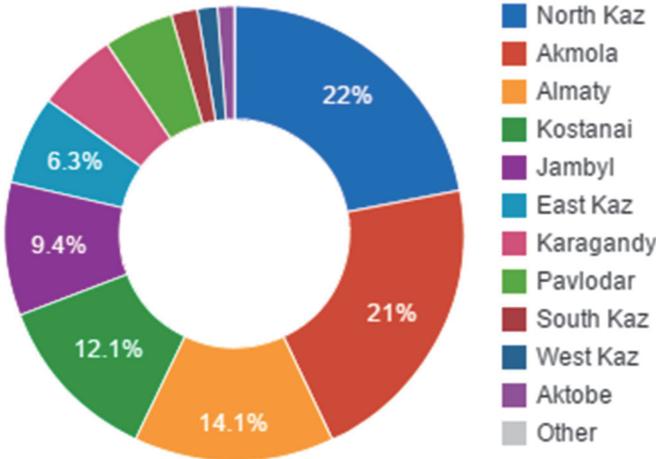


Figure 3.15. Share of provinces in total Barley production in Kazakhstan in 2013, % (source: Committee on Statistics)



Main productive regions

Figure 3.15. shows the share of provinces in barley production. The main barley producing region is north Kazakhstan. Three provinces, namely North-Kazakhstan (22 percent in 2013), Akmola (21 percent) and Kostanai (12 percent), are key growing provinces of wheat. Also, such provinces as Almaty (14 percent), Jambyl (9 percent) and East-Kazakhstan (6 percent) have large production of barley.

The first three provinces produced about 55 percent of total Barley in Kazakhstan. These three provinces are characterized by large croplands and barley is usually grown in one crop rotation with wheat.

Contribution to agricultural GDP

Previous parts of the chapter mentioned that barley is the second most important cereal commodity and in agriculture in general. It accounts for a large share in agricultural GDP after wheat. Figure 3.16. shows barley's share of total GDP between 2008 and 2012. During those years, the share of barley varied from 1 percent to 3 percent depending on the crop size, prices and exchange rate.

Barley balance

The barley balance is presented in Table 3.2. below. On the Supply side, main source was production. On the use side, domestic use was larger than export.

Table 3.2. Barley balance in Kazakhstan during 2009-2013, thousand tonnes

	2009	2010	2011	2012	2013
SUPPLY:					
Beg. stocks	1 225	1 438	543	1 162	789
Production	2 519	1 313	2 593	1 491	2 539
Import	48	14	63	38	25
Total:	3 792	2 764	3 199	2 691	3 353
USE:					
Domestic use	2 018	1 846	1 515	1 579	1 606
Export	336	376	521	322	246
Ending stocks	1 438	543	1 162	789	1 502
Total:	3 792	2 764	3 199	2 691	3 353

Source: Committee on Statistics.

Large beginning and ending stocks can be explained by applying calendar years in building the balances. The crop is usually harvested at the end of the year (September-October) and sold mainly

by the next spring. This is why December (ending stocks) and January (beginning stocks) have large numbers.

In terms of Food Security, Kazakhstan produces enough barley for domestic consumption and contributes to the food security of neighboring countries in the region, mainly Iran.

3.2 Roots and tubers

The main roots and tubers produced in Kazakhstan are potatoes and sugar beet.

Potatoes are produced and consumed around the country (although production is lower in western Kazakhstan). The majority of potatoes are produced by households (65 percent in 2013), followed by small farms (28 percent) and then large farms (7 percent).

Sugar beet is mainly used for sugar production. Compared to potatoes, production quantities are much smaller. Production is concentrated in the south of the country where it is warmer and there is more rainfall and more sunny days. The main groups that produce sugar beet are small farmers (82 percent in 2013), then large farms (17 percent), while very little sugar beet is produced in households (1 percent).

Foreign trade in potatoes is characterized by more imports than exports (Figure 3.19). Imports are more common (from Central Asian countries) before the new crop arrives to market.

Sugar beet in general neither exported nor imported.

Product balances (Tables 3.3. and 3.4.) show losses for both products: Potatoes 9 percent and sugar beet 2 percent of production in 2013.

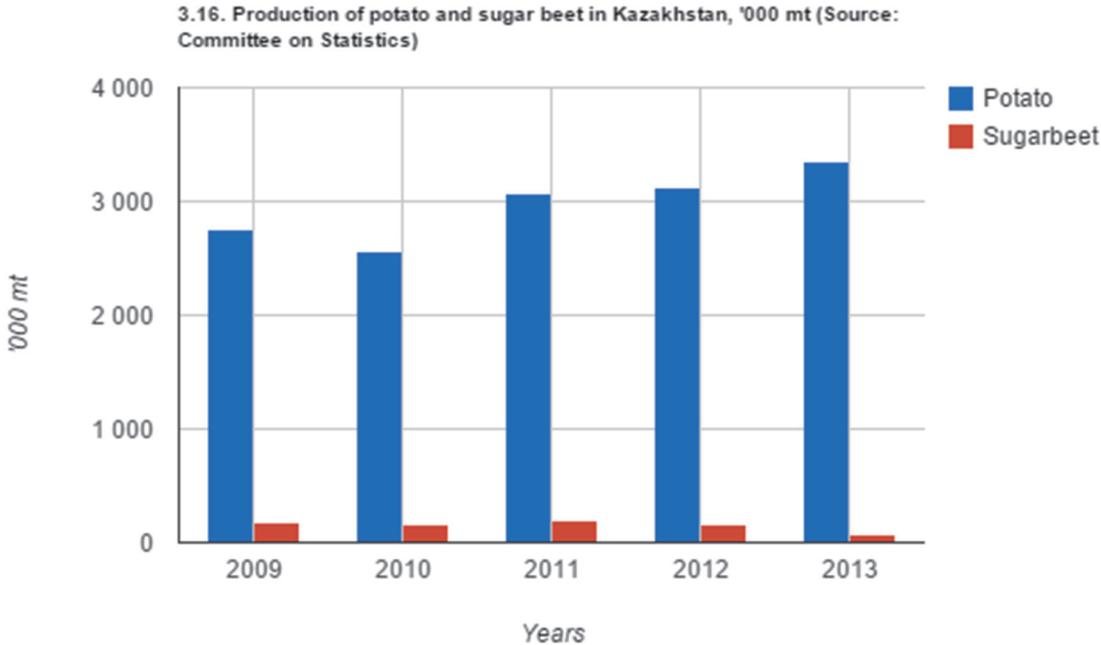


Figure 3.17. Domestic use of potato and sugar beet in Kazakhstan, '000 mt
(Source: Committee on Statistics)

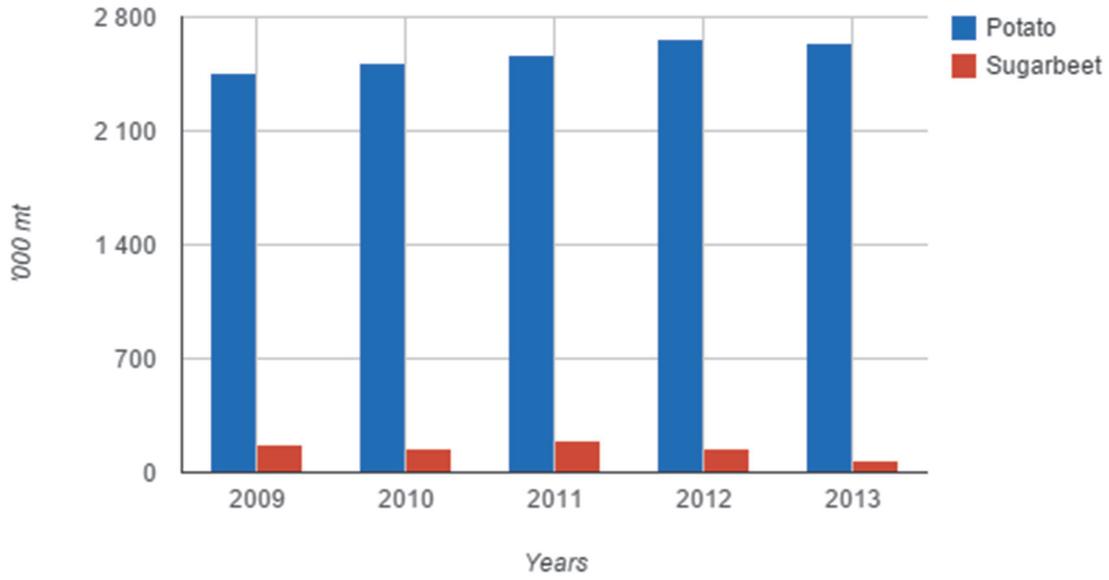


Figure 3.18. Production value of potato and sugar beet in Kazakhstan, Million USD (Source: FAOSTAT)

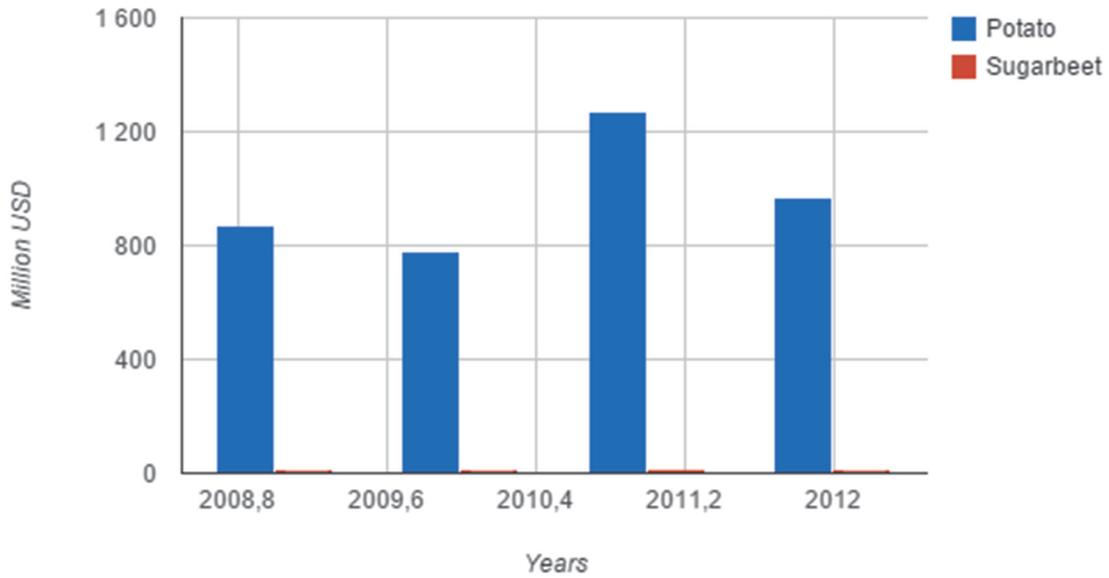


Figure 3.19. Net foreign trade of potato and sugar beet in Kazakhstan, '000 mt (Source: Committee on Statistics)

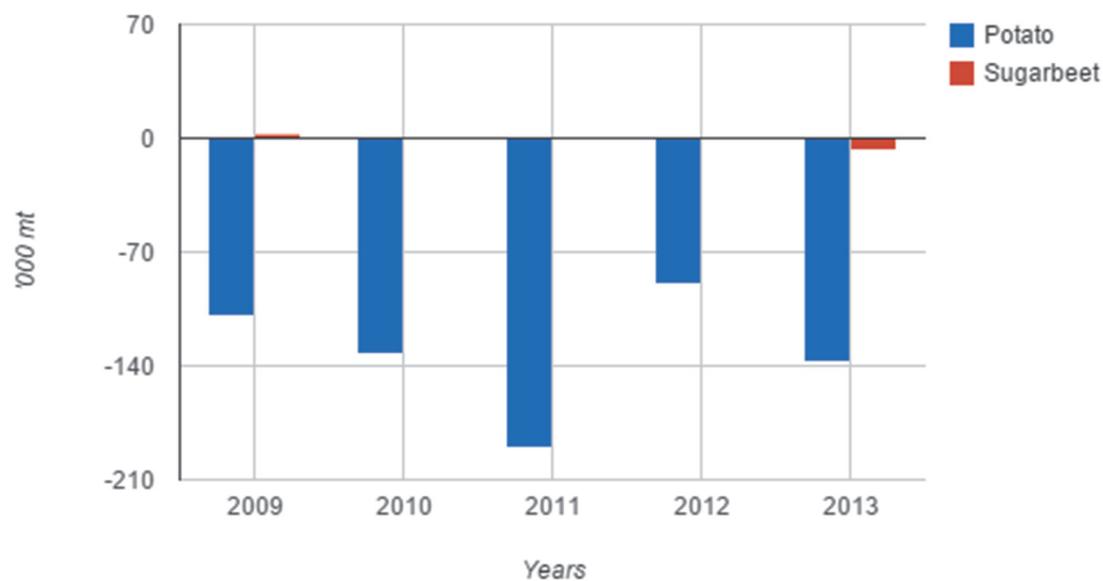


Table 3.3. Potato balance in Kazakhstan during 2009-2013, thousand tonnes

	2009	2010	2011	2012	2013
SUPPLY:					
Beg. stocks	1 258	1 419	1 341	1 593	1 685
Production	2 756	2 555	3 076	3 126	3 344
Import	110	134	192	95	146
Total:	4 124	4 107	4 609	4 814	5 175
USE:					
Own consumption	1 841	1 885	1 786	1 879	1 884
Production use	620	638	786	783	756
Losses	243	242	442	462	305
Export	0	1	1	5	9
Ending stocks	1 419	1 341	1 593	1 685	1 294

Source: Committee on Statistics.

Table 3.4. Sugar beet balance in Kazakhstan during 2009-2013, thousand tonnes

	2009	2010	2011	2012	2013
SUPPLY:					
Production	181	152	200	152	65
Import	-	-	-	-	8
Total:	181	152	200	152	73
USE:					
Processing for Food	170	145	191	144	69
Production use for Feed	5	5	6	5	2
Losses	4	3	4	3	1
Export	3	-	-	-	-

Source: Committee on Statistics.

3.3 Oilseeds and pulses

Oilseeds and pulses produced in Kazakhstan include the following:

- Sunflower seeds
- Linseeds
- Rapeseeds
- Safflower seeds
- Soybeans (considered an oil crop, although some agronomists consider it a pulse)
- Peas
- Lentils
- Chickpeas

Figure 3.20. shows quantities of production for individual oilseeds and pulses in general. It can be seen on the graph that main crop is sunflower seeds, followed by the other oilseeds with similar quantities. Linseed has become very popular crop in recent years and the sown area increased significantly between 2009 and 2014. However, because its main use is not for food, it is not included in the detailed description. The next most popular crop used for food is rapeseed, which will be included in the present report (despite some rapeseed being used in bio-diesel production in Europe).

