FAO INVESTMENT CENTRE / EBRD
COOPERATION PROGRAMME

REPORT SERIES - N. 18 - SEPTEMBER 2013

Ukraine

Improving Milk Supply in Northern Ukraine

Technical assistance to Ukraine's dairy sector

European Bank
for Reconstruction and Development

Food and Agriculture Organization
of the United Nations

FAO INVESTMENT CENTRE / EBRD
COOPERATION PROGRAMME

REPORT SERIES - N. 18 - SEPTEMBER 2013

Ukraine

Improving Milk Supply in Northern Ukraine

Technical assistance to Ukraine's dairy sector

European Bank
for Reconstruction and Development

Food and Agriculture Organization
of the United Nations

ISBN 978-92-5-107938-6 (print)
E-ISBN 978-92-5-107939-3 (PDF)

For further information please contact:
Director
Investment Centre Division
Food and Agriculture Organization of the United Nations (FAO)
Viale delle Terme di Caracalla
00153 Rome, Italy
e-mail: Investment-Centre@fao.org.

TABLE OF CONTENTS

FOREWORD

Ukraine is a net exporter of milk and dairy products. However, in recent years, its dairy exports have been steadily declining as imports gradually rise. The main issue affecting the sector is the decreasing quantity and poor quality of raw material, due to the large share of milk produced by household farms.

In December 2007, the European Bank for Reconstruction and Development (EBRD) acquired 17.5 percent in one of the largest cheese producers in Ukraine, OJSC Shostka City Milk Factory, owned by the French Groupe Bel, one of the world's leading branded cheese manufacturers. In order to help this dairy processor maintain and improve its relationship with the local milk suppliers, who were facing serious quality and supply problems, EBRD called upon FAO to conduct milk sector analysis and provide rural household dairy farmers' training. The team carried out an overall analysis of the dairy sector in Ukraine to identify its constraints and opportunities and to initiate policy discussions with a wider group of stakeholders. FAO also partnered with local agricultural educators in Sumy to provide training to household farmers under the FAO/EBRD Cooperation and in partnership with Bel-Shostka, a member of Groupe Bel and an EBRD client. The present report summarizes the FAO-EBRD technical assistance project and presents the analytical work conducted in 2008-2011 to address the sector's development issues.

The project "Improving Milk Supply in Northern Ukraine: Technical Assistance to the Ukraine's Dairy Sector" aimed at improving milk supply, mainly through farmers' training on animal nutrition, dairy cattle management, sanitary issues, milk quality, logistics and the overall milk collection process and to demonstrate positive effects to dairy farmers throughout the region. It also allowed the testing of some important hypotheses regarding investment in milk production efficiency, quality, and seasonality issues by various types of milk producers under specific conditions of northern Ukraine. While most project activities were conducted in the context of EBRD's investment with Bel, conclusions are applicable to the sector as a whole. Initial findings were communicated to national professional media.

This report presents the output of the main activities implemented under the FAO/EBRD technical assistance project, including the analytical work and training activities conducted under the project between 2008 and 2011. The report consists of three chapters: Chapter 1 provides a review of Ukraine's dairy sector, Chapter 2 contains household and commercial dairy farm investment models while Chapter 3 describes rural household dairy farmer training activities in selected communities of Sumy oblast of Ukraine.

ACKNOWLEDGEMENTS

This report was prepared by the Investment Centre Division of the Food and Agricultural Organization of the United Nations (FAO) under FAO/EBRD cooperation to present the achievements of the project "Improving Milk Supply in Northern Ukraine: Technical Assistance to the Ukraine's Dairy Sector". The project was financed by FAO and a grant from the Government of Taiwan provided to the EBRD. Dr. Yan Kuo Chen, an EBRD consultant, provided initial analysis of the raw milk collection system in Ukraine at the beginning of the project.

Dmitry Prikhodko, Economist, Investment Centre, FAO, supervised the overall preparation of the report. Andriy Yarmak, Economist, Investment Centre, FAO, was the main author of Chapter 1, in particular sections on milk production, processing seasonality, supply chain, concentration and trends, leading milk producers and processors, prices, consumption, trade, quality issues, differences in technologies of milk production between Ukraine and the European Union (EU), with inputs from the Ukrainian Agribusiness Club. Sections on dairy policy were prepared by Andriy Yarmak and Dmitry Prikhodko, while sections on gender aspects, seasonality of milk prices and costs perspectives were prepared by Dmitry Prikhodko and Vasyl Hovhera, Economist, Investment Centre, FAO. Dmitry Prikhodko wrote the section on rural smallholder milk production in Turkey. Yves Baraton, International Dairy Specialist, provided background information on investment and dairy feeding costs.

Vasyl Hovhera and Dmitry Prikhodko authored Chapter 2. The initial dairy sector business models for both rural households and commercial dairy farms were prepared in collaboration with Nikolay Vernitsky, Director of ProAgro, and Valerii Karuna, Agribusiness Specialist at ProAgro.

Inna Punda, Programme Officer, Agribusiness Specialist, Investment Centre, FAO, and Dmitry Prikhodko prepared Chapter 3 based on inputs from the Sumy National Agrarian University (SNAU), in particular from Dr Volodymyr Ladyka (Project Leader), Dr Larysa Kalachevskaya (Project Co-leader), Dr Aleksandr Sverdlikov (Dairy Cattle Management Specialist), Dr Yurii Baidevlyatov (Dairy Cattle Health and Milk Hygiene Specialist), Dr Viktor Opara (Dairy Cattle Feeding Specialist) and Sergey Guzhvenko (Specialist of Dairy Cattle Economics at the Household Level). Research assistance on trade statistics was provided by Ivan Vinkovic, Intern, Investment Centre, FAO.

The authors would like to express their gratitude to the Ministry of Agrarian Policy and Food of Ukraine and the State Administration of the Sumy oblast for their valuable support, as well as to the communities of Stepne, Obrazhiyivka and Bilogryve for facilitating farmers' surveys, training, milk testing and other project activities.

Special thanks are extended to Chafiq Hammadi, Macej Mirski, Mykola Tolkachov, and Myron Pundor from Bel-Shostka for helping the FAO team to identify pilot communities and household farms and for their insights on the Ukrainian dairy sector. Bel-Shostka also provided invaluable logistical support to the FAO team throughout the Project and actively supported the farmer training activities.

The report benefited from useful comments from Ekaterina Krivonos, Economist, Trade and Markets Division, FAO; Yoshiko Ishihara, Rural Sociologist, Investment Centre, FAO; Lisa Paglietti, Economist, Investment Centre, FAO; and Andriy Rozstalnyy, Animal Health and Production Officer, FAO Regional Office for Europe and Central Asia.

Lesya Kuzmenko, Senior Banker and Project Operations Leader, EBRD, also provided valuable suggestions and comments. Anja Langenbucher and Antoine Deroide, both from the EBRD, provided guidance at the earlier stages of the project.

The authors would finally like to thank David McDonald, Anastasia Clafferty, Nada Zvekic and Genevieve Joy for assisting with the publishing of the report and its dissemination through the EastAgri website (http://www.eastagri.org). Eliane Di Cinto and the entire Investment Centre administrative team provided efficient support throughout the course of the project to ensure its smooth implementation.

ACRONYMS AND ABBREVIATIONS

AR	Autonomic Republic
BC	Bacteria count
DSTU	Ukrainian National Standard
EBRD	European Bank for Reconstruction and Development
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FOB	Free on board
FSU	Former Soviet Union
IRR	Internal rate of return
JSC	Joint stock company
LLC	Limited liability company
MARA	Ministry of Agriculture and Rural Affairs of Turkey
MT	Metric tonne
MY	Marketing year
NPV	Net present value
OECD	Organisation for Economic Co-operation and Development
ROR	Rate of return
SNAU	Sumy National Agrarian University
SCC	Somatic cells count
SSS	State Statistics Service of Ukraine
UAH	Ukrainian hryvnia (Ukrainian national currency)
UHT	Ultra high temperature
USA	United States of America
USD	United States Dollar
VAT	Value-added tax
WTO	World Trade Organization

EXECUTIVE SUMMARY

Chapter 1 - Ukrainian dairy sector review

Chapter 1 of the report provides an overview of Ukraine's dairy sector.

Production

Cow milk constitutes 98 percent of all milk produced in Ukraine with the remaining 2 percent of milk coming from goats and sheep. Milk production has experienced a decline since the country's independence in 1991 and this agricultural sub-sector is one of the few where this trend has not abated. In spite of this, Ukraine remains an overall net exporter of dairy products.

During the early transition period of 1990-2000, rural households[1] increasingly resorted to subsistence farming and food self-sufficiency and added to the number of cows they held. In 2000, however, the number of cows per rural household started to decrease. In 2009, milk production of commercial farms increased for the first time since the 1990s, but continued to decline at household farms. Despite this shift in milk production trends by different farm types, rural households still account for about 80 percent of all milk produced.

As opposed to dairy cattle inventories, the productivity of dairy cows in Ukraine has been increasing since the mid-1990s, reflecting the sector's improvements in feed conversion and more rational use of farm resources as compared with Soviet times. In 2002-2003, milk yields exceeded levels achieved in the late 1980s during the time of Soviet Ukraine. Average cow milk productivity increased by an impressive 48 percent (nearly 10 percent per year) from 2000 to 2005. Commercial dairy farms increased productivity by 86 percent (17 percent per year) and rural household farms by 23 percent (5 percent per year) during the same period. In 2010, average milk yield per cow for all types of farms was about 4 000 kg/year in Ukraine, or slightly above milk yields in the Russian Federation (3 800 kg) but below these in Poland (4 800 kg), Belarus (4 600 kg) and Western Europe (6 700 kg) according to FAOSTAT data in 2010. However, taking into consideration the favourable climate and availability of both arable land and pastures in Ukraine, there is still significant room for cow productivity growth in Ukraine.

Shifting supplier preferences of milk processors

Poor milk quality has been one of the main constraints on dairy market development. It has an immediate effect on both domestic consumption and exports, especially cheese exports. Therefore, milk processors tend to turn to commercial dairy farms which have historically produced better quality milk than rural households.

1 - Rural households farms ("households") are defined in this report in line with Ukraine's official statistics definition as several persons or one person, who live together in the same building (or its part), share common costs of living and food, and so on, and who reside in the rural areas. This category also includes these who are registered as private entrepreneurs and these who are not registered.

Ukraine has traditionally exported cheese, butter, dry milk and other dairy products, although the domestic milk processing industry has often raised concerns regarding the deficit of fluid milk supply. While rural households in Ukraine continue to be the main producers of milk, the structure of fluid milk purchases by processors has shifted in recent years towards milk produced by commercial farms[2], which accounted for 53 percent of all milk processed in 2010 as compared with 37 percent in 2006. The share of commercially produced milk in total processing already reached 58-60 percent in 2011, and will likely continue to increase at the expense of milk produced by the household sector in the future.

Milk consumption

Per capita milk consumption in Ukraine is about equal to that of the Czech Republic, Poland and Spain, and is higher than in Slovakia. The nature of consumption differs, however, as an average Ukrainian consumes less hard cheeses and other value-added dairy products, but consumes more fluid milk, soft/curd cheese and other homemade dairy products. Today, the per capita cheese consumption in Ukraine is only about a quarter of that in neighbouring Poland or France. Therefore, Ukraine's dairy sector has good domestic market growth perspectives assuming that consumer incomes will continue to increase.

Trade

The Ukrainian dairy products market is estimated at about USD 2.0-2.5 billion per year. Another USD 0.5 billion of revenues originate from the exports of dairy products, mainly cheese. The domestic milk processing sector remains highly dependent on the Russian market as 36 percent of all produced cheese, equivalent to about 20 percent of all milk processing volumes in Ukraine, is exported to the Russian Federation. In the light of trade disputes with the Russian Federation and, most recently, with the Customs Unions of Belarus, Kazakhstan and the Russian Federation, the Ukrainian industry needs to revisit its strong dependence on one single market and explore other export markets.

Dairy policy

Ukraine's policy towards the dairy sector has evolved from negative support in 2002-2007 to slightly positive support in 2008-2010, according to the Organisation for Economic Co-operation and Development (OECD) data. However, the country's sugar and pig farmers have been supported far more generously than dairy farmers in Ukraine. The comparisons of transfers to dairy producers in Ukraine, OECD countries and the Russian Federation, clearly shows that the dairy farmers in Ukraine receive less support, which can be attributed specifically to milk, than their colleagues in other countries. While transfers from government and consumers to milk producers average 30-40 percent of the latter's gross revenues in OECD countries and 10-15 percent in the Russian Federation, the Ukrainian dairy producers receive almost zero support.

2 - Here and below in this report "commercial farms" are farms which are registered as legal entities in various forms ("farm", LLC, OJSC, etc.) and produce milk for the purpose of selling it mainly to processors and, in few rare cases, at the fresh market.

There is no consistent policy towards the dairy sector in Ukraine. The existing state support programmes, in particular the *State Programme for the Development of Milk Husbandry*, are largely disconnected from the current dairy market, setting milk production targets aimed at supplying 380 kg of dairy products (in fluid milk equivalent) per person per year. This production-oriented model of state support linked to milk production or cattle numbers is not likely to work in the future.

Ukraine's commitment to ban sales of fresh milk and milk products produced by households at the retail level, including in open-air markets and other retail outlets, when the country joined the WTO in 2008, creates another uncertainty. A complete ban on milk sales by households at the open air markets/retail trade level will be difficult to enforce by the current implementation date of 1 January 2015, considering existing dairy market realities. Policymakers will likely need to revisit the issue of household milk sales with a longer implementation period and compensation for lost rural income as a result of such a ban.

Considering the above, the problems of poor milk quality and low milk cow productivity at the household level can only be resolved through a combination of proper state support policies and joint efforts of milk processors and education institutions in providing training to rural household farmers. The Government can also strengthen the regulation of sales and use of antibiotics that are frequently found in milk procured from household farms in Ukraine; and increase the focus of public agricultural education programmes on services to smallholder producers. In turn, processors can invest in the milk collection infrastructure so as to separate milk depending on its quality and introduce price premiums to reward rural households that produce higher quality milk.

Gender considerations

Rural woman are key players in milk production in Ukraine as they are largely responsible for cow milking and care. In this context, improving women's knowledge of milk quality and feeding is crucial to improving overall household income received from milk. Professional training of rural women of working age on dairy cattle feeding, management, health and cow milking hygiene, would allow them to improve their own dairy cow productivity and potentially enable them to find employment in commercial dairy farms in the future.

Chapter 2 - Testing investment feasibility of various dairy production systems

Chapter 2 of the report provides insights on the economics of dairy farm investment in Ukraine.

Focus on rural household milk producers

Rural households face multiple constraints in milk production, poor access to credit services and high interest rates (resulting in minimum use of farm machinery and investment versus family hand labour), limited availability of quality forage and concentrate feedstuffs, poor knowledge of animal nutrition and ration balancing. Recent FAO studies[3] confirmed that small-scale milk producers could compete with large-scale, capital-intensive "high-tech" dairy farming.

3 - For more details, see: www.fao.org/docrep/012/i1522e/i1522e00.htm.

There are 5.3 million rural households in Ukraine out of which nearly 2 million raise cattle. The average age of a household head is about 56 years old. However, retirees (people older than 64) raise nearly 34 percent of the cattle owned by rural households. This reveals the largely subsidiary nature of milk production by rural households as retirees often engage in dairy farming to supplement their pension income, reduce purchased food or contribute to the costs of educating their family members.

Rural household dairy farm size

According to the four specific cases reviewed under this project, the investment needs to conduct technical modernization and improve milk quality by rural household dairy farms range from UAH 75 650 (USD 9 465) to UAH 375 700 (USD 46 963) per household. For a 2-4 cow household farm, the minimum price to recoup the investment required for technical modernization exceeds UAH 5.5/kg as compared to UAH 3.7/kg, the average market price at the time of this analysis. In other words, the minimum farm gate milk price required for a viable investment in household dairy farm modernization was almost 50 percent above the market price.

Although milk processors in Ukraine are prepared to pay price premiums for better quality milk received from rural household farms, a 50 percent milk procurement price increase is not realistic for processors as their margins are limited by a number of factors, including consumer willingness and ability to pay more for dairy products and stiff competition in export markets for processed dairy products (cheese, butter, dry milk, etc.).

Only 10-12 cow dairy farms have the potential to generate a rate of return on investment above the opportunity cost of capital according to the calculations of the FAO team at current prices. However, such farms would face existing environmental and sanitary constraints set forth by applicable Ukrainian regulations. For instance, the livestock premises for a 10-12 dairy cow farm, including heifers and calves, would have to be moved outside the existing household premises in villages in order to ensure compliance with sanitary and environmental regulations. Moving the farm outside of the rural community would unavoidably further increase investment and operating costs for such household/family dairy farms as they would need to invest in new infrastructure (water and electricity supply), transportation to the new livestock premises, guarding livestock and cover other related costs. This may explain why milk production in Ukraine has not become a commercial activity for household farms and the future perspectives of milk production by rural households, the most important group of milk producers in Ukraine, are uncertain.

Addressing milk production seasonality

Milk processors would prefer that some rural households switch the currently prevailing cow calving period from March–April to September–October to somewhat reduce milk production variability throughout the years. Therefore, the FAO team researched if households would benefit from higher milk prices during the October–March (low milk production - high milk price season) period as compared with related feeding costs increases in winter. The results of the analysis revealed that switching to cow calving in October would probably allow rural households to receive higher income per cow per year than the current income level (UAH 6 634 vs. UAH 5 973). However, considering higher feed costs in winter, farmers' return on feed cost would still be higher with

the currently prevailing calving period. The current dairy herd feeding allows farmers to take full advantage of cheap pasture feeding at the time of peak milk productivity and potentially receive higher margin on feed costs: 157 percent per year in April as compared with 132 percent per year in the case of the October calving period.

At the time of this analysis, the average weighted annual milk price would have to increase by about 20 percent (from about UAH 2.48 to 2.98 per litre) to incentivize some households to change the existing calving period, herd management practices, and related farming and daily life routines in order to smooth out seasonal milk production variability.

Household dairy farmers in Ukraine have few incentives to invest in improved milk quality or increased milk production as it is difficult to address milk production and quality constraints from an investment point of view. One of the main reasons is that milk production can hardly be considered a normal commercial activity for an ageing rural population in Ukraine.

Commercial milk production by large dairy farms has expanded in recent years with farmers attracted by strong demand from processors for high-quality milk. Investment models developed under this project for 250 and 500-cow farms (provided in Chapter 2 of this report and its Annexes), show that commercial dairy production can be a viable business from an investment perspective.

Chapter 3 - Training of rural household dairy farmers

Chapter 3 of the report summarizes the achievements of the training activities conducted under the project.

Areas of training

A series of milk supply chain problems were identified at the initial stage of this project through a survey conducted by the Sumy National Agrarian University in three rural communities of the Sumy oblast: (i) the presence of antibiotics was detected in some milk samples; (ii) raw milk purchasing price was not differentiated according to milk quality; (iii) a number of other issues related to feed quality, feeding rations and milking hygiene.

Cooperation between rural households has been considered as a possible option to address milk production constraints. This is especially true in the area of milk marketing and services (i.e. milk sales through a cooperative collection point, collective feed procurement, etc.). However, the rural households interviewed in the three pilot communities showed that the number of respondents who would consider cooperating with their neighbours varied from zero to a maximum of 35 percent.

Role of milk processors in training

Processor-linked farmer training therefore focused on group trainings on issues related to dairy herd feeding, economics and health. Individual training was also provided. As evidenced by the project, responsible milk processors can provide useful consultancy and training services to household milk producers and improve access of existing public agricultural extension by these rural communities via their milk collection points.

Immediate impact of training

The regular monitoring of milk safety indicators carried out in the course of project implementation demonstrated the immediate impact of training on milk quality. Average somatic cells count (SCC) in milk samples collected before training was 298 300 per cubic centimetre. It was half of that number after farmer training. The milk samples taken at rural household level also demonstrated an increase in fat and protein content. Although the number of rural households who took part in the milk quality monitoring can be considered as representative, the long-term effects of farmer training could not be assessed within the project.

1. Ukrainian dairy sector review

Snapshot of Ukraine's dairy market: supply and demand balance for milk and main dairy products

Fluid milk

Cow milk is the most important form of milk produced in Ukraine. In 2008-2010, cow milk constituted 97.8 percent of all milk produced in Ukraine with goat milk accounting for 1.9 percent and sheep milk accounting for 0.3 percent according to FAO Stat. This milk does not enter industrial milk processing; therefore, this report focused primarily on cow milk production and processing.

It is a common opinion among Ukraine's milk processors that there is a deficit of milk supply in the country. This opinion is often shared by industry experts and agricultural officials who believe that the per capita consumption of milk and dairy products (in fluid milk equivalent) should average 380 kg per year.[4] Taking into consideration Ukraine's population of 45.6 million people, this consumption target is unrealistic, as it would require at least 17.3 million tonnes of milk per year as compared with current milk production of 11.2 million tonnes. Current consumption levels average 205 kg per person (2011), while the country continues to be a net exporter of milk with a positive trade balance of about 700 000 tonnes (see Table 1).

The Union of Dairy Companies of Ukraine believes that total milk production in Ukraine is actually 3.7-4.0 million tonnes lower than official estimates due to lower milk production at household dairy farms. However, such a drastic underestimation of production is unlikely considering that Ukraine's official statistics derive their estimates of milk production by rural households through a sample survey.[5] Observations of milk production by households during the course of this project in Sumy oblast, Ukraine, also correspond with the official statistics, though the three communities polled do not constitute a representative sample of milk production in the entire country.

4 - Per capita consumption of milk and dairy products peaked at 373 kg (fluid milk equivalent) in 1990 prior to the break-up of the Soviet Union. It has since declined continuously and approximated 205 kg/person/year in 2011 according to official statistics.

5 - The official sample survey covers all regions and districts of Ukraine. This survey covered 29 200 (or 0.5 percent) rural households, representing 2.0 percent of the agricultural land area of households. Forty-two percent of the households surveyed have dairy cattle and 40 percent have dairy cows. The selection of households was carried out in two stages according to a probability proportional to their size (PPS) by land area. In 2010, one hectare of surveyed households represented 50.9 ha of household populations on average in Ukraine.

Table 1. Supply and demand balance of milk and milk products in fluid milk equivalent in Ukraine, thousand tonnes

Fluid milk equivalent	2000	2005	2006	2007	2008	2009	2010
Production	12 658	13 714	13 287	12 262	11 761	11 610	11 249
Imports	50	112	150	199	234	455	273
Total supply	**12 708**	**13 826**	**13 437**	**12 461**	**11 995**	**12 065**	**11 522**
Processing	3 335	5 689	5 607	6 029	5 397	4 671	4 787
Other consumption (population)	6 060	4 963	5 547	4 347	4 415	5 339	4 629
Feed use	2 203	1 270	1 326	1 141	1 038	1 126	1 142
Losses	10	3	7	5	5	10	8
Exports	1 100	1 901	950	939	1 140	919	956
Total use	**12 708**	**13 826**	**13 437**	**12 461**	**11 995**	**12 065**	**11 522**

Source: Authors, based on the State Statistical Service of Ukraine.

Imports of dairy products have increased over recent years while exports have remained rather stable. Therefore, the trade balance of milk has also remained positive.

Conversely, milk processing volumes have decreased. This can be explained by both milk production decline (as Ukraine's milk processors frequently suggest) and extended use of vegetable fats for blending in the dairy industry, and increase of direct milk sales from farmers to retail customers. Certainly, the decrease in purchasing power of Ukrainian consumers has also negatively affected consumption of more expensive dairy products such as cheeses.

Cheese

High-fat, hard cheese is the most important product for the dairy industry of Ukraine. At least one third of all milk produced in Ukraine is utilized for the production of hard cheeses. However, this sector is heavily dependent on exports to only one country: the Russian Federation. Moreover, nearly 100 percent of all cheese is exported to the countries of the Customs Union of the Russian Federation, Kazakhstan and Belarus, which has unified import requirements. This points to a high dependency among Ukrainian cheese producers on a single export market (more detailed cheese foreign trade statistics are given in Table 58).

Table 2. Supply and demand balance of high-fat cheese in Ukraine, thousand tonnes

	2006	2007	2008	2009	2010
Production	217	248	245	228	220
Imports	8	12	13	9	10
Total cheese supply	**225**	**260**	**258**	**237**	**230**
Domestic consumption	175	197	179	159	150
Losses	1	1	1	1	1
Exports	49	62	77	77	79
Total cheese distribution	**225**	**260**	**258**	**237**	**230**
Consumption per person	3.73	4.22	3.87	3.46	3.26
Trade balance	40.79	50.22	64.30	67.57	69.32
Share of exports in production	23%	25%	32%	34%	36%

Source: State Statistical Service of Ukraine.

With the considerable increase in cheese exports (Table 2), dependence of cheese producers on the single export market has increased. In 2010, around 36 percent of all cheese produced was exported, while only five years ago 23 percent of produced cheese was sold outside of Ukraine (Figure 85).

Another alarming trend is declining domestic cheese consumption in Ukraine: in 2010 consumption was 15 percent lower than in 2006. This is due largely to two factors: the decrease in purchasing power of Ukrainian consumers after 2008 (consumption started declining in 2008) and consumer perception regarding the lower quality of Ukrainian cheeses. In an attempt to lower cheese production costs and prices, many producers have turned to using dry milk (see Table 4) or vegetable-based products. However, consumers with higher incomes have not favoured such a shift turning more towards fresh and whole milk products.

As a result, hard cheese consumption per person dropped 4.2 kg per year in 2007 down to 3.2 kg per year in 2010. This is a rather low per capita consumption level compared to about 8 kg per person per year in the EU.

Butter

In the past, Ukraine was a significant butter producer and exporter, but in recent years has become a net importer. Since 2006, butter production in Ukraine has declined by 28 percent. Along with decreasing production, butter quality has also deteriorated from a consumer perspective. Milk processors have started to add vegetable fats to substitute for more expensive milk fat. This move could have helped to keep prices low on butter-margarine mixes, but has not supported domestic consumption. As a result, in 2010 Ukrainians consumed about 16 percent less butter than in 2006.

Table 3. Supply and demand[6] balance of butter in Ukraine, thousand tonnes

	2006	2007	2008	2009	2010
Production	105	99	84	75	76
Imports	0	1	3	16	3
Total cheese supply	**105**	**100**	**86**	**91**	**79**
Domestic consumption	92	96	80	90	78
Losses	0	0	0	0	0
Exports	13	4	6	1	1
Total cheese distribution	**105**	**100**	**86**	**91**	**79**
Consumption per person	1.97	2.06	1.73	1.95	1.70
Trade balance	13	3	3	-15	-2

Source: State Statistical Service of Ukraine.

The butter trade balance has moved from a positive volume of 13 000 tonnes in 2006 to a negative volume of 15 000 tonnes in 2009 (see Table 57 for more detailed butter foreign trade statistics). In 2010, imports of butter somewhat decreased due to a wide range of non-tariff measures, including

6 - The authors used multiple sources of information in addition to official export and import statistics of Ukraine, in particular trade statistics from Ukraine's partner countries. Therefore, export and import estimates provided in this report may differ from those provided in Ukraine's official trade data.

stricter sanitary control of imports from Belarus, one of the main butter suppliers to Ukraine, owing to an existing free-trade agreement between the two countries[7] (Figure 82 and Figure 83).

Dry milk

Dry milk (both skimmed and whole) was the major export item of Ukraine's dairy industry when the country had a significant oversupply of fluid milk. The situation changed in the past three years, when availability of low-priced milk dropped sharply, limiting supply in the summer months – a seasonal production for milk. Another reason for lower exports was higher domestic consumption, as processors used more dry milk domestically (Table 59 and Table 60 provide more detailed dry milk foreign trade statistics).

Table 4. Supply and demand balance of dry milk[8] in Ukraine, thousand tonnes

	2006	2007	2008	2009	2010
Official production	106	125	95	67	69
Total estimated production	106	132	118	67	69
Imports	0	0	0	8	2
Total supply	**106**	**132**	**118**	**75**	**71**
Domestic utilization	10	6	7	38	36
Exports	96	126	110	37	34
Total use	**106**	**132**	**118**	**75**	**71**
Consumption per person	0.22	0.13	0.16	0.83	0.79
Trade balance	96	126	110	28	32

Source: State Statistical Service of Ukraine.

As seen from Table 4, domestic utilization of dry milk went up fivefold in the last two years, while exports dropped three to four times. Imports of dry milk, which were non-existent until 2009, also emerged to meet the demand of domestic dairy processors.

Milk production

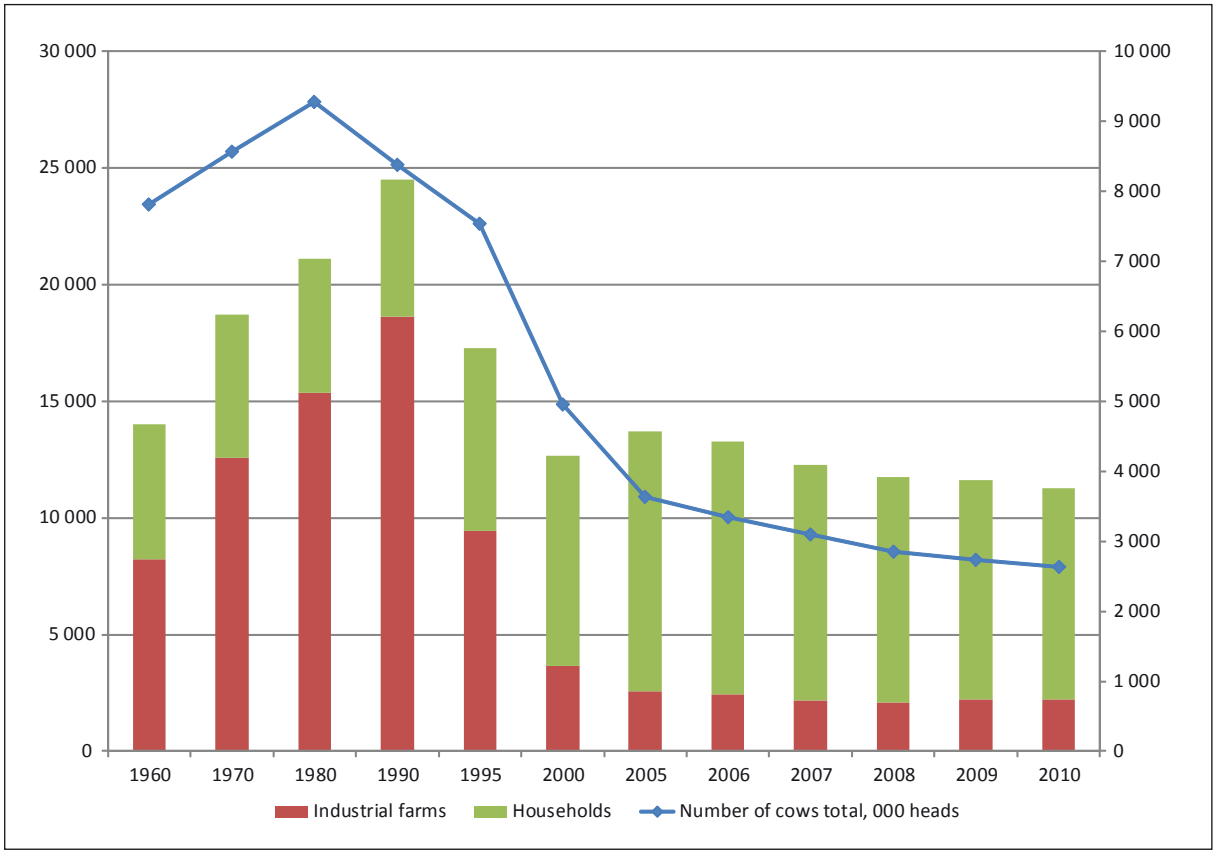
General trends

Ukraine's milk production has been declining since the country's independence in 1991 and it is one of the few sectors where this trend has not yet abated. Nevertheless, Ukraine remains by far a net exporter of dairy products.

7 - Importers from Belarus do not have to pay the 5 percent import duty on butter applicable to other countries in line with Ukraine's existing commitments under the World Trade Organization (WTO).

8 - This table provides average numbers for both skimmed (non-fat) dry milk and whole dry milk.

Figure 1. Milk production in Ukraine by type of producer, (thousand tonnes, left axis) and dairy cow numbers (thousand head, right axis), 1960-2010

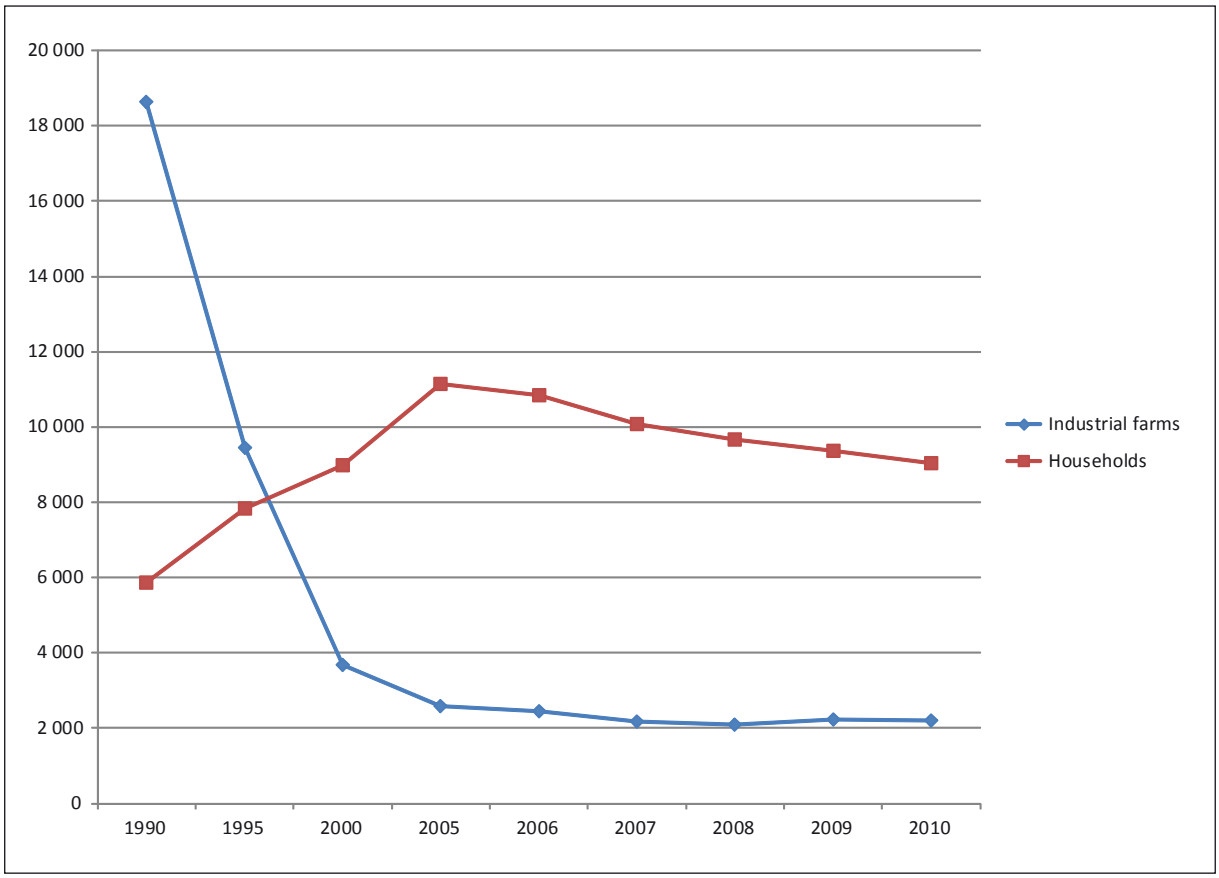


Source: State Statistical Service of Ukraine.