Figure 3.20. Oilseeds and pulses production in Kazakhstan, '000 mt
(Source: Committee on Statistics)

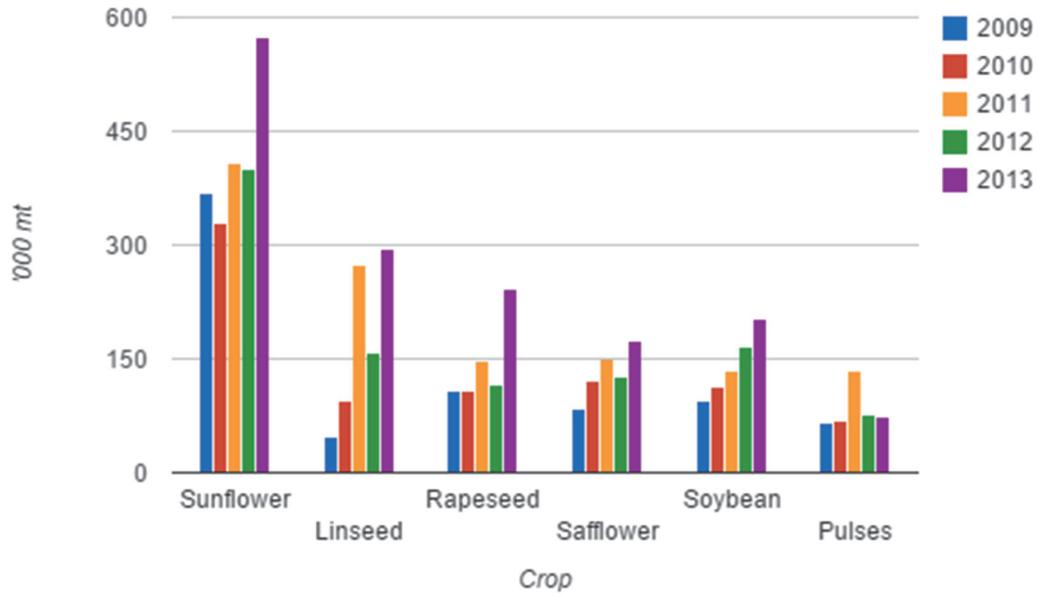


Figure 3.21. Uses of sunflower seed and rapeseed in Kazakhstan, '000 mt
(Source: Committee on Statistics and FAO STAT)

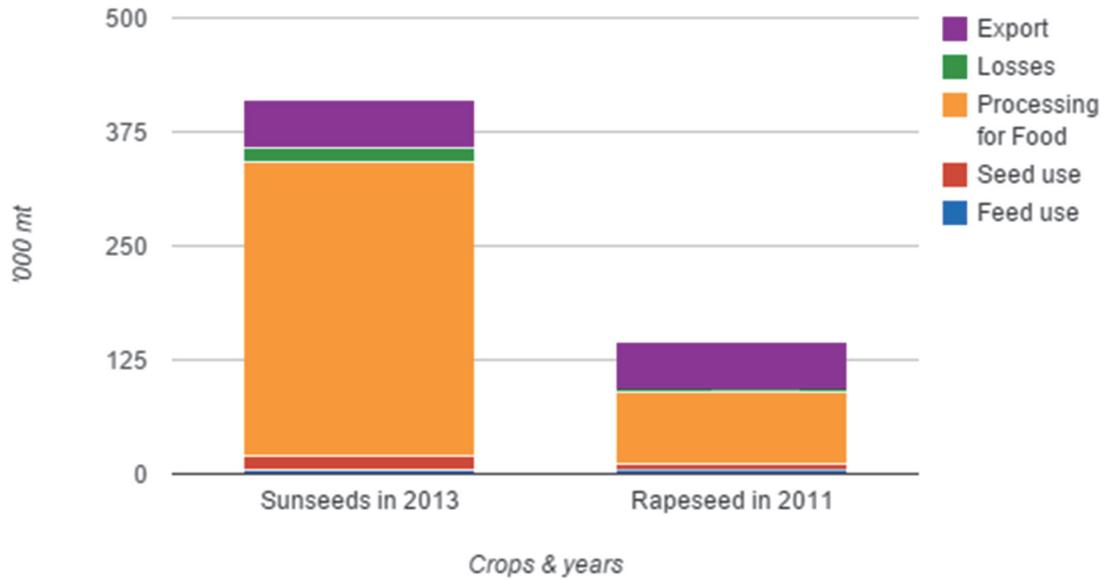
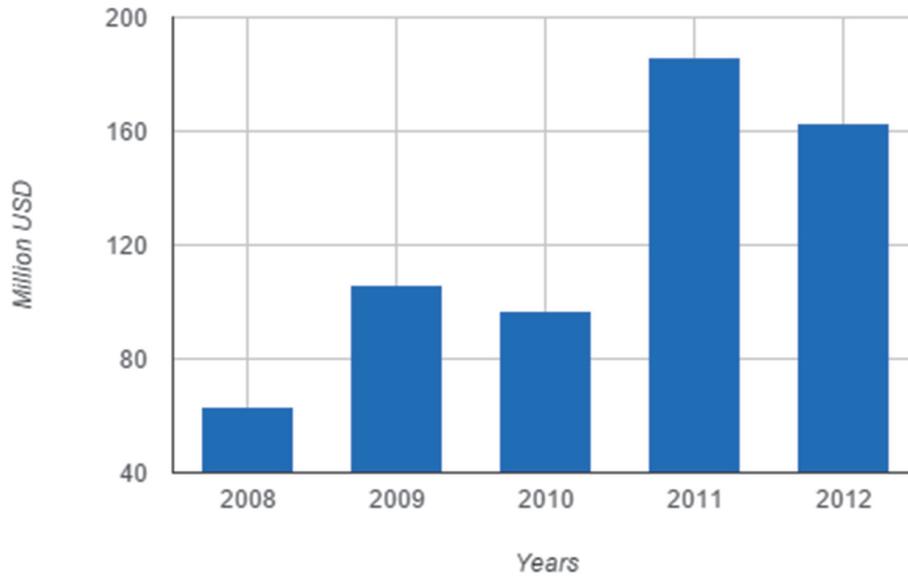


Figure 3.22. Value of produced sunflower seeds in Kazakhstan, Million USD
(Source: FAOSTAT)



Both sunflower seed and rapeseed production cover domestic use purposes and there is an exportable surplus.

Figure 3.21. shows uses of sunflower seeds in Kazakhstan in 2013 and of rapeseed in 2011. Seventy nine percent of sunflower seeds are processed domestically for production of sunflower oil, which is a major type of oil consumed in Kazakhstan. The export share was 13 percent.

Fifty five percent of rapeseed was used for processing. The processed product is usually used to produce solid fats and spreads. The export quantity was 36 percent. Other uses were much less significant compared to processing and export.

Sunflower seeds are mainly grown in the eastern part of the country (67 percent in 2013) in East-Kazakhstan and Pavlodar provinces. Rapeseed is mainly grown in the northern part of the country (95 percent) in North-Kazakhstan, Akmola and Kostanai provinces.

Figures 3.23 and 3.24 show the supply and use of Plant Oil and its Products in Kazakhstan between 2009 and 2013. Supply graph shows that 54-68 percent of the domestic consumption was provided by production. The use graph shows that the main purpose was domestic consumption, and exports accounted for 9-11 percent. Net foreign trade was negative (the country imported more than exported).

Exported products mainly consisted of cotton oil and plant oil margarine. Imported products mainly were raw sunflower oil, bottled sunflower oil and plant oil margarine.

Figure 3.23. Supply of plant oil and products in Kazakhstan during 2009-2013, in '000 mt (Source: Committee on Statistics)

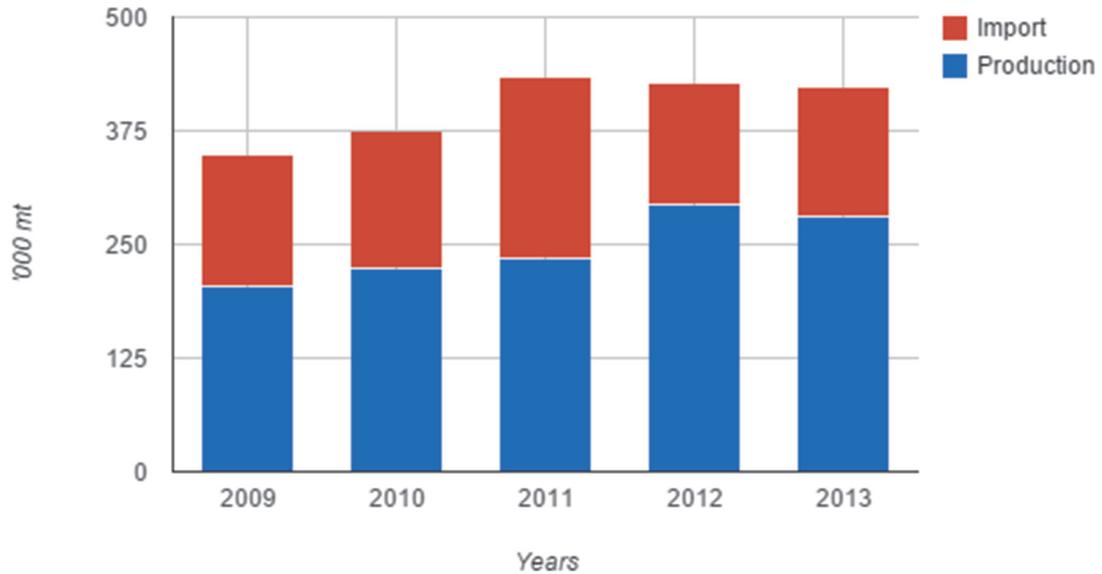
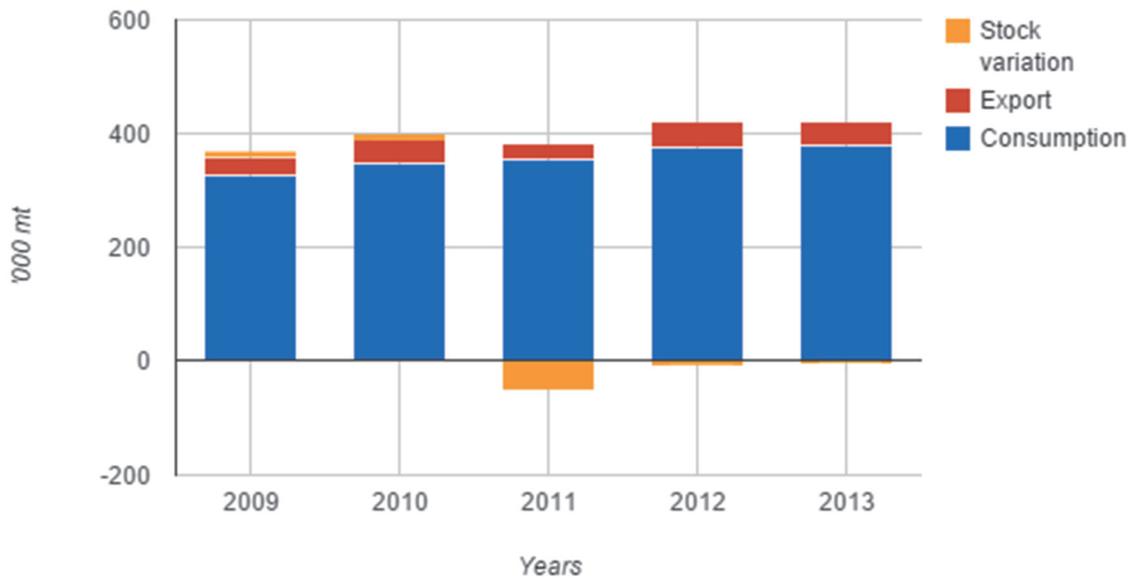


Figure 3.24. Use of plant oil and products in Kazakhstan, in '000 mt (Source: Committee on Statistics)

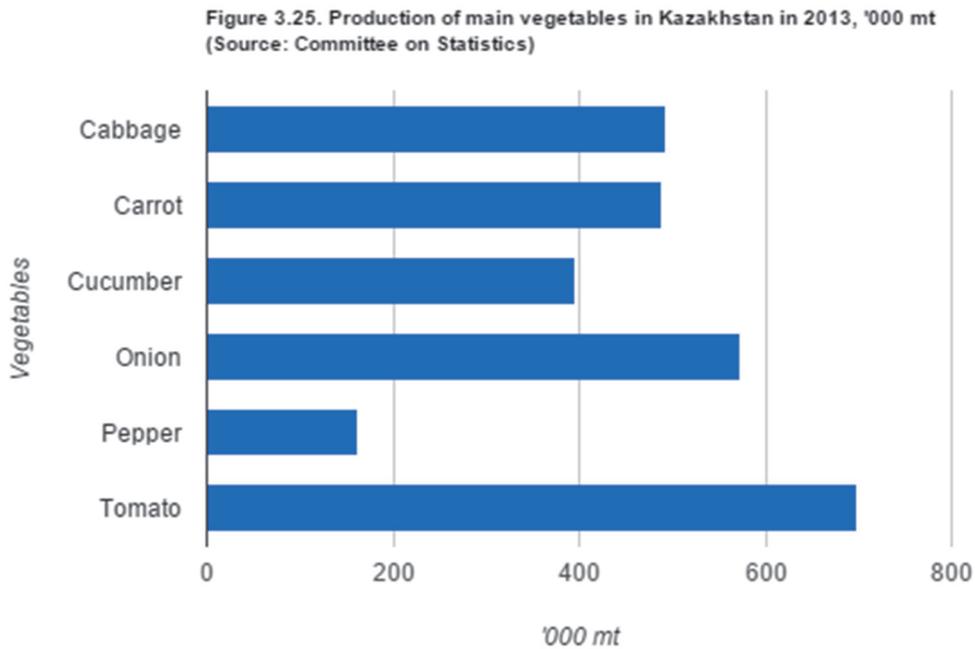


The statistics show that despite of some exportable surplus of sunflower seeds, the country does not cover its needs in plant oil (sunflower seed oil) and needs to balance this with imports. This could be explained by intra-regional trade, when for example, the eastern part of the country exports seeds to Russia and the western part import oils, because Kazakhstan and Russia are geographically large countries and have very long border, and it is economically better to buy/sell to other country than to sell/buy from one part to another within the country. Also, in general, transportation of oil is more advantageous to transportation of seeds. Because the seeds have low test weight and transport cost per tonne becomes almost twice as high as for oil, and oil is a more expensive product than seeds (share of transport cost in the value of the product).

3.4 Fruit and vegetables

The main vegetables produced in Kazakhstan are:

- Cabbages
- Carrots
- Cucumbers
- Onions
- Peppers
- Tomatoes



The main fruits produced in Kazakhstan are:

- Apples
- Apricots
- Cherries
- Grapes
- Pears
- Plums

Production quantities in 2013 are presented in Figures 3.25 and 3.26. Based on the production quantities and values of production, the two main products (one from Vegetables and one from Fruits) selected for the current study are tomatoes and apples. Both products were top of their groups not only in terms of production amounts but also in terms of production value.

Figure 3.26. Production of main fruits in Kazakhstan in 2013, '000 mt
(Source: Committee on Statistics)

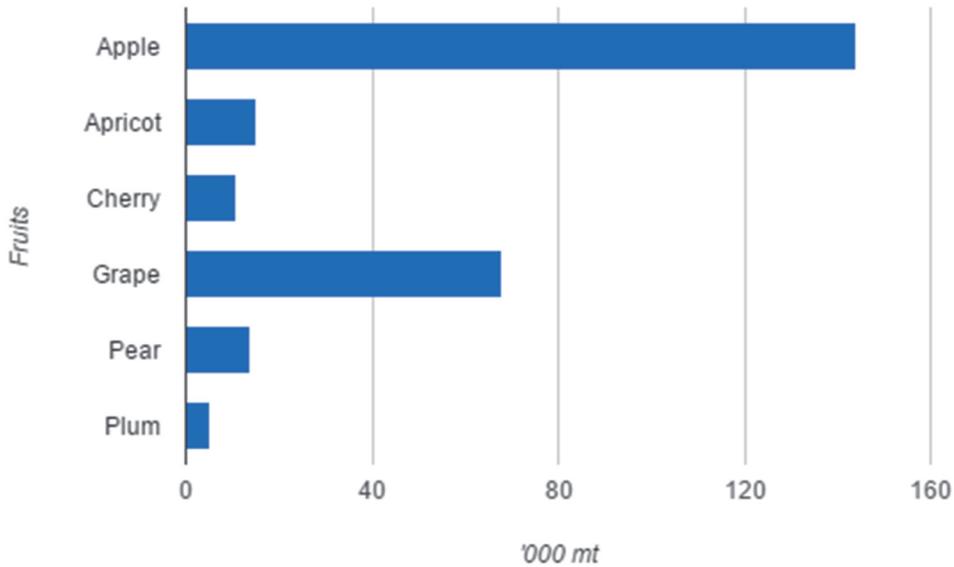


Figure 3.27. shows the supply of tomatoes in Kazakhstan 2011-2013. It shows that main portion of the supply is provided by domestic production. Imports accounted for 8-9 percent during these years. It should be noted that about 60-70 percent of imported tomatoes were fresh and the rest was processed.

Figure 3.28. shows the supply of apples in Kazakhstan in 2011-2013. The situation here looks different than that of tomatoes. Domestic production covered only 52-53 percent of the supply (without consideration of stocks). Imported apples were mainly fresh.

Figure 3.29. shows tomato and apple use in 2011. The main purpose of these products was fresh consumption.

Figure 3.27. Supply of tomato in Kazakhstan in 2001-2013, '000 mt (Source: Committee on Statistics, Customs Committee)

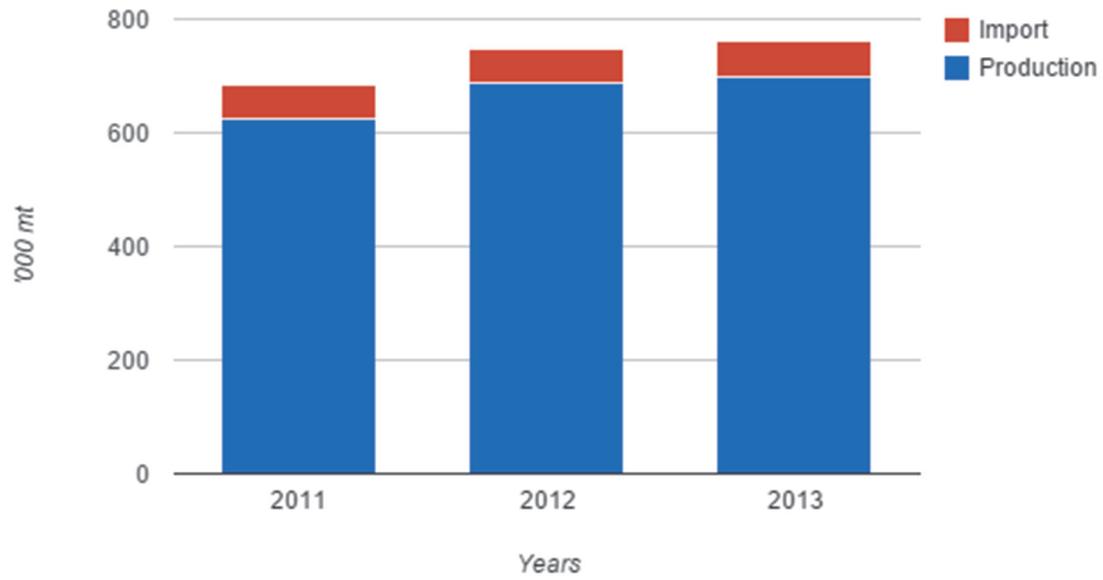


Figure 3.28. Supply of apple in Kazakhstan in 2001-2013, '000 mt (Source: Committee on Statistics, Customs Committee)

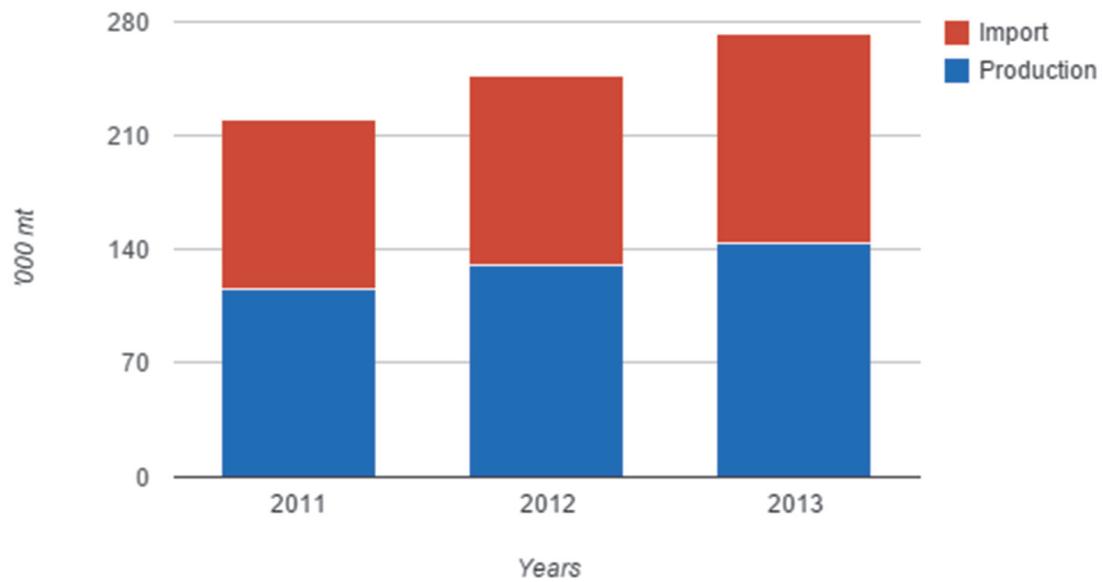


Figure 3.29. Use of apple and tomato in Kazakhstan in 2011, in '000 mt
(Source: FAOSTAT)

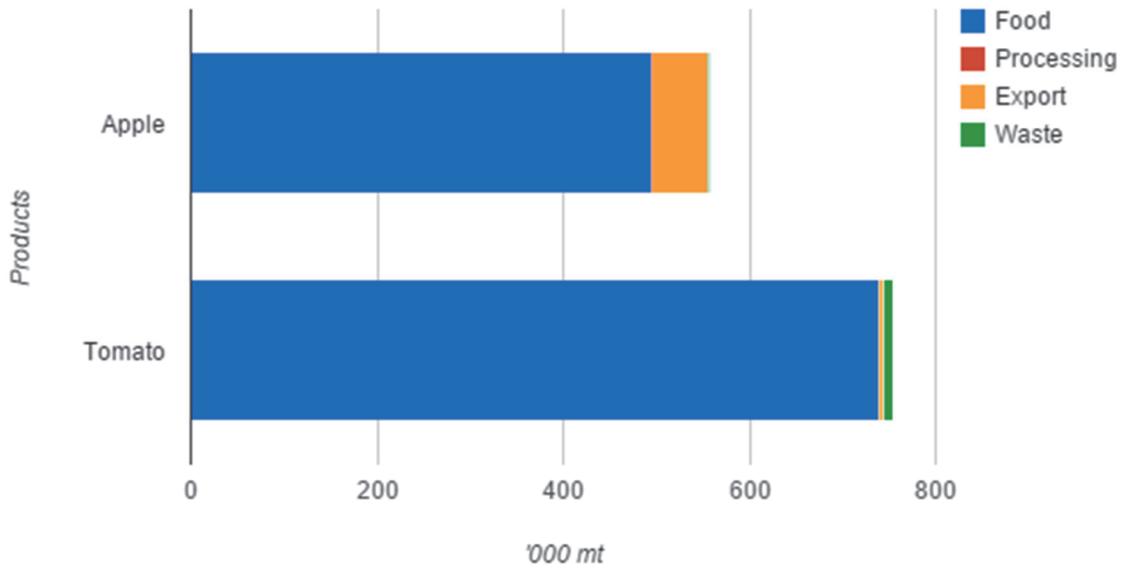
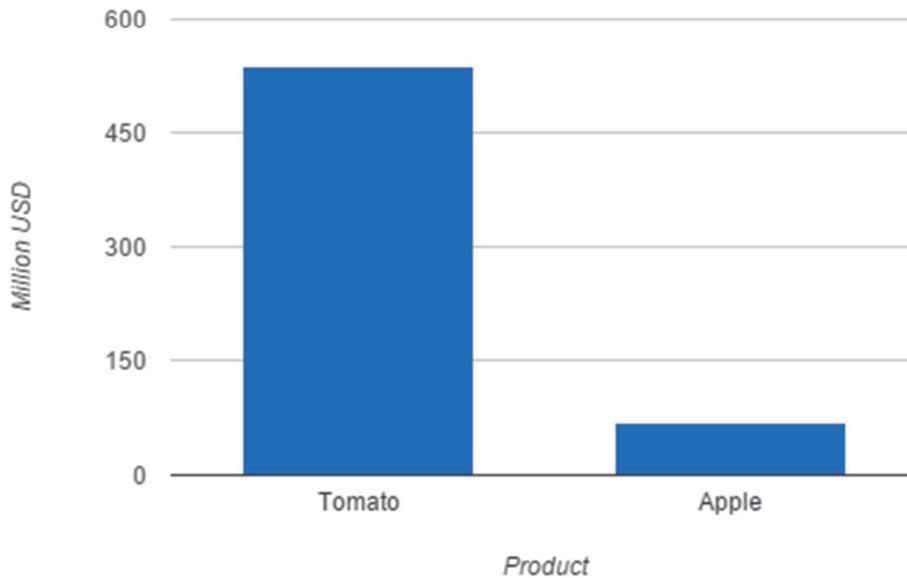


Figure 3.30. Value of produced tomato and apple in Kazakhstan in 2012
(Source: FAOSTAT)



The main tomato producing regions are South-Kazakhstan, Almaty and Jambyl provinces, which produce about 68 percent of open ground tomatoes. For the protected ground (greenhouses), these provinces produced 94 percent.

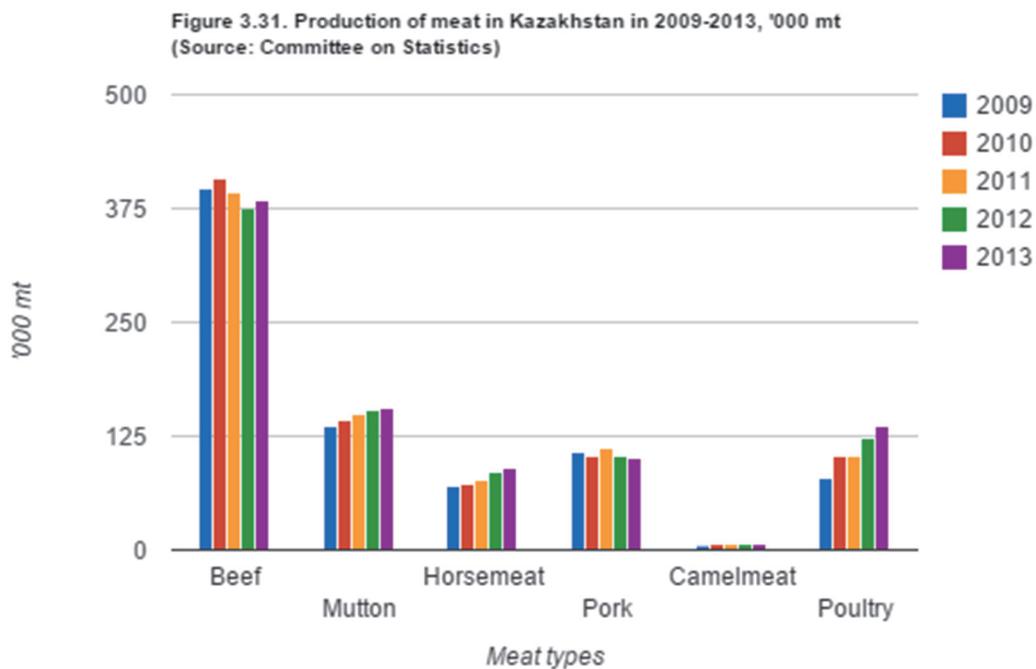
These three provinces are also the main apple producing regions, and accounted for about 87 percent of total production in 2013. This can be explained by more suitable climatic conditions of that area; namely, they are warmer and have more rainfall and sunny days.

3.5 Meat

The main types of meat produced in Kazakhstan are:

- Beef
- Mutton (sheep and goat meat)
- Horse meat
- Pork
- Camel meat
- Poultry

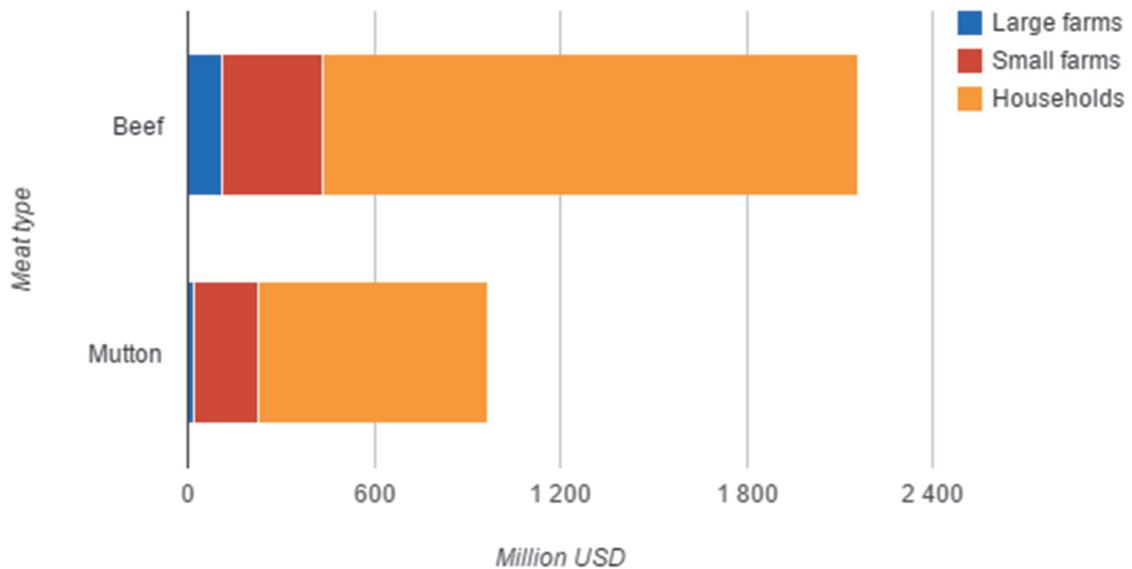
Figure 3.31. shows quantities of meat types produced in Kazakhstan in 2013 in dressed weight. The graph shows that beef was the main type of meat (44-50 percent of the total). The second largest type is mutton (17-18 percent). Poultry production is actively increasing and grew from 10 percent to 16 percent during these years. Beef, mutton and horse meats are popular due to local traditions. Traditionally, pork is not consumed (for religious reasons) and is mainly used in sausage production. Poultry is becoming popular due to its price, increasing number of broiler farms and growing popularity of white meats globally.



This study focuses on beef and mutton. Poultry was a candidate to be the second most important product. However, mutton took this position as it is mainly produced at households, whereas poultry is mainly produced on commercial industrial farms; more people involved and larger impact on smallholder producers.

Figure 3.32. shows the value of beef and mutton produced in Kazakhstan in 2013. The value beef was more than twice that of Mutton. Both products are mainly produced in households. Households raise animals for subsistence and the market, with more importance for subsistence.

Figure 3.32. Value of produced beef and mutton in Kazakhstan in 2013, in Million USD (Source: Committee on Statistics, National Bank of Kazakhstan)



For the analysis of domestic consumption, unfortunately, local statistical data does not provide open-source material for beef or mutton separately. Only 'Meat and Meat Products' are grouped together. For the detailed analysis, FAOSTAT data for 2011 was used.

Figure 3.33 shows the supply of beef and mutton in Kazakhstan in 2011, which was almost totally provided by domestic production. Figure 3.34. presents the use of beef and mutton in the country in 2011. The majority of beef was used for food consumption (86 percent).

Cattle farming is spread all over the country. The top three beef producing provinces are Almaty (16 percent), East Kazakhstan (15 percent) and South Kazakhstan (12 percent). These provinces have larger populations and are more and densely populated and have less cropland than the northern region, which could be a reason for relatively higher beef output.

Sheep farming is also spread all over the country. The top three mutton producing provinces are South-Kazakhstan (21 percent), Almaty (16 percent) and East-Kazakhstan (15 percent).