In the past five years, milk production slowed to about 4 percent per annum due to the downward trend in cow inventories and despite growing average milk yield per cow. Milk production declined at both commercial and rural household farms. During this period, milk production at household farms dropped by 19 percent and at commercial farms by 14 percent – an important shift in trends observed in 2000-2005 when production at commercial farms dropped by 30 percent while milk production at rural household increased by 24 percent.

In 2009, milk production at commercial farms started growing, while decline at household farms continued. Even greater changes were noted in the structure of commercial production, where the share of large commercial farms grew rapidly at the expense of smaller commercial farms. The production of milk in Ukraine is becoming a more commercially attractive business, but less attractive to rural households.

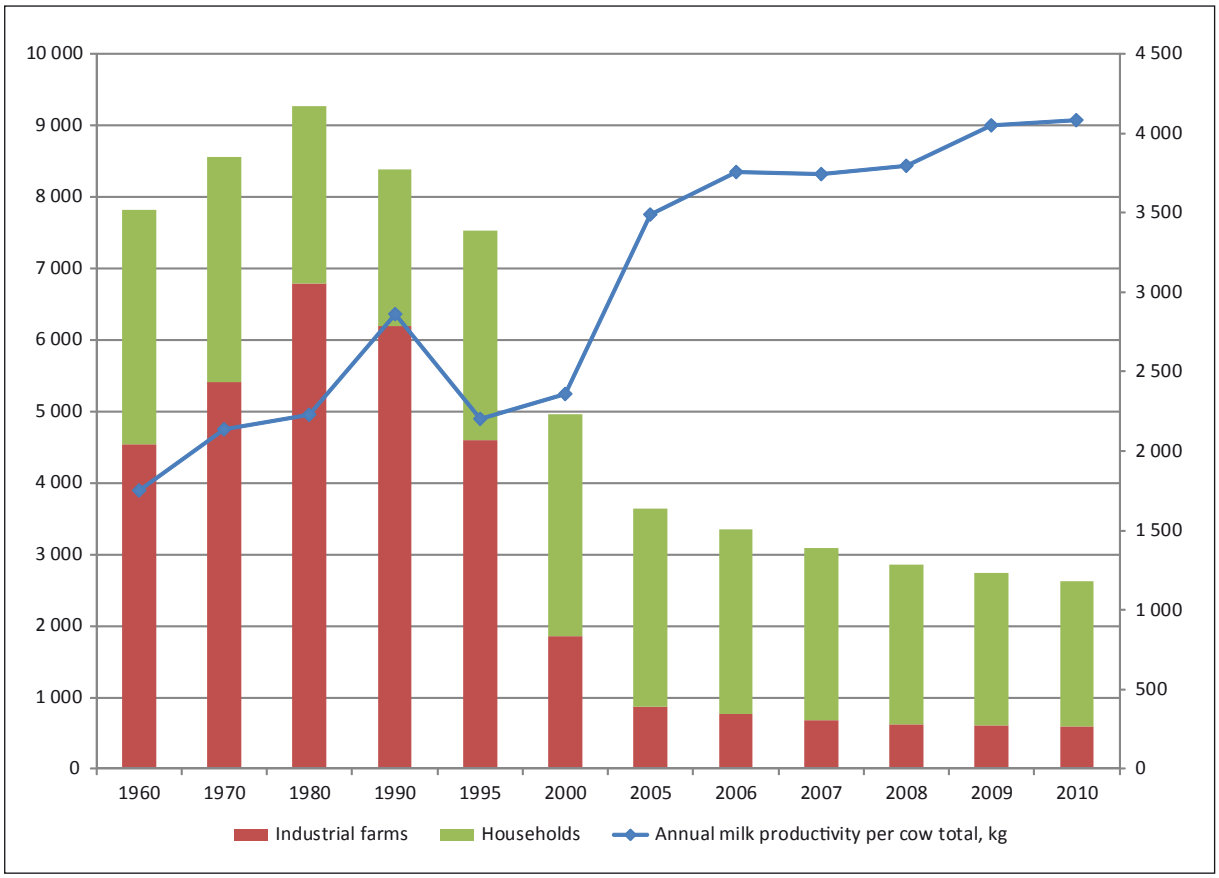
Figure 2. Milk production by type of producer in Ukraine, thousand tonnes, 1990-2010



Source: State Statistical Service of Ukraine.

Similar trends are observed for the number of cows in Ukraine. Since 1990, the number of cows has decreased more than threefold while milk productivity grew by 43 percent. Up until 2003-2004, the government tried to address the issue of decreasing number of cows through administrative pressure on commercial farms. All regional agricultural departments had to ensure that the number of cows in their region did not decrease. Managers of private commercial farms that allowed dairy herd numbers to drop were frequently subjected to various inspection services and audits. These types of administrative measures did not succeed and dairy herd numbers continued to decline rapidly. The primary reason was that commercial farmers did not want to continue loss-making milk production business and maintain low-productive dairy herds. Overall, the number of cows at commercial farms has declined by 90 percent since 1990.

Figure 3. Dairy herd down by type of producer in Ukraine, thousand heads

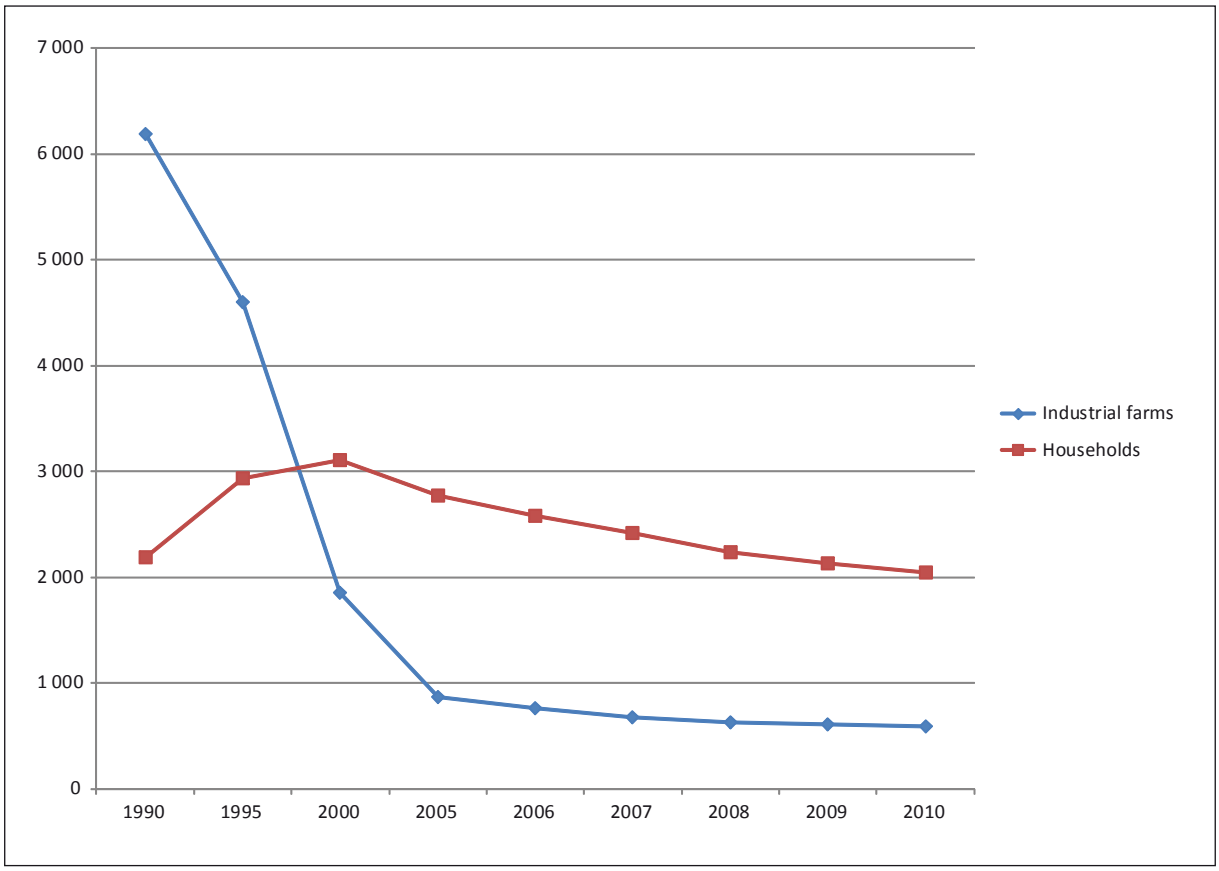


Source: State Statistical Service of Ukraine.

On the contrary, the number of cows at rural households increased during an initial period of transition from the centrally planned to a market-based economy, as rural households resorted to subsistence farming and food self-sufficiency in 1990-2000. However, the number of cows held by rural households has declined since 2000.

Decreasing herd and low prices for milk created a beneficial situation for selecting the best and most productive animals at both types of farms. As can be seen from Figure 1, the smaller number of cows resulted in higher productivity, which has been increasing rather rapidly. This increase in productivity was based mainly on improved animal feeding and local old genetics.

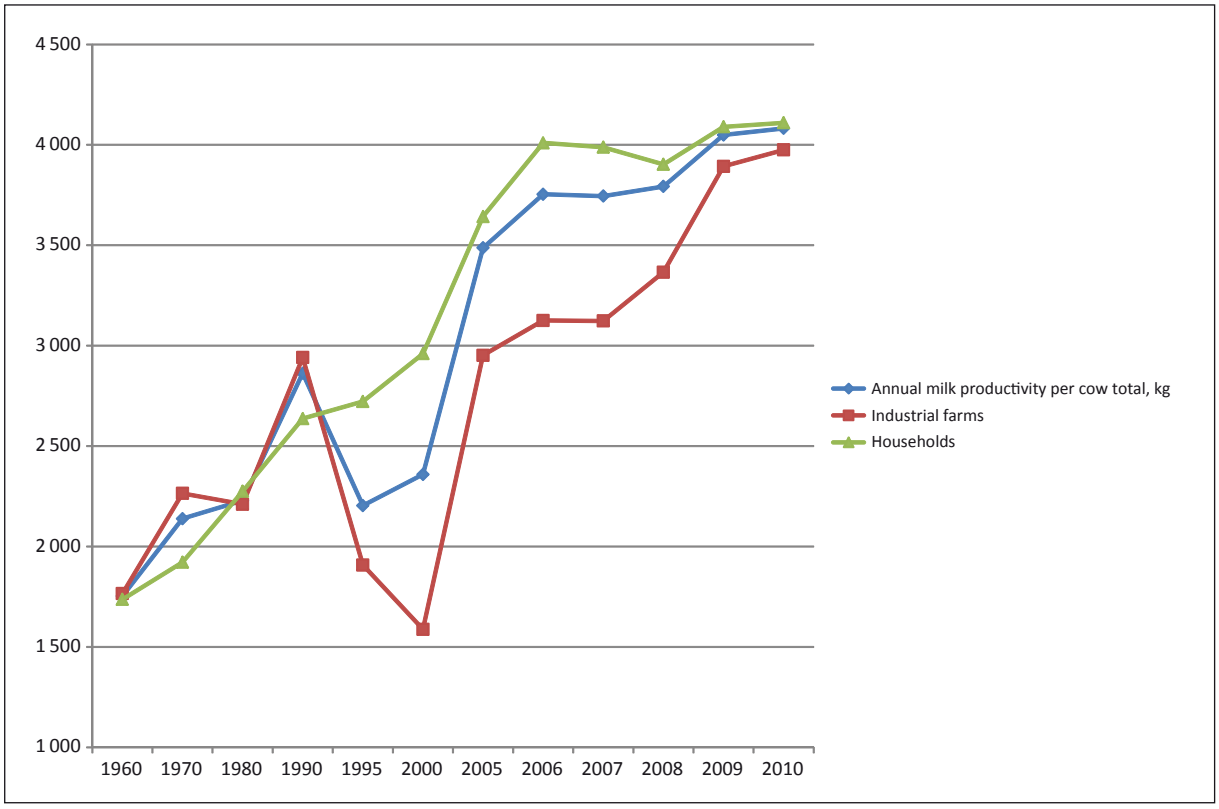
Figure 4. Dairy herd trends in Ukraine by type of producer, thousand heads



Source: State Statistical Service of Ukraine.

As of the end of 2010, commercial farms of Ukraine accounted for only 22 percent of all dairy herds and produced only 20 percent of all milk. The remaining cows were kept at rural household farms, which also have higher milk productivity than commercial farms. As a result of improvement and technical modernization of commercial dairy farms, however, the gap between cow milk yields has narrowed substantially since 2000 (Figure 5).

Figure 5. Productivity of dairy cows in Ukraine by type of producer, kg/cow/year, 1996-2010



Source: State Statistical Service of Ukraine.

Dairy cow productivity in Ukraine began increasing in around 1995, and first exceeded the levels achieved in 1990 in 2002-2003. In 2000-2005 the increase comprised an impressive 48 percent (nearly 10 percent per year) with industrial farms increasing productivity by 86 percent (17 percent per year) and household farms by 23 percent (5 percent per year). During the following five years the increase slowed to about 3 percent per year with industrial farm productivity growing faster again at about 7 percent per year.

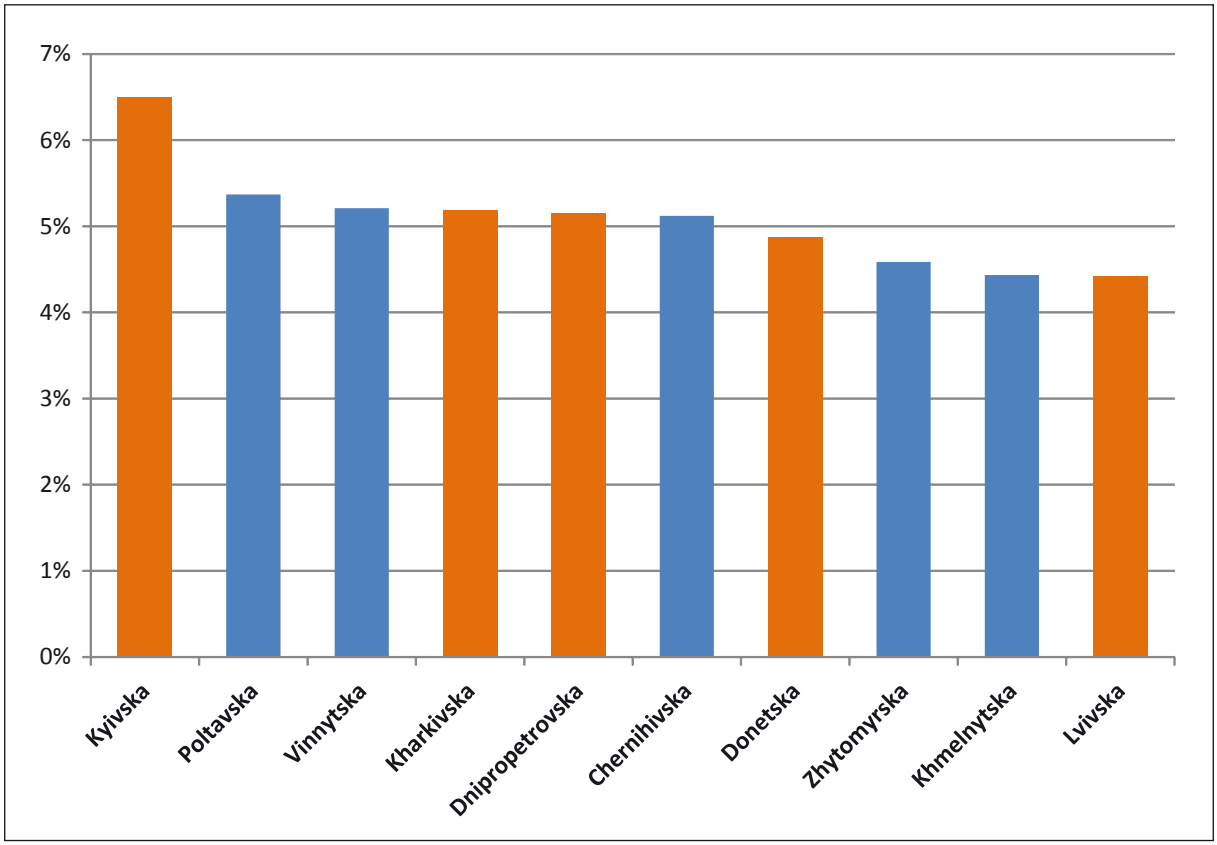
As of 2010, dairy herd productivity at household farms and commercial farms nearly equalized with average per cow productivity at household farms growing by only 3 percent. As a consequence, it is very likely that milk yields at commercial farms in Ukraine will exceed these at rural household farms by 2017.

Regional concentration of milk production

Since the 1990s, regional concentration of milk production has changed significantly. At the time of the break up of the Former Soviet Union (FSU), milk production was concentrated mainly near large cities; afterwards it moved to regions with a high percentage of rural population. The change occurred due to the sharp decrease in dairy herds at large commercial farms, which were usually located near large cities. Ukraine had also lost most of its markets in the FSU and domestic consumption suffered due to a substantial decrease in consumer purchasing power. As a result

there was significant oversupply of milk and milk prices were insufficient to cover production costs. For many people in rural areas, however, milk production was a way to ensure food supply as well as earn extra income from selling the excess milk on the market.

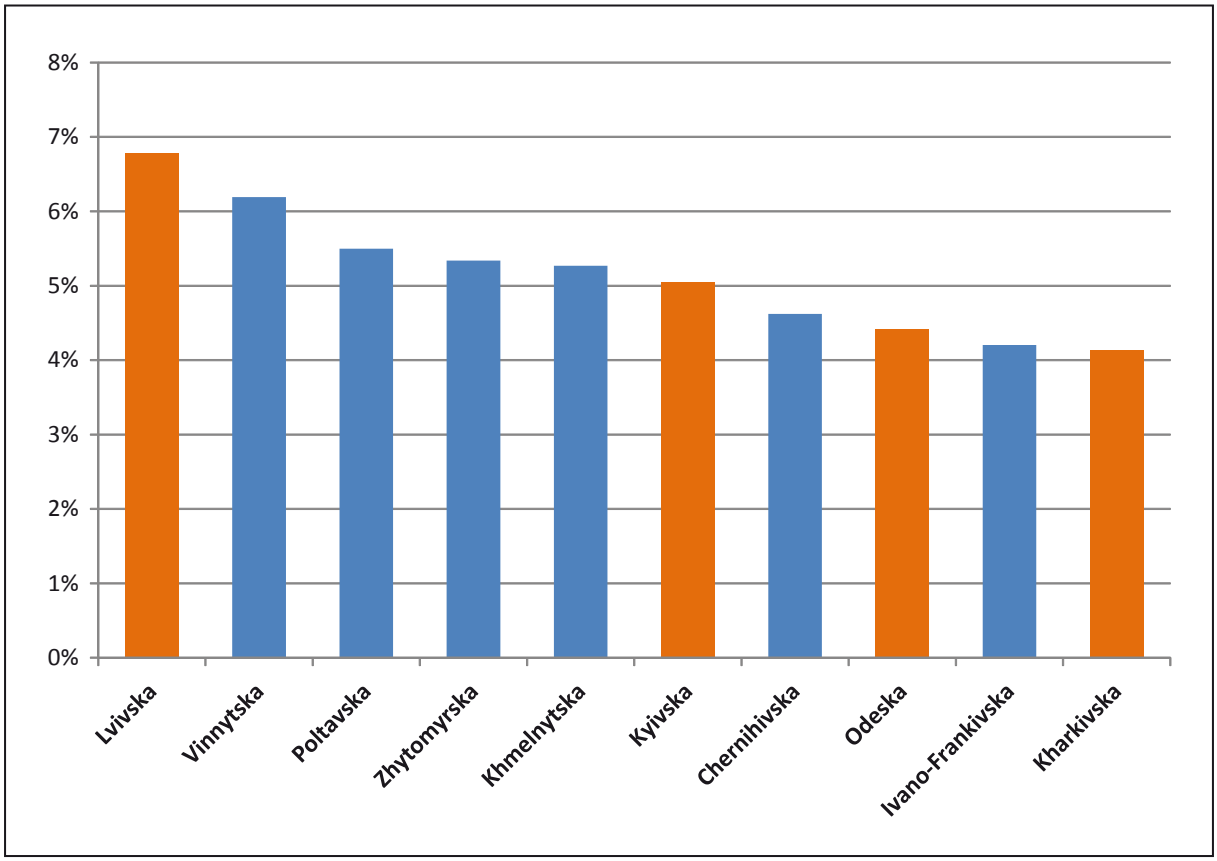
Figure 6. Top ten regions in terms of milk production and their shares, 1990



Note: regions where production declined most rapidly are marked in orange.
Source: State Statistical Service of Ukraine.

The five oblasts (regions) with the five largest cities in Ukraine were among the leading milk producers in 1990 with Kyivska oblast, home to the capital city Kiev, the clear leader. Their combined share of Ukraine's total milk production (including Odessa oblast, the eleventh largest producer) was 30 percent (Figure 6).

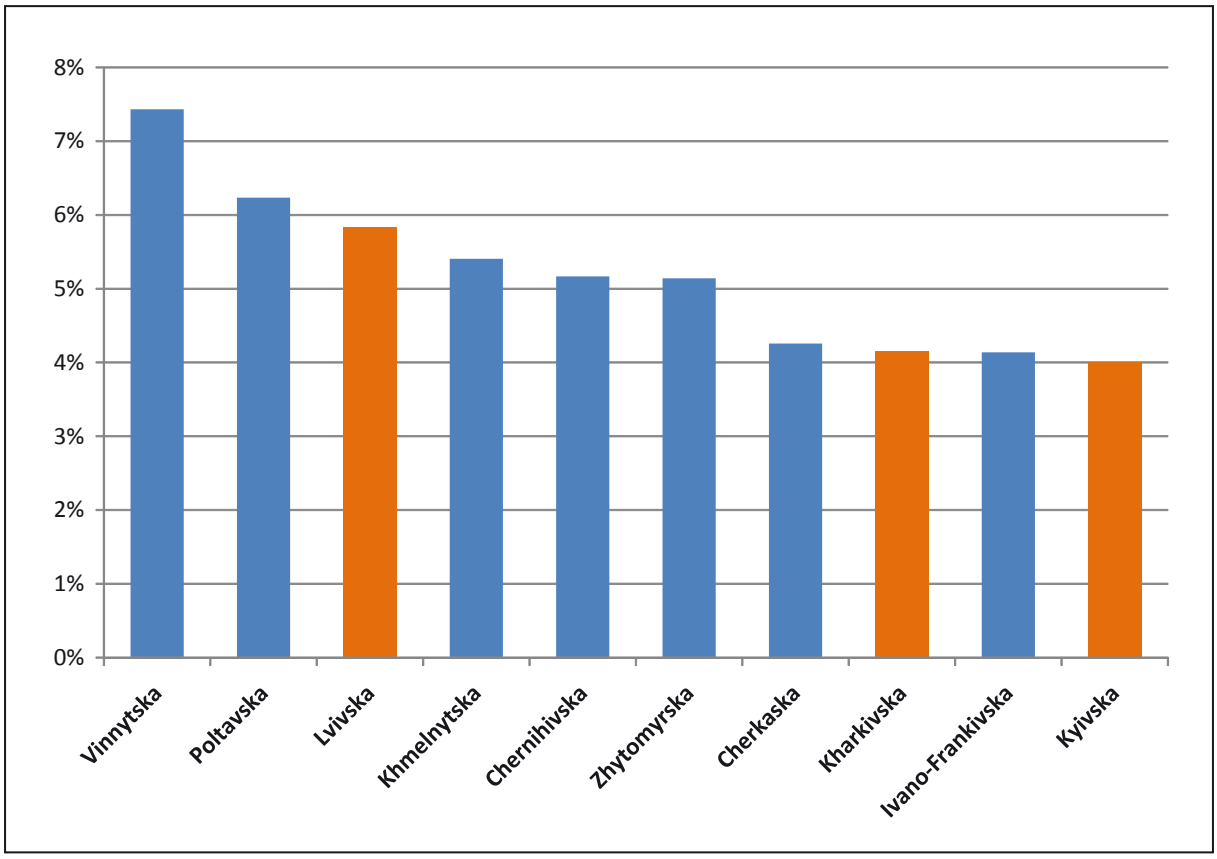
Figure 7. Top ten regions in terms of milk production and their shares, 2005



Source: State Statistical Service of Ukraine.

Fifteen years later the picture has changed completely. Kyiv region has dropped from the largest producer to the sixth, and Donetsk and Dnipropetrovsk are no longer among the top ten largest regional producers. Only four regions with the largest cities are now among the top ten regional producers and the leading region, Lvivska, has the largest rural population of regions with large cities. The combined share of the six regions with the largest cities declined to 28 percent of total milk production (Figure 7).

Figure 8. Top ten regions in terms of milk production and their shares, 2010

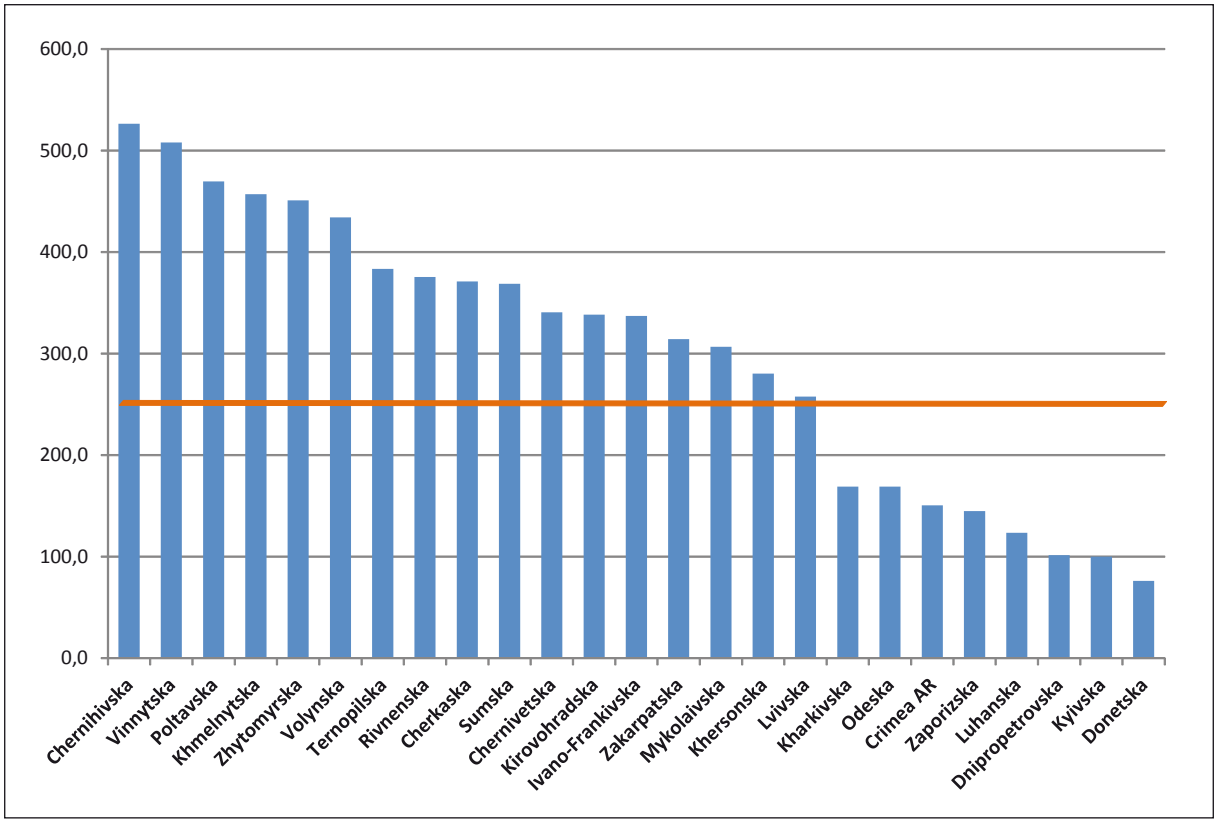


Source: State Statistical Service of Ukraine.

Another five years later only three out of six regions were among the top ten and Kyiv region was now ranked last. Lvivska had also lost its leading position to the Vinnytska and Poltavska regions. The combined share of the six regions in total production fell to 24 percent (Figure 8).

All of the new leading regions for milk production have moderate or cool climates and significant areas of pasture (belonging to the forest steppe or forest agroclimatic zone of Ukraine). Most of these regions also have a high percentage of rural population (Figure 9).

Figure 9. Per capita production of milk in Ukraine by region (kg), 2010



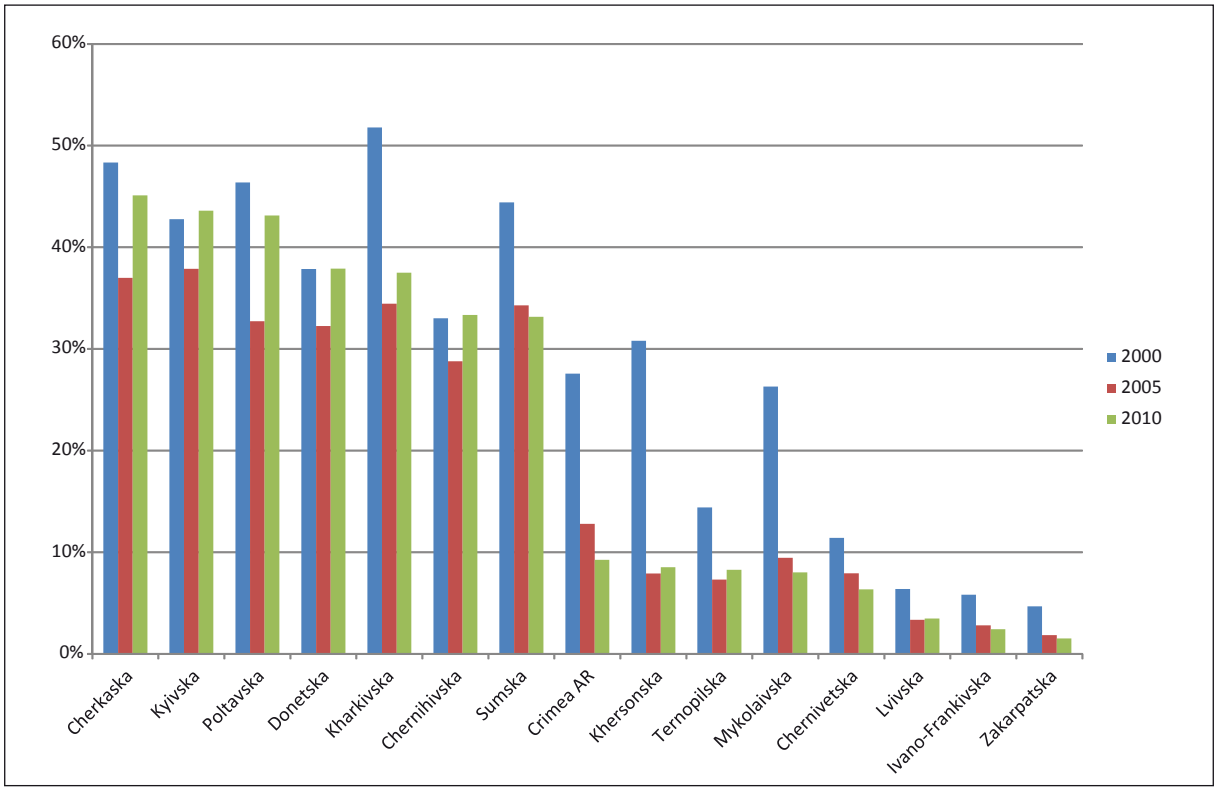
Source: State Statistical Service of Ukraine.

From Figure 9 it is also possible to see which regions of Ukraine are likely to produce more milk than their the local consumption needs and which regions can experience milk deficit. The highest per capita consumption is noted in Chernihivska and Vinnytska oblasts. Among the leaders are also Poltavska, Khmelnytska, Zhytomyrska and Volynska oblasts. The lowest per capita production is noted in Donetska, Kyivska, Dnipropetrovska, Luhanska and Zaporizska oblasts.

In 2010, only three regions of Ukraine had more than 40 percent of milk produced by commercial farms: Cherkaska (45 percent), Kyivska (44 percent) and Poltavska (43 percent) oblasts. Four other regions accounted for 30-40 percent share of commercial milk output in total milk production: Donetska, Kharkivska, Chernihivska and Sumska. There is a huge difference between these seven oblasts and the remaining regions, which have a share of commercial milk production below 20 percent.

Regions with very limited share of commercial milk in total production were: Zakarpatska, Ivano-Frankivska, Lvivska, Chernivetska, Mykolaivska, Ternopilska, Khersonska oblasts and the Crimea Autonomous Republic (AR). The share of commercial milk in total milk output of these regions varied from 2 percent to 9 percent (Figure 10).

Figure 10. Regions with highest and lowest shares of commercial milk production, % of total milk production in the region

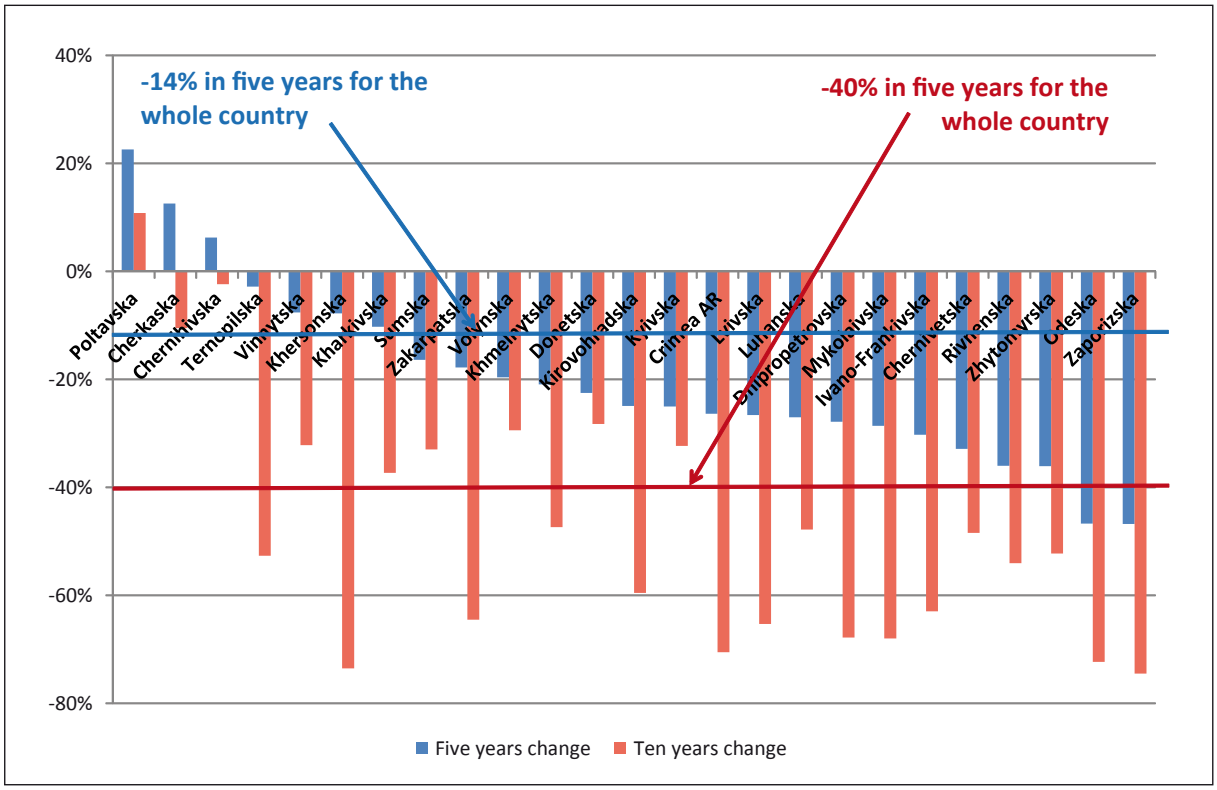


Source: State Statistical Service of Ukraine.