Figure 3.33. Supply of beef and mutton in Kazakhstan in 2011, in '000 mt
(Source: FAOSTAT)

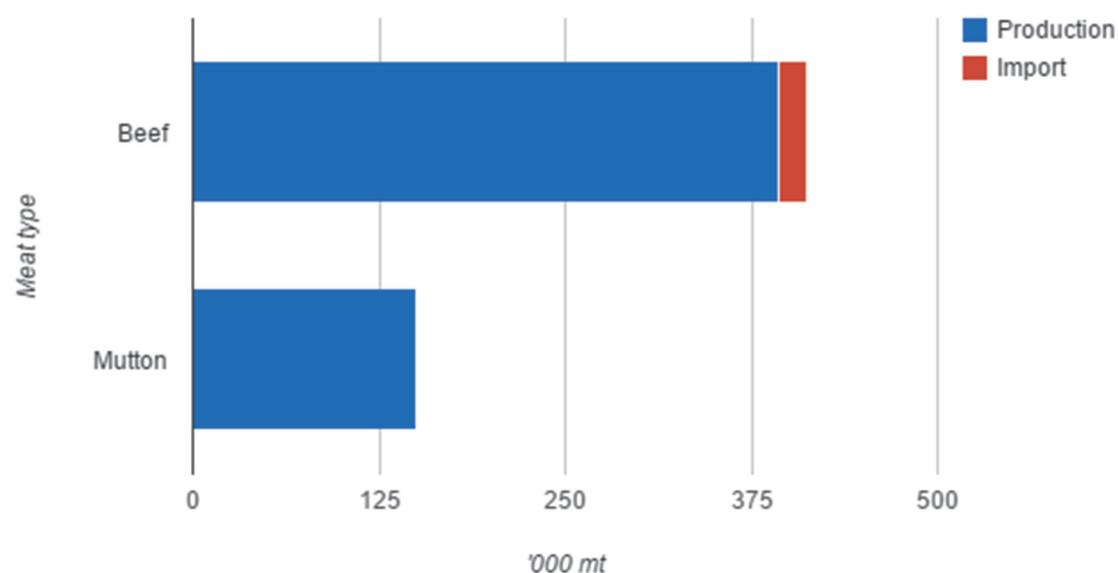
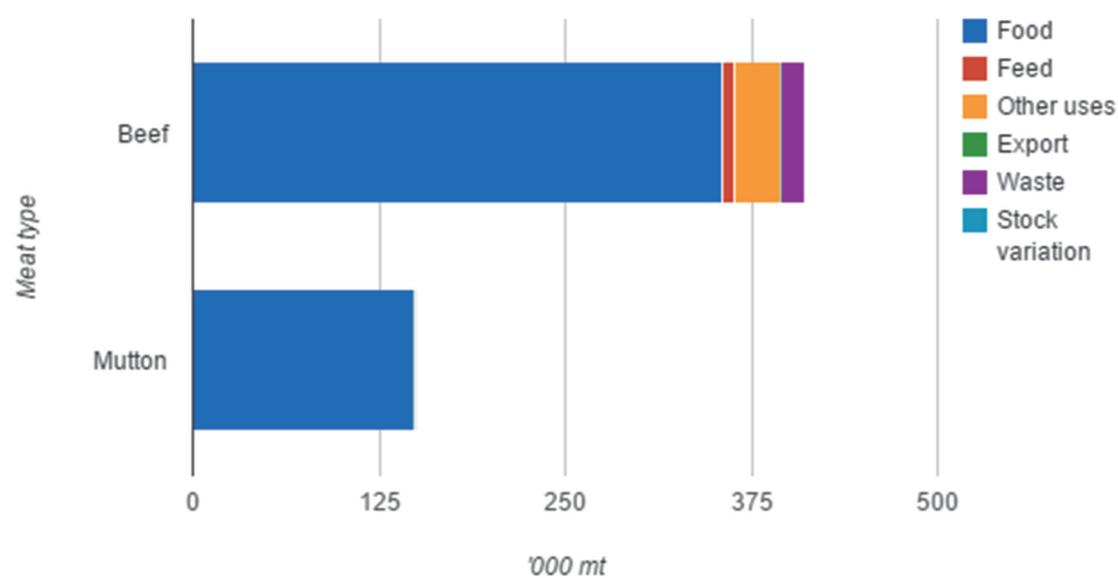


Figure 3.34. Use of beef and mutton in Kazakhstan, in '000 mt (Source: FAOSTAT)



3.6 Fish and seafood

Kazakhstan is a landlocked country and does not have seafood production as such. There are internal waters, the most important of which are the Caspian Sea, the Aral sea, Balkhash lake and Zaisan lake (Figure 3.35). The main fish and seafood industries are located around these bodies of water.

Figure 3.35. Map of Kazakhstan with main lakes (Source: <http://www.4gress.com/sights/entry/100679.html>)

The main fish species produced in Kazakhstan are (more than 1 000 tonnes):

- Bream
- Pike-perch
- Crucian
- Carp
- Dace
- Roach
- Catfish
- Perch
- Asp

Production quantities are presented in Figure 3.36.

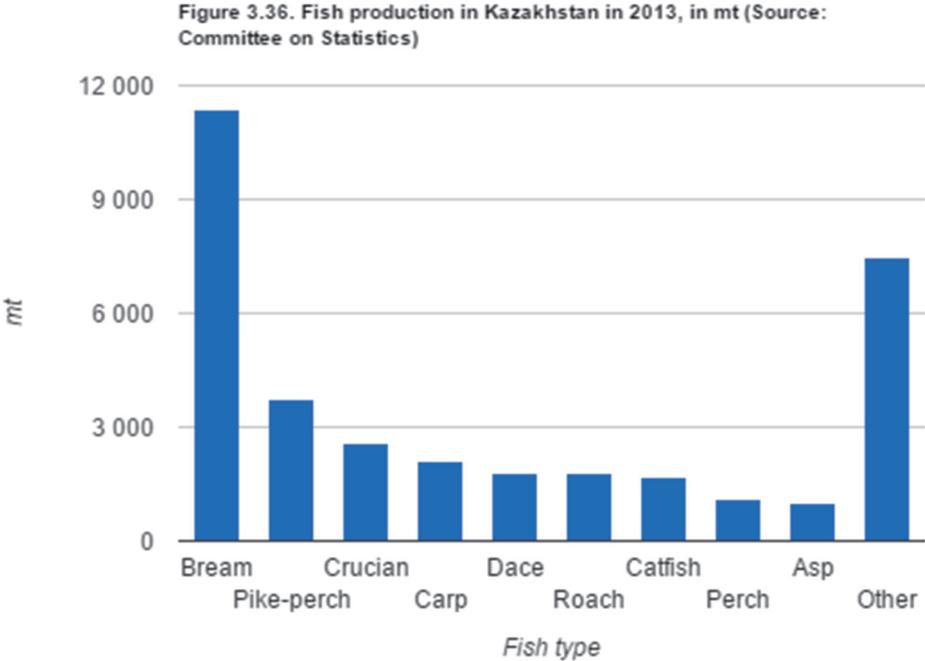


Table 3.5. shows the balance of fish and fish products in total, not by species. Average annual production for five years was about 54 000 tonnes and average imports were 66 000 tonnes. The main import was a frozen fish from countries that export sea fish, such as Norway, Vietnam, Iceland and Estonia. On the use side of the balance, fish was mainly consumed (87 000 tonnes average per annum) and exported (31 000 tonnes).

Table 3.5. Balance of fish and fish products in Kazakhstan, in thousand tonnes (Source: Committee on Statistics)

	2009	2010	2011	2012	2013
SUPPLY:					
Beg. stocks	58	54	55	49	41
Production	50	61	46	40	71
Import	63	74	64	65	62
Total:	170	188	165	153	174
USE:					
Own consumption	76	94	87	83	96
Production use	3	3	3	3	3
Export	38	36	27	27	25
Ending stocks	54	55	49	41	51

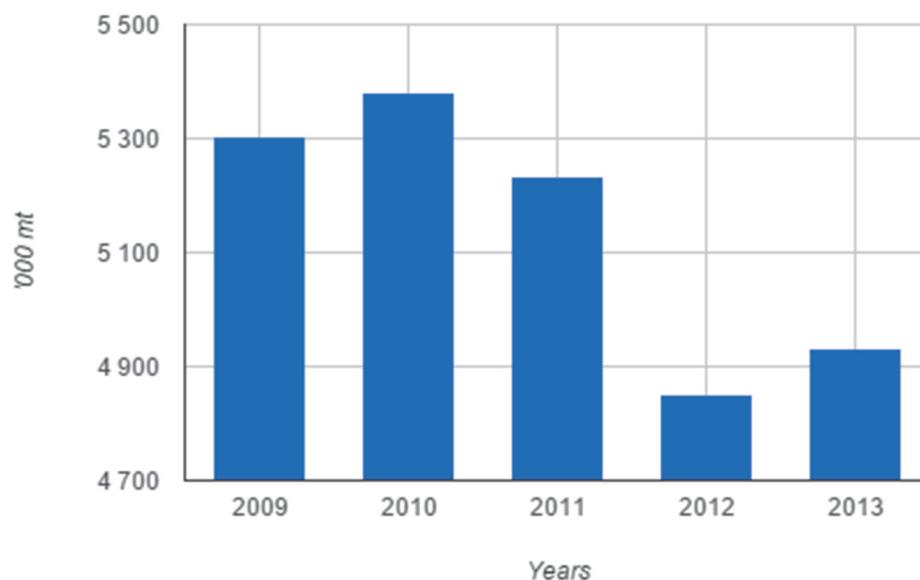
The main provinces where fish is produced are located near the main lakes: Atyrau, (40 percent of total), Kyzylorda (14 percent), Almaty (14 percent), South- Kazakhstan (11 percent) and East-Kazakhstan (10 percent).

3.7 Milk

Milk types produced in Kazakhstan include the following:

- Cow (99.2 percent in 2013)
- Horse (0.5 percent)
- Goat (0.04 percent)
- Camel (0.3 percent)

Figure 3.37. Milk production in Kazakhstan in 2009-2013, in '000 mt (Source: Committee on Statistics)



Milk is mainly produced by households: 84 percent in 2013 (Figure 3.38). The figure also shows value of the produced milk, which in total constitutes 14 percent in the total gross agricultural product.

Table 3.6. presents a balance for milk and milk products. On the supply side, the share of imports was about 10 percent of the production quantity. On the use side, the main use was for own consumption for food. FAOSTAT breaks down the use in a slightly different way in 2011: food - 75 percent, feed - 12 percent, processing - 11 percent and the rest (waste, other and exports) 2 percent.

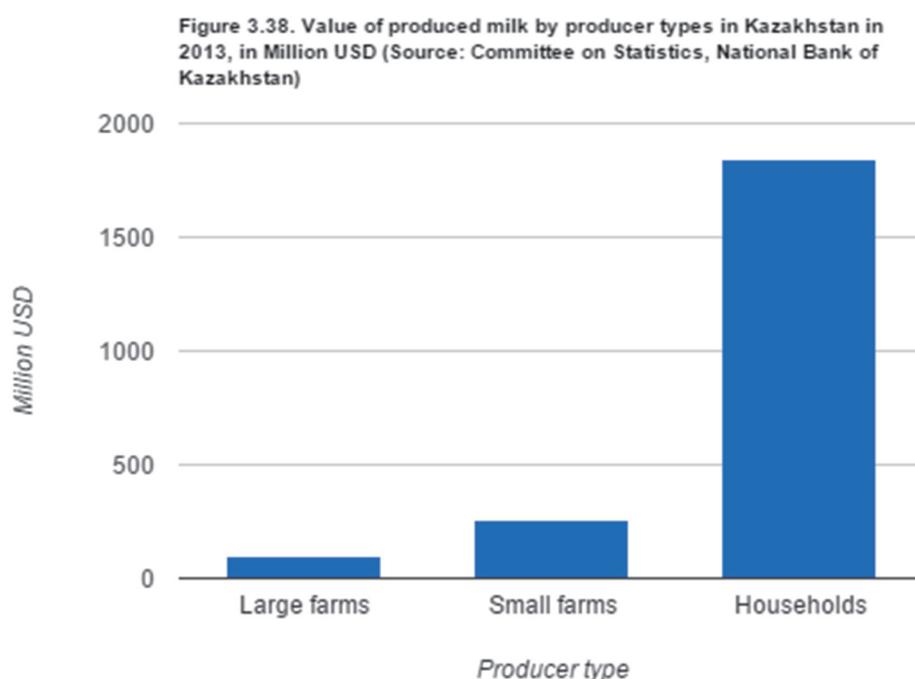


Table 3.6. Balance of milk and milk products in Kazakhstan, in thousand tonnes (Source: Committee on Statistics)

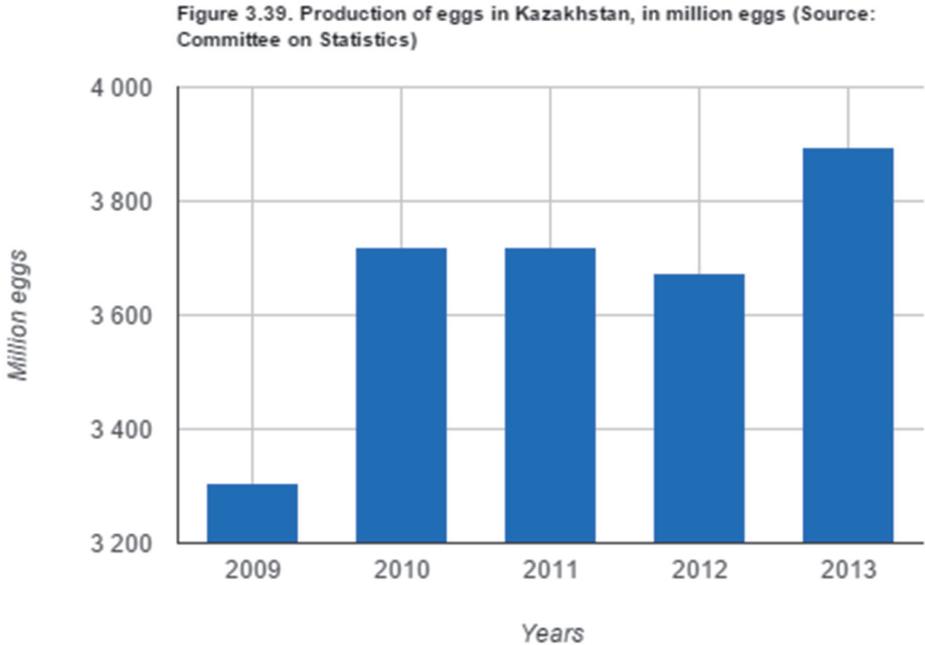
	2009	2010	2011	2012	2013
SUPPLY:					
Beg. stocks	609.1	619.9	610.4	609.1	574.3
Production	5 303.9	5 381.2	5 232.5	4 851.6	4 930.3
Import	544.0	357.0	502.2	521.3	538.5
Total:	6 457.0	6 358.1	6 345.1	5 982.0	6 043.1
USE:					
Own consumption	4 168.3	4 065.4	4 098.5	3 886.3	4 077.7
Production use (feed)	1 621.5	1 645.1	1 599.7	1 483.2	1 507.3
Export	14.4	4.7	5.4	7.7	30.3
Losses	32.3	31.8	31.7	29.9	30.2
Ending stocks	619.9	610.4	609.1	574.3	397.0

Milk production is spread all over the country. The three main milk producing provinces in 2013 were East-Kazakhstan (15 percent), South-Kazakhstan (14 percent) and Almaty (14 percent). The same provinces were among the top ones for both types of meat production.

3.8 Eggs

Egg types produced in Kazakhstan include:

- Hens: 99.6 percent (of total in 2013)
- Goose: 0.17 percent
- Duck: 0.20 percent
- Other: 0.06 percent



Hen’s eggs are the most commonly produced type of eggs produced in Kazakhstan (99.6 percent). The value of eggs produced was USD 324 million in 2012.

Table 3.7. provides the balance of eggs in Kazakhstan for 2009-2013. The main source of eggs is local production, and they are mainly consumed as food.

Egg production is mainly done at large poultry farms (66 percent), which are totally market oriented. Thirty three percent of eggs are produced in households, which produce eggs for their own consumption, although a small proportion is marketed. Small farms produce (less than 1 percent of the total).

Egg production is spread all over the country, but the top three egg producing provinces are Almaty (23 percent), Karagandy (14 percent) and Akmola (13 percent).

Table 3.7. Balance of eggs and egg products in Kazakhstan, in million eggs (Source: Committee on Statistics)

	2009	2010	2011	2012	2013
SUPPLY:					
Beg. stocks	117.1	201.0	127.8	143.3	115.6
Production	3 306.4	3 720.4	3 718.5	3 673.4	3 896.0
Import	462.0	234.2	300.5	128.2	123.6
Total:	3 885.5	4 155.6	4 146.8	3 944.9	4 135.2
USE:					
Own consumption	3 360.2	3 693.9	3 650.3	3 493.9	3 597.0
Production use (feed)	89.4	95.6	103.7	90.7	95.1
Production use (incubation)	196.1	196.7	197.2	200.8	205.0
Export	0.0	0.1	0.2	0.4	0.0
Losses	38.9	41.6	52.1	43.4	41.4
Ending stocks	201.0	127.8	143.3	115.6	196.7

4. ASSESSMENT OF FLW IN SELECTED AGRI-FOOD CHAINS

4.1 Identification of priority agri-food chains

Based on the previous chapter, the following five priority agri-food chains for detailed Critical Loss Point analysis have been selected based on their economic importance, employment generation, contribution to foreign exchange and contribution to food security:

1. Cereals: milling wheat
2. Oilseeds: sunflower seeds
3. Roots and tubers / Fruit and vegetables: potatoes
4. Meat: beef
5. Milk

4.2 Description of priority agri-food chains

This section describes agri-food chains of the above selected products, including chain components and organizations, chain flows, components that will be analyzed in-depth.

Wheat

The wheat flow chain is presented in Figure 4.1. In most cases, wheat from the field goes to growers' warehouses, where it goes through primary cleaning and drying, if possible. This is done in order to:

- Separate residues/admixture and use them for either animal feeding or sell it as an animal feed either to animal farmers or to households
- Transport less foreign material from the farm to the elevator
- Have less deductions during acceptance at the elevator
- Have lower costs for drying and cleaning at the elevator

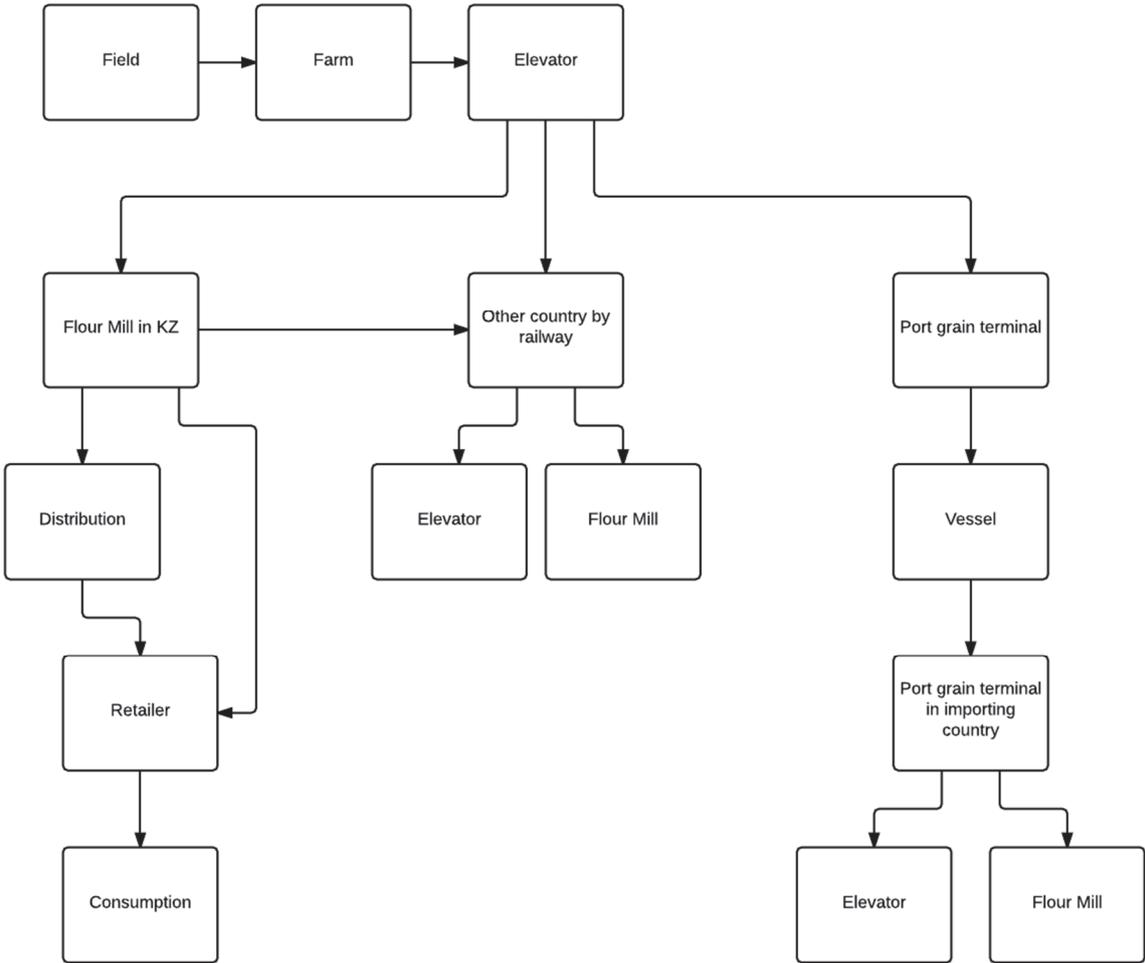
After the product has gone through cleaning, it is stored on-farm and later transported to the elevator. The duration of storage usually depends on the financial requirements of the farmer and the moisture of the product (if a farmer does not have a dryer). If he needs cash then it is not stored for a long time on the farm. However, if a farmer has the chance to wait, then he takes some time because prices are higher after the harvest season is over. In some areas wheat is transported directly to flour mills.

All elevators and flour mills in Kazakhstan use 'basis conditions' for the acceptance and storage of wheat. This includes moisture, admixture (or foreign material) and grain admixture (damaged, broken grain, other grains, as barley, oat, etc.) levels, which allow the product to be stored normally and have homogenous parcels/lots. These conditions are usually determined in accordance with the local standard for wheat. For example, in Kazakhstan, the standard is called ST RK 1046-2008 "Wheat. Technical conditions", which has the following levels for the indicated specifications: 14 percent moisture, 2 percent foreign material and 5 percent grain admixture. If the product has higher than the basic conditions (wet and/or impure), then the elevator dries and cleans the

product in order to bring it to the required levels. For this, elevator charges the farmer and in addition to costs the quantity is also deducted.

Almost all farmers were dissatisfied with the way most elevators operate at acceptance. They think that the elevators show incorrect data on the moisture and admixture, so that their product is subject to higher moisture and admixture. In this case the elevators may earn additional money on their cleaning and drying services and get some extra unaccounted grain. The extent of fraud differs depending on the elevator. In some cases farmers do not bring their wheat to the nearest elevator, but drive several hundred kilometers to another elevator with a better reputation.

Figure 4.1. Wheat flow chain in Kazakhstan



Elevators, which are located on railways in most cases, provide storage for farmers. Millers and traders usually buy wheat, which is already delivered and stored at these elevators against a document called a grain receipt. When the miller or trader decides to ship its wheat from the elevator, they provide railcars or trucks and the elevator makes the discharge of the product into them. After the shipment, grain is transported to its destination; e.g. to mills or to other countries or to port grain terminals. At port grain terminals, wheat is stored and shipped into vessels, which travel to destination ports, where a similar transport procedure is carried out, but in reverse.

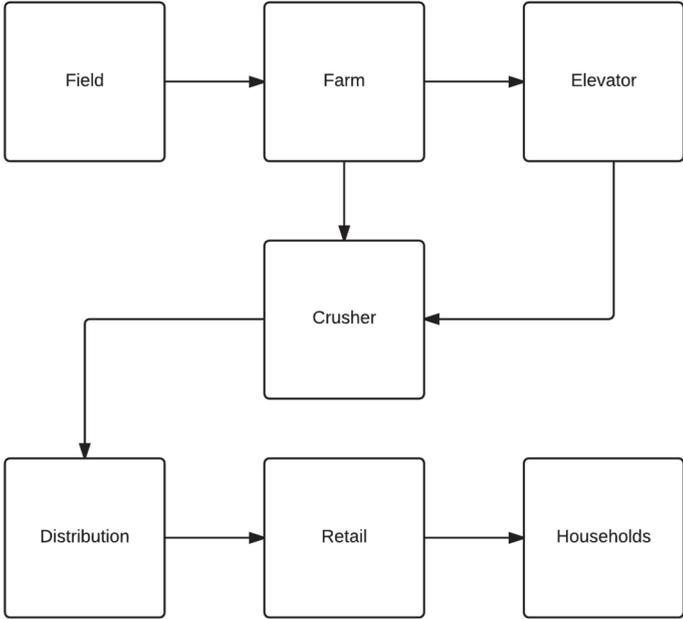
Sunflower seeds

Sunflower seeds, like wheat, also follow from the field to farmers’ warehouses for cleaning and drying – if possible – for the same reasons. Depending on the region and the proximity of the sunflower seed crushers (oil plants), the seeds are either transported to the crushers directly or to the elevator.

Basis conditions are described in the standard GOST 22391-89 “Sunflower. Requirements for state purchases and deliveries” and include: moisture 7 percent, admixture 1 percent, oilseed admixture 3 percent.

The main buyers of sunflower seeds in Kazakhstan are local crushers and in most cases this product is not exported. The crushers produce sunflower oil, which goes through several stages (e.g. hydration, neutralization, freezing, filtering, deodorization) so that finally it is called “refined oil”. Then the oil is bottled in 0.5 L. 1.0 L. 2.0 L and 5.0 L plastic bottles and distributed through (in most cases) the companies’ own distribution networks, which work with retailers. Households buy the oil in retail outlets and use it mainly for frying and adding into salads.

Figure 4.2. Sunflower seed flow chain in Kazakhstan

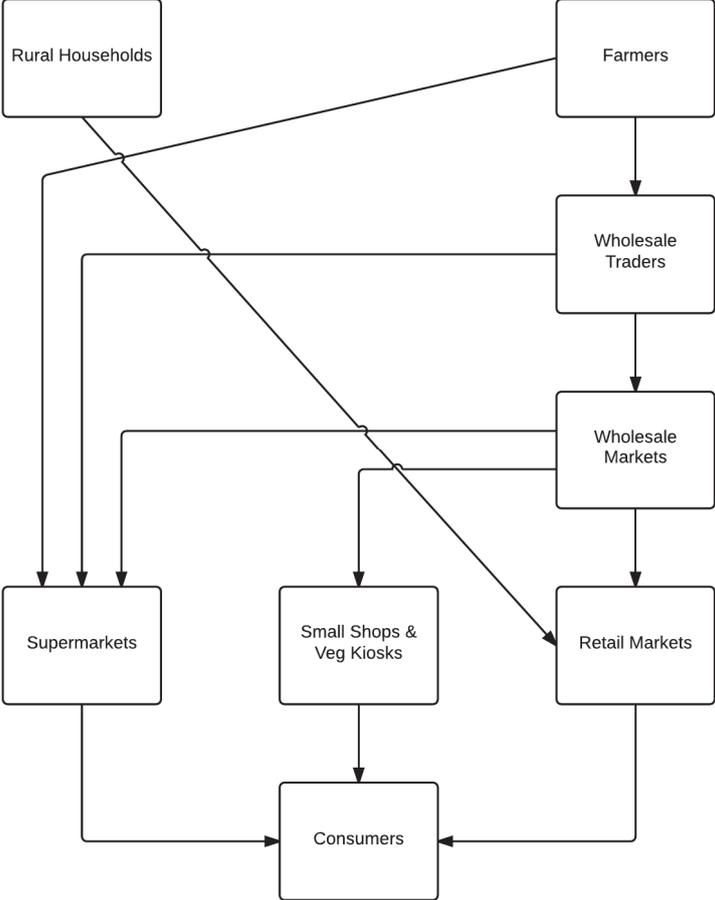


Potatoes

Domestic potato production almost covers domestic consumption and less than 10 percent of consumption is imported. This mainly happens before the arrival of the new crop (June-July). More potatoes are produced than consumed. However, due to a lack of adequate storage until the new crop, some domestically produced potatoes are sold after harvest (mainly to Russia) and stocks usually run out in April-May. During June-July, imported potatoes dominate the market (from Kyrgyzstan, Russia, Pakistan, China).

The main producers of potatoes in Kazakhstan are rural households. Most of them grow the crop for their own consumption, although they do sell some on retail markets. The main domestic suppliers are farms, which tend to be smaller than wheat and sunflower farms. This is due to higher per ha investment costs and more intensive and labor-consuming technologies. Description of the potato chain will be done mainly on the example of such market-oriented farms (Figure 4.3.).

Figure 4.3. Potato flow chain in Kazakhstan



Potato farmers usually store their products in warehouses. The main buyers are wholesale traders who collect the product by truck. Some supermarkets work directly with farmers. In some regions, owners of warehouses buy potatoes from farms and operate as wholesale markets.

In recent years, the government initiated a program of regional food reserves, under which a government company signs agreements with farmers and warehouses to buy and store their products. Sales from warehouses are mainly done when there is a deficit on the market, in most cases at the end of the season, before the new crop.

Wholesale traders bring potatoes in trucks to wholesale markets in cities and sell to retailers. Retailers sell potatoes on retail markets and fruit and vegetable shops and kiosks.

Consumers usually buy from retailers, although some visit wholesale markets in order to buy at lower prices.

Beef

The beef flow chain (Figure 4.3) differs slightly depending on the producer. As described in Chapter 3, households are the main producers, accounting for 80 percent of total production.

Households produce beef for their own consumption and for sale. Meat from households is usually bought by small-scale meat traders, who drive between villages and cities and collect meat. For individual households it would be costly to bring one animal to the city since transport costs per kg would be high and household farmers tend not to know how wholesale markets operate in the city. Traders usually buy 3-10 animals and bring them to the wholesale market in the city.

Pricing in the villages is done in most cases by trader's visual estimation of the animal's weight and no scales are used. If the household and the trader agree on the weight and price per kg and the total value, then the animal is slaughtered in the household yard or at a slaughterhouse, if it is not too far. The seller provides all necessary documents to the trader for transportation and marketing. The trader usually takes the carcass, by-products (liver, heart, kidney, etc.) and the skin for the agreed total value. Traders do not usually take the stomach and intestines.

Once the animal has been slaughtered and the trader has collected enough meat, he decides where to market it. Depending on the market situation, he can sell either at the wholesale market, to supermarkets and meat stores or to meat processing plants.

Operations at farm and large companies are usually more organized: there are special staff, there are scales and some may have special refrigerated trucks. The operations sell their meat to wholesale traders, supermarkets and processing plants. Some do export, especially Russia, although is not a widespread practice.

Meat wholesale traders, meat retailers, supermarkets and meat processing plants meet at wholesale markets. These markets open early in morning the before retailers open. Meat retailers usually sell their meat on bazaars and markets. Retail outlets buy several carcasses, split them to parts and sell the parts at different prices. End-buyers/population visit the retail outlets and buy needed parts and quantity.