It is interesting to note that during the past five years the share of commercial milk in total milk output of Ukraine has not changed significantly. However, there were some significant regional changes. In the past five years only three regions increased the volume of commercial milk production: Poltavska, Cherkaska and Chernihivska oblasts (Figure 11).

The largest increase was noted in Poltavska oblast where commercial milk production increased by 23 percent and share of commercial milk production grew by 10 percentage points. Poltavska oblast was also the only region of Ukraine to increase commercial milk production in the past 10 years, while all others noted a decline for this period of time.

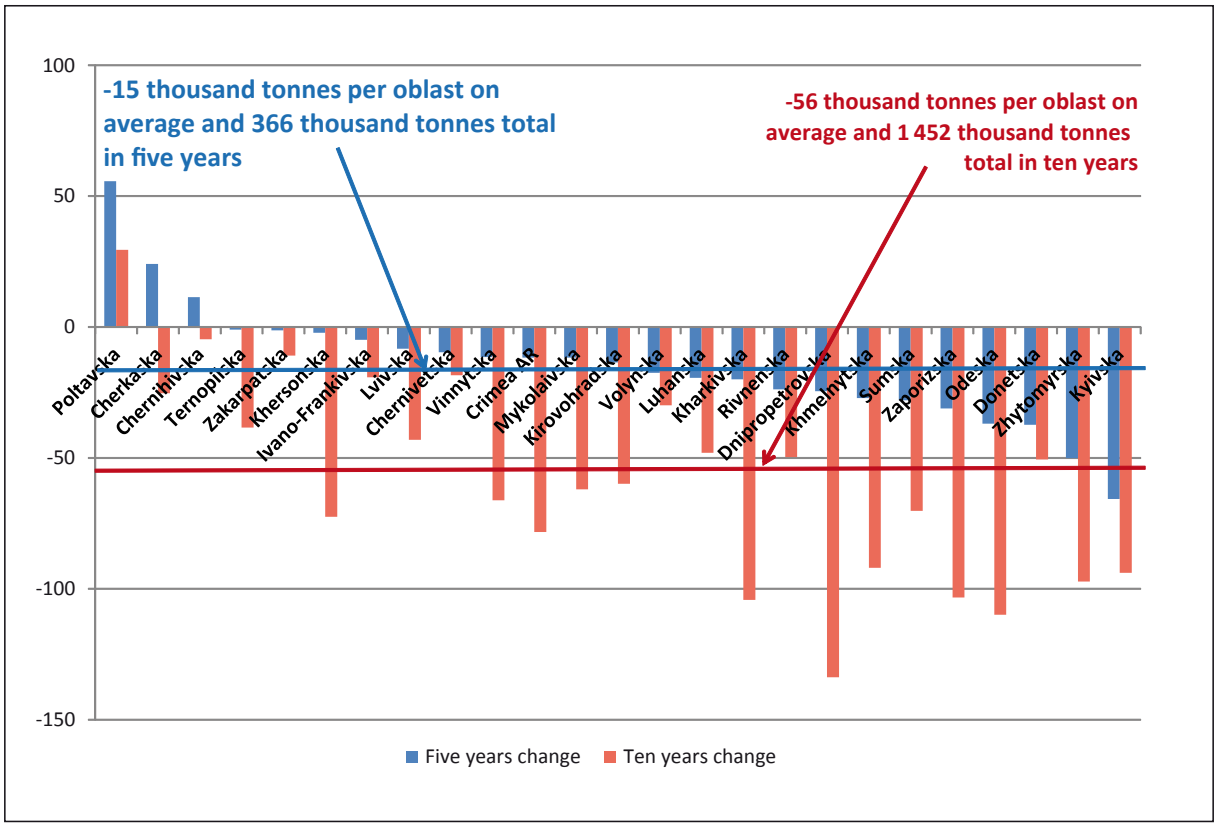
Figure 11. Changes in commercial milk production by region in Ukraine (%), 2005-2010 and 2000-2010



Source: State Statistical Service of Ukraine.

The greatest five year decline in commercial milk production in terms of volume was noted in Kyivska (66 000 tonnes), Zhytomyrska, Donetska, Odeska and Zaporizska oblasts, and in terms of percentage in Odeska and Zaporizska (47 percent in both regions).

Figure 12. Changes in commercial milk production by region in Ukraine, thousand tonnes, 2005-2010 and 2000-2010

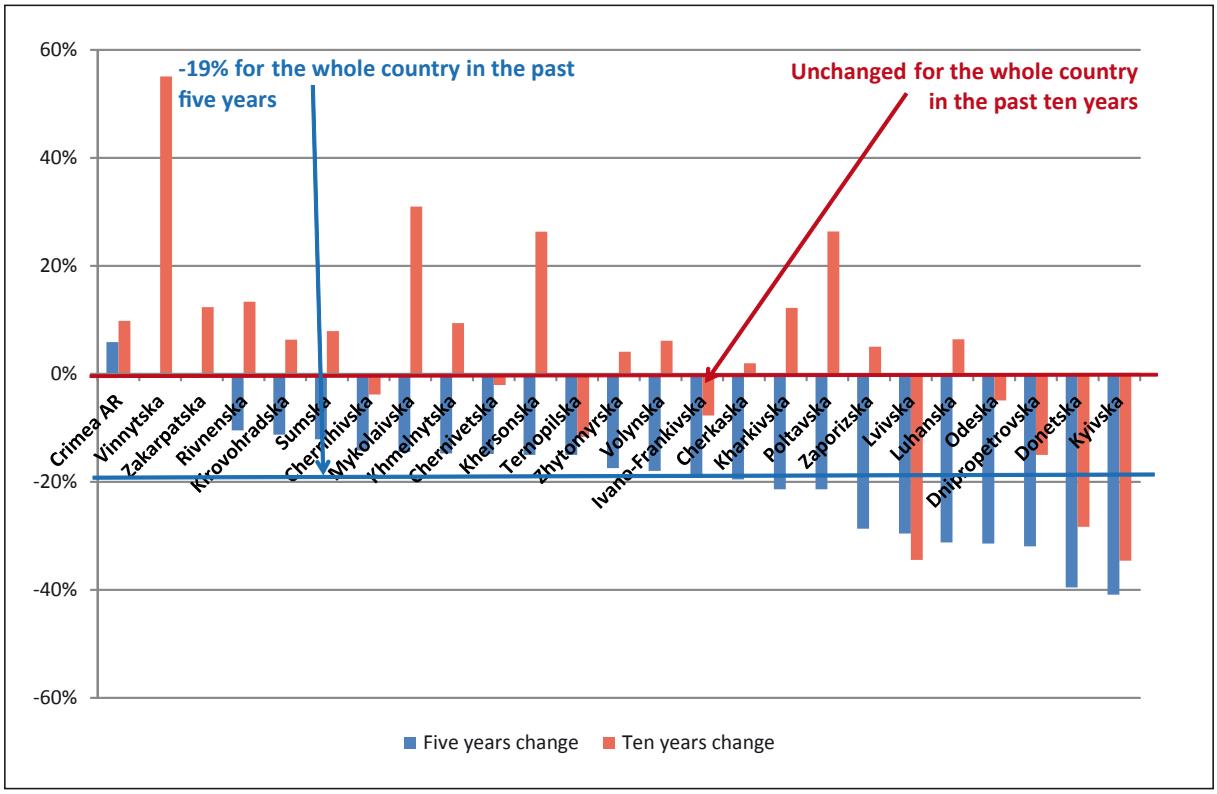


Source: State Statistical Service of Ukraine.

Over the past ten years, four regions "lost" more than 100 000 tonnes of commercial milk production – Dnipropetrovska, Odeska, Kharkivksa, Zaporizska oblasts – and Zhytomyrska and Kyivska lost more than 90 000 tonnes. Percentagewise, the sharpest declined was noted in Khersonska and Zaporizska oblasts (74 percent), Odeska oblast (72 percent) and AR Crimea (71 percent).

After a period of significant growth in the previous five years, milk production by rural households in 2005-2010 declined more rapidly than that at commercial farms. During the latter period, milk production at rural households decreased by 2.1 million tonnes and at commercial farms by 0.37 million tonnes. Milk production at rural households only increased in the AR Crimea – by 6 percent (Figure 13). Household milk production was virtually unchanged in the Vinnytska and Zakarpatska regions and declined significantly in all other regions. The sharpest drop in volume of household milk production was noted in Lvivska, Kyivska, Odeska, Donetska and Dnipropetrovska oblasts. The greatest declines were observed in Kyivska and Donetska where production dropped by 40-41 percent.

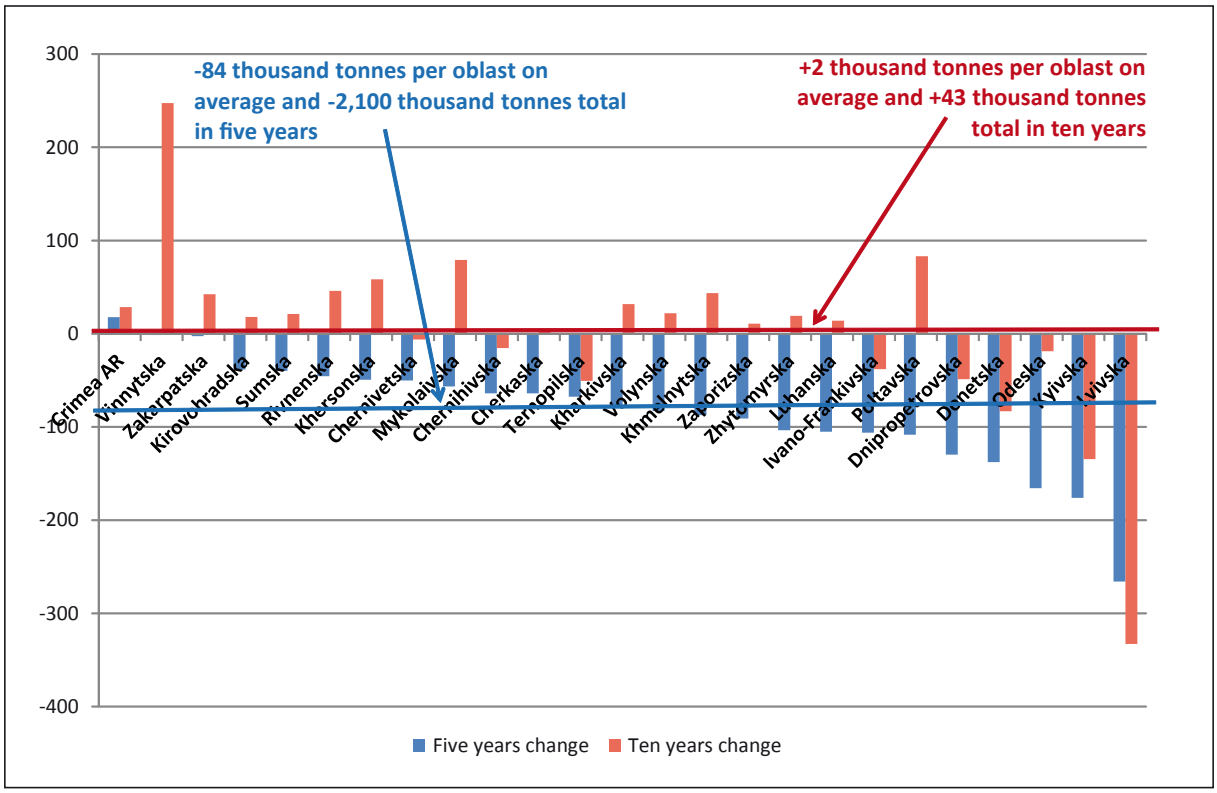
Figure 13. Changes in milk production by rural households by region in Ukraine (%), 2005-2010 and 2000-2010



Source: State Statistical Service of Ukraine.

It should be noted that milk production by rural households declined in 2005-2010 for regions with dynamically developing off-farm employment opportunities (near large cities). In terms of milk production volumes (Figure 14), rural households still produced slightly more milk in 2010 than in 2000 (43 000 tonnes or 0.5 percent). However, the figure below clearly shows that the trend of increasing milk production by rural households has reversed in Ukraine.

Figure 14. Changes in milk production by rural households by region in Ukraine, thousand tonnes, 2005-2010 and 2000-2010



Source: State Statistical Service of Ukraine.

Seasonality in the dairy business

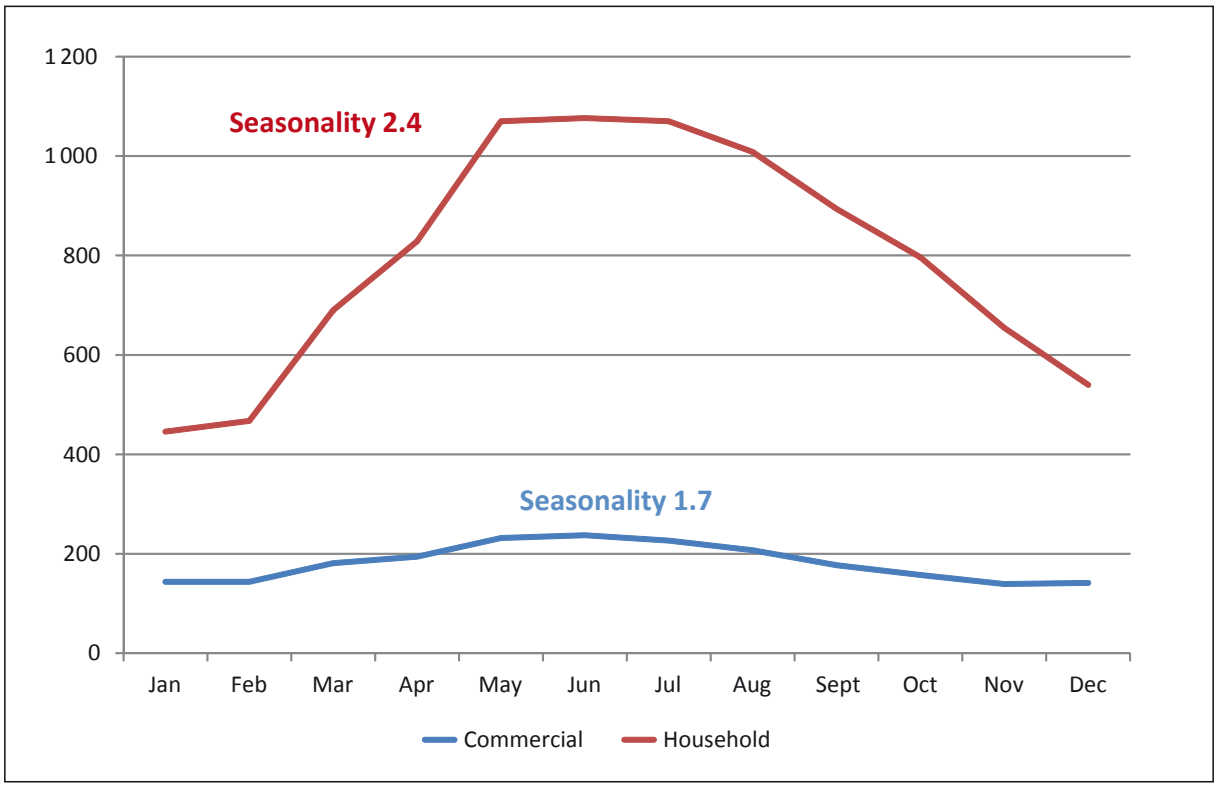
Milk production seasonality

Farmers all over the world aim to reduce feed costs by utilizing cheap pasture during peak milk production periods. This also reduces the need to store feed as cows entering the dry period (about 60 days prior to calving, usually in winter) are not milked and thus need less metabolized energy. Some farmers manage their dairy herd to maximize income from higher dairy prices at times of seasonal milk production decline. However, this approach raises a number of challenges related to reproductive management of the lactating cowherd and requires very good breeding.

Milk production in Ukraine has historically been highly seasonal throughout the year due to traditional technologies and feed availability. Both commercial farmers and rural households try to take advantage of cheap feed availability during the summer months. Thus, milk production is highest in May–July and lowest in November–February of each year. Unfortunately for dairy processors, they face the opposite demand patterns: milk consumption is high in the winter and spring months and low in the summer. This situation reflects the high variability of milk prices throughout the year in Ukraine. To make matters worse, low temperatures and bad road access to remote villages in January to February complicate milk collection. This makes milk even more

"precious" for processors in winter. Information on average monthly volumes of milk production by various types of producers in Ukraine are given below (Figure 15).

Figure 15. Monthly milk production by household and commercial milk producers in Ukraine, thousand tonnes, 2007-2010 average production



Source: State Statistical Service of Ukraine.

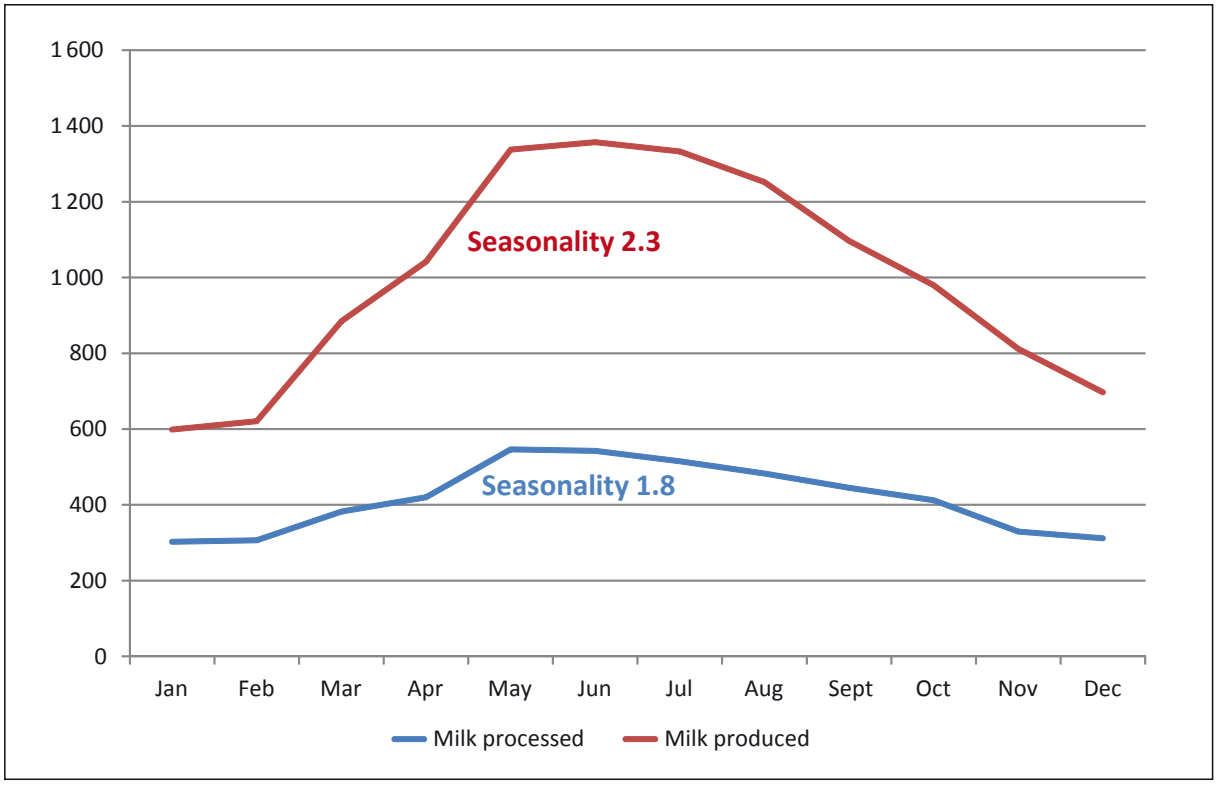
The Index of Milk Production Seasonality was calculated based on a four year average of monthly milk production, dividing milk production in each month by that of the month with the lowest milk output. This approach was selected to demonstrate milk production seasonality from the perspective of processors, who need to have rather stable (or, even better, guaranteed) milk supplies to respond to demand for fresh milk products such as sour cream, kefir, pasteurized milk and so on. This approach clearly demonstrates the seasonality problem caused specifically by supplies from rural households.

The index of rural households' milk production seasonality in 2005-2010 was 2.4 as compared with 1.7 for commercial farms. This means that milk production by rural households in summer exceeds that in winter by 240 percent, and by 70 percent for commercial farms. While commercial-type milk producers in the EU, New Zealand or United States also face seasonal production fluctuations, seasonality milk production patterns are not as extreme as at commercial dairy farms in Ukraine.

Milk processing seasonality

Figure 16 below clearly indicates that there is much lower seasonality in milk processing than in milk production. This can be explained by two reasons: (i) milk production peak is not entirely reflected in milk deliveries to dairies as farmers use about 10 percent of total annual milk production for feeding the calves during the peak production period; and (ii) dairies in Ukraine actively use non-milk additives and/or dry milk replacers when milk production is low while demand is highest.

Figure 16. Monthly variations in milk production and processing in Ukraine, thousand tonnes, annual average for 2009-2010

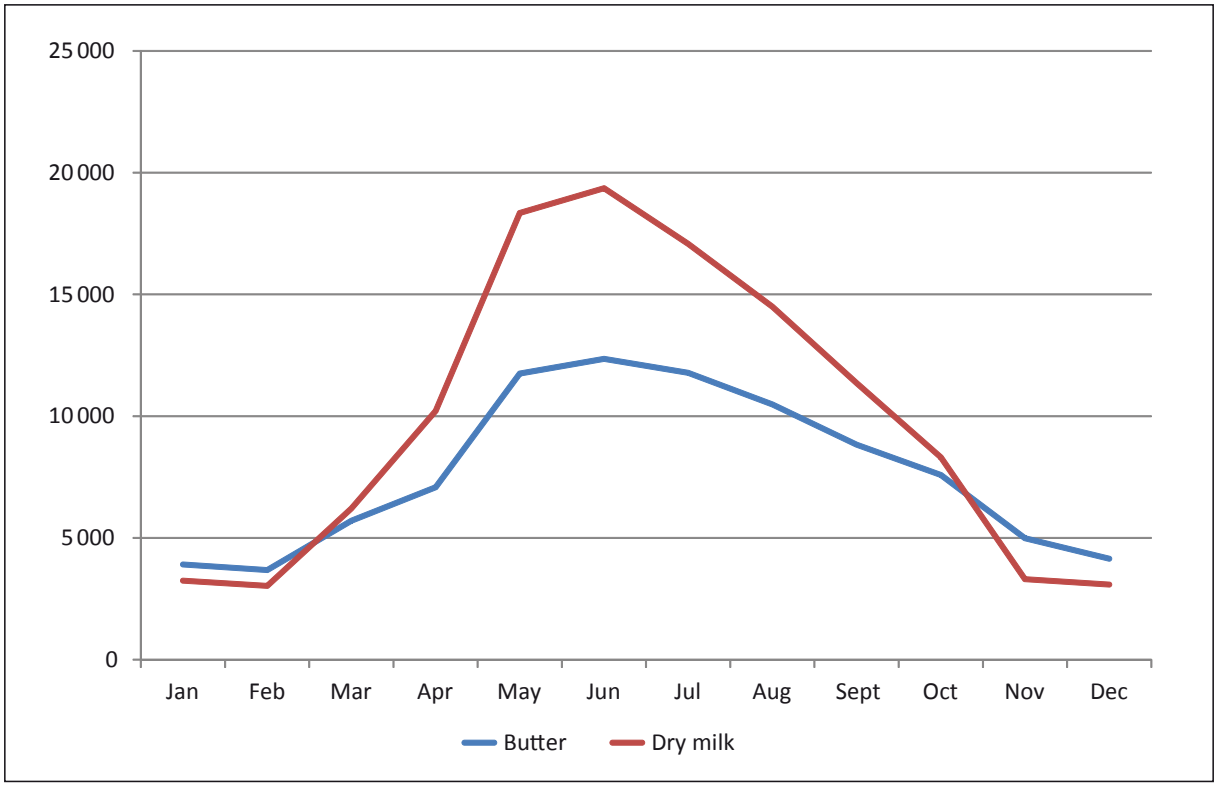


Source: State Statistical Service of Ukraine.

The seasonal demand for milk from processors is reflected in key dairy products and their output reviewed below. Production of butter and dry milk are interconnected. In Ukraine, the majority of dry milk is of the non-fat variety as the fat is skipped and used for the production of butter and other products. Most of the production occurs in the peak season, when there is an ample supply of relatively inexpensive milk. Since both products are storable, it is logical to use the extra milk purchased for production of these products in the summer.

Seasonality in butter production is lower than for dry milk production. The lowest production of both products is noted in February and in June it jumps 3.4 times for butter and 6.4 times for dry milk (Figure 17).

Figure 17. Monthly variations in butter and dry milk product production in Ukraine, thousand tonnes, annual average for 2009-2010

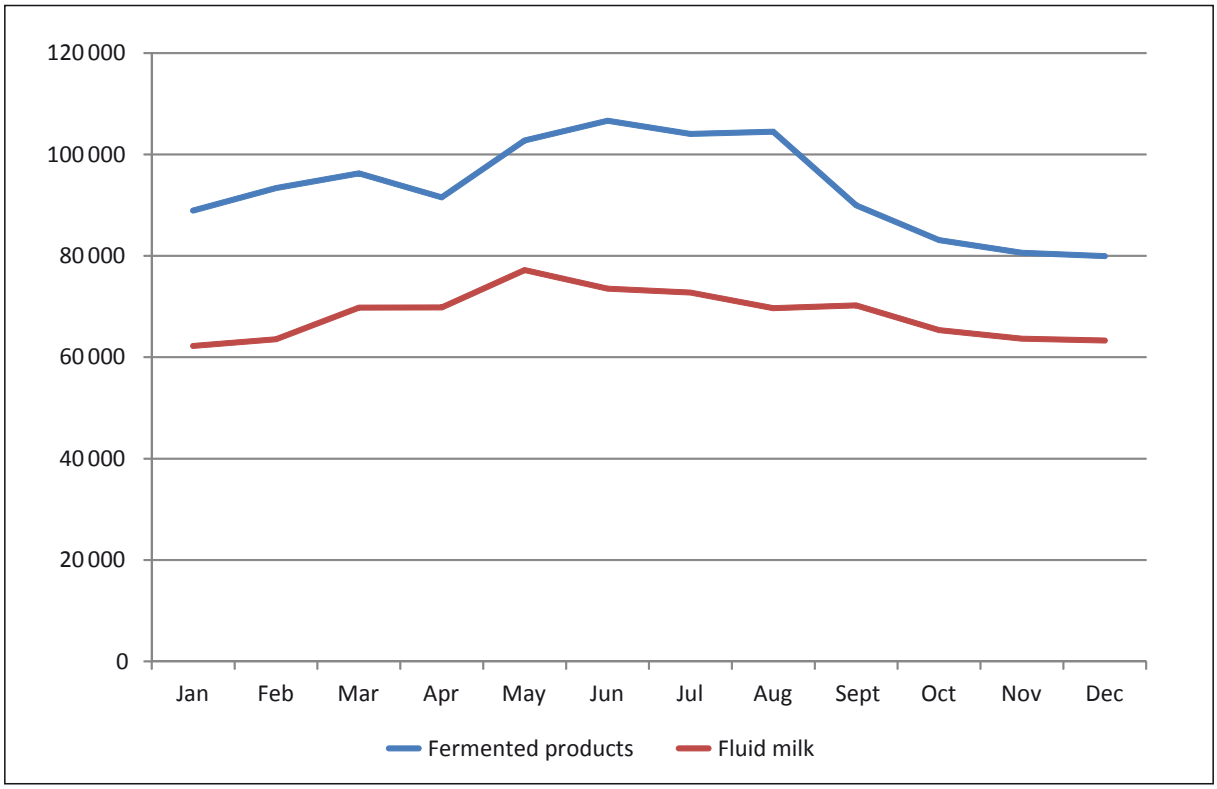


Source: State Statistical Service of Ukraine.

Another two products with almost identical seasonal trends are fluid milk and fermented milk products. Since only ultra-high temperature/treatment (UHT) milk can be stored for 3-6 months, it can be assumed that the consumption of fluid milk and fermented dairy products largely reflects the trend of milk production.

Both fluid milk and fermented dairy products are part of the daily diet and thus have very low production seasonality. The largest monthly production exceeds the lowest only by 20-25 percent. This does not include fresh unprocessed milk consumed without processing.

Figure 18. Monthly variations in fluid milk and fermented dairy products production in Ukraine, thousand tonnes, annual average for 2009-2010

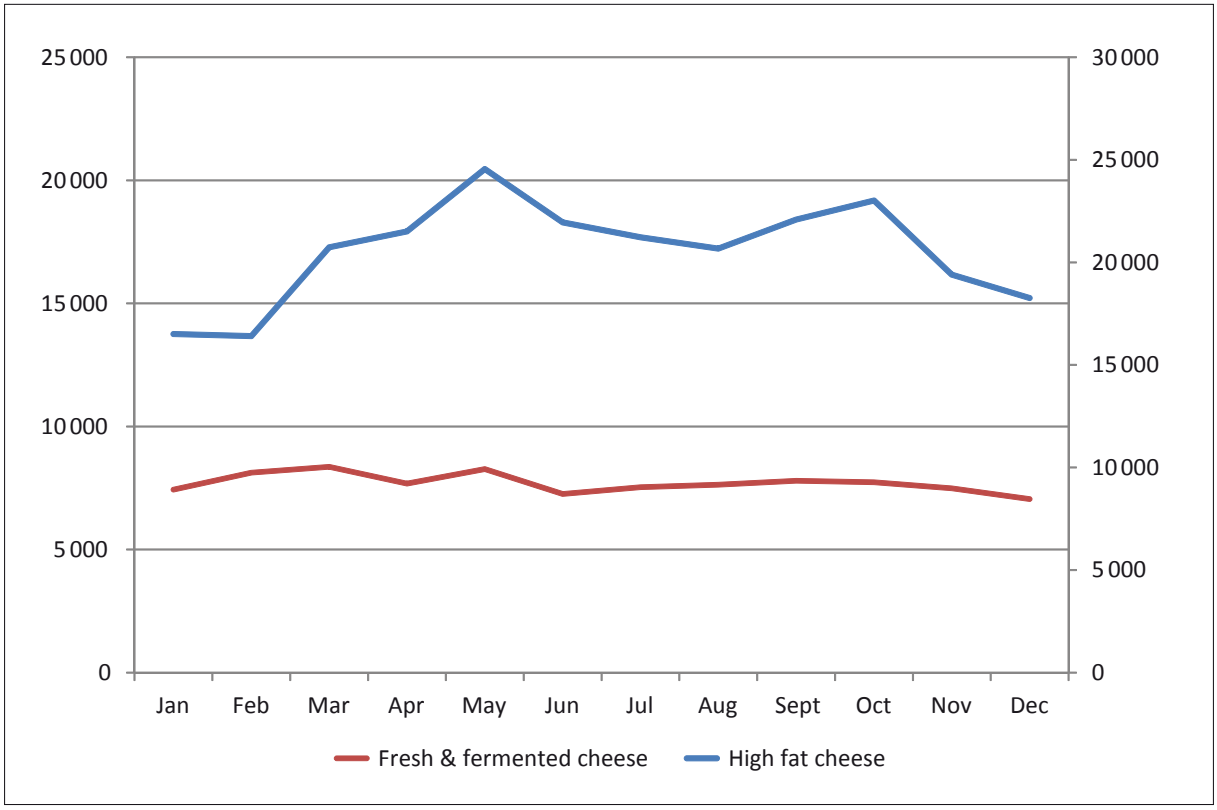


Source: State Statistical Service of Ukraine.

Naturally, higher seasonality is noted in the production of dairy products that have a longer shelf life (high-fat hard cheese, butter, dry milk) and lower seasonality than in the production of those which have a shorter shelf life (curd/fresh cheese). The seasonal trends in the production of hard cheese in Ukraine, however, differ from the trends noted for other products.

As seen from Figure 19, production of storable cheese is highest in May but declines in June–August when milk supply is still relatively high. Production is also quite high in April, when milk production only starts growing seasonally. Another production peak occurs in October, when milk production is already rather low. Producers of storable cheese are under serious price pressure, as this is the only dairy product with a significant positive trade balance in Ukraine. Thus they try to find the best balance between price of milk, storage period and demand for cheese. The higher October production is aimed at serving demand for the Christmas holidays and New Year.

Figure 19. Monthly variations in production of cheeses in Ukraine, thousand tonnes, annual average for 2009-2010

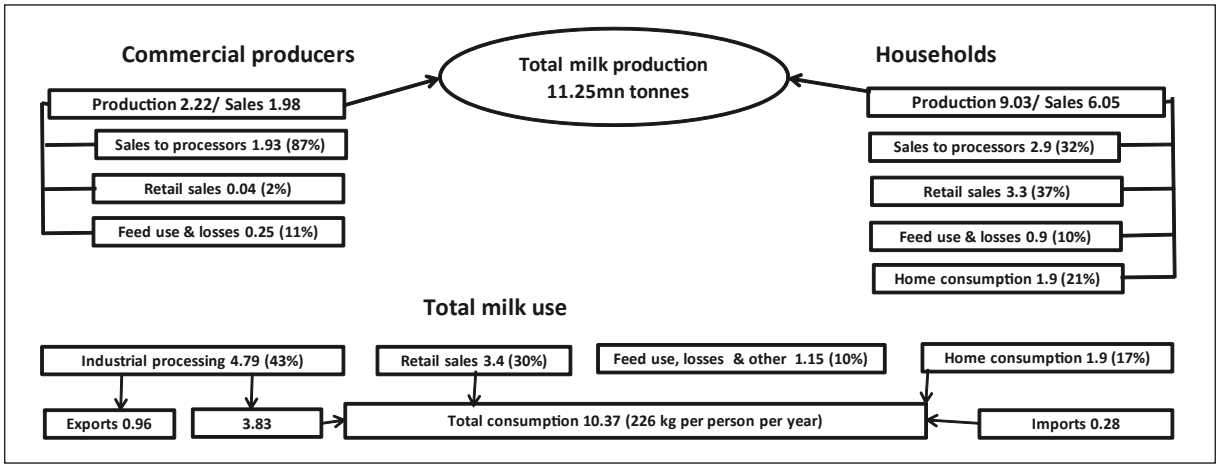


Source: State Statistical Service of Ukraine.

Milk and dairy products supply chain in Ukraine

The following figure depicts the utilization of milk from the two main producer types – commercial farms and rural households in Ukraine (Figure 20).