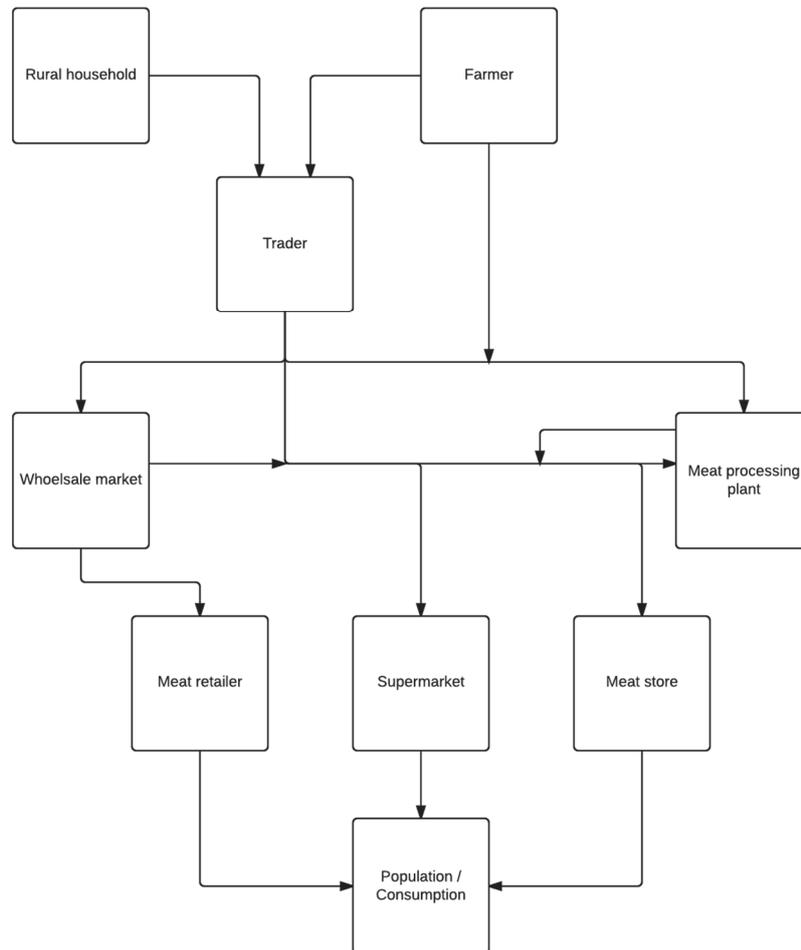
People usually buy chilled meat and store it in refrigerators. Meat is usually consumed in portions is not usually wasted.

In addition to the above, there are several local traditions related to meat consumption:

- Animals are slaughtered in advance for winter. In Kazakh it is called "согым" (Sogym), which means that whole animals are slaughtered (sometimes shared) and stored at home in the refrigerator and consumed throughout winter. The majority of the rural Kazakh population does this and many urban dwellers also continue to do so. Sogym animals are usually bought by consumers directly from the producers.
- Cooking a lot of meat for various occasions / events (e.g. weddings, funerals and anniversaries). During these occasions, too much meat is usually cooked. If it is not eaten (which is usual), then it is given to guests. Depending on the celebration and the number of guests several animals are usually slaughtered (horses, in most cases). This most probably takes place not only in Kazakhstan, but also in Kyrgyzstan, Azerbaijan and other neighboring countries.

- Feast of sacrifice ('Id Al-Adha, Kurban Ait, Kurban Bayram). This is an Islamic holiday which considers slaughtering a sheep (or goat) by every family or a cow by several families jointly. The meat is usually distributed among the poor, cooked for invited relatives and friends, while some is kept to be consumed later.

Figure 4.4. Beef flow chain in Kazakhstan



Milk

According to statistics from, the Milk Union of Kazakhstan and dairy producers, about 85 percent of milk is produced by rural households. About 25-30 percent of this total is used for processing. The rest is consumed by households and used as feed. In this section, only marketed and processed milk is described.

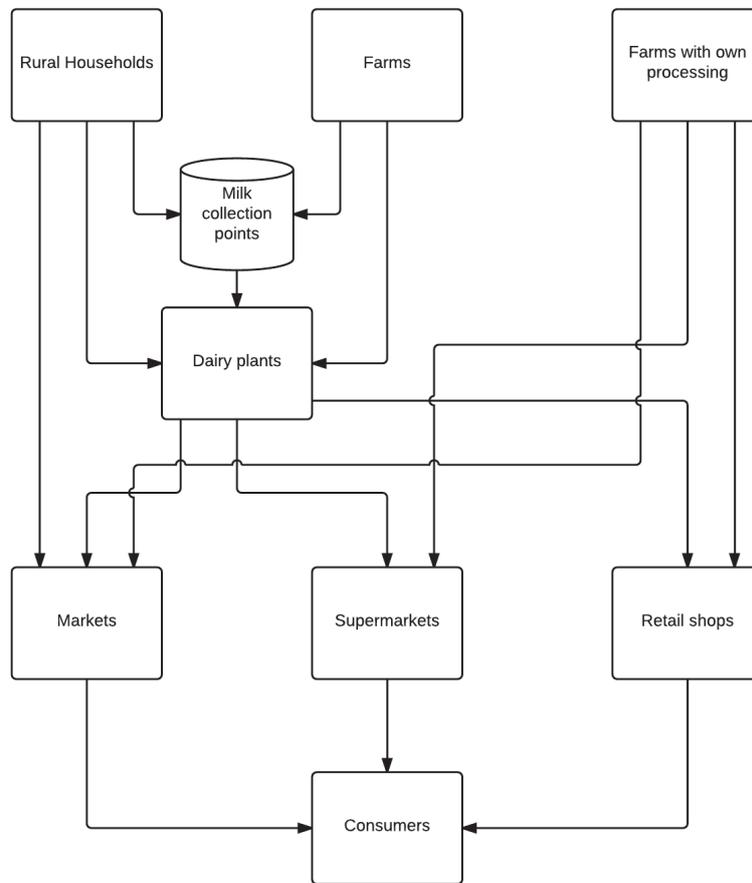
Rural households are mainly subsistence-oriented and sell their milk when there is a surplus. In general, they are characterized as having simple growing conditions, poor genetics, and milking and milk storage is simple.

Most small and medium sized farms produce milk to sell to processing plants. Large farms also sell to milk processing plants. Some of them process milk themselves, making several products.

There are two main types of logistics chain for milk and milk products (Figure 4.4.):

- Milk is produced at one site and then marketed to milk processing plants.
- Milk is produced and processed in one place (farms with own processing).

Figure 4.5. Milk flow chain in Kazakhstan



Most dairy plants do not have their own dairy farms. Some have started to invest in dairy farming and rely on both sources. Depending on the plant and the distance, milk may be collected directly by trucks with milk tanks or there may be milk collecting points where milk is collected and then transported. Milk collecting points filter, chill and store the milk. Quality control is done by express tests on trucks or at milk collecting points. About 15 quality indicators are applied at purchase, the most important of which are a microbial test, thermal stability and oil and protein content. As soon as milk is received by dairy plants, it is filtered, chilled down, and stored before processing. After milk is processed, the dairy products are shipped to wholesale warehouses, and then distributed to retail outlets. Most such plants produce a wide variety of products. Pasteurized milk is uncommon and UHT milk is preferred due to its longer shelf-life. Many of these plants also use milk powder during periods of fresh milk deficit, mainly in winter.

Dairy farms which do milk production and processing has simpler logistical chain. Milk is produced, then processed and then distributed to retail outlets directly. They are mostly located near large cities and also produce a wide variety of dairy products. Milk is mainly pasteurized and not UHT. Milk powder is very uncommon.

The large size of the country creates some difficulties and differences in milk production. The main difficulties are the long distances between milk producers, high milk collection costs and provision of quality assurance during transportation. The main differences are: the northern and eastern parts of the country have relatively more areas for grazing, there are more relatively large milk

producers and there are dairy plants that have their own livestock; the southern part of the country is characterized by higher population density, fewer grazing areas, smaller milk producers and dairy plants that most rely on milk produced offsite; in the west of the country there are much fewer grazing areas. There are also fewer dairy plants and the region mainly imports dairy products from other regions.

4.3 Assessment of food losses and waste and critical loss points

This section analyzes points in the agri-food chains where FLW have the highest magnitude, the highest impact on food security, and the highest effect on the economic result of the FSC.

The FLW will be analyzed along the following stages:

- Production
- Postharvest handling and storage
- Processing and packaging
- Distribution
- Consumption at household level

The analysis of FLW at production level is done from the moment the product is ready to be harvested / slaughtered / collected. Production technology and possible reduction of yield / weight / quantity due to application of improper technology are not described, since this is subject to a separate technological study and a lot of materials and studies are already available on this.

Wheat

Production stage of wheat includes the FLW during:

- Combine-harvesting
- Transportation to the farm warehouse or to the elevator directly

Like in Ukraine (and many other countries), wheat producers can be divided into three major groups depending on how technically they are equipped; namely, large, medium-sized and small.

Large producers are usually called grain holdings and consist of several medium-scale farms, with a head-office doing central management operations (centralized input purchases, sales, financial management, production coordination). Such holdings in Kazakhstan usually have from about 50 000 ha up to over 1 million ha each. Such companies are usually more equipped with modern western machinery, like John Deere, Claas and New Holland. Combines of these brands usually have high efficiency and result in the lowest losses.

Medium-sized producers usually have from 5 000 ha to 30 000 ha. In general these are former Soviet farms (sovkhoz, kolkhoz). They have a certain management structure on-site which has agronomic, accounting and planning departments, production brigades (responsible for a certain acreage of the cropland), as well as engineering services (responsible for maintenance of the machinery). Medium-sized producers usually have less access (compared to agro-holdings) to financial resources and leasing possibilities (which may be a positive factor in the end). However, depending on the management, they also use modern western machinery, sometimes of a smaller size. In most cases though, medium-sized producers use top Russian combines, such as Vector and Acros. These combines have lower productivity than western brands, but they do not cause greater losses and they are more affordable.

Small producers are usually family-owned farms, usually with no more than 3 000 ha. The owner of the farm does most of the work himself and sometimes attracts machinery services from outside. In most cases small producers have old machinery from Soviet times. Very few small producers use modern western machinery. If a new combine is bought, then in most cases this is a Russian Vector or Enisei. In recent years combines assembled in Kazakhstan have become available, including as Esil and Vector. Small farmers usually do not need highly productive western brands since they do not have large areas and yields are much lower than what these combines are manufactured for. On average, small producers have higher losses due to the combines.

Figure 4.6. Combines in Kazakhstan



Source: author's collection.

There are usually optimal periods when the crop is ready to be harvested and the weather is still good. At this point, the number of combines a farm has is important since it allows harvesting to be completed in the optimal period. If this period is missed, then the weather may change and the harvesting may be extended. If it rains, the moisture of the grain increases and the protein and gluten levels decrease. If the rain lasts too long, then grain may sprout on the plant. If it snows, then crop may be left under the snow and harvested in spring with lower quality. Or, if it is harvested, then losses increase, since the presence of snow and high moisture make it more difficult to harvest.

The condition of the machinery is important. If it is maintained well, then fewer breakdowns occur and less time is lost to repairs. With expensive machinery, additional time is required until service staff from the dealer arrives and makes the repair.

The number of trucks is important in order to have continuous transportation of grain from the field to the warehouse or the elevator. If there is a deficit, combines wait until empty trucks return.

On-farm storage space plays an important role, since it allows the crop to be collected locally and after harvesting, to be moved to the elevator, which can sometimes be more than 100 km away. If space is limited, then trucks need to spend more time transporting grain to the elevator, which leads to increased idle time for the combines.

Property factor plays some role in the magnitude of FLW. If the farm is managed and/or operated by the owners, then production and business processes are settled up in a way that efficiency is always controlled. This could be a case of small and medium-sized farmers. However, if the farm is managed by hired staff and the connection between the owners and the management is weak, this creates a risk of lower efficiency of operation and higher losses. This case is more applicable to grain holdings.

Entrepreneurship also plays a role in the extent of FLW. If the farm manager is not afraid to try new technologies and is ready to take some risks, then usually their business is more successful and losses are lower.

The size of the farm plays a role in the extent of losses. If the farm is too large and geographically dispersed, this usually leads to lower operating efficiency and higher losses. This is known as 'extensive development'. There is widespread consensus that 'intensive development' should be given more focus, where increasing production technology, operating efficiency and reduction of losses (of goods, time, resources, etc.) is the most important factor (especially in Kazakhstan's environment, where farming is acknowledged to be risky).

Weather during harvesting plays an important role in the extent of losses. The ideal weather during harvesting is dry, sunny with no rain and snow. However this is not usually the case and 2013 and 2014 were very hard in terms of harvesting in Kazakhstan. There was dry weather during the beginning of the vegetation period and rains came a month later than usual, which led to shift of maturation. Wheat is normally harvested in September-October. But in these years the wheat was ripe only at the end of September or the beginning of October. When farmers started harvesting, continuous rain and cold weather hampered their efforts. This did not allow for any field operation which lead to harvesting being stopped. Finally harvesting was done in October-November before snow covered the crop. Most of the crop was harvested at very high moisture and losses were prevalent. Some of the harvest was left under the snow.

Losses during transportation are usually not critical since farmers control the hermeticity of the truck beds and cover the grain with a tent. Truck drivers are trained to do this and are responsible for this.

One of the factors affecting losses during transportation is a theft of grain. Sometimes a truck full of grain does not drive to the warehouse or elevator directly, but stops off at a house and part or even full load is discharged. Grain is also regularly stolen from warehouses. Drivers are usually involved in this because they either get paid, re-sell the grain or use it to feed their yard animals. Such cases are becoming less widespread, but still occur. In most cases this happens at grain holdings and large farms, where the distances are long, the management is weak and it is hard to control the movement of trucks. In order to reduce this, companies have separate security staff, who drive around the farm and control the movement of goods and resources. Companies also use GPS to control the movement of trucks.

Theft of grain (and other resources) not only during transportation, but throughout agribusiness, is a serious problem for the industry. Sometimes this becomes critical to the overall success of the company. There are some cases in which this problem has been successfully controlled.

In Kazakhstan, an interesting story is of a company called 'Agrofirma TNK'. This company works on 200 000 ha, has several elevators, a large livestock business and a lot of other activities. The company made a large investment in computer technologies which allow it to control the production processes. The achievements are impressive.

Another success story is a Russian company 'Avangard Agro', which has about 300 000 ha. There is an article in the Forbes Russia magazine (July 2013), where control of theft and losses were described. The article says: '*... decisive part of the success in this field he (the owner) attributes to a computer program which was written under his supervision. The program does not manage growth of wheat or barley - it gives the owner a possibility to control people and personally look after all processes in the company*'.

Postharvest handling and storage stage includes the following:

- Cleaning and drying on farm

- Storage on farm
- Acceptance of the grain by the elevator
- Storage at the elevator

On-farm operations are usually done with the farmer's supervision and losses are not significant in normal years. Residues after cleaning (grain screenings) are either used to feed animals or sold to people in villages to feed their own animals. Grain is stored in concrete buildings and is moved within the warehouse if there is a risk of it heating due to high moisture. In abnormal years, when the crop is large and storage space is not enough, there may be some losses, especially if grain was left outside without shelter. In 2011 there were lots of cases like this.

In most cases, when farmers need to sell their wheat, they bring it to the elevator for sale, which was described above in more detail. Almost all farmers complained of how elevators assessed the quality of their wheat. In most cases elevators show a higher admixture and moisture and lower gluten content; i.e. downgrading. This brings higher losses, more service costs and a decrease of the value of the goods. Some farmers argue that the directors of elevators find extra grain, in order to sell it further and make additional personal earnings.