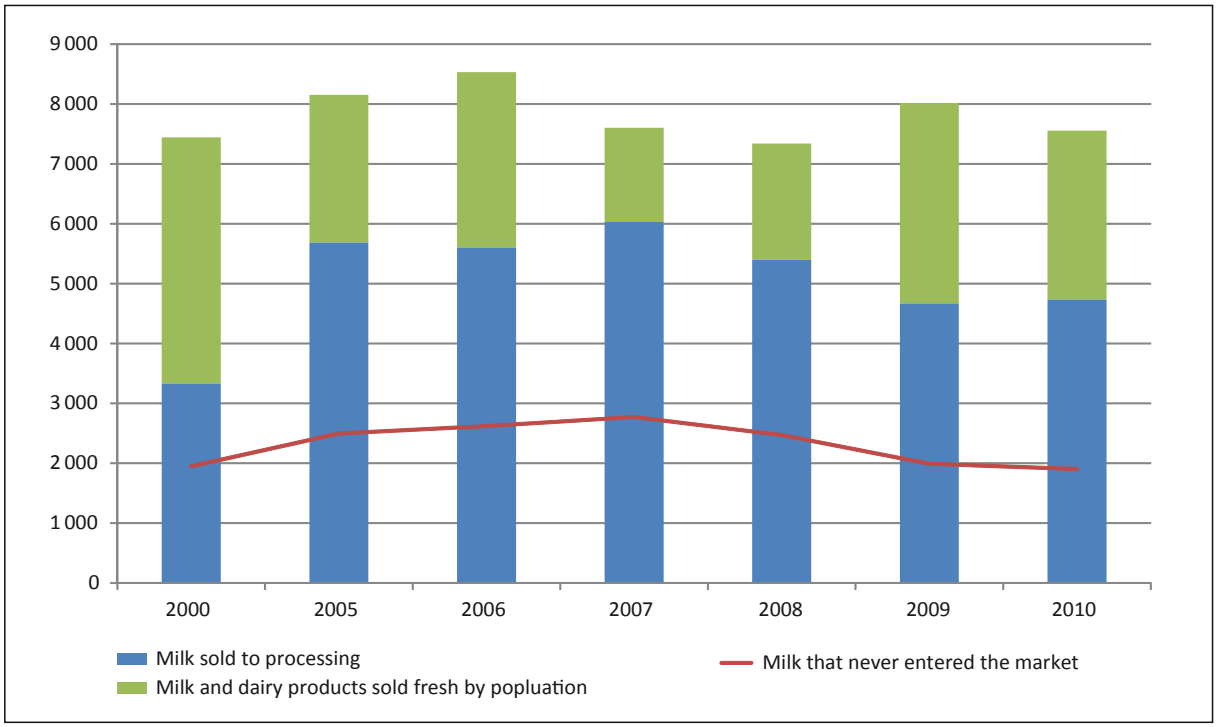
Figure 20. Milk production and use in Ukraine, 2010



Source: State Statistical Service of Ukraine.

According to the authors' estimates, sales of fluid milk in Ukraine averaged about 7.8 million tonnes over the past five years (Figure 21).

Figure 21. Milk market in Ukraine by major marketing channels, thousand tonnes, 2000-2010



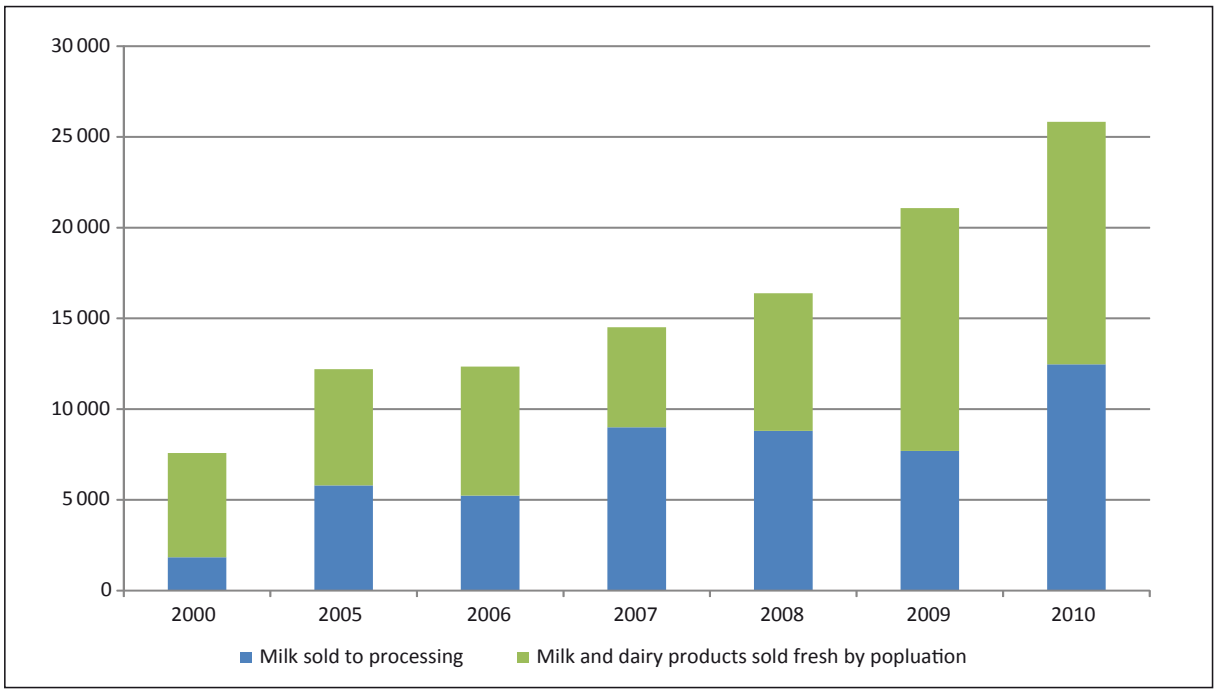
Source: State Statistical Service of Ukraine.

As shown above (Figure 21), when processors decrease the volumes of milk purchases, household milk producers tend to sell more milk and fresh milk products directly to consumers through unorganized channels such as sales at bazaars, direct delivery, and so on. Another reason for direct sales of milk from households is the higher margin on fluid milk sales as opposed to that from selling milk to processors. Higher prices received from direct sale also allow farmers to compensate for growing feed and energy needs. In most cases, farmers obtain three times as much from the sales of fluid milk and homemade dairy products at the retail level than from selling milk to processors. Despite legitimate food security concerns, consumers in Ukraine respond positively to homemade milk and dairy products. As mentioned above, these direct sales mostly take place through unregulated sales channels; therefore, it is very likely that authorities in Ukraine would pay more attention to the enforcement of food safety regulations at the time of milk sale by households.

About 2 million tonnes or 27 percent of all milk produced in Ukraine (red line, Figure 21) does not enter the market. This milk is used for calf feeding and direct human consumption.

The value of the milk market has varied during the same period reflecting milk price fluctuations. In the past five years, the market of fluid milk has dropped nearly 8 percent in terms of volume and more than doubled (by 114 percent) in terms of value expressed in UAH.[9] In 2010, milk producers received the highest gross revenues from milk sales estimated at UAH 26 billion (Figure 22). In value terms, the milk market grew by 24 percent in 2010 despite a 6 percent decrease in volumes of milk purchases.

Figure 22. Milk market in Ukraine broken down by type major marketing channels, million UAH, current prices, 2000-2010

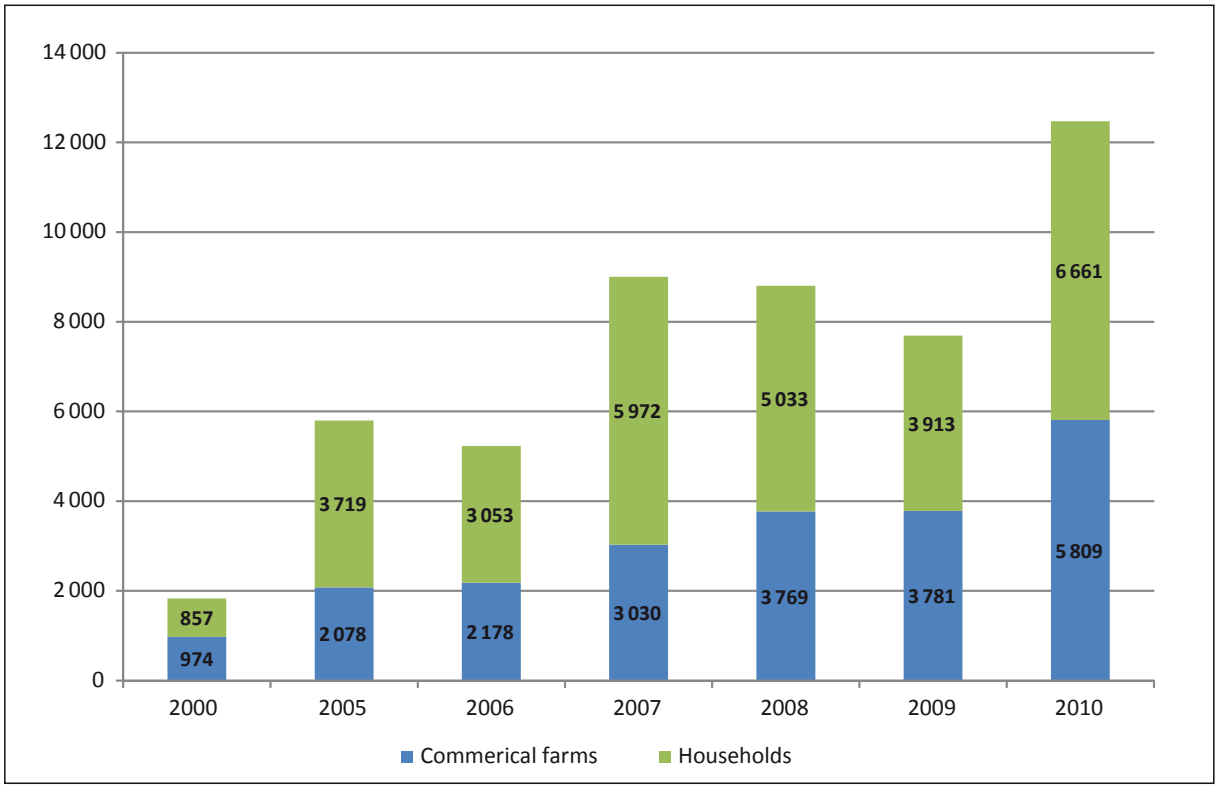


Source: State Statistical Service of Ukraine.

9 - Current prices in UAH. Even re-calculated in USD or euro the value of the Ukraine's milk market has continued to increase over this period.

In 2010, milk processors spent UAH 12.5 billion on milk purchases while producers (predominantly households).[10] Households in Ukraine usually receive lower milk prices than commercial farms due to lower quality and higher milk collection costs (refer to the Milk Prices Section below in this report for more information). Therefore, commercial farms receive equivalent revenues from milk sales to those received by households despite lower milk deliveries for processing.

Figure 23. Market of processed milk in Ukraine broken down by type of suppliers, million UAH, current prices, 2000-2010



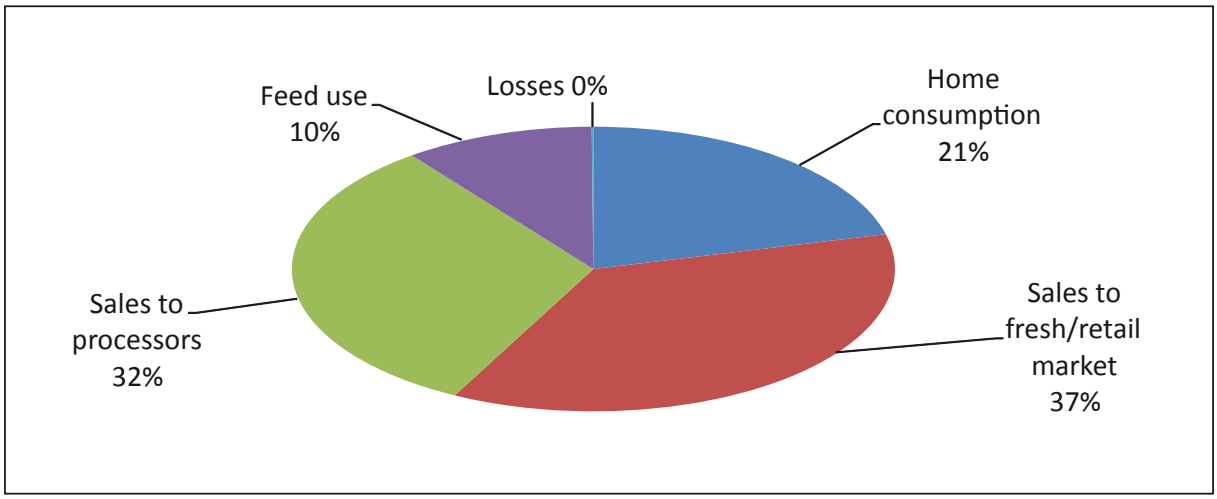
Source: State Statistical Service of Ukraine.

Milk sales to processors are especially important for households located far away from large and medium towns. As of today, about 37 percent of sales of milk produced by households go to the retail market[11] and only 32 percent to processors. In recent years there has been an upward trend for direct milk sales to consumers.

10 - Commercial farms sold 95 percent of their milk to processors and, thus, their share in total fresh market sales was close to 3-4 percent only.

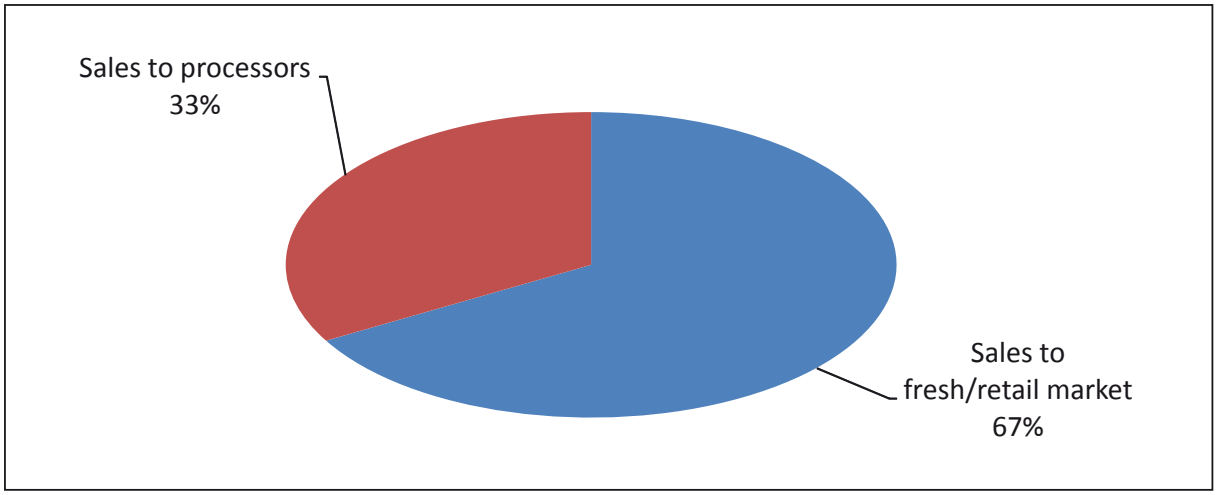
11 - Milk sold as fluid milk, sour cream, cottage cheese and other products including products exchanged for other products and services.

Figure 24. Channels of household milk use, 2010



Source: State Statistical Service of Ukraine.

Figure 25. Share of key marketing channels in revenues from milk sold by households, 2010



Source: State Statistical Service of Ukraine.

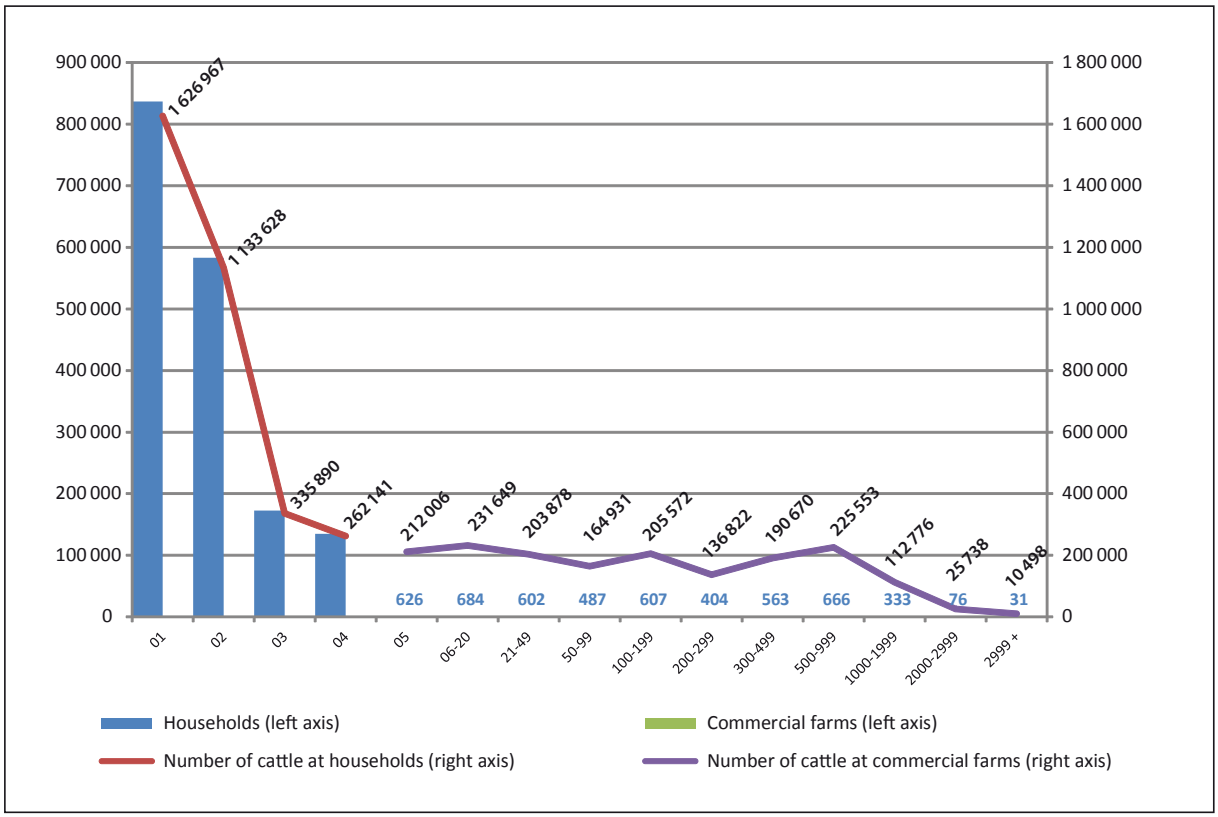
According to estimates, households received about 67 percent of revenues from direct milk sales to consumers and only 33 percent from milk sold to processors. The later percentage also includes the revenues of milk collectors and other intermediaries, who account for about 10-15 percent of the revenues received from milk processors.[12] Therefore, out of the UAH 6.6 billion received from processors, households pay up to 0.8 billion to intermediaries.

12 - Margins of intermediaries are usually 20-25 percent, but part of the milk is bought directly by processors through their own collection points.

Milk production concentration and trends

Ukraine's milk production is highly dispersed among many small rural households and commercial milk suppliers. The official statistics of the number of both rural households and commercial farms by cattle inventories per one farm, suggest that the majority of rural households have only one cow (Figure 26). The households that have only one cow together raise approximately the same number of cattle as all commercial dairy farms in Ukraine.

Figure 26. Grouping of rural households and commercial farms by cattle inventories in Ukraine, head



Source: Authors' presentation based on Ukraine Agricultural Statistics Yearbook 2008 and Ukraine Agricultural Household Sample Survey 2009.

Rural households

As of the end of 2010, the average size of a rural household herd was 1.3 cows compared with 1.23 cows five years ago. However, considering the very small size of the household farm, such an increase does not impact the general milk supply situation in any significant way. These numbers are reflected in the situation detailed above in Sumy oblast. The growing average age of the rural population will likely lead to smaller dairy herds on household farms in the future.

Another factor that may lead to decreasing household dairy herds is improvement in living standards in rural areas and off-farm employment. In addition, Ukraine may also abide by its commitments

at the time of WTO accession to improve food safety control by enforcing stricter controls over sales of unprocessed milk and homemade dairy products at retail markets. The government has already twice considered imposing such a ban in 2005 and 2010. The next term is due on 1 January 2015.

It is possible that in seven to ten years, processors will procure very little or next to no milk from rural household farms due to the above-mentioned factors. Moreover, decreasing dairy herds in most villages make milk procurement more expensive with a resultant decline in the number of milk collection points.

There has been a lot of discussion about the development of mid-sized household dairy farms in Ukraine. As shown below in this report, such farms in most cases will be unfeasible due to limited space at existing household premises (environmental protection aspects), and high financing and investment costs which cannot be met by milk quality premiums.

According to official estimates, only about 32 percent of milk produced by rural households is sold to milk processors. Therefore, special attention was paid to milk produced by commercial farms that are rapidly increasing their share of milk supplies to processors at the expense of household milk producers.

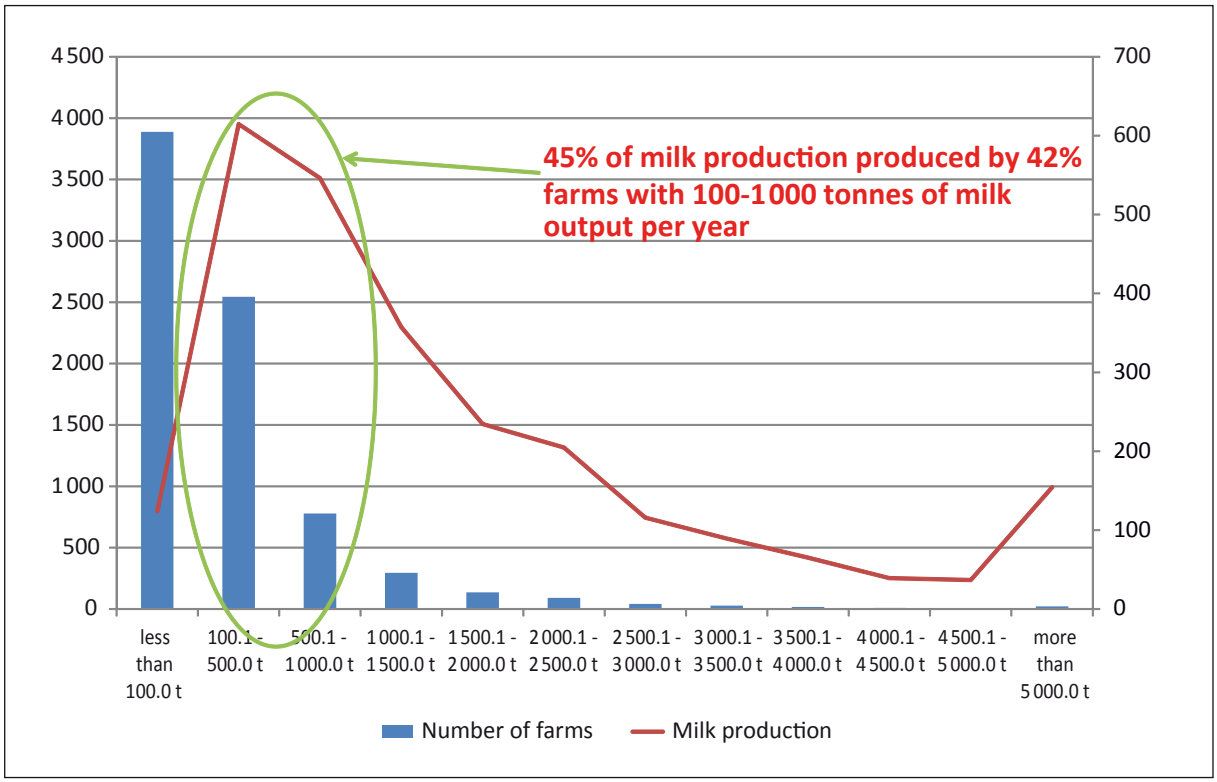
Commercial dairy farms

There have also been signs of increasing production concentration at commercial milk farms. The number of commercial farms producing milk in Ukraine decreased by half in the past five years from 7 860 to 3 960. In the meantime, production of milk at these farms declined by only 14 percent. Thus, average milk production per farm increased by 70 percent in just five years. An average commercial farm in 2010 produced around 600 tonnes of milk per year or 1.5 tonnes per day.

The dynamics of production were analysed for different commercial farm categories based on the available official statistics. In 2005, 45 percent of all milk in this producer category was produced by about 42 percent of farms with an annual milk output of 100-1 000 tonnes per farm. The majority of farms (about 50 percent) produced less than 100 tonnes of milk per year each (less than 275 litres per day), but accounted for less than 5 percent of total commercial milk production (Figure 30).

About 23 percent of commercial milk was produced by farms with an annual milk output of between 1 000 and 2 000 tonnes, but the total number of such farms was 228 or less than 3 percent of the total. Really large farms (more than 3 000 tonnes per year or 8.2 tonnes per day) produced only about 15 percent of milk. However, at that time there were only 84 such farms in Ukraine or 1.1 percent of total farms in the country.

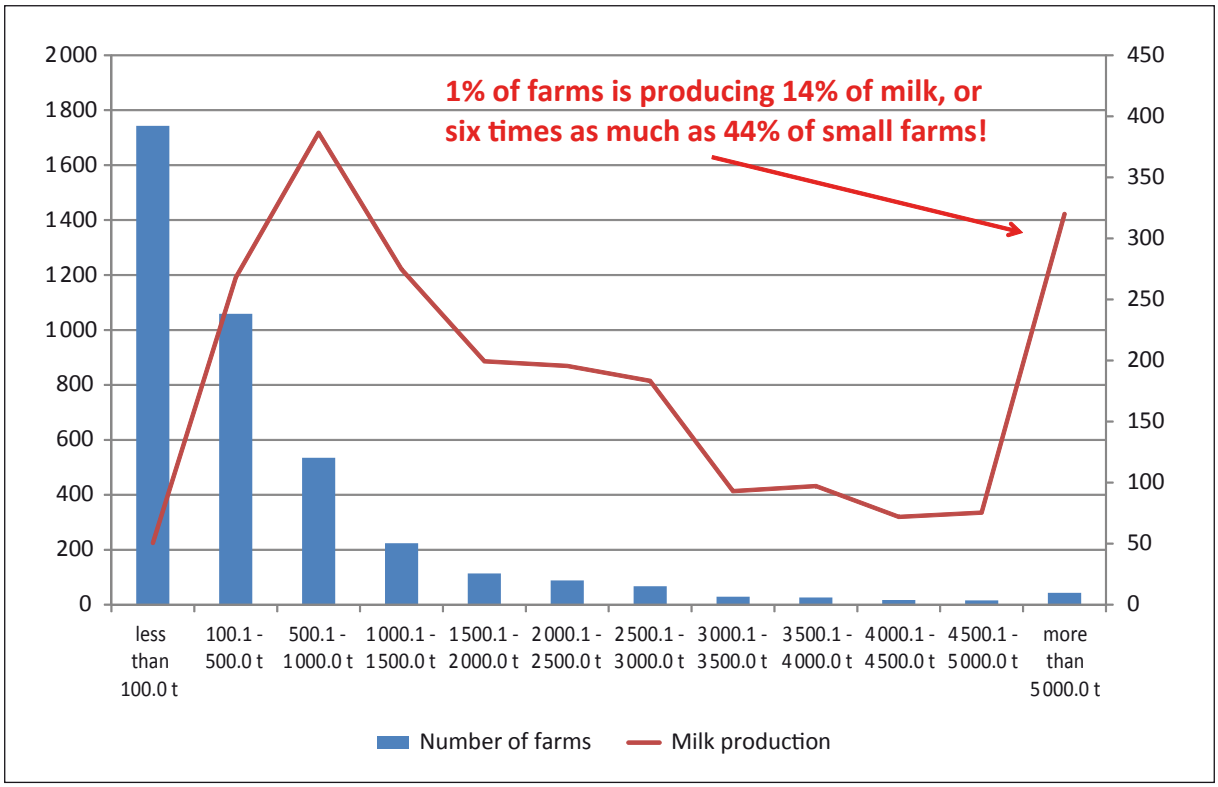
Figure 27. Grouping of Ukrainian commercial milk producers by annual milk output, 2005



Source: State Statistical Service of Ukraine.

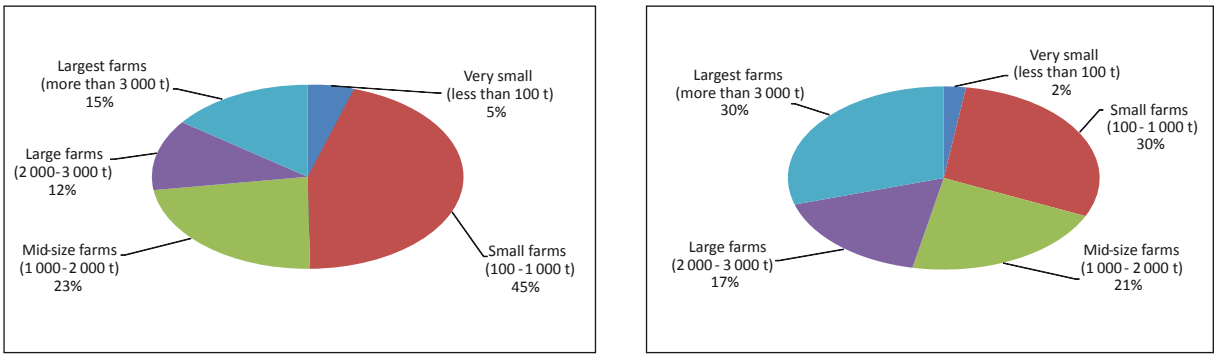
Five years later the situation has changed considerably: the share of small commercial farms has decreased while the share of large farms has increased. In 2010, 1 percent of farms produced already more than 14 percent of all commercial milk (Figure 28). Each of these farms produced more than 5 000 tonnes of milk per year or more than 13.7 tonnes per day. The group of largest farms (with annual milk output of more than 3 000 tonnes) increased in five years to 131 farms (+56 percent) and their total share of milk production by commercial farms reached 30 percent. Therefore, their share in total milk production doubled in just five years (Figure 29).

Figure 28. Grouping of Ukrainian commercial milk producers by annual milk output, 2010



Source: State Statistical Service of Ukraine.

Figure 29. Share of different farm categories grouped by annual milk output in total milk production, 2005 (left side) and 2010 (right side)

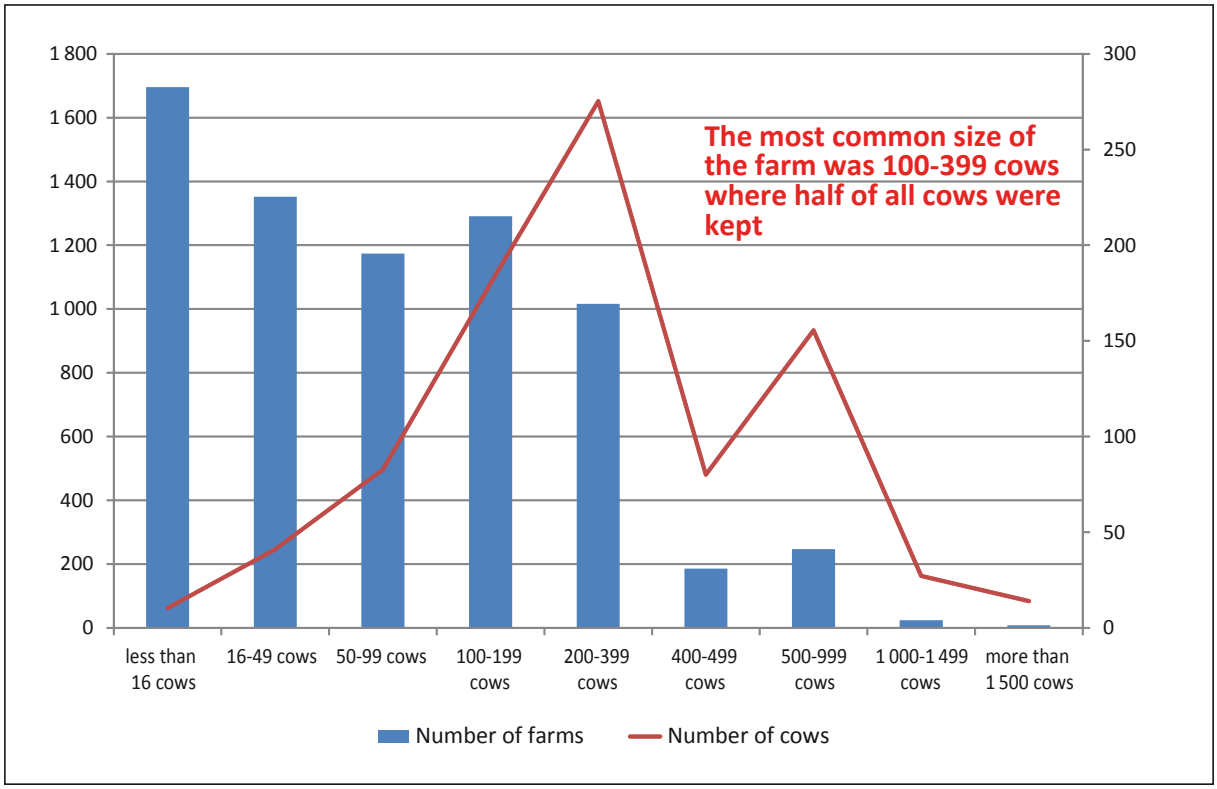


Source: State Statistical Service of Ukraine.

As clearly demonstrated in the chart above, the share of small and medium-sized farms in total commercial production of milk in Ukraine dropped by 19 percent from 2005 to 2010. In 2010, large and largest farms, which produced more than 2 000 tonnes of milk each per year, accounted for nearly half of total production (47 percent), while five years ago their combined share was only about 27 percent. The greatest increase of production was noted in the group of largest farms (more than 3 000 tonnes per year) and the greatest decline in the group of small farms (100-1 000 tonnes per year). The share of mid-sized farms remained largely unchanged.

Analysis of the number of cows kept per farm shows that the situation differs slightly from that of production as a result of different productivity levels at various farm categories.

Figure 30. Grouping of Ukrainian commercial milk producers by number of dairy herd at each farm, 2005

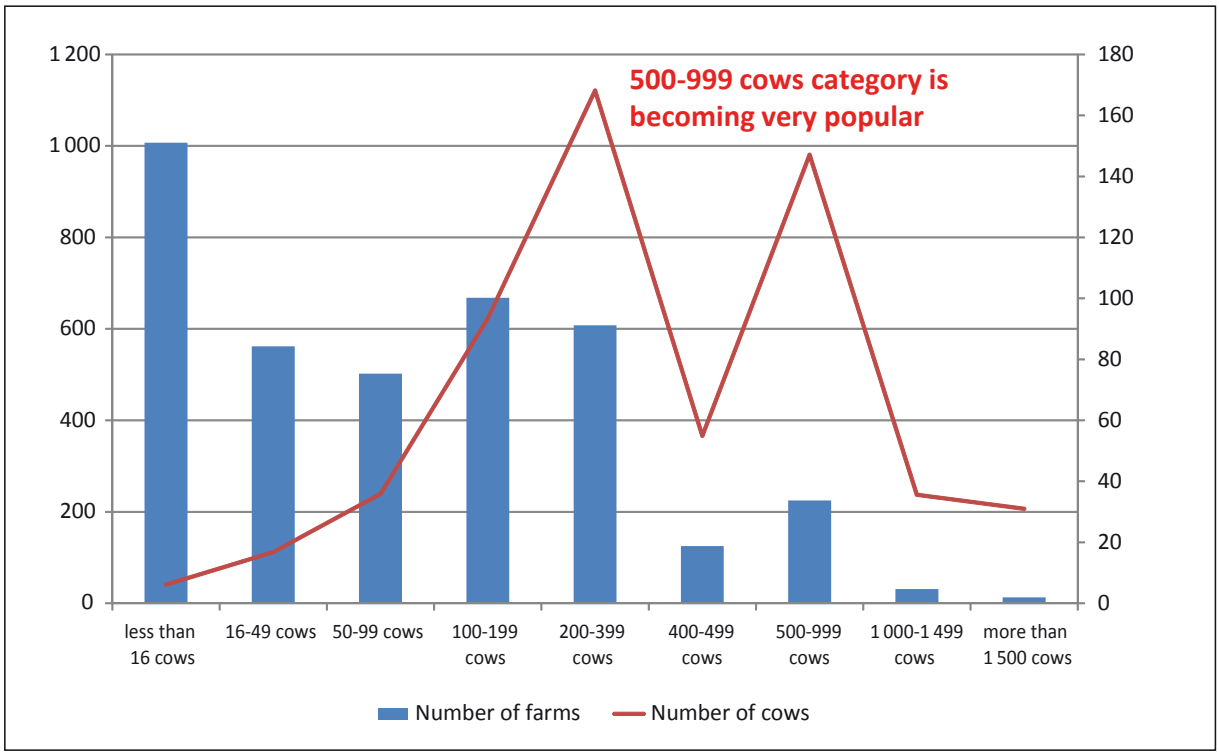


Source: State Statistical Service of Ukraine.

In 2005, only 32 farms or 0.5 percent of all dairy farms in Ukraine kept more than 1 000 cows (Figure 30). The share of their total dairy herd was only 4.5 percent of the total herd kept by commercial dairy farms. Five years later this category of farms grew to 44 farms, which suggests that significant growth was achieved due to higher productivity as numbers of farms producing larger amount of milk grew much faster than the number of farms that kept more cows. In 2010, these 44 farms represented 1.2 percent of all dairy farms and accounted for 11 percent of all dairy herds (Figure 31).

More than half (53 percent) of the total herd of cows in 2005 was kept at farms which had 100-399 cows each. There were about 33 percent of such farms. Five years later, only 44 percent of all cows were kept at such farms as the category of large farms (500-999 cows at each) was growing faster.

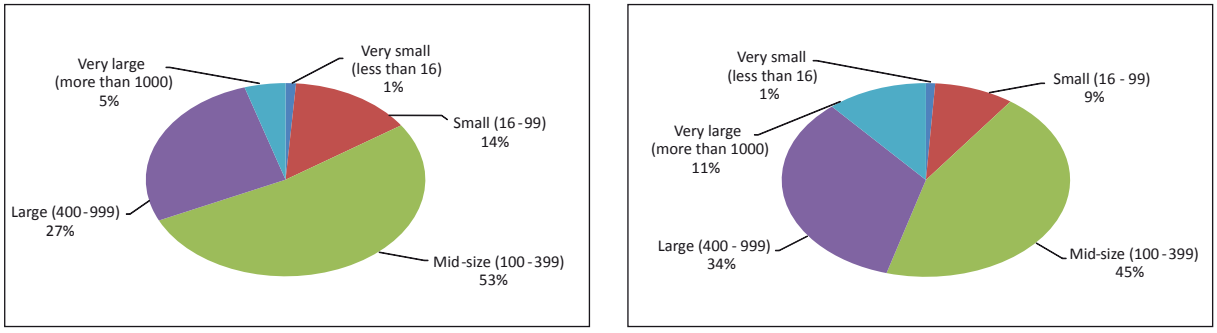
Figure 31. Grouping of Ukrainian commercial milk producers by the number of dairy herd at each farm, 2010, head vs. number of farms



Source: State Statistical Service of Ukraine.

In general, the average number of cows kept at commercial farms grew dynamically (Figure 31). In 2005, an average commercial farm had 65 cows; by 2010 this had increased to an average of 158 cows. Most likely, farms that had less than 100 cows found it uneconomical to produce milk and usually either increased their dairy herd and its productivity or ceased business.

Figure 32. Share of different commercial farms grouped by the average size of dairy herd in Ukraine, 2005 (left side) and 2010 (right side)



Source: State Statistical Service of Ukraine.

Leading milk producers and processors

The largest commercial milk producers in Ukraine continue to increase their dairy herds, motivated by high margins. The largest milk producer is agro-holding *HarvEst* (formerly Illich Agro), a recent acquisition by Ukraine's System Capital Management and Smart-Holding. Its share in total commercial milk production of Ukraine is estimated at about 2.5 percent (about 57 million litres) produced by 28 different farms of the agro-holding.

Astarta is the second largest milk producer, although in 2011 it could become the largest, as milk production increased by about 28 percent. In 2011, the company was expected to produce about 65 million litres of milk.

Ukrainska Molochna Kompaniya (UMK), owned by Eduard Prutnik, has the largest single dairy farm in Ukraine with a herd of about 3 500 cows. Milk production at the farm is estimated at about 30 million litres per year. It is expected that the company will launch another dairy farm in Chernigiv oblast, which will be larger than the present one and will eventually milk about 6 000 cows, potentially tripling milk production. UMK were also among the first in Ukraine to invest in bio-gas equipment and to obtain a "green tariff" for the energy sold to Ukraine's central electrical grid.

Ukrlandfarming is the largest agro-holding in Ukraine by area of land cultivated. It is also becoming one of the top milk producers after its acquisition of Rise. In addition to Rise's farms, it also owns several dairy farms, which could potentially make it a leader in terms of milk production volumes. However, the company is highly diversified at present and it is not clear whether it views dairy as a strategically important segment of its business.

Agro-Soyuz is one of the pioneers in the modern dairy business of Ukraine. Today, it is one of the leading producers of high-quality milk from its modern dairy farm, which has a total annual milk production of around 18-20 million litres.

Myronivsky Hliboproduct is also among the leaders in milk production in Ukraine through its subsidiary Zernoprodukt MHP. Total production is similar to that of Agro-Soyuz, although milk is produced at several smaller farms.

Other leaders with similar production volumes include: Agrofirma Mayak in Poltavska oblast, Agrotis in Donetska oblast, Podillia in Vinnytska oblast, Yaroslavna in Sumska oblast, Vostok in Kharkivska oblast and Shakhtar in Donetska oblast.

Consolidation is also underway in the milk processing segment. Today, the largest Ukrainian milk processors are Unimilk, Wimm-Bill-Dann, Milkiland and Lactalis, which jointly control around 50 percent of the dairy sector.

Unimilk owns 33 milk processing plants and one baby food plant in Kazakhstan, Russian Federation and Ukraine. In Ukraine, it owns some of the leading brands in the fermented products sector. Unimilk processes about 1.7 million tonnes of milk, about 0.5 million tonnes of which is in Ukraine.

Wimm-Bill-Dann owns 37 milk processing factories of which 3 are located in Ukraine. The company processes about 3.2 million tonnes of milk per year, of which 0.6 million tonnes are in Ukraine.

Milkiland sells dairy products produced by 16 milk processing plants in 9 oblasts of Ukraine and offers a full assortment of dairy products. The company also owns a Ostankinskiy milk processing plant in the Russian Federation. Total milk processing of the company is estimated at about 1.0 million tonnes per year, of which about 0.5 million tonnes is in Ukraine.

The Lactalis group was one of the first international companies to enter Ukraine in 1996 by buying shares in the Mykolaiv Dairy Plant. In 2004, Lactalis bought factories belonging to FoodMaster and in 2007 it purchased Molochnyj Dim. Today, it is one of the market leaders offering a wide assortment of dairy products. Lactalis processes about 150 000 tonnes of milk per year in Ukraine. Danone is another company actively working in the Ukrainian dairy market. In 2006, the company bought a Rodich factory in Kherson and modernized it. Danone is estimated to process about 100 000-120 000 tonnes of milk per year in Ukraine at this factory. However, in 2010 Danone acquired Unimilk and its combined processing volumes are estimated at 0.6-0.7 million tonnes per year.

Milk prices

As Ukraine supply continues to adjust to domestic consumer demand, milk prices in nominal terms have gradually increased. In 2010, the milk price paid by processors to suppliers was 4.7 times higher than in 2000 in UAH (Figure 33) and 3.2 times higher in USD equivalent.[13] The milk price increase in 2005-2010 was about 2.6 times in UAH and 1.5 times in USD. As the Ukrainian Hryvnia devalued sharply in 2008-2009, data are provided here in USD equivalents, based on the average rates of the National Bank of Ukraine. Annual inflation rates in Ukraine are provided in the table below for illustrative purposes.

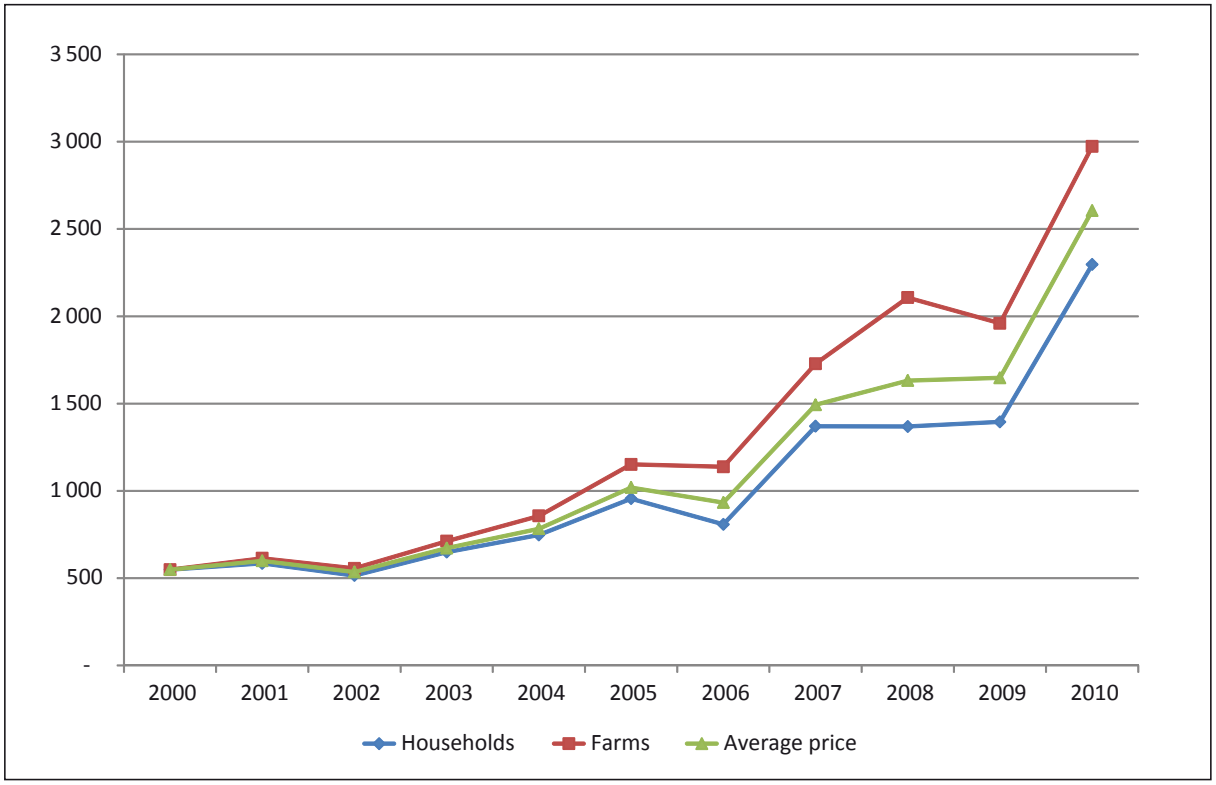
Table 5. Annual inflation rates (consumer price index) in Ukraine (%), 1999-2010

Country	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Ukraine	20	25.8	12	-1.2	5.2	12	13.5	11.6	12.8	25.2	15.9	9.8

Source: Index Mundi.

13 - The prices provided in this report are nominal actual market prices based on data from the State Statistical Service of Ukraine. These prices are not adjusted for the consumer price index (inflation) or the producer price index.

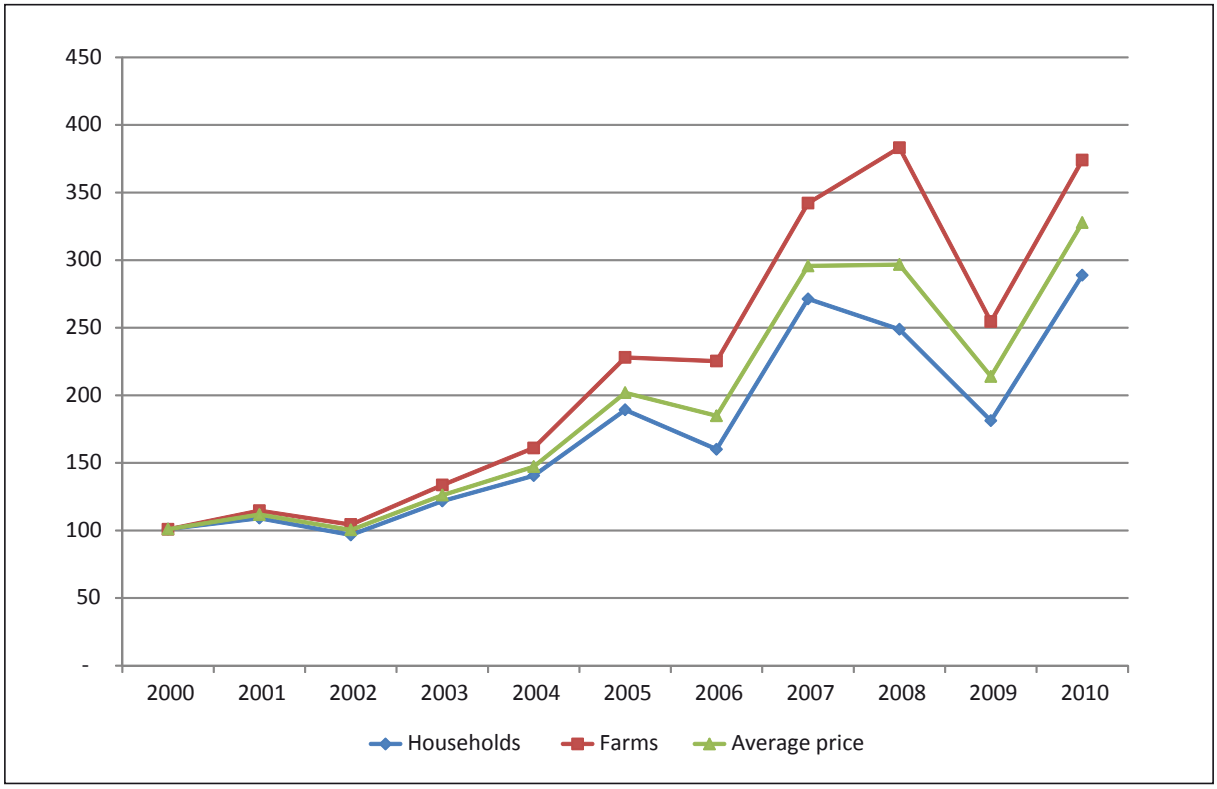
Figure 33. Average annual price of milk paid by processors to different kinds of suppliers in Ukraine, UAH/MT



Source: State Statistical Service of Ukraine.

The milk price dynamics in USD equivalent, based on the current exchange rate, are provided here to eliminate local currency devaluation as a factor (Figure 34).

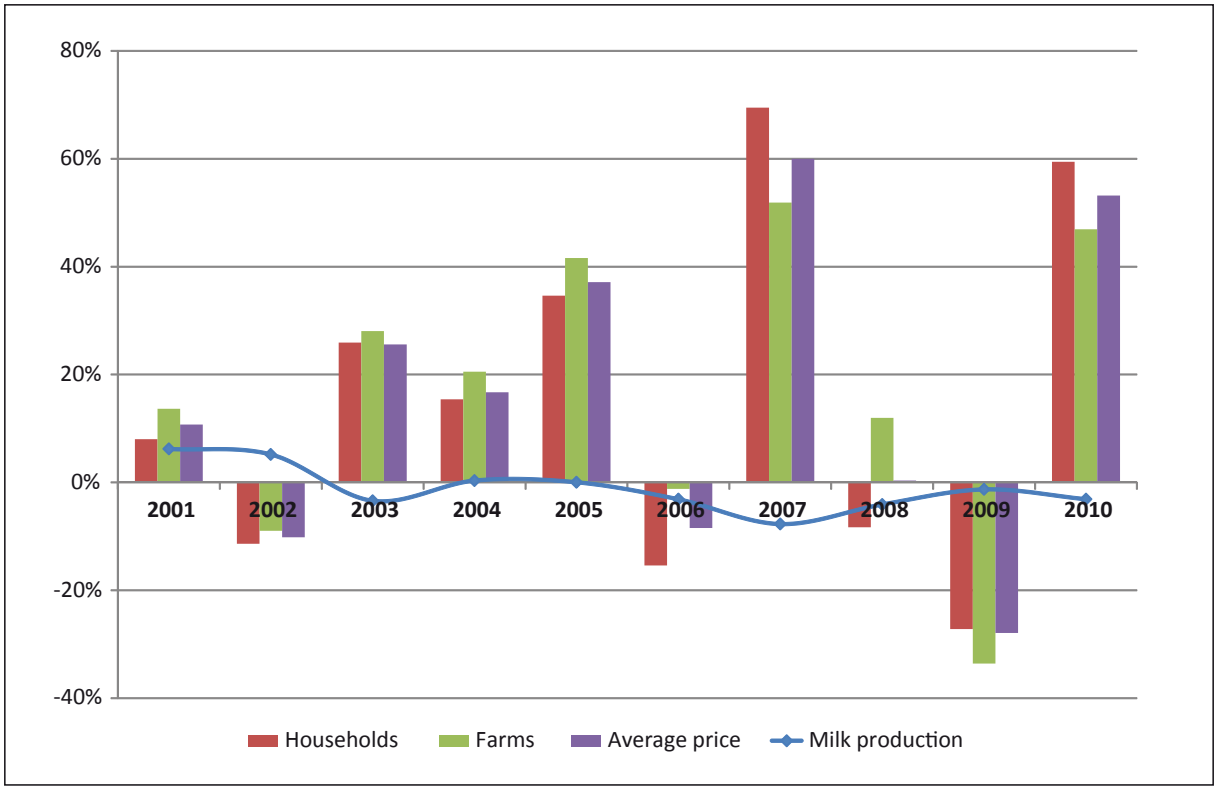
Figure 34. Average annual price of milk paid by processors to different kinds of suppliers in Ukraine, USD/tonne



Source: State Statistical Service of Ukraine.

The difference between price paid for milk to households and price paid to commercial farms has widened with years. While in 2000, the price of milk was basically the same, the gap in prices paid to commercial milk producers and rural household reached 20 percent in 2005 and doubled in 2006 to 41 percent. After that it fluctuated between 26 percent and 54 percent, depending on the market situation for dairy products (Figure 35).

Figure 35. Average annual variation of milk prices paid by processors to different kinds of suppliers recalculated into USD vs. changes in milk production volumes



Source: State Statistical Service of Ukraine.

The prices that processors paid for milk decreased for only three years in 2000-2010. These years usually saw an increase of total milk production. In 2009, another factor affected price – smaller consumption as a result of the financial crisis. Interestingly, in 2006 and 2008, prices for milk supplied by households dropped while prices for milk from commercial farm either increased or remained sufficiently unchanged.

It is important to note that while nominal prices of milk paid to households are much lower than prices paid to commercial farms, such milk usually costs as much to processors or even more. For instance, if milk processors paid UAH 2.2 per one litre of milk to rural households in 2010, they also experienced the following additional expenses:

- 20 percent VAT (UAH 0.44);
- intermediary (procurement centre) (UAH 0.5 –price varied from UAH 0.3 to 0.8 per litre); and
- logistics of procuring milk (UAH 0.2-0.5 per litre).

Thus, the actual cost of milk to processors was closer to UAH 3.0-3.5 per litre of milk, which was higher than the price actually paid to the commercial farms according to official reports.

In the future, prices for milk are expected to remain rather high and preserve their uptrend. As prices of Ukrainian dairy products are already comparable to those of imported products, even on the local market after WTO accession and thanks to free trade with ex-Soviet countries, future

milk prices will correlate closer with prices in the EU and the Russian market. They could also be affected by possible changes in the trade policy of the Russian Federation in relation to Ukrainian dairy products.

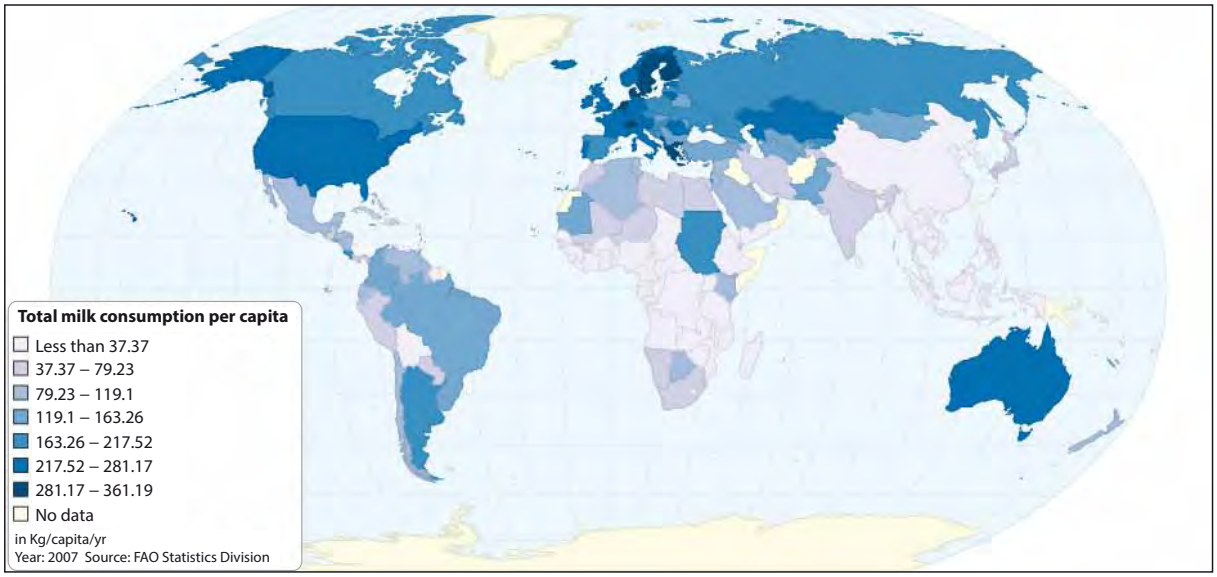
Consumption of milk and dairy products

According to the FAO-OECD Agricultural Outlook, global production of milk in recent years has grown fast at more than 2 percent per year in response to increasing demand. In 2011-2020, global milk production is expected to grow by 153 million tonnes with 73 percent of growth occurring in developing countries (most of it in China and India). For the first time in the history of the dairy industry, production of milk in developing countries is expected to exceed that in developed countries.

Global consumption of milk is expected to grow by 9 percent in ten years with highest growth observed in Asia (2.1 percent per year). Consumption will grow rather rapidly in Latin America by about 1.1 percent per year. The developed world will account for only about 0.5-0.6 percent of the consumption increase per year. As of today, average per capita consumption of milk in the EU is estimated at about 280 kg.

Discussions in recent years about low consumption of dairy products in Ukraine have made reference to the so-called "medical norm of healthy consumption". Even the state programme for development of dairy husbandry in Ukraine is based on this norm, which is widely believed to be 380 kg per person per year, including children and elderly citizens. It is not clear, however, how this desirable consumption target was developed. Nevertheless, it seems to be a serious overestimate considering the fact that Ukraine does not lag far behind most European countries in terms of per capita milk consumption.

Figure 36. Average annual per capita milk consumption worldwide

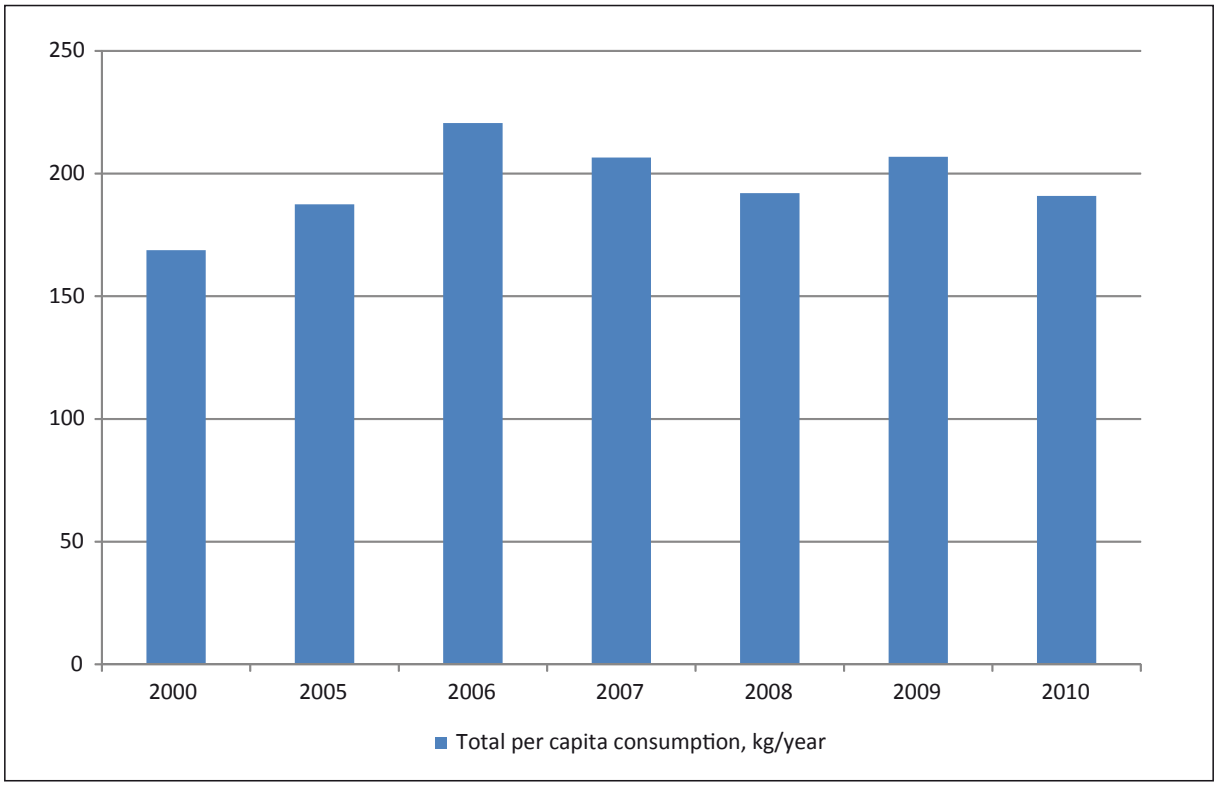


Source: FAO Statistical Division.

Per capita milk consumption in Ukraine, according to data from FAO's Statistical Division (see Figure 36), is about equal to that of the Czech Republic, Poland and Spain, and is higher than in Slovakia and most of the non-EU Balkan countries. The nature of consumption differs, however, as an average Ukrainian consumes less cheeses and other more expensive processed dairy products. As a result, the per capita cheese consumption in Ukraine (Figure 38) is only about a quarter of that in neighbouring Poland or France (Figure 39).

In this regard, consumption of dairy products in Ukraine has significant potential, which has been hampered only by the relatively low consumer disposable incomes.

Figure 37. Average per capita milk consumption, fluid milk equivalent, kg per year



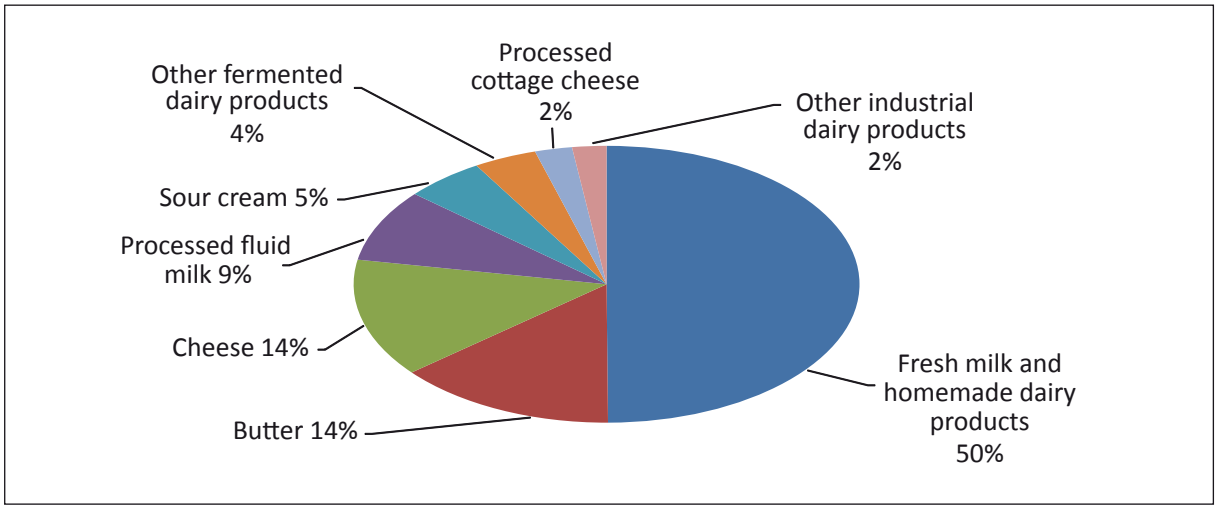
Source: State Statistical Service of Ukraine and own FAO calculations based on its data.

The supply and demand balance estimates provided above show that consumption of milk in Ukraine grew rather rapidly until 2006, reaching its highest level of about 221 kg per person (Figure 37), a 31 percent increase as compared to the consumption level in 2000. The primary factors behind this increase were increasing real per capita incomes and the rapid development of the milk processing industry in Ukraine. The situation changed in 2007-2008 when milk consumption decreased again, probably as a result of a sharp increase in retail prices of milk and milk products, which outpaced consumer income growth.

In 2009, per capita consumption recovered slightly thanks to higher consumption of fresh unprocessed milk and milk products produced by rural households, while volumes of milk processing declined sharply. In 2010, milk and dairy products (mainly cottage cheese and sour cream) from rural households accounted for about 50 percent of all consumption according to estimates.

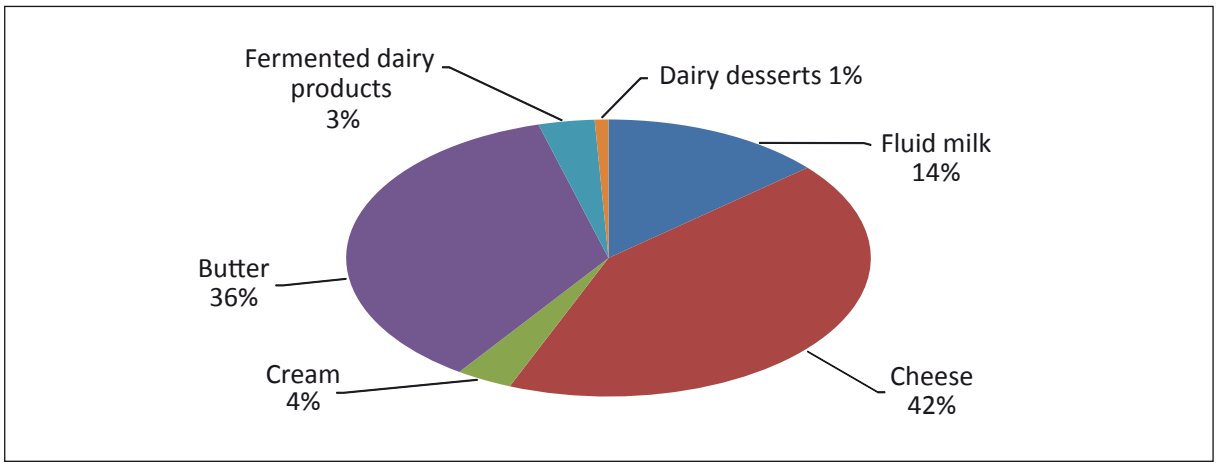
In addition to milk and homemade dairy production, two other major dairy products, butter and cheese, have a 14 percent share in total milk and dairy product consumption (Figure 38). Processed fluid milk (pasteurized, UHT, etc.)[14] accounts for another 9 percent of all consumption: sour cream represents 5 percent and other fermented milk products (kefir, ryazhanka and yogurts) together represent 4 percent.

Figure 38. Structure of dairy products consumption in Ukraine, 2010



Source: State Statistical Service of Ukraine and authors.

Figure 39. Structure of dairy products consumption in France

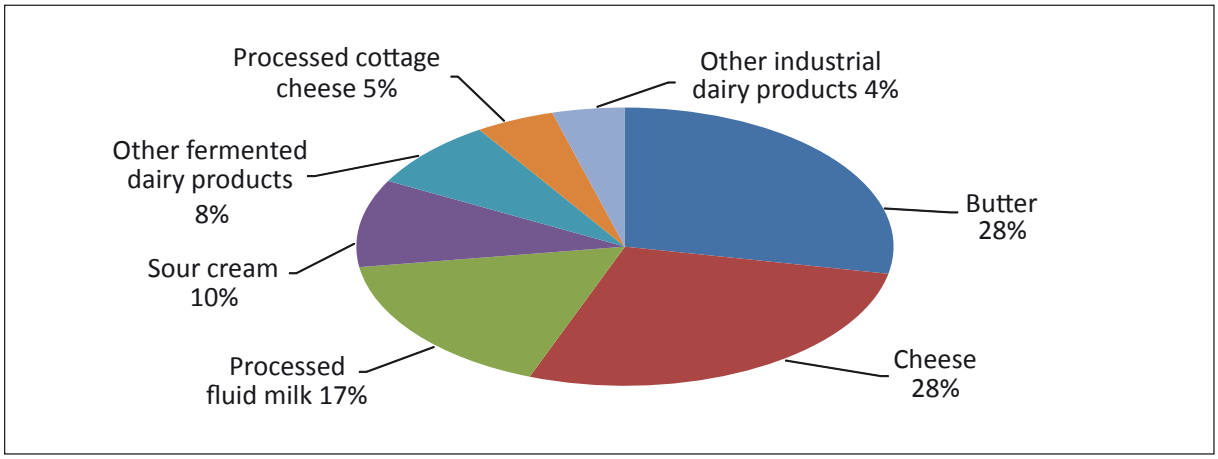


Source: Eurostat data.

14 - Ultra-high temperature processing or ultra-heat treatment milk (UHT) is produced through the sterilization of fresh milk by heating it at a temperature exceeding 135°C for a short period of time (1-2 sec).

Taking into account only dairy products processed by registered milk processing facilities, the shares of cheese and butter account for 56 percent of all consumption, and processed fluid milk accounts for another 17 percent (Figure 40).

Figure 40. Consumption structure of industrially produced dairy products in Ukraine, 2010 (based on fluid milk equivalent)

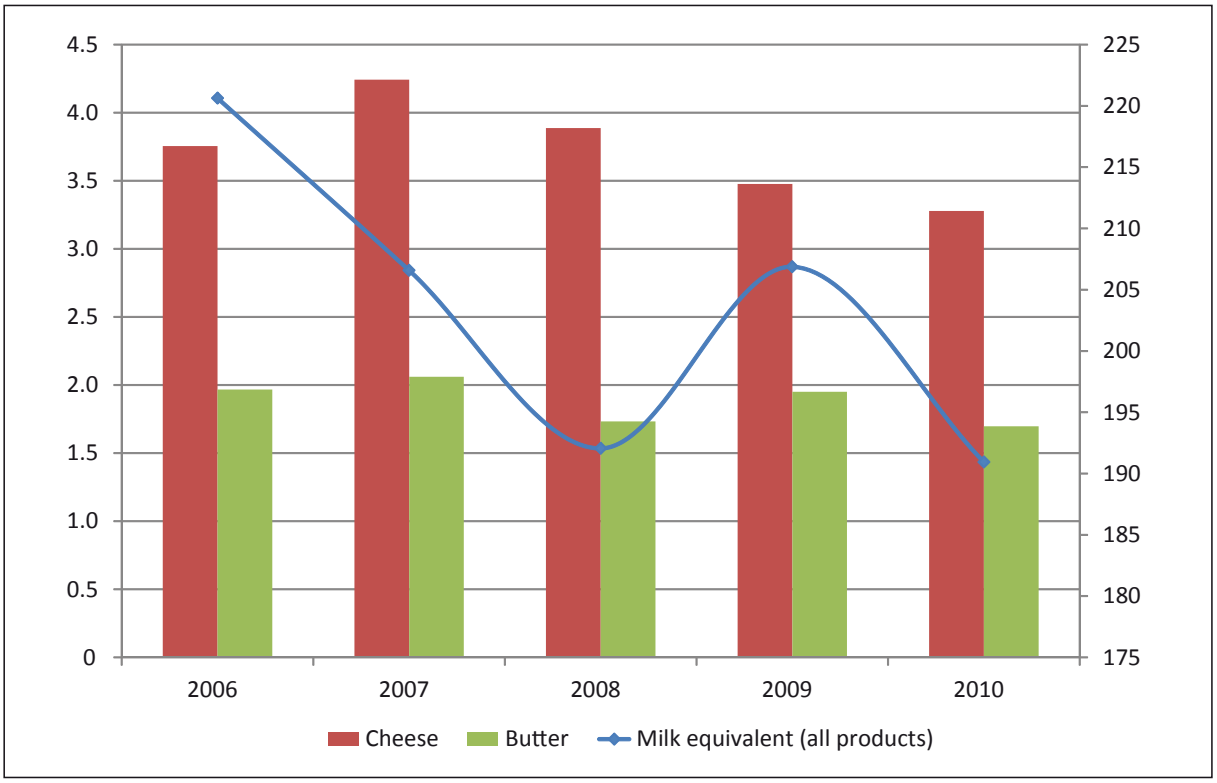


Source: State Statistical Service of Ukraine and authors.