As soon as wheat is accepted and a grain receipt is issued, the quantity and quality are fixed. When wheat is transported out of the elevator, acceptance of wheat by the owner is done according to this document. Weighing is done on railcar scales and quality is usually tested by supervision companies at shipment. This way grain owners control the risk of getting less and lower quality. Further control of quality and quantity along the transport chain (rail, port terminal, sea transport) is done by attracting supervision companies, like SGS. They look at the weight, take samples and perform quality testing. All this is done in order to meet contract requirements and avoid any financial losses. Quality usually does not change, but quantity may slightly fluctuate within ranges, approved by the industry as normal.

Processing and packaging stage includes:

- Acceptance of wheat by a miller
- Processing into flour
- Packaging of flour
- Shipment and transportation of flour to distribution locations

This stage can be characterized as having low losses. All operations are done within a closed territory and processes are automated. Measurements are made at every stage on scales and labs test the quality. The main product, wheat flour, is packed in 50kg bags (or sometimes smaller bags), if prepared for a retail sale. Another main product, wheat bran, is also sold as an animal feed. It can be sold as it is pellet form. Wheat screenings, which are residues after flour and bran, are also sold as an animal feed. As it can be seen from this short description, almost everything is used, has a value and sold.

In bread baking, this sub-industry has less turnover of flour and quantity and quality control is even higher, so losses are low.

Distribution stage includes:

- Shipment from the mill or wholesale warehouse or a bakery
- Delivery to retail outlets
- Retail sale

This stage can also be characterized by low losses. Shipment and delivery are usually done by respective staff. Reporting is made at every stage and the staff bear responsibility for any losses.

Since flour has a relatively long shelf-life, the problem of deterioration and losses is rare. Bread is sometimes left unsold. This is also usually controlled by the retailers in order to avoid losses (they may order less bread next time as for them it is better if the bread runs out by the end of the day, than to have some left unsold).

Consumption stage includes:

- Purchase of flour or bread or pasta
- Storage
- Consumption
- Use of uneaten products

Flour and pasta are usually bought in excess as they can be stored for a relatively long time and do not require special storage conditions. If anything cooked is left, then it is usually stored in the fridge and consumed during the next meal.

Bread is slightly different as it has a shorter shelf-life. In most cases it is bought on-demand and consumed when needed. Uneaten pieces are usually thrown away, even though throwing away bread is considered bad, especially among the elderly. The main reason for this waste is a relatively low price compared to other food products.

Sunflower seeds

Sunflower seeds, like wheat, are a field crop and have similarities in some stages of the chain.

Production stage also includes:

- Harvesting
- Transportation to the farm warehouse or to the elevator or to the crusher directly

Harvesting of sunflower seeds has also optimal periods. Some farmers said that it is better to harvest when there is frost and snow in the field, which leads to ripening of the plant and a reduction in moisture content. General factors affecting losses during the harvest have similarities with wheat and include the following:

- Number of combines
- Condition of the combines
- Number of trucks
- Size of on-farm storage
- Private vs hired management
- Entrepreneurship of the farmer
- Farm size
- Weather during harvesting
- Theft

Postharvest handling and storage is similar to wheat and complaints over acceptance of the seeds by elevators and crushers are similar: in addition to moisture and admixture, oil content is an additional important indicator.

Processing and packaging stage includes:

- Acceptance of sunflower seeds by a crusher
- Production of oil
- Packaging of oil into bottles
- Shipment and transportation of oil to distribution locations

This stage can also be characterized as having low losses. All operations are done in a closed territory and processes are automated. Measurements are made at every stage on scales and labs test the quality. The main product, sunflower seed oil, is packed in 0.5 L, 1 L, 2 L and 5 L bottles. Another main product, sunflower meal, is sold as an animal feed ingredient. Once oil is extracted from the seeds, the residual material goes as meal - so losses are minimal. Almost everything is used, has a value and is sold.

Distribution stage includes:

- Shipment from the oil mill or wholesale warehouse
- Delivery to retail outlets
- Retail sale

This stage can also be characterized by low losses. Shipment and delivery are usually done by staff. Reporting is done at every stage and staff bear responsibility for any losses. Since bottled oil has a relatively long shelf-life, the problem of deterioration and losses is rare.

Consumption stage includes:

- Purchase of oil
- Storage
- Consumption

Bottled oil does not require special storage conditions; it can be stored for a long time and usually used on-demand without waste. It is mainly used for frying and as a dressing for salads.

Potatoes

Production stage includes harvesting and initial sorting of the product. Potato harvesting is done by special potato harvesters. Some farms use more manual work during harvesting, some less. In recent years, more modern machinery for harvesting and sorting has been bought by potato farmers (e.g. Grimme).

Since potatoes are also a field crop, some general factors described in wheat and sunflower seeds are also applicable for potatoes.

As soon as potatoes are harvested, they are sorted in the field by hand or using a machine. In some cases bagging is done in the field. After that the product goes into the storage.

Losses at this stage include: potatoes being left in the soil, damaged potatoes during harvesting, and rejected potatoes in the field due to inappropriate size and appearance.

Postharvest handling and storage include the following operations: sorting the product mainly into three categories (1) food/market, 2) seed, and 3) small/rejection), bagging in 35-45 kg bags, and storage. After that potatoes are shipped mainly in trucks, about 20 tonnes each.

Losses at this stage are found due to discarding substandard product: small and 'bad' looking potatoes. Some losses could be due to human or machinery errors, but this does not have a constant value on all farms. Farmers say that the rate of rejection could be reduced by growing 'good' varieties, which provide not only high yields and taste, but also normal size and appearance. Due to this, the potato seed market is dominated by seeds from Germany and the Netherlands.

Another reason of losses is a lack of adequate storage facilities with normal ventilation and temperature control. A couple of years ago, about 50 percent of one regional potato stock was spoiled. Most existing warehouses are old and do not meet potato storage requirements. Some years ago, the government started a program to finance (loans and leasing) building modern warehouses for vegetables. Due to this, some modern warehouses appeared in various regions, which helped reduce losses and supply potatoes during deficit periods.

Distribution stage includes transactions by wholesalers and retailers. When they buy potatoes, they pay attention to the size, appearance, color and variety (affecting taste and shelf-life) as consumers are not willing to buy a substandard product.

Losses at this stage include rejection of substandard product, and losses during transportation and storage mainly due to inadequate storage conditions. In order to reduce losses during transportation and storage, potatoes need to go through a special pre-storage stage on farm (treatment stage). When potatoes ripen, the skin of damaged products gets stronger, and the flavour becomes better. During this period there are requirements for temperature, ventilation, and moisture. After this period, those potatoes that cannot be stored further and can affect other healthy potatoes are sorted out. Other storage phases also require special conditions, but they will not be described, since it is a technological question.

Consumption stage includes purchase by consumers, storage, cooking and eating. During purchase, consumers pay attention to the size, appearance and color, in addition to price. Storage is usually done in dark, cool places in order to avoid rot and germination. Cooking is done after peeling. If potatoes are of low quality, then more skin is peeled. Losses during eating are not significant and if anything is left, then it is stored in the refrigerator and usually consumed during the next meal.

Beef

Since most beef is produced in households and animals are sold one-by-one in most cases, the description of the chain focuses on this segment of the market.

Production stage includes slaughter of an animal. This is usually done at household yards. The meat, internal organs and skin are usually taken by the buyer/meat trader. The stomach and guts are left for animal owners and are usually consumed. Losses are usually minimal since everything is made by hand and under close control.

Pricing is usually done by visual estimation of an animal and its condition (e.g. fat content and age). Traders said that they usually know the approximate weight of an animal and tell their ideas with some deduction in order to cover the risk of overestimation and to get a 'bonus'. If an animal owner is an experienced person, then they may argue with the trader. In these cases scales are sometimes used. Traders are not keen on using scales as estimations is usually done in their favor. Also, traders usually see that a seller needs money and use their 'monopoly status'. In case of farms, they use scales and such cases don't happen.

Postharvest handling and storage includes transportation of the carcass to wholesale markets, supermarkets or processing plants. Losses are usually not observed here, since this is done under close control of a trader.

Weight loss can be observed due to some evaporation, blood leakage or freezing (during winter). One trader said that weight change from 2 to 10 kg out of 100 kg (2-10 percent). However, this is not an actual loss but only a change in the moisture level.

Quality may change when carcasses are transported during hot weather and meat can start to smell. In order to avoid this, traders usually slaughter animals at night or in the early morning while it is cool and dark. The timing of slaughters in summer also depends on the distance from the village to the market: the longer the distance, the earlier the animal is slaughtered, and transportation is done at night.

Processing and packaging includes:

- Retail outlets: split of the carcass to the parts
- Processing plants: processing into sausages, splitting, and production of smoked meats

Retail outlets usually buy the carcasses and split them into parts, which are sold at different prices. The byproducts of splitting are sold as separately or converted into minced meat. Losses are almost zero since everything is made by hand and is closely monitored. Meat is stored in market refrigerators. The amount of meat bought and sold is usually managed on-demand and sellers try to buy only what can be sold in one day.

Processing plants are usually automated and sausage production is a technological procedure with low losses. During production of smoked meat, splitting is done by hand and meat is smoked using special equipment. Meat that cannot be smoked is used for sausage production.

Distribution stage includes:

- Meat: through markets, supermarkets and meat stores
- Sausages and smoked meats: through markets, supermarkets and stores

Meat losses are usually not observed at this stage, since meat is bought and sold and any losses lead to monetary losses.

Sausages and smoked meats have a longer shelf-life and can be sold over several days. Additional amounts are usually bought when previous product has almost run out.

Consumption stage includes:

- Meat consumption
- Sausages and smoked meats consumption

Meat is usually bought on-demand and stored in freezers or refrigerators. Meat is cooked on demand and is not usually left uneaten.

Sausages and smoked meats are also bought on demand and stored in refrigerators.

Losses of meat and meat products are very low since they have relatively higher prices. Another factor: meat is very flavoursome and desirable, unlike bread or potatoes for example.

Milk

Production stage of the chain includes milking. At households milking is done by hand and milk is collected in buckets. Many farms also use hand milking in buckets and collection in milk tanks for

further shipment. Some farms use automated milking with collection in milk tanks. Losses during milking mainly occur due to human and mechanical errors, which are rare.

One potential loss of milk for human consumption is when milk is used as feed. Some milk farms use a calf milk replacement (milk substitute). This could increase the amount of milk supplied to the market for human consumption.

Postharvest handling and storage stage includes filtration, chilling, storage and transportation of the milk. Households use simple but effective techniques: filtration through gauze or bandage tissue, chilling and storage in a refrigerator or cool, dark place. Farms use automated processes and special milk tanks. Transportation is mainly done by trucks with milk tanks, some of which have temperature control. Losses at this stage mainly occur due to improper cooling and storage and transportation conditions and spillage.

Processing and packaging stage is usually fully automated, although various technologies are used, which affect the shelf-life. Losses are usually minimal. Only if the final product does not meet the requirements or there are any mistakes in production is the whole produced lot may be removed from the process. This mainly happens due to human error and at newly established plants.

Distribution stage can also be characterized by low losses. Shipment and delivery are usually done by staff, reporting is done at every stage and staff bear responsibility for any losses. Possible losses occur if anything is broken or packing is damaged. Another reason for losses is if the product is unsold before the expiry date.

Consumption stage has also low losses. The most common reason is spoilage due to improper storage or expiration of 'use by' date. Wasting of dairy products is a rare case since it is consumed at smaller quantities – than bread or potatoes for example – and is more expensive.

4.4 Summary

This section provides a summary of overall losses and waste in the priority food chains, for each stage of the food value chain according to the estimated weight percentages.

The value intervals represent averages for best and worst case scenarios. Extreme situations (or force-majeure), like hail, strong wind and epidemics are not included in the estimation.

Agricultural production stage is one of the stages in which the largest losses along the food chains occur. The greatest losses at this stage are noticed for potatoes, wheat and sunflowers as they are field crops and depend greatly on harvesting conditions, the size of the producers and they type of harvesting machines.

Table 4.1. Weight percentages of food losses and waste (in percentage wheat enters each step), in percent

	<i>Agricultural production</i>	<i>Postharvest handling and storage</i>	<i>Processing and packaging</i>	<i>Distribution</i>	<i>Consumption at household level</i>
<i>Cereals (Wheat)</i>	5-20%	5-10%	1-3%	1-2%	5-15%
<i>Oilseeds and pulses (Sunflower)</i>	5-15%	5-10%	1-2%	1-2%	1-2%
<i>Roots & Tubers (Potato)</i>	10-20%	10-30%	3-5%	10-15%	5-15%

<i>Meat (Beef)</i>	1-3%	3-5%	1-2%	1-2%	1-2%
<i>Milk (Cow milk)</i>	3-5%	5-10%	1-2%	5-10%	1-5%

Postharvest handling and storage stage is also one of the stages where the largest losses occur, especially for potatoes, wheat, sunflower and milk. For potatoes and milk the main reasons for losses are inadequate storage conditions, whereas for wheat and sunflowers it is misinformation about quality by elevators and crushers.

Processing and packaging stage is observed to have lower losses than previous stages. This is mainly due to the fact that main operations are done by machines where losses are low. The largest value is found with potatoes, which could be explained by additional sorting during bagging.

Distribution stage also has lower level of losses, since in most cases it is a processed and packed product and it is controlled and accounted for by special staff. The highest levels of losses are observed with potatoes and milk caused by inadequate storage conditions and/or due to expiration.

Consumption stage has different values. The highest losses are found for wheat and potatoes. This is mainly explained by much lower price for the products and less attention to the issue of losses and waste.

Losses and waste at every stage always lead to monetary losses. In the initial stages this could be explained as a loss of possible income, while in the next stages it means actual monetary losses, as money is spent on purchasing the products.

All stakeholders along the food chains are aware of losses. They understand them and try to reduce them by applying various measures including investment in production, processing, storage and other technologies.

5. ANALYSIS OF KEY FACTORS FOR FLW

This section analyzes key factors that impact the magnitude of FLW in the five priority agri-food chains identified for Kazakhstan..

- *Weather during harvesting.* Weather during harvesting plays an important role in the size of losses. Ideal weather during harvesting would be a dry, sunny with no rain and snow. However, perfect conditions are uncommon. In 2013 and 2014 harvesting in Kazakhstan was very difficult. On average, there was dry weather at the beginning of the vegetation period and rains came one month later than usual, which led to a shift of maturation. Wheat is normally harvested in September-October but these years it was ripe only at the end of September / beginning of October. When farmers started harvesting, the weather was cold and wet. This did not allow field operations, which lead to a stoppage in harvesting. Finally, harvesting was done in October-November before snow covered the crop. Most of the crop was harvested at very high moisture and losses and some of it was left under the snow.
- *Type of harvesting machinery.* Use of efficient modern machinery may result in lower losses during harvesting. Whereas use of outdated technologies result in higher losses.
- *Inadequate storage facilities.* There is a lack of adequate storage facilities with normal ventilation and temperature control for potatoes. A couple of years ago, about 50 percent of one regional potato stock was spoiled. Most existing warehouses are old and do not meet potato storage requirements. Some years ago, the government started a program to finance (loans and leasing) building of modern warehouses for vegetables. Due to this, a number of modern warehouses appeared in some regions, which could help to reduce losses and supply potatoes during deficit periods.
- *Number of harvesting machines.* Harvesting usually has optimal periods when the crop is ready to be harvested and the weather is still appropriate. At this point, the number of combines at the farm is important since it allows harvesting to be completed in the optimal period. If this period is missed, then the weather may change and the harvesting may be extended. If it rains, the moisture of the grain increases and protein and gluten levels decrease. If rains are too long, then grain may sprout on the plant. If it snows, then the crop may be left under the snow and harvested in spring with lower quality. Or, if harvested, then losses increase, since the presence of snow and high moisture make it more difficult to harvest.
- *Condition of the harvesting machinery.* If the machinery is maintained well, there are fewer breakdowns and less time is spent on repairs. For expensive machinery, additional time is required until service staff from the dealer arrive to make the repair.
- *Number of trucks.* This is important in order to have non-stop transportation of grain from the field to the warehouse or the elevator. If there are not enough trucks, combines wait until empty trucks are back.
- *Size of on-farm storage.* On-farm storage space plays an important role, since this step allows the crop to be collected locally and after completion of the harvesting to be moved to the elevator or markets, which can sometimes be more than 100 km away. If space is limited, then more time is needed for transportation, which leads to increased idle time / stoppage of the combines.
- *Private vs hired management.* The property factor plays a role in the extent of FLW. If the farm is managed and/or operated by the owner, then production and business processes

are more efficient. This is usually the case for small and medium-sized farmers. However, if the farm is managed by hired staff and the connection between the owners and the management is weak, this creates a risk of lower efficiency of operation and higher losses. This case is more applicable to grain holdings.

- *Entrepreneurship of the farmer.* Entrepreneurship also plays some role in the extent of FLW. If the farm manager is not afraid to try new technologies and is ready to take some risks, then their business is usually more successful and losses are lower.
- *Farm size.* Size of the farm plays a role in the extent of losses. If the farm is too large and geographically dispersed, then it usually has lower operating efficiency and higher losses. This is known as 'extensive development'. There is widespread consensus that 'intensive development' should be given more focus, where increasing production technology, operating efficiency and reduction of losses (of goods, time, resources, etc.) is the most important factor (especially in Kazakhstan's environment, where farming is acknowledged to be risky).
- *Theft of products.* One of the factors affecting losses during transportation is a theft of products, especially grain. Sometimes it happens that a truck full of grain is diverted to the driver's home (or another place), where part or even full load is discharged. Grain is also stolen from the warehouse. Drivers are usually involved in this because they either get paid for the theft, sell the grain on or use it to feed animals. Such cases are becoming less widespread, but do still occur. In most cases this happens at grain holdings and large farms, where the distances are long, management is weak and it is hard to control the movement of trucks. In order to reduce this, companies often have a separate security staff, which drive around the farm and control movement of goods and resources. Companies also use GPS to control the movement of trucks.
- *Assessment of quality by elevators and oil crushers.* Almost all farmers complained about how elevators assessed the quality of their wheat. In most cases elevators show higher admixture and moisture and lower gluten content, i.e. downgrading. This brings higher losses, higher service costs and decrease of the value of the goods. Some farmers argue that directors of elevators do this to make extra money for themselves. For sunflowers, in addition to moisture and admixture, oil content is an important indicator.
- *Relatively low price for wheat products and potato.* One of the reasons for the relatively higher rate of losses of bread and potatoes is that consumers do not worry about financial losses caused by discarding these products due to their low price.
- *Use of improper varieties.* With potatoes, this leads to a higher rate of rejection due to small size and appearance.
- *Inadequate estimation of meat weight.* Estimation of live animal weight and slaughtered weight is usually done by visual assessment by the trader at the household level. This leads to underestimation of the weight in most cases. Use of scales could improve the situation.
- *Inadequate transportation methods.* When transporting perishable products over long distances, the truck becomes a temporary storage. The problem of inadequate storage conditions is described above.
- *Qualification of people, involved in the whole chain.* When people lack professional knowledge and skills about how to produce, handle, transport, process, store and distribute their products, this may lead to higher losses of products.
- *Inadequate equipment for postharvest handling.* This may lead to higher rate of products being refused or separated as a substandard product or a foreign matter.
- *Number of railcars in the country.* In years with large crops, elevators are usually limited in their capacity to accept all grain during a short period of time. In order to be able to

accept extra grain, already accepted grain has to be shipped quickly. In this situation, the number of railcars plays an important role, since there were cases when traders wanted to make the shipment, but the railway company was not able to provide enough railcars at short notice.

- *Lack of cooperation.* Potato, meat and milk producers could potentially benefit from cooperation by building collection, handling and storage facilities for common use. Also, in some respects, cooperation in production could be beneficial for all parties.
- *Access to loans and leasing.* Since reduction of losses in some part is related to machinery and equipment, this implies investment in production and postharvest technologies. Some farmers have poor access to loans and leasing possibilities, which leads to no changes with losses and waste of their products.
- *Low level of involvement of research and science.* Scientific and research institutes could potentially be advisors to the business about how to reduce level of losses and waste. However, agricultural science and research needs help itself in order to improve its overall operational efficiency.
- *Condition of business climate.* Since almost all food production is done by businesses, the environment in which businesses operate is very important. It affects the operating efficiency of the existing business and willingness of people to make investments for the future business or expansion of the existing business. As mentioned in the report, a lot of measures require investments and many improvements need financing of expenses by the business. A World Bank ranking called "Doing Business" could be one of the tools to measure this environment. According to this ranking, Kazakhstan's rank is No 77. Main factors downgrading the rank are: (1) trading across borders - rank 185, (2) dealing with construction permits - 154, and (3) getting electricity - 97.

6. PRIORITY ACTIONS AND POLICIES FOR REDUCTION OF FLW

This section is comprised of two parts. Firstly a brief overview is provided of government agri-food policy priorities, support programs and activities related to selected agri-food chains. Secondly a series of recommendations are provided of potential initiatives to monitor levels of losses and waste and to reduce losses and waste at critical loss points identified early in this study.

6.1 The enabling environment for agri-food chain performance.

In general, the whole state support of agriculture is included in six programs/directions:

1. Business road-map
2. Agribusiness 2020
3. Exporter 2020
4. Employment 2020
5. Productivity 2020
6. Development of innovations and investments

Main activities within these programs are:

1. Business road-map:

- Support of new business initiatives
- Rehabilitation of the business sector
- Support of export-oriented productions
- Improvement of entrepreneurship potential

2. Agribusiness 2020:

- Financial rehabilitation of agricultural companies
- Improvement of economic access to of goods and services for agricultural companies
- Development of government procurement systems for agricultural companies
- Improvement of efficiency of government regulation system in agriculture

3. Exporter 2020:

- Service support of exporters
- Reimbursement of expenses for exporters
- Financing of export trade operations

4. Employment 2020:

- Education and assistance with employment of self-employed, unemployed and poor population
- Assistance with entrepreneurship development in rural areas
- Mobility improvement of labor resources

5. Productivity 2020:

- Improvement of management and production technologies in companies
- Modernization (technical re-equipping) and of existing and creation of new competitive productions

6. Development of innovations and investments:

- Innovation grant for purchase of technologies
- Innovation grant for adoption of management and production technologies
- Technological business incubation services
- Investment preferences: exemption from customs duties, tax preferences, industrial preferences, state natural grants

The main program related to agriculture is Agribusiness 2020. It has many components and those of which are related to the five priority agri-food chains will be briefly described here.

Wheat:

- Free expertise on sowing seeds.
- Subsidy for elite seeds up to 40 percent.
- Subsidized loan with for sowing and harvesting works from KazAgro (government agent).
- Subsidy for fertilizers and herbicides - up to 50 percent (domestically produced) and up to 30 percent (imported chemicals).
- Subsidies for fuel and other materials per 1 ha - up to 40 percent (the higher the level of technology, the higher the subsidy rate).
- Subsidized interest rate for leasing of machinery - 7 percent of 14 percent will be covered by the government.

Sunflowers:

- Free expertise on sowing seeds.
- Subsidy for elite seeds up to 40 percent.
- Subsidized loan with for sowing and harvesting works from KazAgro (government agent).
- Subsidy for fertilizers and herbicides - up to 50 percent (domestically produced) and up to 30 percent (imported chemicals).
- Subsidies for fuel and other materials per 1 ha - up to 40 percent (the higher the level of technology, the higher the subsidy rate).
- Subsidized interest rate for leasing of machinery - 7 percent of 14 percent will be covered by the government.
- Subsidy for irrigation water - from 20 percent up to 90 percent depending on the irrigation method.

Potatoes:

- Free expertise on sowing seeds.
- Subsidy for elite seeds up to 40 percent.
- Subsidized loan with for sowing and harvesting works from KazAgro (government agent).
- Subsidy for fertilizers and herbicides - up to 50 percent (domestically produced) and up to 30 percent (imported chemicals).
- Subsidies for fuel and other materials per 1 ha - up to 40 percent (the rate is higher with drip irrigation).
- Subsidized interest rate for leasing of machinery - 7 percent of 14 percent will be covered by the government.
- Subsidy for irrigation water - from 20 percent up to 90 percent depending on the irrigation method.

Beef:

- Three levels of technology are supported.
- Level 1: 220 KZT¹ per kg, number of cattle stall from 3 000 animals, slaughtered live weight from 450 kg.
- Level 2: 170 KZT per kg, number of cattle stall from 1 500 animals, slaughtered live weight from 420 kg.
- Level 3: 120 KZT per kg, number of animals fattened per year min 400, slaughtered live weight from 400 kg.
- Feed (succulent and rough) subsidies - up to 50 percent. 4 500 KZT per cow condition to existing areas and breeding stocks from 30 cows.

Milk:

- Three levels of technology are supported.
- Level 1: 25 KZT per kg, number of breeding stock of cows and heifers (min two years old) from 400 animals, number of milking cows and heifers min 350 animals, average milk yield min 4 500 kg per year, the production should be in a form of a dairy complex/facility.
- Level 2: 15 KZT per kg, number of breeding stock of cows and heifers (min two years old) from 400 animals, number of milking cows and heifers min 300 animals, average milk yield min 3 250 kg per year, the production should be with machine milking.
- Level 3: 10 KZT per kg, number of breeding stock of cows and heifers (min two years old) from 100 animals, number of milking cows and heifers min 60 animals, average milk yield min 2 500 kg per year.
- Support for establishment of new and extension of existing dairy farms for 50 and 100 animals. Purchase of pedigree breed stock of dairy breed and necessary machinery and equipment. Loan amount - up to 60 million KZT per farm at 4 percent subsidized interest rate and 11 percent non-subsidized interest rate.

General cattle breeding support measures for beef and milk:

- Subsidization of pedigree young stock purchase - up to 50 percent depending on the origin: Kazakhstan (118 000 KZT per animal), Australia, USA, Canada, Argentina, Brazil (235 000 KZT), EU (154 000 KZT), Russia, Ukraine, Belarus (118 000 KZT for heifers of dairy breed).
- Subsidization of breeding and selection activity. Cows and heifers of beef and dairy breeds - 14 000 KZT per animal.
- Subsidization of artificial insemination and embryo transplantation: 18 000 KZT per embryo; 600 KZT per one dose of domestic digenous semen; 1 100 KZT per one dose of imported digenous semen; 3 300 KZT per one dose of imported unigenous semen.
- Subsidization of maintenance of pedigree stud/service bulls of beef breed for public/community herds - 104 000 KZT per animal.

Credit financing (operated by government companies Agrarian Credit Corporation, KazAgroFinance, Fund of Financial Support for Agriculture):

- Development of existing production: purchase of animals, equipment, operating expenses, construction, processing of agricultural products. Interest rate 6-14 percent, up to 10 years, from 1 Million KZT.

¹ Official exchange rate on 31 Dec 2014 (National Bank): USD 1 = KZT 182.35.

- Investment projects: construction and installation works, equipment and machinery. Interest rate 6 percent, up to 12 years, co-financing from 15 percent.
- Loans and leasing for machinery and equipment: from 5 to 10 years, at 12,8 percent interest rate (with subsidy 5,8 percent or 2,8 percent).
- Micro-credits for starting entrepreneurs: up to 4.5 years, 6 percent interest rate, up to 3 million KZT.
- Other programs similar to mentioned above.

Above mentioned support measures are the main ones. Smaller programmes and detailed info on above and smaller programmes could be obtained at respective Ministries and agencies involved in this process.

6.2 Actions and policy proposals

In this section, key factors that impact the magnitude of FLW in the five priority agri-food chains identified for Kazakhstan during the study are presented and ways possible solutions are suggested.

Weather during harvesting.

- This is the most difficult factor for the farmers to handle.
- Research and experienced farmers suggest using varieties with different vegetation periods in order to manage the risk.
- Use of efficient machinery capable to work under hard conditions would help to reduce losses.
- Use of desiccation in order to speed-up the maturation process in cases when vegetation is extended.
- Installation of cleaning and drying equipment on farms could help in saving the harvested crop.
- Research could make a study around developed countries and their practices in such situations. Results could be distributed among the farmers.

Type, number and condition of harvesting machinery. Number of trucks on farm. Inadequate equipment for post-harvest handling. Size of on-farm storage.

- It is known to everyone that new and efficient machinery operates better than old units. But it is dependent on financial ability of the farmers. This also refers to post-harvest handling equipment and the size of on-farm storage since it requires investment in construction or reconstruction.
- Cooperation among small and 'financially weaker' farmers could give them a chance to access new harvesting machinery. There are several government support programs facilitate the purchase of machinery with interest rates lower than the average market level.

Inadequate storage facilities.

- This problem is more related to potatoes. Everyone understands its importance. Recent launch of government programs for support of construction vegetable warehouses and purchase of equipment for them at lower interest rates already supported several initiatives in the regions.
- Cooperation among potato farmers.
- Better dissemination of information on available opportunities could be one of the ways.

- Increase of the budget of the program could also be one of the ways to solve the problem.

Private vs hired management.

- This is fully up to the owners of the business.
- Management training could partially be a measure to improve the situation. Cooperation between them and agencies performing the training could be an advice in this situation.

Entrepreneurship of farmers. Use of improper varieties. Qualification of people, involved in the whole chain.

- Training of farmers and stakeholders along the product chain could be a part of the measure.
- More active involvement of the farmers to the existing training programs.

Farm size.

- This is fully up to the owners of the business.
- Management training could partially be a measure to improve the situation. Cooperation between them and agencies performing the training could be a solution.

Theft of products.

- Security staff on farm.
- Use of IT technologies to control the movement of materials.
- Training of people.
- Increase of remuneration.

Assessment of quality by elevators and oil crushers.

- Involvement of independent inspection companies for testing the quality.
- Regulation from the government giving farmers a power to use data from inspection companies for acceptance of their products as final and binding.

Relatively low price for wheat products and potatoes.

- Educating children to change their attitude to food and any other resources.
- Information campaigns to save food.

Inadequate estimation of meat weight.

- Use of scales by households. This would allow households to control the weight of the meat they sell, better negotiate with the traders, have less unaccounted amount and finally get more revenue for their meat.

Inadequate transportation methods.

- Use of trucks with refrigerators. This mainly refers to perishable products like meat and milk for long distances during summertime.

Number of railcars in the country.

- More railcars are needed for the transportation of grain. Their deficit causes stocking of grain at the terminal/railway elevators and reduced overall turnover of grain, which brings to more grain that need to be temporarily stored on farms. There are a lot of discussions about this issue and some measures have been taken, such cooperation with Russian and other CIS railway companies.

Lack of cooperation.

- This issue is being actively discussed in the Ministry of Agriculture. Recently a draft bill on agricultural cooperation was prepared in cooperation with FAO and other international organizations. The draft bill is available on the web-site of the ministry.

Access to loans and leasing.

- Better involvement of farmers into available government programs on financing, leasing and financial rehabilitation.
- Improvement of bureaucratic procedures at the agencies operating the government programmes.

Low level of involvement of research and science.

- Existing system of agricultural science and research need to be reformed. Ministry of Agriculture recently initiated an activity to do this. More cooperation with international organizations and national agricultural research systems from developed countries could positively contribute into the process.

Improvement of business climate.

- World Bank ranking "Doing Business" ranked Kazakhstan as No 77. Main reason is low ranks in the following topics: (1) trading across borders - rank 185, (2) dealing with construction permits - 154, and (3) getting electricity - 97. All 3 factors also have relation to agriculture. These factors are looked at in detail below. This means that the government should pay attention to these factors in order to improve the business climate.
- Trading across borders: too many documents, long time to export and import, high cost to export and import.
- Dealing with construction permits: too many procedures.
- Getting electricity: many procedures, and long time.

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