Butter and cheese consumption in 2007 was highest during the period 2006-2010. The per capita cheese consumption of 4.2 kg reached in 2007 declined by 23 percent in the following three years to 3.3 kg in 2010. Butter consumption decreased by 18 percent from 2.1 kg down to 1.7 kg (Figure 41).

This shift can be attributed to changing consumer preferences and perceptions in Ukraine. The per capita consumption of bread and bread products and vegetable oils also declined during the same period in Ukraine, while consumption of vegetables, fruits, eggs and meat increased. The overall composition of calories, fats and protein has remained basically unchanged: in 2007, an average Ukrainian consumed 2 940 kcal, 79 g of protein and 96 g of fat per day. In 2011, these indicators were 2 951 kcal, 80 g and 96 g respectively, according to official Ukrainian statistics.

Figure 41. Per capita consumption of cheese and butter compared to consumption of all dairy products, kg/person/year



Source: State Statistical Service of Ukraine and authors.

Cheese consumption in Ukraine is very low compared to the EU. Average per capita cheese consumption in Poland is estimated at about 11 kg per person per year and is almost four times as high as in Ukraine. EU-12 countries have much higher consumption than Poland with leading countries (France) consuming as much as 30 kg per person per year. This suggests that Ukraine's cheese consumption can increase significantly if there is growth in incomes of Ukrainian consumers and a positive shift in consumer quality preferences. Cheese exports from Ukraine may decrease by half if consumption recovers to pre-2008 levels.

France is a global leader in butter consumption with more than 8 kg consumed per person per year. Consumption of butter in Poland is about 3.9 kg, which is only slightly lower than in the Russian Federation, where consumption is estimated at about 3.6-3.7 kg. Thus, Ukraine still has potential to increase butter consumption from its current level of 1.7 kg per capita.

Butter consumption is frequently impacted by health-related information. For example, butter consumption in the United States and the EU in recent decades has been heavily affected by the growing popularity of margarine, which was much cheaper and also considered healthier, although this trend has somewhat reversed in recent years. Butter also competes with a variety of other spreads and even sauces. As Ukraine is a heavily price-sensitive market, it is expected that butter consumption will continue to stagnate unless consumer incomes recover substantially.

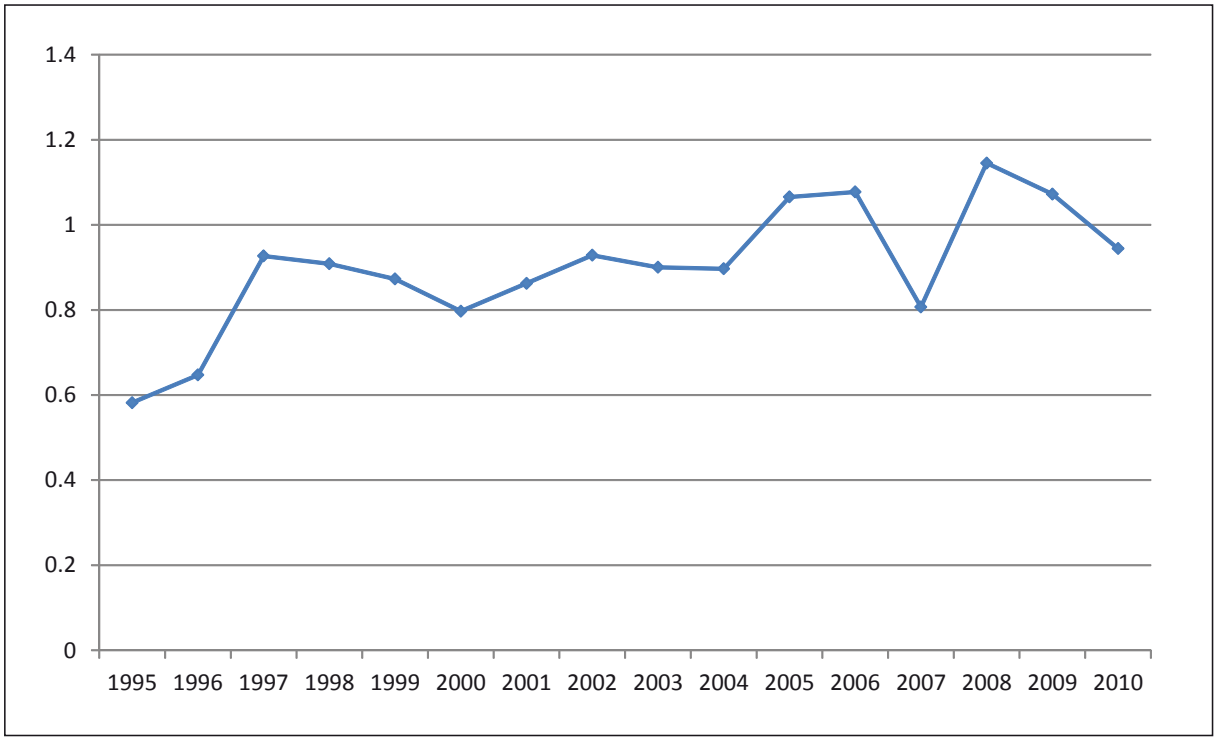
Trade policy for dairy products

Ukraine joined the WTO in 2008 after almost 15 years of accession negotiations. Since then, import tariffs for dairy products decreased to 10 percent of the value of import customs. Prior to WTO accession, import duties for dairy products in Ukraine were specific and ranged from EUR 0.1-0.2 per kg to EUR 3 per kg. Currently, Ukraine's dairy import policy is rather liberal compared to its neighbouring countries. For instance, import duties for dairy products in Turkey, also a member of the WTO, range from 108.3 percent to 140 percent and import duties for dairy products sold to the Russian Federation range from 15 percent, but not less than 0.22 euro per kg.

Market protection

According to the OECD, Ukraine's Producer Nominal Protection Co-efficient (NPC)[15] for dairy products ranges closely to 1 (Figure 42).

Figure 42. Producer Nominal Protection Co-efficient for dairy products in Ukraine



Source: Based on OECD data.

15 - The NPC is an indicator of the nominal rate of protection for producers, measuring the ratio between the average price received by producers (at the farm gate), including payments per tonne of current output, and the border price (measured at farm-gate level). A producer NPC of 1.2 indicates that domestic producer prices are on average 20% above border prices for the same commodity. A producer NPC of 1 indicates that prices received by producers are on average the same as border prices (i.e. domestic producers are not protected from import competition).

In the past 16 years the coefficient has averaged 0.9, suggesting that development of milk production in Ukraine is market driven. Although the level of domestic dairy market protection has somewhat increased since 1995, Ukraine's milk NPC has remained below one in most years. This means that the level of domestic market protection is rather low and that the domestic dairy industry has not been isolated from international market price signals.

Exports and imports of dairy products

Ukraine remains a net exporter of milk and dairy products. When all dairy products traded are re-calculated into milk equivalent, the trade balance for this segment emerges as consistently positive. It was highest in the middle of the past decade exceeding 1.7 million tonnes and fluctuated around 700 000 tonnes during the past five years (Figure 43).

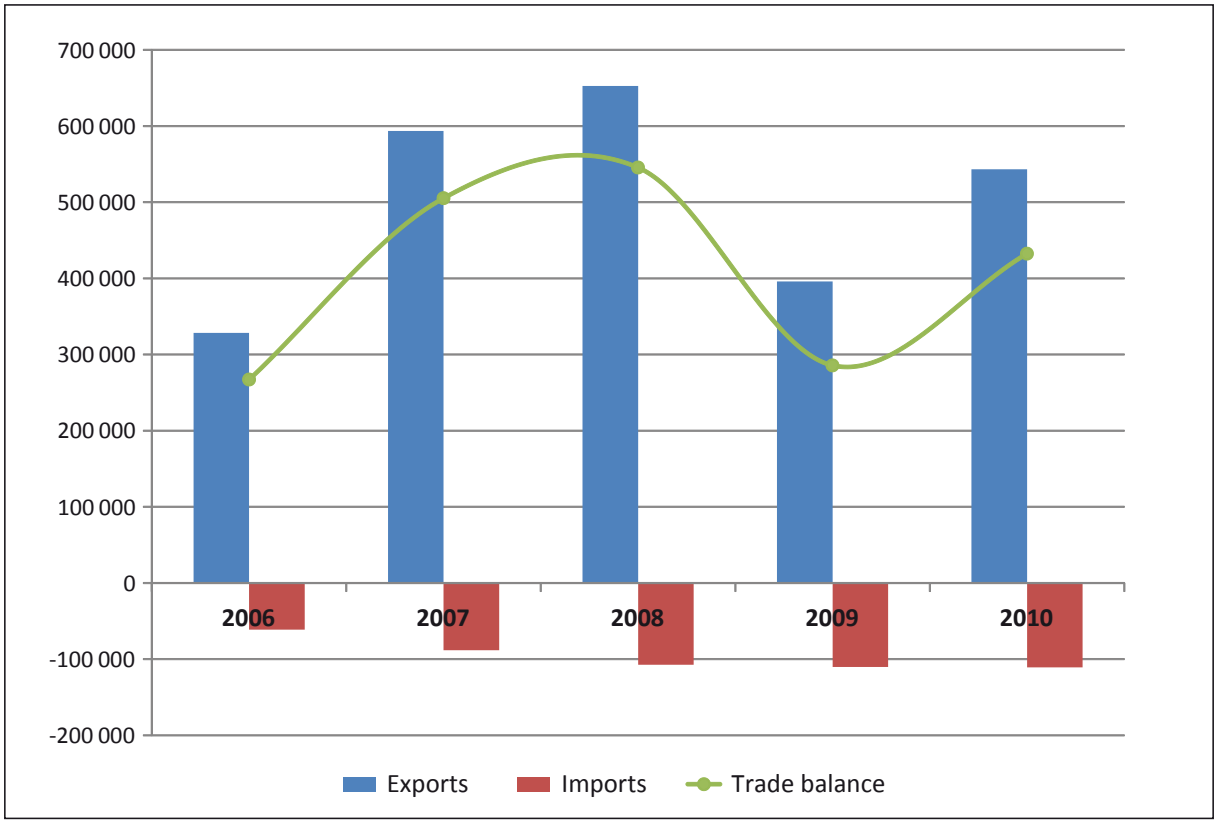
Figure 43. Exports, imports and trade balance of dairy products, fluid milk equivalent, thousand tonnes

Source: ITC.

While exports declined by only 13 percent in the past ten years, imports increased more than five-fold. Nevertheless, in 2010, exports were 3.5 times as high as imports and Ukrainian milk processors remained significantly dependent on foreign markets.

In terms of value trade, the trade pattern looks rather stable. Positive trade balance varies between USD 300 million and USD 500 million. Exports in the past five years have averaged USD 0.5 billion and imports were about one fifth of that at around 95 million per year (Figure 44).

Figure 44. Exports, imports and trade balance of dairy products, thousand USD

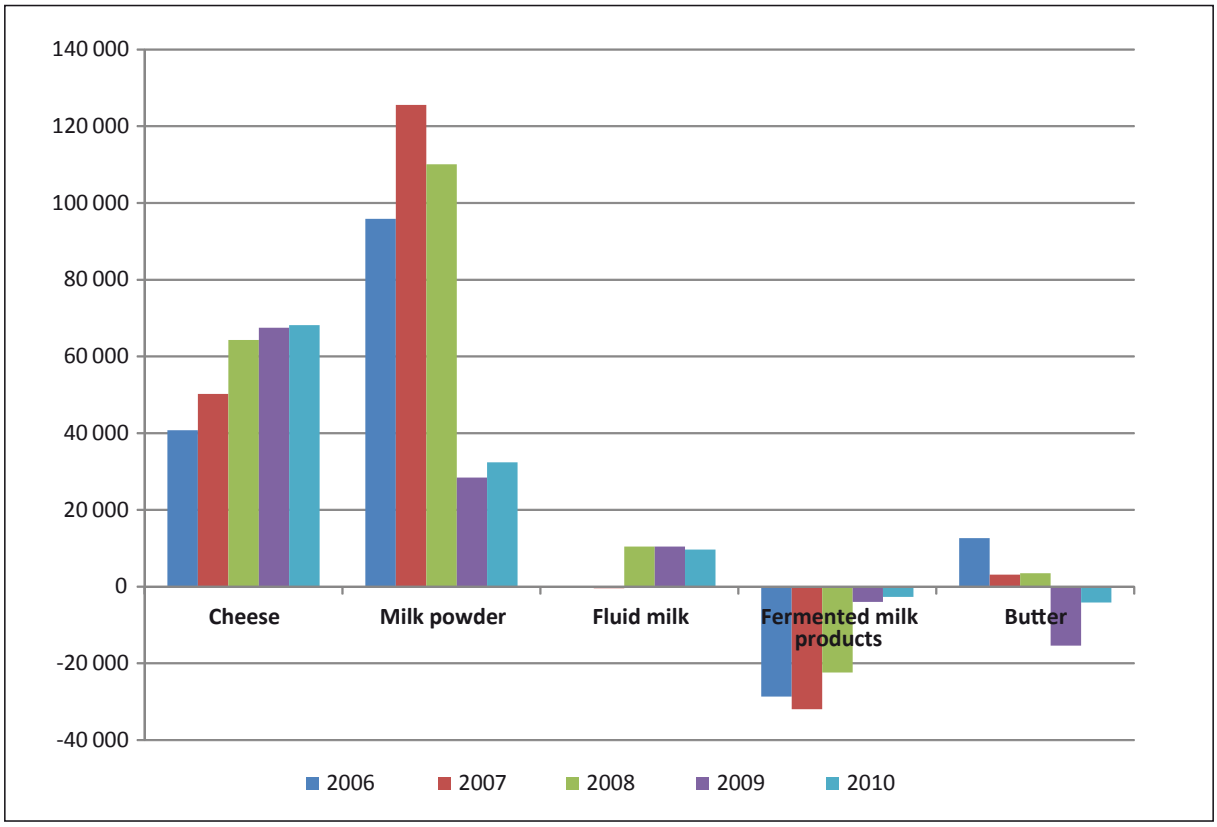


Source: ITC.

Cheese and milk powder are products with a high positive trade balance (Table 58, Table 59 and Table 60). While trade balance is constantly improving for cheese, it has worsened sharply in the past two years for dry milk. As mentioned above, this is largely due to increased domestic use of the latter as well as the decreasing offer of inexpensive milk to processors in the summer season. Fermented milk products have the most negative trade balance, but this has improved in the past two years and is now close to zero, although in general terms it was of low significance.

Ukraine has become a net importer of butter in the last two years, but trade balance in 2010 improved mainly thanks to non-tariff barriers imposed by Ukrainian authorities (Figure 45; additional information in Annex 6).

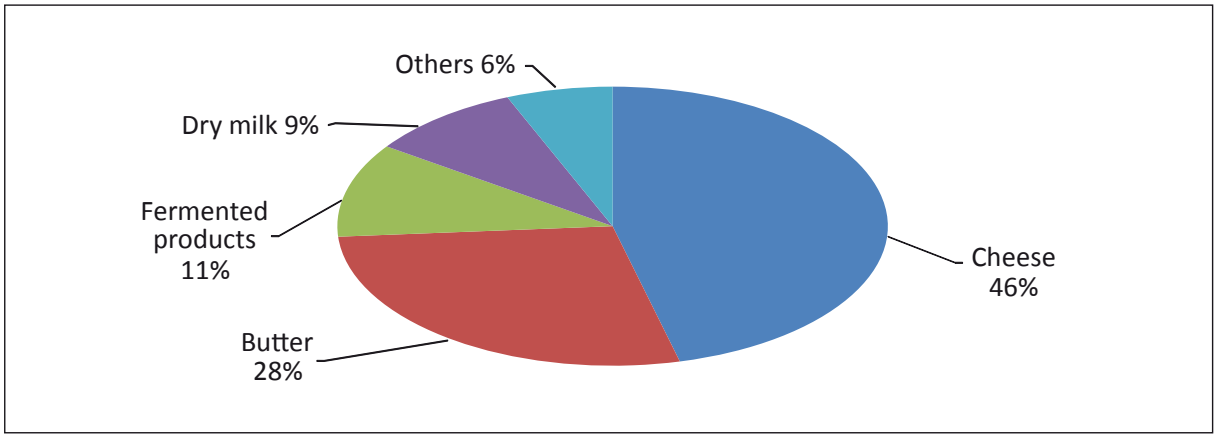
Figure 45. Trade balance dynamics for key dairy products, tonnes



Source: ITC.

In 2010, cheeses accounted for 46 percent of the value of dairy imports in Ukraine, being the largest import category (Figures 46 and 84). Butter was second largest with a 28 percent share in the total value of imports (Figures 46 and 82). Other products had much smaller shares (Figure 46).

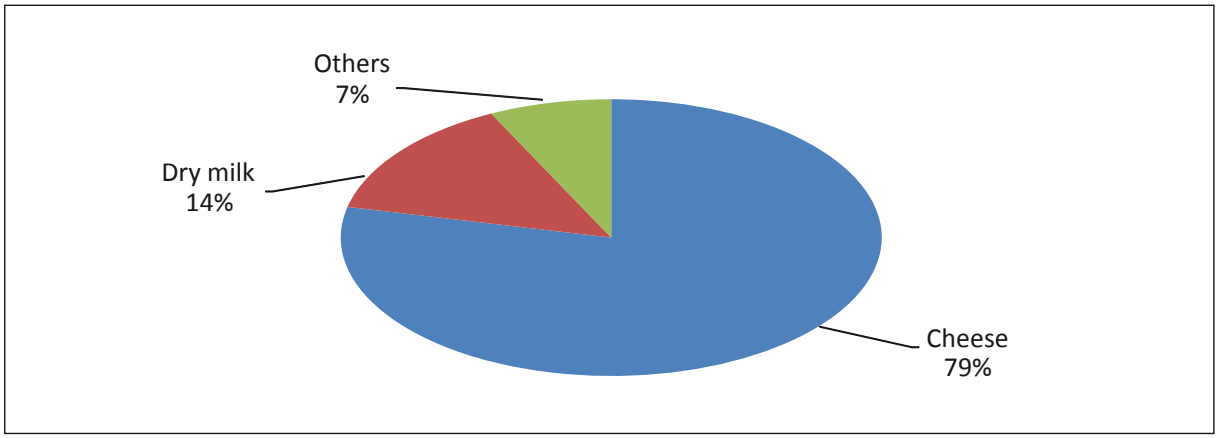
Figure 46. Structure of dairy products imports in 2010 in terms of value



Source: ITC.

In the meantime, cheese accounted for about 79 percent of all exports (Figures 47 and 85) and another 14 percent was gained from exports of dry milk (Figures 47, 87 and 89). All other product categories had a combined share of 7 percent in total exports.

Figure 47. Structure of dairy products exports in 2010 in terms of value



Source: ITC.

The Russian Federation was the key buyer of Ukrainian dairy products: it accounted for 83 percent of cheese exports from Ukraine and for 15 percent of dry milk imports, being the major destination for both products. Moldova and Kazakhstan were the two other most important destinations for a variety of dairy products from Ukraine.

Ukraine has exported cheese to only three countries: the Russian Federation, Kazakhstan and Moldova. Kazakhstan bought about 13 percent of all cheese and Moldova another 3 percent (Table 58).

Exports for the second most important export product, dry milk, were much more diverse. The list of importers for this product included more than 100 countries over the past five years (top 10 countries in Table 59 and Table 60). However, this list has shortened as export volumes dropped. In 2010, only 38 countries imported dry milk from Ukraine. Besides the Russian Federation, key export destinations of dry milk were: Bangladesh (12 percent), Turkmenistan (10 percent), Kazakhstan and Azerbaijan (9 percent each), Armenia (6 percent), Georgia (5 percent), Moldova (4 percent), Cuba, Egypt, Nigeria, Syria and Turkey (3 percent each).

Fluid milk was exported mainly to Kazakhstan (70 percent) and smaller volumes to Moldova and Azerbaijan (15 percent and 11 percent respectively). Moldova and Kazakhstan also bought the majority of the fermented products from Ukraine (49 percent and 43 percent respectively) and the same countries were key importers of Ukrainian butter (30 percent and 57 percent respectively).

Ukraine imports cheese mainly from the Netherlands, Poland and the Russian Federation. Butter has been imported mainly from Belarus with smaller volumes coming from Belgium, France, Poland and the United States. Nearly all fermented products (mostly yogurts) were imported from the Russian Federation. Dry milk was imported from Belarus, Poland and the United States.

Ukraine exports dairy products to Commonwealth of Independent States (CIS) countries under the free-trade regime. Only Value Added Tax (VAT) on the value of imported products is paid, which is common practice in international trade. The same trade regime applies to dairy products imported from CIS countries. However, the Russian Federation has been actively applying non-tariff barriers in trade with Ukraine, mainly because of concern about the high share of Ukrainian cheese makers on the local market. At the time of writing, only a limited number of Ukrainian cheese producers were allowed to export to the Russian Federation by Russian sanitary authorities.

All dairy products imported to Ukraine from non-CIS countries are subject to a 10 percent import duty based on customs value. VAT is also paid on top of this amount. In the last two years, Ukrainian customs officials have frequently refused to recognize customs value based on contracts and have made importers pay import duties based on their own valuation of imported goods. While customs valuation is banned under WTO Agreements, reference pricing, which in theory should only serve as information to customs officers, is widely applied in Ukraine.

Milk quality issues

Milk quality remains one of the main issues in Ukraine, affecting the quality of the final dairy products and Ukraine's geography of exports. While not a problem for dry milk (both non-fat and full-fat), milk quality remains a key issue for cheese exports, the main dairy export product. Since about 25 percent of Ukraine's processing industry depends on exports, of which 20 percent are quality-sensitive products, this issue is of importance. Moreover, since local consumption is not developing very rapidly, the only way to encourage dairy industry development would be to improve the quality of its products and expand export geography.

Since Ukrainian processors still procure a substantial share of milk from households (see above), meeting existing food safety and quality indicators for milk outlined in the State Standard of Ukraine DSTU 3662-97 "Whole cow milk: requirements for purchasing" (Table 6) proves difficult.

Table 6. Key indicators used to determine milk quality grades in Ukraine according to DSTU 3662-97 "Whole cow milk: requirements for purchasing"

Indicators	Limits for grades			
	Extra	*Highest*	*First*	*Second*
Acidity, °T	≤16-17	16-17	≤19	≤20
Degree of cleanness according to etalon, group	I	I	I	II
Overall bacterial count, thousand per cm³	≤100	≤300	≤500	≤3 000
Temperature, °C*	≤6	≤8	≤10	≤10
Dry content, %	≥12.2	≥11.8	≥11.5	≥10.6
Cell count, thousand per cm³	≤400	≤400	≤600	≤800

* *Note: Buyers have a right to accept un-cooled milk of all grades if its temperature is higher than 10°C.*

It is difficult to ensure high-quality milk from rural households. The milk quality sampling in three villages of Sumy oblast conducted under this project confirmed this well-known fact. While most of the quality parameters fall within existing requirements, cell count is too high to ensure high quality. Moreover, quality of milk drops sharply in the summer and up to 35 percent of all milk provided to processors in some villages cannot be used for processing, as it is sour. Levels of protein and fat in milk also drop substantially in the summer due to differences in summer and winder feed rations. While fat levels declined in sampling by only 3-7 percent, protein content dropped by 20 percent on average.

Cell count in the winter, in the three villages where samples of milk were taken, showed an average of 210 000 in cubic centimetres. In the summer, the cell count went up to an average of 620 000. Thus, this indicator nearly tripled, dropping milk quality to second grade or no-grade.

The experience in Sumy oblast shows that nearly all households have problems with ensuring basic conditions for production of high-quality milk:

- hygienic conditions of barns;
- cow milking by hand in the barn (cleanliness of pails and hands, pails without lids, lack of hot water access, etc.);
- milk storage (only a few use refrigerators, most accumulate and keep milk in basements where temperature in the summer is 10-15ºC, where many keep milk for as long as 24 hrs);
- feed quality and rations (based on availability and not appropriateness);
- breeding and animal health;
- falsification of milk by households (non-milk components added such as water, antibiotics, non-dairy fats, etc.); and
- procurement points (milk not frequently tested, hygiene of cooling tanks not always ensured).

Addressing these problems is possible; however, it requires additional investments, which are beyond the reach of households in the majority of cases. If financial resources were made available, household farmers would need to obtain higher prices for their milk in order to repay these investments. This is not achievable as milk procured from rural households already costs processors about as much as milk bought from commercial farms despite the lower quality of the former.

Price incentives for higher-quality milk are only efficient for 5-10 percent of suppliers, who actually already supply high-quality milk. Others prefer not to worry about extra small revenues, as they are not worth the additional effort.

Milk testing at the collection point is an important psychological measure to improve the quality of supplied milk. However, in a lot of cases this causes significant reduction of milk procured as people immediately switch to buyers who accept any milk without testing. Besides, proper testing techniques have prohibitive costs considering the small amount of milk supplied by one household. Therefore, this solution is impractical unless codified in law and actually enforced.

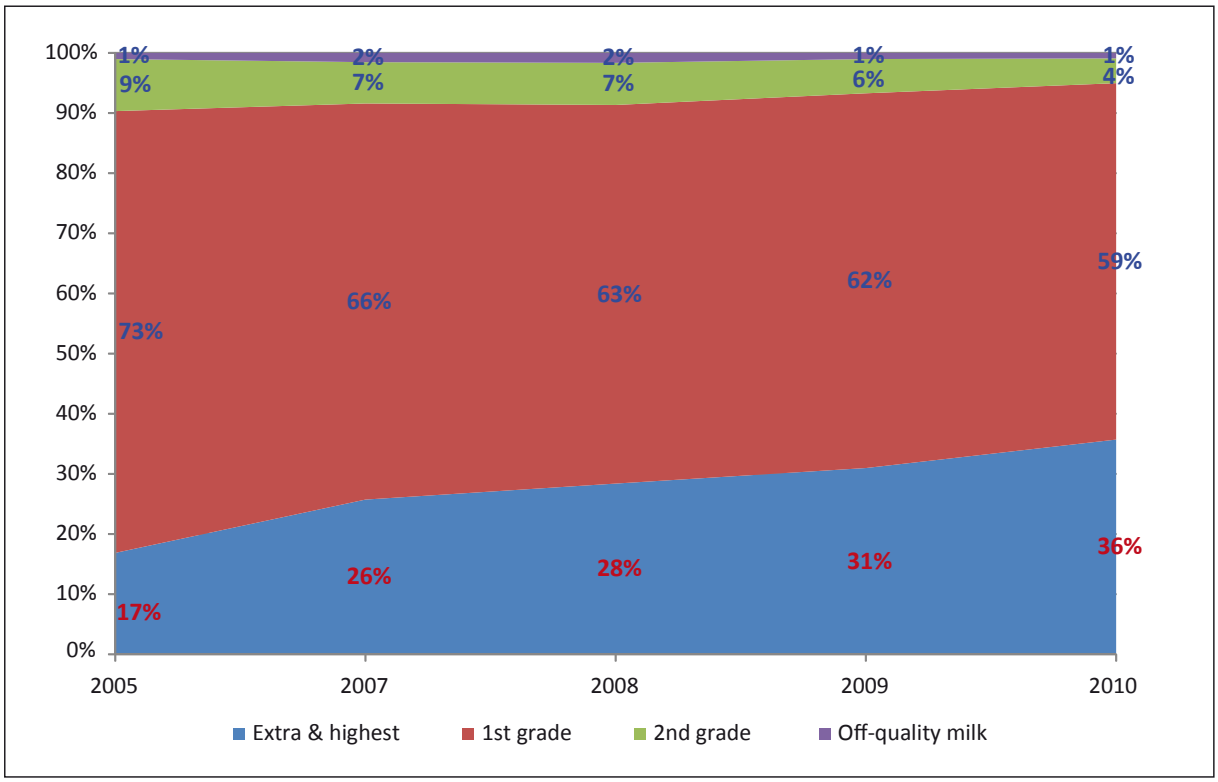
Some Ukrainian processors have equipped their collection points with special filters to improve the situation regarding cell count indicators. This does not resolve all problems but could be of significant help in keeping milk quality under control.

Addressing milk quality and other problems of small rural household dairy farming through the creation of cooperatives[16] can help; however, the long-term sustainability of these efforts without donor funding is not yet clear. The principal difference between a private (or a plant's) milk collection point and a cooperative is that the cost of milk procured from a cooperative is frequently higher and the quality is not always markedly better.

As of 2008, the government introduced an "extra" milk quality grade to motivate farmers to supply better quality milk. There were three milk quality grades, including "off-quality" (milk not be used for human consumption) prior to the introduction of the "extra" grade. According to official information, the quality of milk supplied by commercial farms to processing enterprises has increased over the last five years in Ukraine (Figure 48).

16 - See: www.heifer.org.ua/en/indicators-of-our-success.html.

Figure 48. Evolution of milk quality sold by commercial farms to processors by grades in Ukraine, 2005-2010



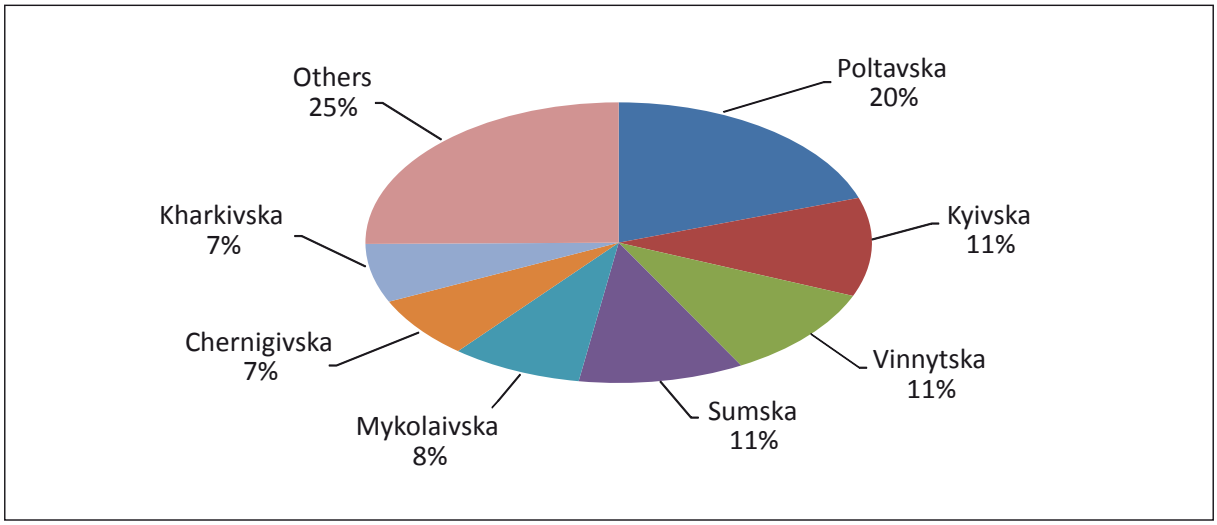
Source: State Statistical Service of Ukraine.

In 2005, the share of the highest grade of milk was only 17 percent, but in 2010 it more than doubled to 36 percent. In the meantime, the second grade milk category declined from 9 percent to 4 percent. The main reason for the improved milk quality was technical modernization and enlargement of commercial dairy farms.

Therefore, it is not surprising that the highest volumes of "extra" and highest grade-quality milk are noted in regions with the largest farm size. Poltavska region supplies one-fifth of all highest quality milk in Ukraine by volume, and is also a leader among Ukrainian regions with the highest percentage of milk produced by commercial farms.

In total, seven leading regions supply three quarters of the total highest quality milk, while the remaining 17 supply only 25 percent. Thus, there is a significant degree of concentration of high-quality milk production in Ukraine today. There are no regions from western Ukraine among the leading producers of highest quality milk as these regions have a high percentage of household or small-scale milk producers.

Figure 49. Share of Ukrainian regions in supply of "extra" and highest grade milk, produced by commercial farms

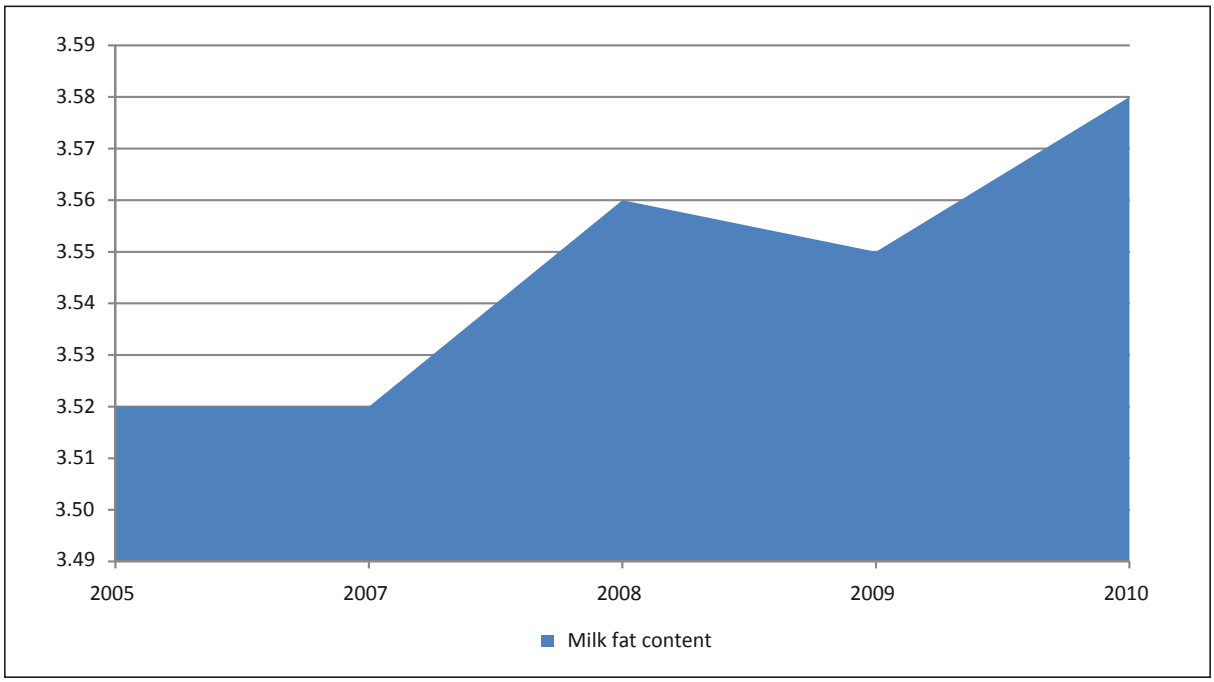


Source: State Statistical Service of Ukraine.

Of these regions, almost 60 percent of all milk supplied by commercial farms in Mykolaivska oblast is of the highest quality grades – the highest percentage achieved in Ukraine. The share such milk in Vynnytska oblast is 56 percent, in Poltavska it is 50 percent and in Sumska oblast it is 47 percent.

Ukrainian statistics only keep track of fat content in milk; no information about protein content is available. Although fat content in milk depends on many factors, such as feeding, animal breed and so on, a certain uptrend in recent years has been noticed, although the variation was not very significant: fat content was 3.52 percent in 2005, but increased to 3.58 percent in 2010 (Figure 50).

Figure 50. Evolution of fat content in milk sold by commercial farms to processors in Ukraine (%)



Source: State Statistical Service of Ukraine.

Differences in the technology of milk production in Ukraine and the EU

The development of Ukraine's dairy sector is causing a transformation of all key elements of milk production technology, including barns, feeding, milking, veterinary and animal breeding, and herd management services. It is possible to find various types of old and modern milk production technologies in Ukraine. Households in the vast majority of cases only keep one to two cows in the small barn next to the house in a village. Frequently, the barn also accommodates other farm animals. Usually, household cows are milked in the same barn, and in most cases milk is not refrigerated. The following section reviews the key differences between typical technology of commercial milk production in Ukraine (mostly inherited from the Former Soviet Union [FSU]) and developed EU countries.

Barns and keeping

Most of the barns in Ukraine were developed as tie-stall barns, where animals are tied in fixed positions. The majority of new barns and old barn conversions are free-stall barns, which provide a better environment for behaviour, motion and health, longevity and performance of cows, leading in turn to higher yields and better profits for dairy farmers. The new barns are equipped with modern stalls to provide good access to the manger and water and have automatic manure removal to keep animals clean.

Barn structures differ depending on the region, climate and readily available materials as construction costs usually account for 40-50 percent of capital investments. Some farmers find it

cheaper to reconstruct and modernize existing old barns instead of constructing new ones at the first stage of dairy farm modernization. Barn equipment usually accounts for 10-15 percent of the costs. A properly equipped barn would provide significant savings on labour and help to reduce feed losses.

In Ukraine, most farms use tie-stalls while EU farms are mostly free-stall and US farms are almost exclusively free-stall. There is also a worldwide trend towards free-stall barns.[17]

On large farms (400 cows and more) it is often difficult to find alternatives to sheltering animals in the barn year around, particularly considering existing climate conditions in Ukraine. During the warm period, animals can be fed and rest in outside areas next to the barn. Smaller farms can use combined systems whereby animals graze on pasture during the warm period of each year. Various combinations of these systems are in place.

Feeding

Feeding alongside breeding is one of the major problems facing Ukraine's dairy sector. In most cases, dairy cattle diets in Ukraine are based on available feed (support diet) rather than efficient ration formulation and animal breeding to achieve the best combination of costs, productivity and returns. Ukrainian farmers can also pay more attention to the quality of their feeds, in order to improve feed conversion, increase yields and reduce costs per unit of milk. Here are some of the most frequently noted problems:

- most of the pastures or fields used for hay production are basically wild grasses and weeds with low productivity;
- hay quality is poor due to late grass cutting;
- farms in Ukraine frequently use straw for cow feeding, which makes no economic sense;
- quality of silage used in Ukraine is very low and thus farms frequently end up overusing expensive concentrated feed, which does not resolve the problem of metabolized energy supply but does increase feeding costs;
- outdated farm equipment increases the use of fuel per 1 kg of feed. It is estimated to be 2-3 times as high in Ukraine as in the EU.

Key indicators impacting the quality of main feed for dairy herd are as follows:

- balanced fertilization of feed crops;
- timely harvest at the optimum feed crop stage (in Ukraine it is typical to delay grass cutting to increase hay production volume, which worsens quality);
- preservation of feed with limited losses; and
- balanced feeding technology.

17 - Please refer to the publications, *An Update on Dairy Cow Freestall Design*: www.vetmed.wisc.edu/dms/fapm/fapmtools/5house/Update_to_Stall_designAABP.pdf or *Opportunities for improved cow comfort through freestall barn renovations:* www.milkproduction.com/Library/Scientific-articles/Housing/Opportunities-for-improved-cow-comfort-through-freestall-barn-renovations/.

In Ukraine, dairy cow feeding types are classified as follows depending on the use of concentrate feedstuffs:[18]

- *concentrate-intensive* uses more than 370 g of concentrated feed per 1 litre of milk produced. It is only used for cows with productivity of more than 6 000 kg of milk per year;
- *semi-concentrate type* uses from 230 to 360 g of concentrated feed per 1 litre of milk produced. It is used for cows with productivity of 3 500-5 500 kg of milk per year;
- *low-concentrate type* uses from 150 to 220 g of concentrated feed per 1 litre of milk produced. It is mainly used in regions with low grain production and productivity resulting in higher costs of concentrated feed;
- *voluminous type* is used for cows with low productivity, and by households when no more than 100 g of concentrated feed is used per 1 litre of milk.

A similar classification is also available by amount of juicy components used in the ration. However, the amounts of silage, beets, beet pulp and other similar components used, depends mainly upon availability. Overall, development of balanced feeding aimed at productivity maximization using local and purchased feeds in Ukraine remains a serious issue for the majority of farms.

Breeding and veterinary services

Ukraine inherited a large number of cattle breeds from the former Union of Soviet Socialist Republics (USSR), including some native "dual purpose" dairy/beef breeds: the Brown Carpathian, Lebedyn and Ukrainian Grey. Local dairy cattle from pure dairy breeds of Red Step, Black-and-White (adapted Holstein genetics) were not very productive in terms of milk yields. Modern farms in Ukraine prefer to import pure-bred animals or frozen embryos mainly from the EU or United States.

To achieve maximum productivity it is not enough to have the best and most productive pure-bred animals. All elements comprising modern dairy technology have to be in good order, including feeding, herd management and veterinary service. In most cases, Ukrainian farms are able to achieve no more than 8 000-9 000 kg of milk per year from the best-imported breeds. From this perspective, the country's best farmers need to consider importing animals with a potential to produce 10 000-12 000 kg/cow/year.

In Ukraine, large and medium commercial farms try to maintain their own veterinarians, while household farms usually use the services of local vets and pay for their services. Since the size of farms in the EU is very small, most use private veterinarians. There is a shortage of good veterinarians in Ukraine who understand the specifics of working with highly productive animals. Therefore, leading farms invest significant funds into the education of their specialists, paying particular attention to their training in leading milk-producing countries.

Milking and milk collection

In the EU, milking mainly occurs in milking parlours. After milking, milk goes into the milk

18 - Concentrate feeds in Ukraine are based on cereals (corn, barley, feed wheat, etc), oilseeds and meals (sunflower seed and soybean meal).

pipeline through a filter then directly into a cooling tank where it quickly cools down to 4 degrees Celsius. Milk is then collected by milk processors' trucks equipped with milk-cooling tanks and is thus not exposed to outside air and foreign contamination. Milk pricing is clearly linked to its quality and the possibility of segregating milk quality along the supply chain exists.

In Ukraine, large commercial farms use a similar approach and are usually able to sell their milk to the most efficient processors, who value quality of milk the most. However, since they do not represent a majority of milk suppliers, there are various ways of milking and milk collection available in the country.

Mid-size suppliers usually use machine milking, which uses either milk buckets or the milk pipe system. Contamination of milk, especially in the case of bucket milking, is much higher than with large commercial farms. However, many use cooling tanks, assuming the size of their milk production is sufficient. In these cases, milk is collected in a manner similar to its collection in the EU.

Household owners in Ukraine predominately milk their cows by hands in the barn. In most cases there is no access to warm water, cooling/fridge or basic sanitary cleaning of buckets for milking. Thus, milk is often contaminated from the very beginning. The milk is then stored in a cold cellar, which in summer could have a temperature of 10-14 ˚C – obviously too high to cool the milk and keep it from becoming sour.

Milk from rural households in Ukraine is usually collected by small trucks up to four tonnes with isothermal tanks, rarely cooling tanks. Where available, milk is collected from local village collection points that usually are equipped with a cooling tank. Milk collection points in Ukraine can be of several types: private, cooperative or the property of processors. Each has its advantages and disadvantages depending on the region and the strategy. However, in each case it is difficult to control the quality and safety of the milk supplied due to the small size of each household milk supplier.

Some of the old and less efficient milk processing facilities in Ukraine have been recently converted into rather large milk collection points. It is not unusual for milk processors to procure milk from a 400-500 km radius. In these cases, milk may change several containers/tanks and usually gets further contaminated. In the summer, milk brought by small producers is already sour. Despite existing milk quality standards in Ukraine, many processors accept this milk.

State policy in the dairy sector

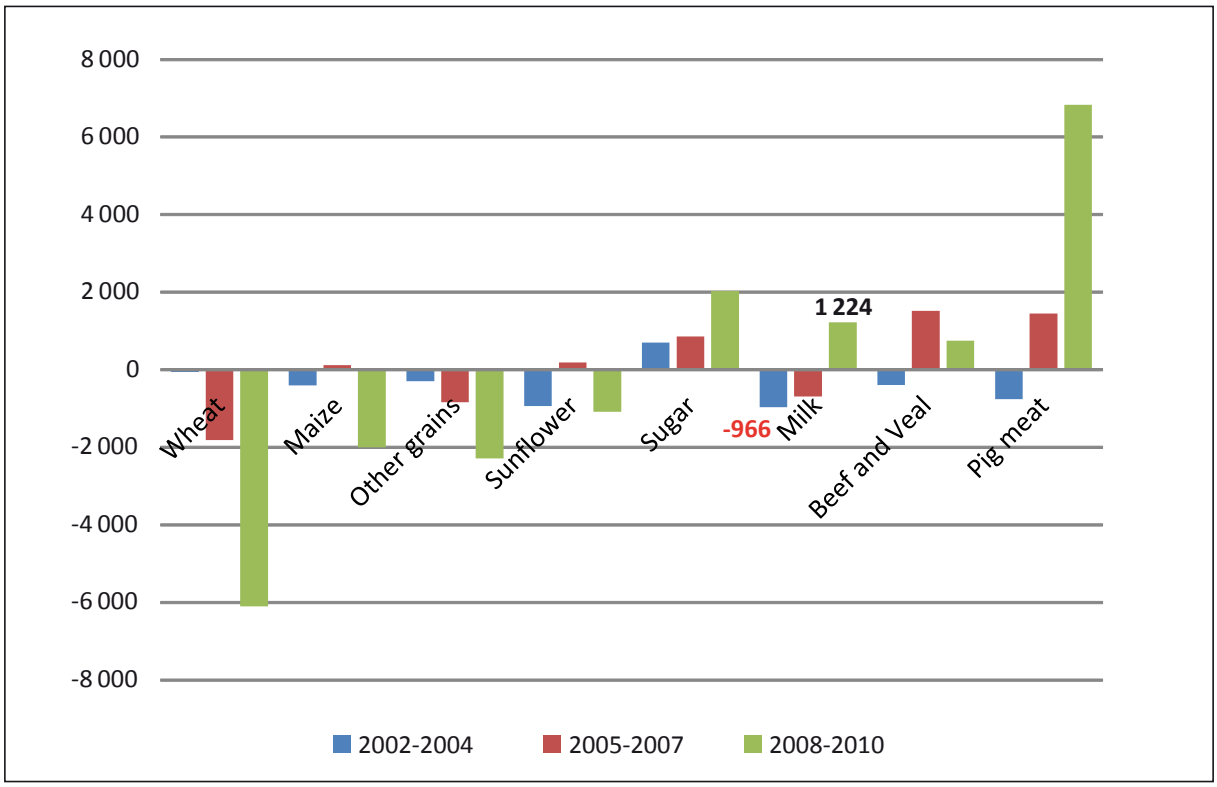
A country may provide farmers with various kinds of support programmes (direct payment per tonne of output, price support, farm services, grant credit concessions/interest rate subsidies, etc.). Policy support not only comprises budgetary payments that appear in government accounts and budget, but also includes support of market prices, as well as other concessions that do not necessarily imply actual budgetary expenditure, such as tax concessions. The common element to all these policies is that they generate transfers to farmers.[19]

19 - For a more detailed explanation of agricultural policies and support, please refer to: www.oecd.org/tad/agricultural-policies/psemanual.htm.

Ukraine's policy towards the dairy sector has evolved from negative support/transfers in 2002-2007 to rather positive support in 2008-2010. In other words, it has changed from "taxation" of dairy farmers by consumers/taxpayers to transfers from consumers and the government to farmers. Sugar and pig farmers, however, have been supported far more generously than dairy farmers in Ukraine (Although, comparing the value of Specific Commodity Transfers (SCT)[20] to dairy producers in Ukraine with that of OECD countries and the Russian Federation, it is clear that Ukrainian dairy farmers receive less support, which can be attributed specifically to milk, than their colleagues in other countries.) While the transfers from government and consumers to milk processors averaged 30-40 percent of gross receipts in OECD countries and 10-15 percent in the Russian Federation in the last three years, Ukraine returned to the net taxation of dairy farmers.

If large commercial sugar beet growers are the main recipients of these transfers from consumers, in the case of pork (pig meat) and dairy farmers, the main beneficiaries are rural households. As in Ukraine the vast majority of support are product-specific, it is possible to use SCT's to illustrate the levels of supports of different agricultural products (Figure 51 and Figure 52).

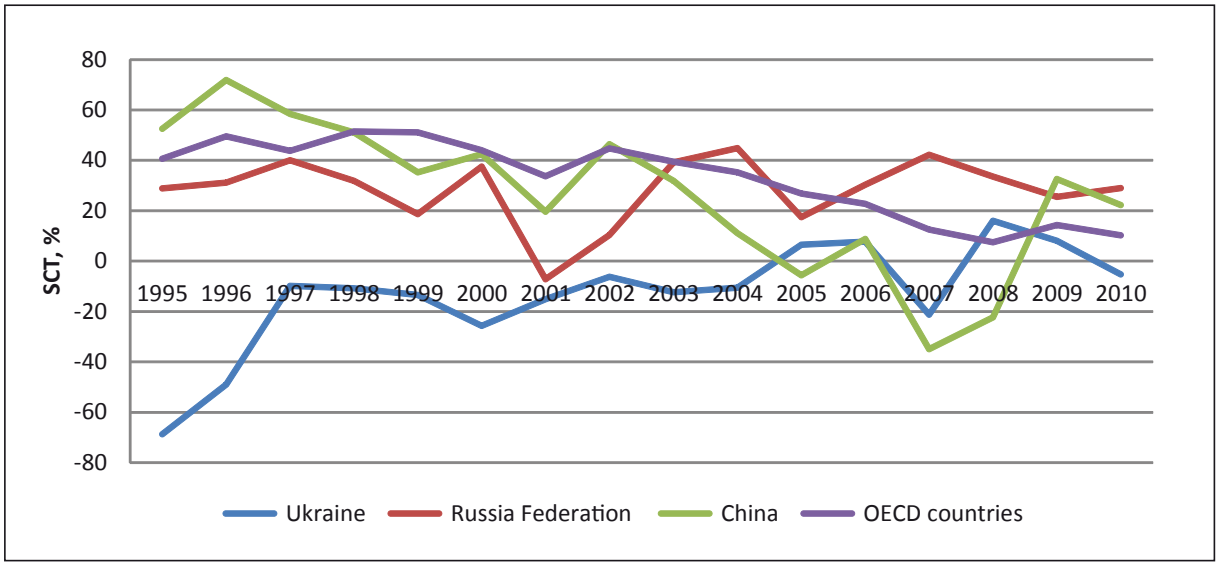
Figure 51. Specific commodity transfers to various agricultural products in Ukraine, million UAH, average annual each three year period, 2002-2010



Source: OECD Stat.

20 - Producer Single Commodity Transfers (producer SCT): the annual monetary value of gross transfers from consumers and taxpayers to agricultural producers, measured at the farm gate level, arising from policies linked to the production of a single commodity such that the producer must produce the designated commodity in order to receive the transfer (OECD, PSE Manual 2010).

Figure 52. Specific commodity transfers to milk producers in China, Russian Federation, Ukraine and OECD, % of gross milk receipts



Source: OECD Stat.

Specific state support programmes in the dairy sector of Ukraine remain rather unfocused. The state programme for development of dairy husbandry is aimed at increasing dairy herds and production, instead of increasing efficiency and addressing pressing industry issues like milk quality. As mentioned above, a goal of reaching 20 million tonne production in 2015 is unrealistic as it continues the downward trend. The programme is also very unclear about potential markets for such milk supply. Since Ukraine is a net exporter of dairy products, almost doubling production would mean a great need for new markets; however, there are no financing or other efforts to develop such markets in the programme by improving milk quality and assisting the industry in export market promotion activities. There is also no analysis of the potential impact of increased production on milk prices or the attractiveness of the dairy business for investors.

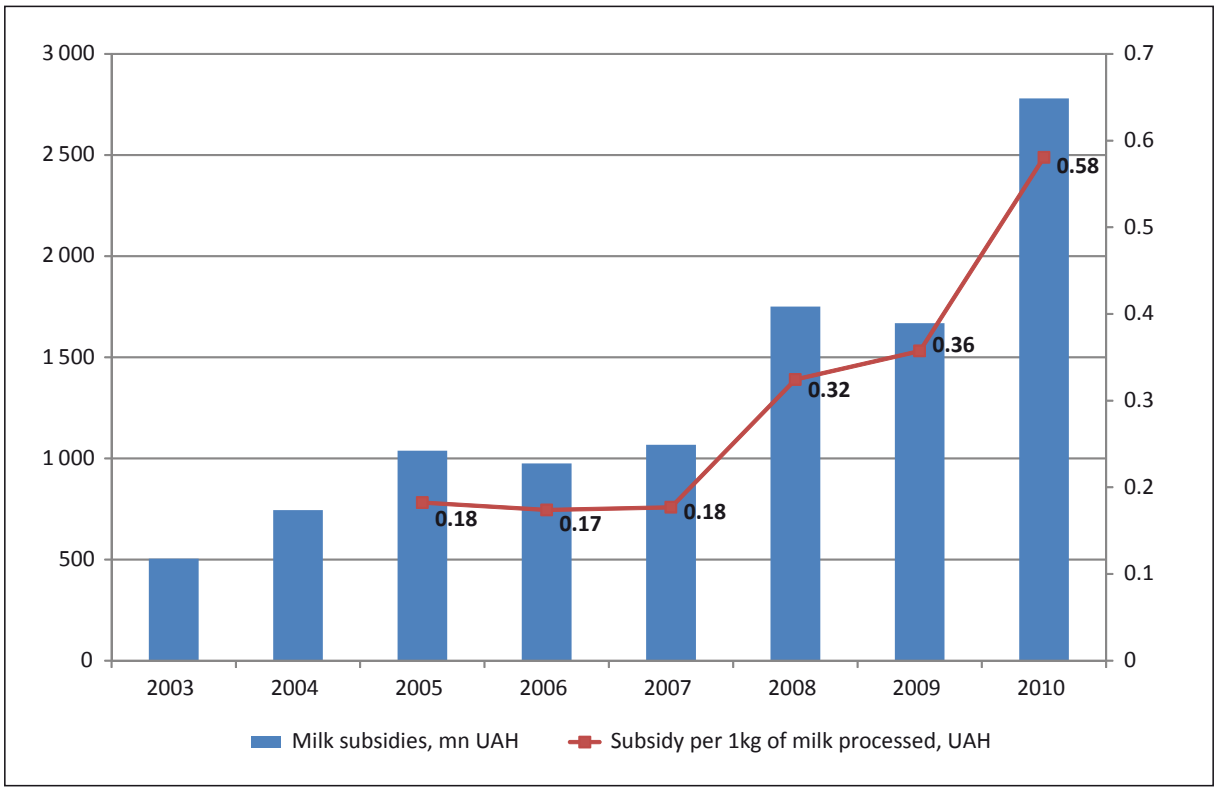
Ukrainian dairy farmers have also been able to benefit from a number of general support programmes that are not milk-specific: simplified agricultural taxation and unified agricultural tax (an important support programme provided to agricultural producers via foregone tax revenues on profit, payroll and other taxes), VAT compensations from dairy processors and other support programmes.

However, regulatory changes in Ukraine have been frequent and inconsistent over the last three years, changing the conditions and level of support provided over a relatively short period of time. Examples include: the Law of Ukraine from 2 February 2009 #922-VI "About urgent measures for prevention of negative influence of the financial crises and about changes in some legal acts of Ukraine"; the Law of Ukraine from 22 December 2009 #1782-VI "About changes in some laws of Ukraine related to support of agro-industrial complex in the conditions of global financial crises"; and the Decree of the Cabinet of Ministers of Ukraine from 2 February 2010 #152 "Some issues of implementation of clause 11.21 article 11 of the Law of Ukraine 'About VAT'".

The current system of VAT in the new "Tax Code of Ukraine" envisages the accumulation of VAT due from milk processors to a Special Fund of the State Budget of Ukraine, where it is then distributed to milk producers depending on the number of cows. The same fund is also used for subsidizing the cost of construction of new livestock farms.

Many producers interviewed on this project say that the current support system to dairy producers is rather cumbersome and not transparent. It is estimated that all subsidies to milk producers (including those from the VAT refund) are growing every year (Figure 53). However, the subsidies actually received by Ukrainian milk producers were expected to drop sharply in 2011. Please note that not all the amount specified went to producers as a direct subsidy.

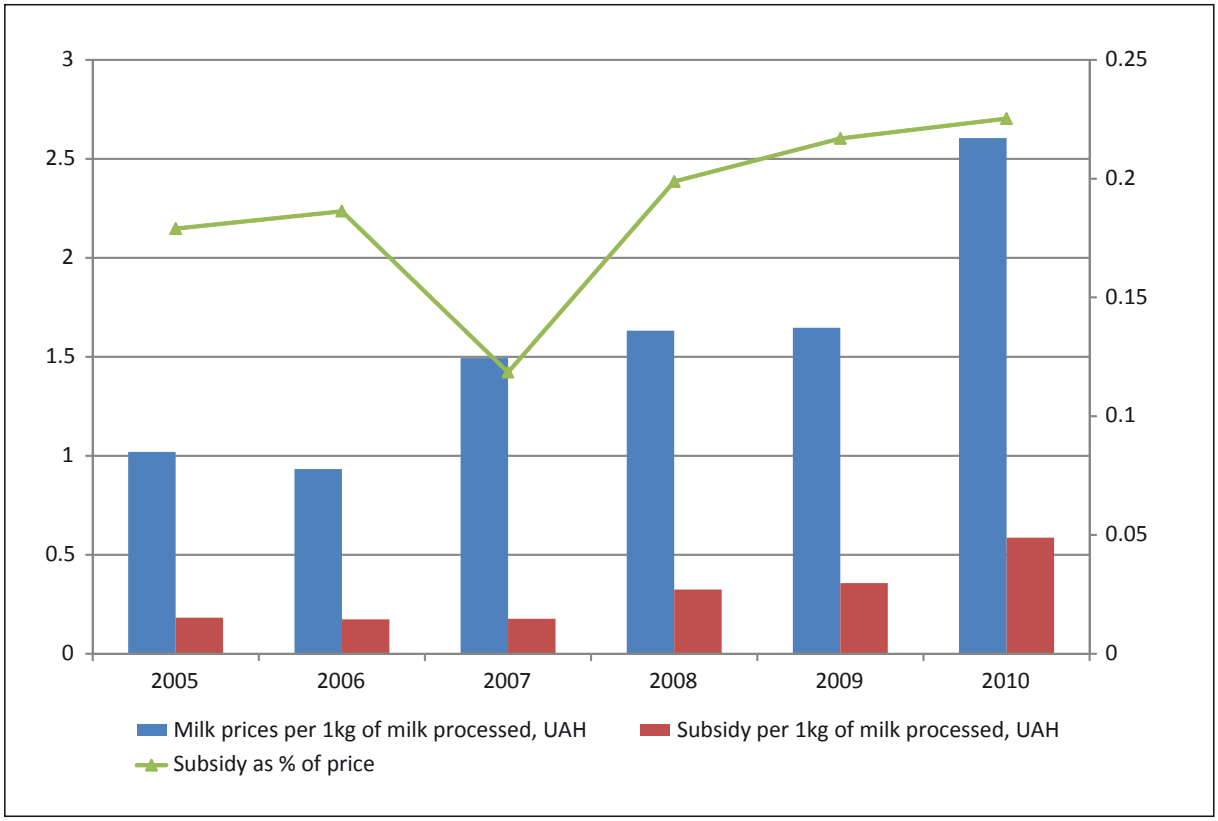
Figure 53. Milk producer subsidies in Ukraine, 2003-2010



Source: Ministry of Agrarian Policy of Ukraine.

It is interesting to note that Ukrainian producers also received higher subsidies per litre of milk sold to processors as prices for final dairy products increased (Figure 54).

Figure 54. Milk producer subsidies vs. prices of milk paid by processors in Ukraine



Source: Ministry of Agrarian Policy of Ukraine and State Statistical Service of Ukraine.

As a part of overall milk-specific transfers received by farmers, the importance of subsidies in receipts can be determined as a percentage of the average price received for milk sold to processors. As shown by Figure 54, subsidies were close to 20 percent of the processors' price.

The Law of Ukraine "On milk and dairy products" of 21 June 2004 #1870-IV (as amended) includes provision for financing from the state budget of the following programmes:

- development of selection and breeding in dairy husbandry;
- subsidies for whole milk of higher, first and second grades (from 30 November 2006);
- subsidized short and long-term credit;
- leasing services for new equipment and introduction of new milk production technologies; and
- incentives for increased milk quality through additional payments for higher quality of milk.

However, in practice most of these programmes are not working or cover only a very small number of selected commercial dairy farms, and lack transparency.

On 16 April 2010, the law "On milk and dairy products" was amended to introduce a system of incentives for higher milk quality. It introduced payment for "extra" grade milk in the amount of 25 percent from the purchasing price and decreased payment for "highest" grade of milk from 25 percent down to 20 percent. It also removed completely the incentive for the "first" grade of milk.

In 2006, Ukraine adopted the minimum-purchasing (floor) price for milk, which immediately led to increased imports of dairy products, thus affecting domestic milk producers. This mechanism was abandoned for a while but was then re-enforced in 2009 and preserved in 2010 with no significant enforcement mechanism in place.

Food safety legislation and regulations

Key legal acts regulating dairy business in Ukraine include:

- the Law of Ukraine "On milk and dairy products"; and
- the Law of Ukraine "On safety of food products".

The latter law, #2809-IV from 6 September 2005 included provision for the prohibition of sales of unprocessed milk and cottage cheese on retail markets from 1 January 2010. However, the ban has been extended to 1 January 2015, as incomes from milk sales are still important to rural households and the dairy processors milk-receiving infrastructure was not ready to accept all milk for processing. These were official reasons for extending the ban on milk sales from rural households.

If such a ban would be implemented and actively enforced, the dairy herd at rural households would decline sharply.

Ukrainian milk processors cannot buy milk from commercial farmers if the latter do not have a certificate "of milk producer" issued by local agricultural departments and a certificate from the local state sanitary-epidemiological service. In the meantime, rural households do not have to produce either of these certificates to sell milk to processors.

The Law of Ukraine "On milk and dairy products" was amended on 16 April 2010 to apply strict food safety and quality requirements to imported dairy products, while the previous version of the law only applied the same requirements to local products. These amendments also included a clear definition of dairy product. However, there is still no effective way of controlling the use of the term on the consumer market.

Other laws that regulate the dairy industry in Ukraine are:

- the Law of Ukraine "On safety of food products"; and
- the Law of Ukraine "On veterinary medicine".

The Law of Ukraine "On safety of food products" dated 23 December 1997 #771/97-B regulates the relationships between the executive branch of power, producers, processors, traders and consumers, and includes legal provisions for ensuring the safety and quality of dairy products produced, traded, imported and exported.

The Law of Ukraine "On veterinary medicine" #2499-12 of 25 June 1992 appoints the State Department on Veterinary Medicine as a central executive agency for state veterinary-sanitary control and supervision over animal health, safety and quality of food products, and milk production and processing. There are several orders of veterinary department related strictly to milk and milk products.

Overall, the objectives of state policy in the dairy sector have remained largely reminiscent of the era of central planning in the FSU aimed at increased production. There has been no comprehensive policy related to the dairy industry in Ukraine aimed at developing the sector under free market conditions and addressing its main bottlenecks, including milk quality and safety issues.

Assuming budget constraints, it is very unlikely that the level of subsidies provided to all milk producers will grow. Conversely, it is very likely that the government of Ukraine will shift its focus on to commercial milk producers (by compensating part of the construction costs for modern dairy farms and other investment costs) and will likely decrease support to rural households producing milk over the long run.

Rural smallholder milk production: the case of Turkey

Similarities in milk production structure between Turkey and Ukraine

Turkey has a long tradition of milk production and consumption of dairy products; however, the industrial processing of milk into dairy products remains relatively small compared to EU countries and even to some Mediterranean countries. Whereas the informal system accounts for about 70 percent of milk produced, 30 percent of milk is further processed by industrial dairies, the lowest share compared to EU countries.[21] In this regard, Turkey can serve as a good example, illustrating the challenges the dairy industry faces in meeting EU requirements. This is especially noteworthy, based on the country's experience of EU accession negotiation and considering Ukraine's aspiration of joining the EU.

Comparison of milk standards

The following table summarizes the main criteria for milk quality and safety in Ukraine, Turkey and the EU. It is clear that Ukraine's standards lag far behind those in the EU and Turkey, especially in terms of number of bacteria and somatic cell counts.

Table 7. Comparison of official milk quality and safety indicators in Ukraine, Turkey and the EU

Criteria	Ukraine	Turkey	EU
Protein, at least (%)	3.0 (base level)	2.8	2.9
Fat, at least (%)	3.4 (base level)	3.5	3.5
Fat free dry material (%)	11.5-12.0, including fat	8.5	8.5
Number of bacteria in total 30° C (per ml)	<100 000 – extra quality category, up to <3 000 000 for 2nd category milk is allowed	< 100 000	< 100 000
Number of somatic cells (per ml)	<400 000 – extra milk quality category, up to 800 000 for 2nd category milk is allowed	< 500 000	< 400 000

Source: Turkish Dairy Sector Analysis citing Raw Milk and Heated Drinking Milk under the Turkish Food Codex; EC Regulation No. 853/2004; State Standard on Raw Milk of Ukraine DSTU 3662-97.

21 - Agro economic policy analysis of new member states, the candidate states and countries of the western Balkans: www.euroqualityfiles.net/cecap/Report%203/Section%201%20country%20report/CEECAP%20report%203%20section%201%20TURKEY.pdf.

Direct sale of small quantities of raw milk to the final consumer is common as a result of the small scale and geographically dispersed nature of milk farms in both Turkey and Ukraine. Legislation covers these sales in both countries. However, EU milk quality levels are only reached by a limited number of large-scale dairy farms in both Ukraine and Turkey.

Turkey's EU accession negotiations and "non-compliant raw milk"

Turkey, as any candidate country for the EU, must prepare itself for accession. Should Ukraine advance its integration with the EU, it would follow the same accession path, and would be obliged to meet all major EU conditions, including food safety regulations. The accession negotiations cover the adoption and implementation of European legislation (*acquis*) and, more specifically, the priorities identified jointly by the Commission and the candidate countries (i.e. screening). Each year, the Commission reviews the progress made by candidates and evaluates the efforts required before their accession. This monitoring is the subject of annual reports presented to the Council and the European Parliament.

Agricultural and rural development issues are covered in Chapter 11 of the *acquis*, and food safety and sanitary policies are covered in Chapter 12.[22] The initial screening of both chapters was completed in early 2006; however, actually negotiations on Chapter 12 were opened only in December 2010.

The main issues discussed under Chapter 12 for Turkey's accession are: adoption of a framework law on food, feed and veterinary matters compliant with EU requirements; functionality of the system for the identification and registration of bovines and registration of their movement in compliance with the EU *acquis*; classification of the agri-food establishments by category based on the EU *acquis*; and preparation of a National Programme for upgrading those establishments. The structure of the Turkish dairy industry/establishments is currently not classifiable following EU standards according to EU experts. According to national classification, Turkey counted 2 160 milk establishments in 2005.[23] A major part of meat and milk establishments are small scale and scattered in structure.

One of the biggest problems in Turkey's dairy sector according to the EU experts is the large share of the informal market. Authorities legally banned street milk back in 1930s; however, there remain thousands of street milk vendors. While bigger milk processors try to source quality milk and promote it with a higher price, the share of street sellers in total consumption is about 10 percent.[24]

22 - Chapter 11: Agriculture and rural development covers a large number of binding rules, many of which are directly applicable. The proper application of these rules and their effective enforcement and control by an efficient public administration are essential for the functioning of the common agricultural policy (CAP), the integrated administration and control system (IACS), and the capacity to implement rural development measures. Member States must be able to apply the EU legislation on direct farm support schemes and to implement the common market organisations for various agricultural products. Chapter 12: Food safety, veterinary and phytosanitary policy covers detailed rules in the area of food safety. The general foodstuffs policy sets hygiene rules for foodstuff production. Furthermore, the acquis provides detailed rules in the veterinary field, which are essential for safeguarding animal health, animal welfare and safety of food of animal origin in the internal market. http://ec.europa.eu/enlargement/policy/conditions-membership/chapters-of-the-acquis/.

23 - http://ec.europa.eu/enlargement/pdf/turkey/screening_reports/screening_report_12_tr_internet_en.pdf.

24 - An assessment of the competitiveness of the dairy food chain in Turkey, February 2009.

Currently, the issue of "non-compliant raw milk" (i.e. milk that does not meet official quality and safety standards) is considered to be one of the main issues related to the country's negotiations on food safety issues. The Ninth meeting of the Accession Conference at Ministerial level with Turkey (30 June 2010), suggested that:

> Turkey submits an approved national programme for the upgrading of establishments for products of animal origin, including establishments for animal by-products. This programme must include a precise plan for the monitoring by the Turkish authorities of the process of upgrading establishments. As regards the milk sector, the national programme must include a strategy for the use of *non-compliant raw milk*. Turkey must also demonstrate *sufficient progress* in the implementation of this national programme. Furthermore, Turkey demonstrates that it has devoted sufficient human and financial resources for monitoring the process of upgrading the establishments covered by the national programme.[25]

The issue of non-compliant milk, reduction of informal trade, and enforcement of food safety standards will likely remain one of the main stumbling blocks related to harmonization with EU requirements in agriculture and food safety areas.

Reflections for Ukraine

The Government of Ukraine should carefully consider the extent of issues resulting from non-compliant milk, originating from a large number of small farms in Turkey, in relation to its EU integration. Ukraine is a significant regional exporter of milk and dairy products and the issue of non-compliant or uncontrolled milk from the rural household sector has already caused problems in dairy trade with the Russian Federation – the main dairy export market for Ukraine.

From a consumer protection and food safety point of view, Ukraine will eventually have to make choices in using its limited budgetary resources. Some options are whether to invest in the existing commercial farm sector or in less organized rural household milk production; whether to allocate resources to financial improvements in the state food safety control monitoring systems, or to the promotion of animal identification requirements through consumer education programmes. The social problems related to a gradual exit of rural household milk producers will need to be addressed in parallel.

Consideration of gender aspects

Legal framework

Ukraine is signatory party to a number of international conventions recognizing the equal rights of men and women. There is also a fairly comprehensive legislative network in place aiming at promoting gender equality. Article 7 of the Law of Ukraine #2866-IV of 8 September 2005 "On Providing Equal Rights and Opportunities to Men and Women" identifies the Parliament of Ukraine, the Human Rights Commissioner of the Parliament, the Cabinet of Ministers of

25 - EU Enlargement: Ninth meeting of Accession Conference at Ministerial level with Turkey: www.consilium.europa.eu/uedocs/cms_data/docs/pressdata/en/er/115577.pdf.

Ukraine, special central bodies of the executive power and authorized persons (coordinators) in governmental and regulatory bodies as responsible for ensuring equal rights and opportunities for women and men. The implementing regulations of the law, Resolution 504 of 12 April 2006 "On Conducting Gender Legal Examination" and Resolution #1087 of 5 September 2007 "On Advisory Bodies for Issues of Family, Gender Equality, Demographic Development and Human Traffic Prevention", envisaged the creation of a National Gender Resource Centre and have enabled staff reviews of executive authority bodies and supporting educational initiatives.

Participation in the labour market

In 2011, according to official statistics, the average employment rate in Ukraine was 67 percent (Table 8). Women account for almost 45 percent of the working age[26] population. The female employment rate is slightly lower at 64 percent, compared to 69 percent for men. The unemployment rate for both men and women in Ukraine decreased in 2011 as compared with 2010 and the economic activity of both men and women show similar trends.

Table 8. Economically active population by gender and place of living, 2011 (working age population)

	Units	All	Women	Men	Urban	Rural
Economically active population	'000 persons	20 247.9	9 311.3	10 936.6	14 138.8	6 109.1
Economically non active population	'000 persons	7 601.5	4 207.0	3 394.5	5 430.8	2 170.7
Level of economic activeness	% of all population of the considered age group	72.7	68.9	76.3	72.2	73.8
Employed population	'000 persons	18 516.2	8 586.5	9 929.7	12 928.6	5 587.6
Employment rate	% of all population of the considered age group	66.5	63.5	69.3	66.1	67.5
Unemployed population	'000 persons	1 731.7	724.8	1 006.9	1 210.2	521.5
Unemployment rate	% of all economically active population of the considered age group	8.6	7.8	9.2	8.6	8.5

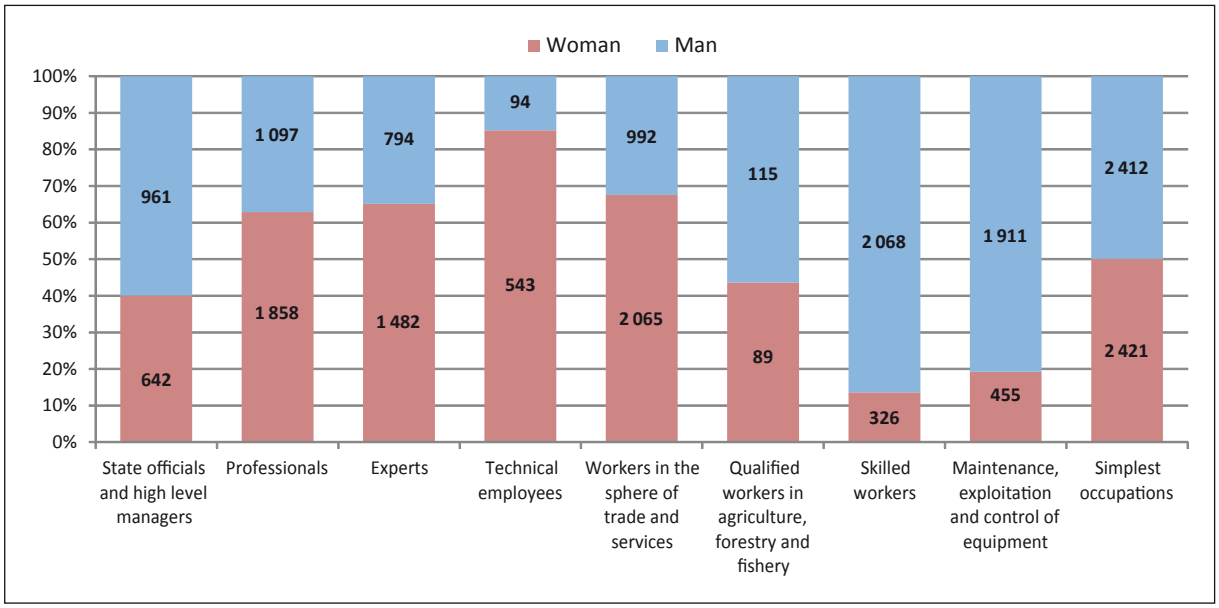
Source: State Statistics Committee data.

26 - 17-50 years old.

However, women in the 15-24 and 60-70 year age categories had the lowest levels of employment. While over one-third of the Ukrainian population between the ages of 15 and 70 is economically non-active, 61 percent are woman. This gender asymmetry can be partially explained by traditional life styles. One out of four economically non-active women was involved in housekeeping activities as compared with only one out of ten men. Some gender asymmetries were also noted in access to education for young non-economically active women: less than one-quarter of economically non-active women were students as compared with one-third men.

Men dominate among blue-collar workers and labour groups involved in legislation, public administration and private sector management (Figure 55). Women are predominant among professionals, technical specialists and workers in trade and commerce.

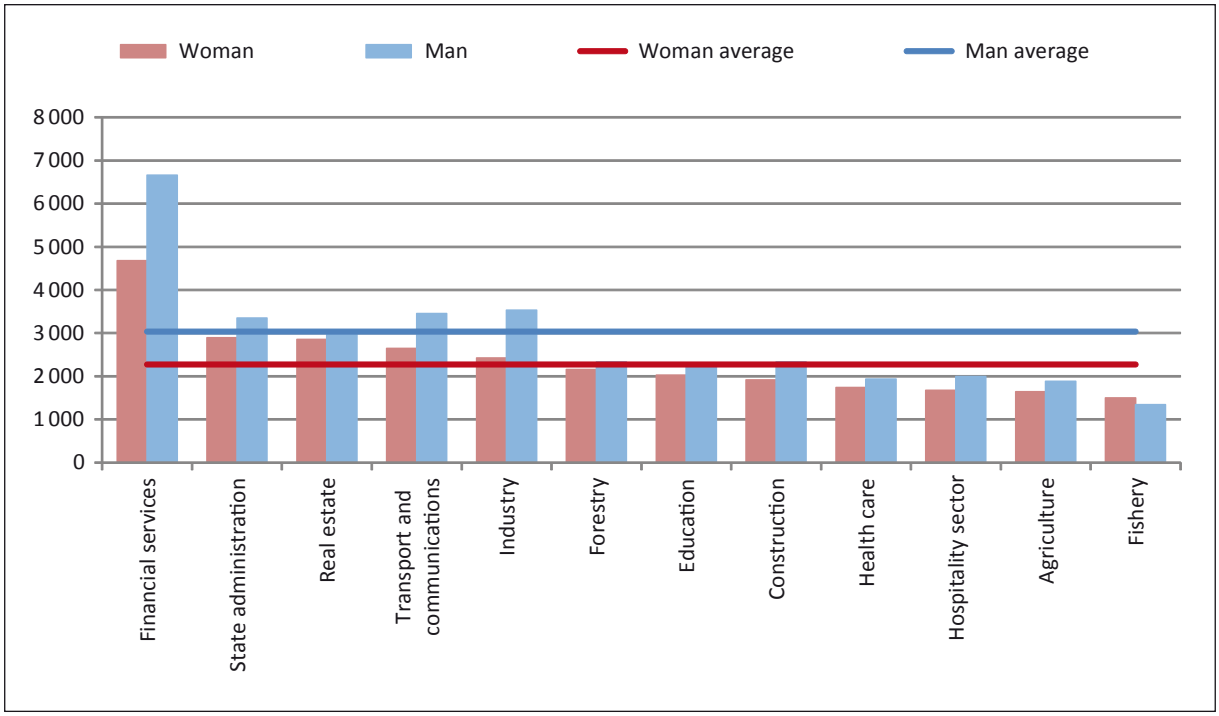
Figure 55. Employment in Ukraine in 2011 by professional categories and gender (thousand persons)



Source: State Statistics Committee data.

Official statistics also register gender inequalities in salary levels (Figure 56). On average, in 2011 women in Ukraine were paid 25 percent less than men. Sector-specific and regional statistics also register about the same level of salary difference between men and woman. For instance, the average salary of women in Sumy oblast, the main project area, was slightly above the national average (UAH 1 909 or USD 239); however, it was still 30 percent lower than that of men in the same oblast. The average monthly salary of women employed in agriculture in 2011 was UAH 1 639 (or about USD 205) or 15 percent below UAH 1 881 (or USD 235) of men.

Figure 56. Monthly salary levels by sector and gender in Ukraine, 2011



Source: State Statistics Committee data.

The rural population in Ukraine has declined continuously registering just over 14 million people in 2012, 53 percent of whom were women (Table 7). The rate of rural population decline has been more or less equal for men and women. Among all rural household members 53.8 percent were females. Women provided 47.3 percent of households' work force.

Table 9. Rural population in Ukraine, millions, 2002-2012

	2002*	2008	2009	2010	2011	2012
Ukraine total population Including:	48.2	46.2	46.0	45.8	45.6	45.5
Male	22.3	21.3	21.2	21.1	21.0	21
Female	25.9	24.9	24.8	24.7	24.6	24.5
Rural population Including:	15.9	14.8	14.6	14.5	14.4	14.3
Male	7.4	6.9	6.8	6.8	6.7	6.7
Female	8.5	7.9	7.8	7.7	7.7	7.6
Share of rural population at the age 16-59 years (%) Including:	29.4%	29.1%	29.2%	29.3%	29.4%	29.6%
Male	30.6%	30.4%	30.4%	30.5%	30.7%	30.8%
Female	28.3%	27.9%	28.0%	28.1%	28.2%	28.4%

**Note: According to Ukrainian General Census of the population at 5 December 2001.*
Source: State Statistics Committee data.

From a formal employment perspective, agriculture accounted for over half a million workers in 2011, of which only 36 percent were women. The share of young women employed in agriculture was even more disappointing. Therefore, agriculture in Ukraine seems to perform worse in terms of gender equality. Sector-wide, there are no special provisions aimed at enhancing the role of women in agriculture or in the dairy sector in particular.

Significant gender disparity is observed in the formal commercial agriculture sector/farms. Women head less than 20 percent of medium to large agricultural enterprises. In contrast, at the rural household level, which largely mirrors unofficial employment, the ratio between female-headed households and male-headed ones was more equal (Table 10).

Table 10. Distribution of agricultural holdings by gender of heads, 2011

	Agricultural holding		**Including**					
			Commercial farms		**Small enterprises**		**Rural households**	
Headed by	Female	Male	Female	Male	Female	Male	Female	Male
Ration of holdings								
By number	50.5	49.5	17.1	82.9	18.7	81.3	50.8	49.2
By the area of agr. land	16.1	83.9	10.1	89.9	12.8	87.2	38.2	61.8
By number of cattle	29.8	70.2	7.7	92.3	8.2	91.8	40.7	59.3
Number of cattle per 100 holdings	49	118	1 314	3 242	137	355	45	68

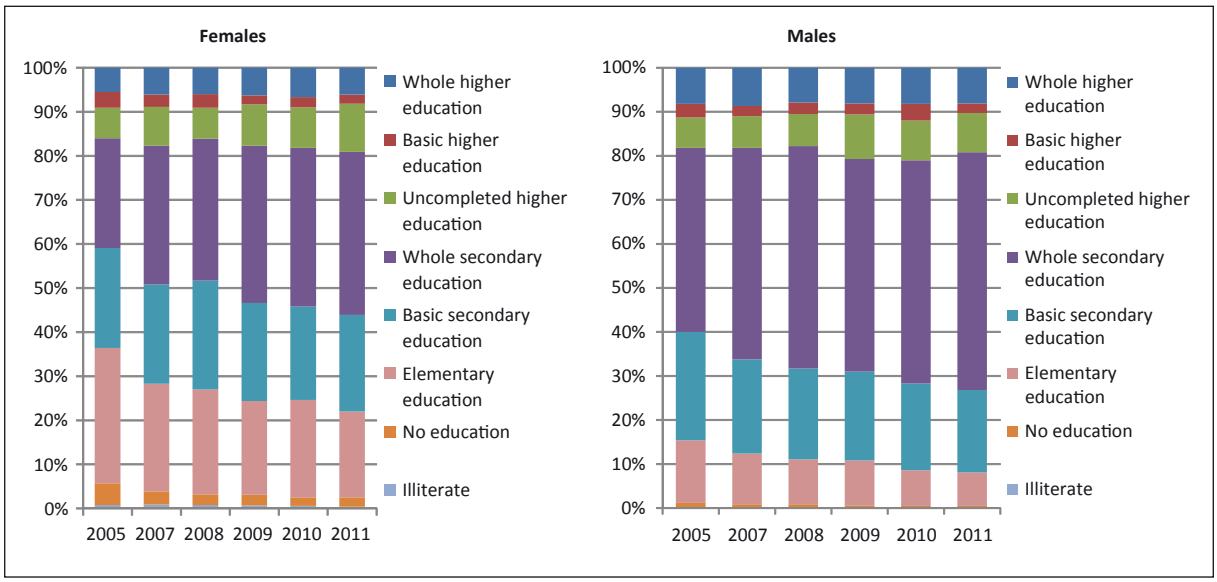
Source: State Statistics Committee data.

Gender context in the dairy sector

Women are more disadvantaged in owning cattle and even more disadvantaged in access to agricultural land in Ukraine, the latter being a necessary precondition for own feed production (Table 10). At the same time, rural women in Ukraine are actively involved in milk production. While forage harvesting and stockpiling (hay, straw other roughage feeds), feeding and barn cleaning are usually equally performed by men and women, women are predominantly responsible for cow milking.

When comparing the level of education of women who head rural households with that of male-headed households, it becomes evident that over 20 percent of females who head households lack elementary school education (e.g. uneducated or illiterate as compared to 10 percent of men who head households) (Figure 57). This suggests that special attention should be paid to women's education.

Figure 57. Educational level of rural household heads



Source: State Statistics Committee data.

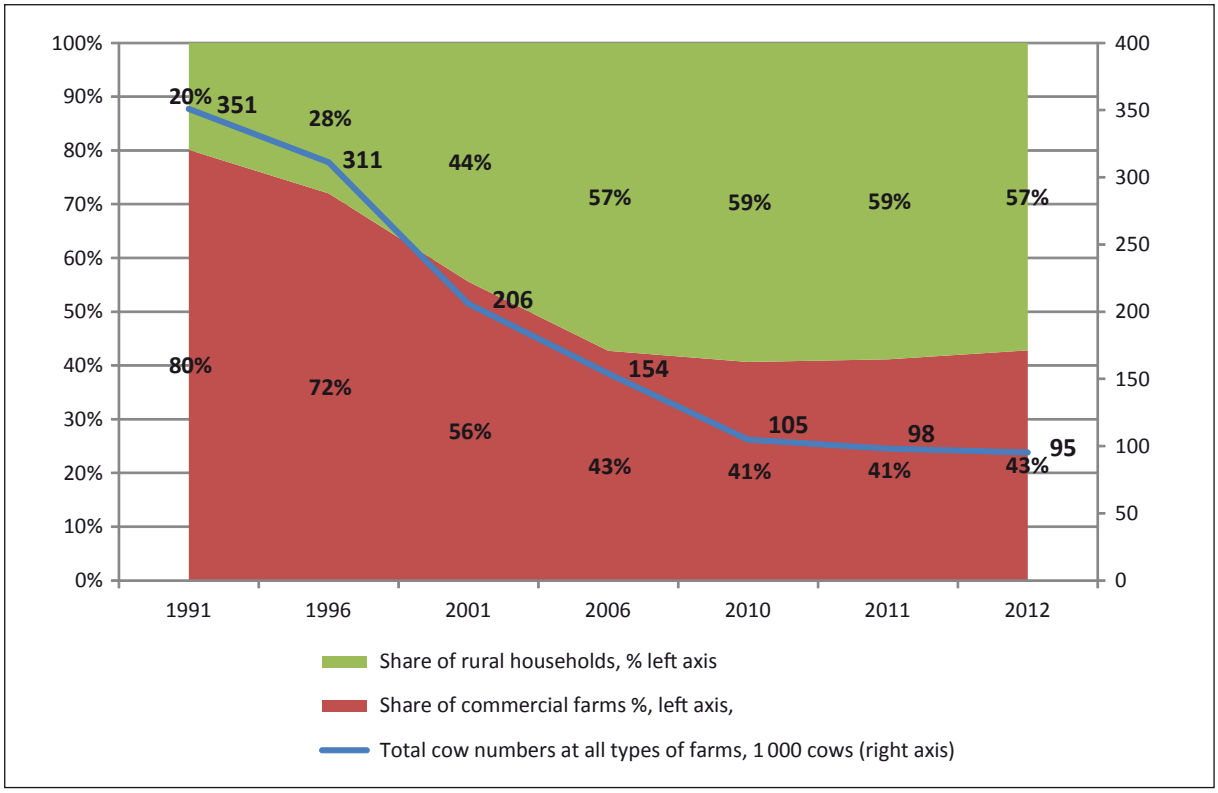
In view of women's active roles in milking and cow care, improving their knowledge of milk quality, dairy cattle feeding and management would be crucial in improving milk production efficiency and thus improving household income from milk. Additional professional training would also enable women to be better positioned in finding formal employment outside households with the growing commercial dairy farm sector in the future.

2. Investment in milk production in Sumy oblast, Ukraine

Introduction

FAO worked together with Bel-Shostka, one of the largest cheese producers in Ukraine, located in Sumy oblast, to examine dairy industry issues in detail at the local/regional level. In Sumy oblast, the number of dairy cows decreased from 351 000 in 1991 to 95 300 in 2011 (Figure 58). From 1991 to 2010, household cow inventories decreased slowly whereas a rapid decrease was observed at commercial farms; the situation changed in 2011 when the share of commercial dairy farms reached bottom and started to increase once more. Similar trends were observed in Kharkov and Chernigov oblasts, the other two important regions for Bel Shostka milk procurement.

Figure 58. Number of cows in Sumy oblast of Ukraine and share of various farm types, 1991-2012



Source: Based on State Statistics Service of Ukraine data.

In recent years, milk processors have invested heavily in milk collection points so as to purchase milk from rural households. This approach has often been driven by strong competition among processors for raw material supplies, seldom providing quality price incentives. It is presumed that rural households will continue to play an important role in overall milk supply for milk processors in northern Ukraine.

Investment in modernization of rural household dairy production

Milk production by rural households: demographic perspective in Sumy oblast

Sumy oblast – the main area of project activities under the FAO-EBRD project on *Improving Milk Supply in northern Ukraine* (circled in red on Figure 59) – was ranked fourteenth for cattle inventories and thirteenth for milk production out of 25 oblasts in Ukraine in 2011. The rural households in this oblast accounted for 42 percent of all cattle as compared with 66 percent national average. There are about 52 000 rural households in Sumy oblast of about one to ten people each; 52 percent of the population are women, and 32 percent of all rural households have dairy cows. Each household raise 1 to 36 head of cattle. Most households surveyed by the State Statistics Service of Ukraine's (67 percent) in Sumy oblast keep only one cow, about 23 percent keep two cows and 7 percent keep three. Only one household has 36 cows.

Figure 59. Map of milk production by oblast by all types of farms in Ukraine, 2011

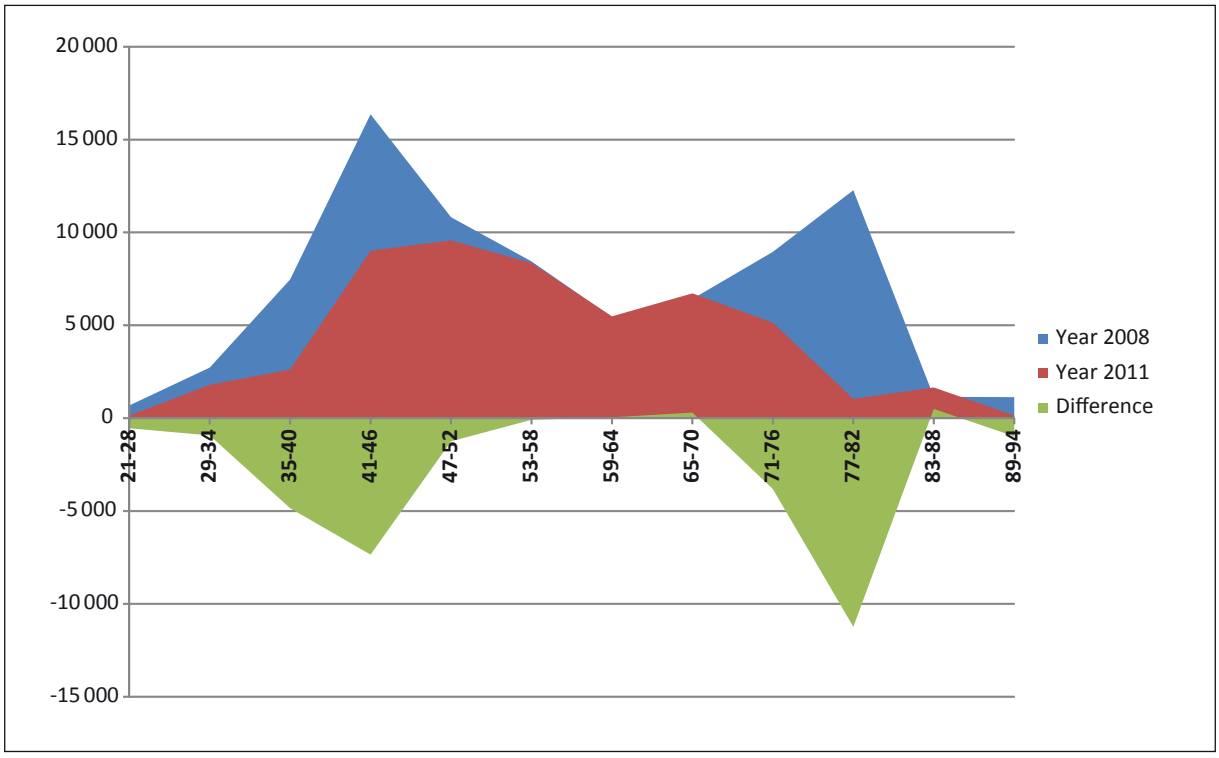
Source: State Statistical Service of Ukraine, 2011 Agricultural Statistics Yearbook.

According to official data, the youngest rural household head in Sumy oblast is 21 years old, while the eldest is 93. The distribution of dairy cattle by age of household heads is far from normal. As illustrated here (Figure 60), most cattle are raised by people in their late 40s. However, people over 64 years old (i.e. retirees)[27] own nearly 37 percent of all cattle raised by rural households. This, once

27 - Men in Ukraine are eligible to receive a "labour pension" after reaching the age of 60 (assuming that they have worked for more than 25 years). Women can retire after 55 (assuming they have worked for 20 years).

again, reveals the subsidiary nature of milk production by rural households. Due to the relatively early age of retirement in Ukraine, retirees often engage in milk production as they still have sufficient physical capacity and want to supplement their relatively low incomes from pensions[28] and reduce household food expenditures. From this perspective, milk production by rural households in Ukraine is an attempt to remedy a social problem whereby pensioners' incomes are low and people have to supplement incomes by engaging in livestock and other agricultural activities.

Figure 60. Distribution of number of cattle at rural households by age group of owners in Sumy oblast



Source: FAO presentation based on State Statistics Committee of Ukraine data.

Since 2008, the share of incomes from milk in the total income of rural households has declined steadily due to growing pensions and the relatively low prices of milk. Moreover, costs of producing milk have increased significantly. As the above graph (Figure 60) demonstrates, very few new households have entered the milk production business since 2008. This is illustrated by the 77 to 82 years age group, which accounted for 15 percent of all dairy herds in Sumy oblast in 2008, but dropped to only 2 percent by 2011. Another reason for the sharp reduction in this group was the rapid increase in the cost of purchased feed, as people at this age have limited physical ability to produce feed on their own.

This trend was also found for the 41-46 years age group. In 2008, this group represented the largest group of cow owners with a 20 percent share, but by 2011 the largest share of cattle herd (19 percent) was kept by the 47-52 years age group, where numbers of cows remained virtually unchanged. The

28 - In 2011, the average monthly national pension in Ukraine was USD 145, as compared with USD 195 in neighbouring Belarus or USD 249 in the Russian Federation.

41-46 years age group, meanwhile, had seen an 11 percent reduction in cow numbers and its share dropped to 17 percent, almost equal with the 53-58 years age group.

Given the rapidly ageing rural population and the fact that 7 percent of people who have cows live alone (one-person household), further reduction of cow inventories at rural households can be expected. People in their 70 to 80s find it more difficult to take care of cattle on a daily basis and it is most likely that this age group will soon exit milk production by either selling or slaughtering their cows.

Milk production by rural households, the main milk producers in Ukraine, face multiple constraints, including lack of financing and/or prohibitive interest rates (resulting in minimum use of farm machinery and investment) versus hand labour, limited availability of quality forage and concentrate feedstuffs, poor knowledge of animal nutrition and ration balancing. However, it is difficult to address declining household milk production from an investment point of view as milk production is not a commercial activity in which a rapidly ageing population of cow owners would agree to invest their own or borrowed funds. This also limits the future perspectives of milk production by this important group of producers in Ukraine.

The evolution of individual household milk producers from subsistence farmers (current level) to small commercial dairy farmers can potentially address many issues (e.g. seasonality of milk production, low milk quality and high production costs) faced by the dairy sector in Ukraine. In particular, it can facilitate higher cow productivity and improve milk quality, thus contributing to higher rural incomes.

A model was created to simulate the minimum dairy farm size and determine the investment possibilities for rural households to expand their dairy herds and improve milk quality. The minimum size for a viable dairy farm was used with the aim of: (i) comparing it with the existing realities of the dairy market in Ukraine, and (ii) examining the possibility of investing in the modernization of rural household dairy farms. Four typical households (hereinafter "pilot farms") in two communities were selected to test the model with assistance from Bel-Shostka.

To obtain a better understanding of the commercial dairy sector, the project team conducted an analysis of the sector's structure based on available statistical data, and studied possible investments anticipating technical and economic indicators for medium-large commercial dairy farms (250 and 500-cow dairy farms, hereinafter "large commercial farms").

Prior to the elaboration of any possible investment options, a detailed cost analysis of milk production by commercial farms and rural households was conducted, including environmental and hygiene considerations, bacteriological quality, necessary investment in equipment and resultant profitability levels.

The following models were developed to simulate investments and assess the main economic, financial and structural indicators: a minimum dairy farm size model:

- pilot farms option 1 (improved milk quality and quantity) and 2 (improved milk quality only) models;
- 250 and 500 dairy cow farm models; and
- a commercial dairy farms ranking model.

Minimum dairy farm size considerations in Sumy oblast

Based on criteria of investment economic viability in household dairy farming and the current market situation, a minimum farm size model was developed, taking into account existing rural household dairy farming conditions, to show how a rural household dairy farm can remain a profitable business.

To ascertain the minimum number of cows needed to make a rural household milk production a viable business, the following main assumptions were made:

- investment levels were set for a new start-up business: purchase of an initial stock of dairy cows, equipment and machinery, and construction of premises (Table 24);
- the average annual weighted first grade milk price was set at UAH 3.81/L and the second grade milk price at UAH 2.24/L, increased by 17 percent of annual inflation (Table 26);
- a 15 percent interest rate on a local currency loan was set with a discount rate (Table 27);
- the shadow labour cost was included to allow for proper consideration of family labour costs (Table 25);
- a 6 year project duration was set and a respective cashflow calculated to reflect the maximum terms of financing available from local financing institutions (Table 28 and Table 29).

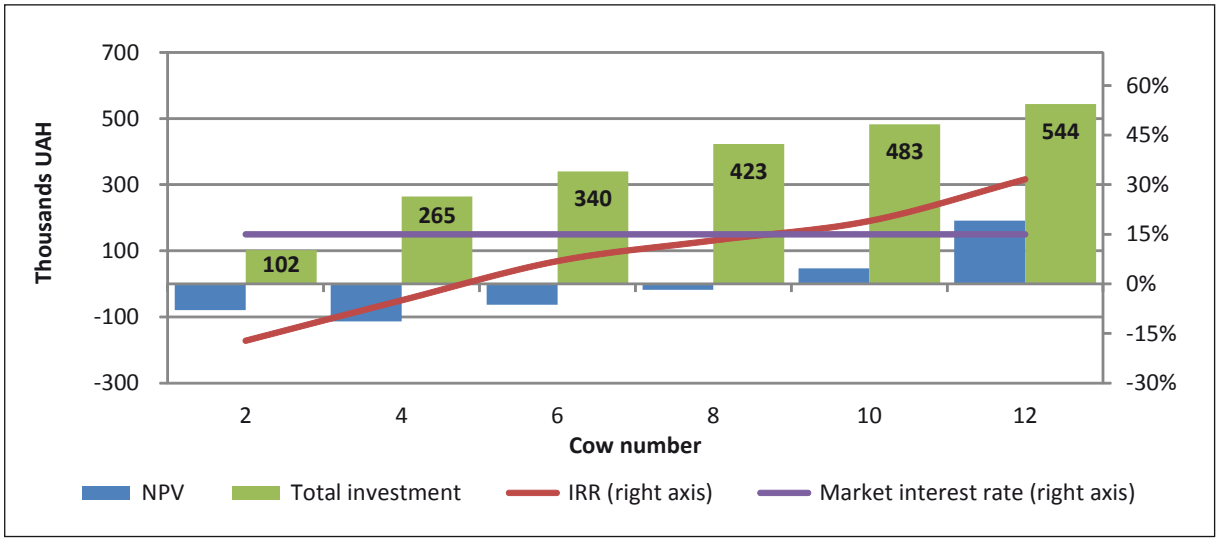
The minimum farm size model allowed calculation of investment efficiency indicators for various rural household size dairy farms: 2, 4, 6, 8, 10 and 12 cows. Annex 1 contains more information and instructions on how the model works.

The net present value (NPV) and internal rate of return (IRR)[29] were calculated for different types of machinery and equipment needed for each farm size. The default investment plan was designed to represent the minimum investment needed to set up a small dairy farm producing at least first grade milk as per existing quality standards.

The main economic results of the investment simulation per farm are presented in Figure 61 and Table 29.

29 - Net Present Value (NPV) is a standard method for using the time value of money to appraise long-term investment projects by determining the difference between the present value of cash inflows and the present value of cash outflows. Read more at ftp://ftp.fao.org/docrep/fao/008/v4810e/v4810e00.pdf or http://www.investopedia.com/terms/n/npv.asp#ixzz2DA3LWIHa.
The internal rate of return (IRR) is the discount rate at which the net present value of costs (negative cashflows) of the investment equals the net present value of the benefits (positive cash flows) of the investment. IRR is commonly used to evaluate the desirability of various investments or projects.

Figure 61. Number of cows and estimated investment profitability



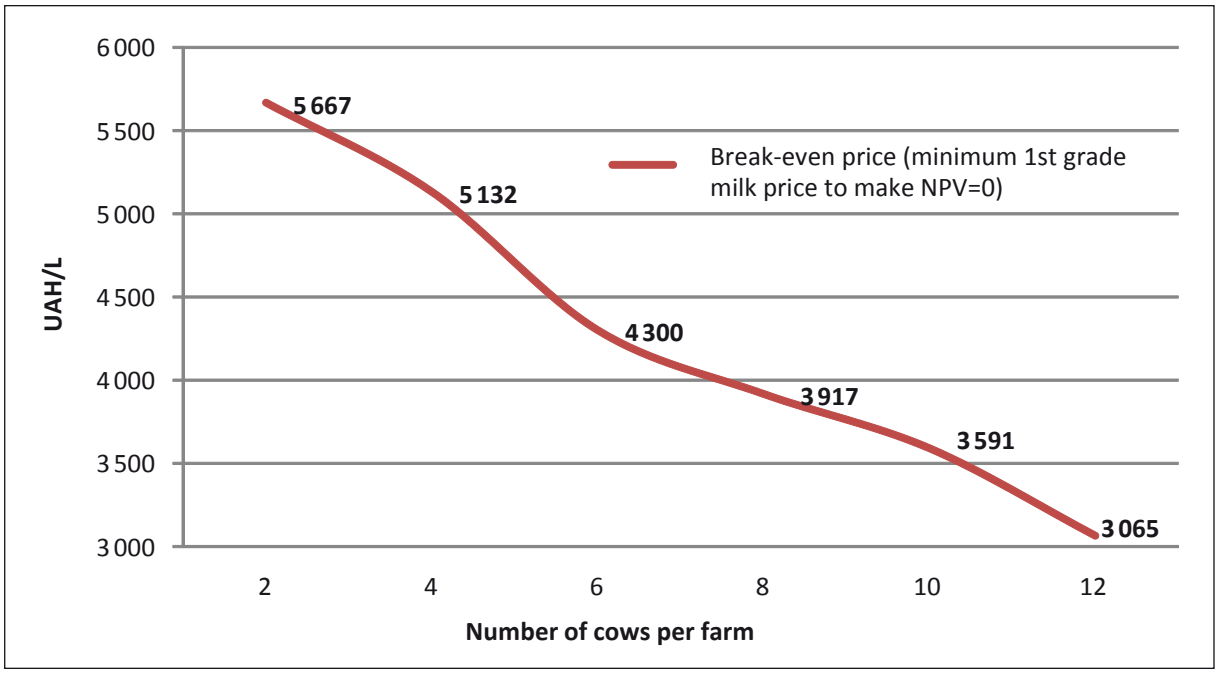
Note: NPV and IRR depend on cow number (milk price: grade I, UAH 3.81/kg; grade II, UAH 2.24/kg).
Source: Authors' calculations.

Investment in farms with two, four or six cows is not financially viable, as it produces a negative NPV (Figure 61). Farms with less than six cows cannot expect to recover the investment needed for a successful commercially viable operation under the main assumptions used in the model (15 percent discount rate and UAH 3.81/L first grade milk price). A farm with eight cows can hardly expect to generate a net positive income; its NPV is close to zero and its IRR rate only approaches the current opportunity cost of capital at 15 percent.[30] The proximity of the NPV to zero makes investment in an eight-cow farm highly exposed to market fluctuation risks. Only 10-12 cow farms have a potential to generate a rate of return above the 15 percent opportunity cost of capital for a rural household.

Milk break-even prices – the threshold milk price that a farmer should receive to make an economically viable investment – illustrate the market exposure of each of the considered farms (Figure 62). For a farm with two to four cows, the minimum price to recoup the investment should be around UAH 5.5/L, while at the time of conducting model calculations it was around UAH 3.7/L. The threshold price declines to 3.07 UAH/L for the 12 cow farm (Figure 62).

30 - Rural households can invest in other alternative activities or make deposits with banks or other financial institutions that yield 15-17 percent annual interest per year in Ukraine (taking into account the fairly high annual inflation rate).

Figure 62. Minimum grade I milk price to permit household dairy farm viability depending on number of cows



Source: Authors' calculations.

Rural households would have to borrow credit in order to invest. Therefore, the main efficiency indicators and size of affordable investments for rural households also depend on another important variable – the interest rate applicable to the loan. If the interest rate increases up to 25 percent, only a 12-cow farm is likely to see a viable return on investment. If the interest rate is set to 0 percent, assuming that households receive support from a donor-funded project (which is highly unlikely), even a farm with six cows would be able to repay the loan principle. Under the zero interest rate scenario, 10 and 12-cow farms would be able to tolerate a decrease in average milk prices to UAH 3.05 and 2.55/L respectively. (For details on main efficiency and investment sensitivity to various variables, refer to Annex 1, Tables 29 and 30.)

The above analysis of minimum dairy farm size is just an indicative calculation as investment needs and market conditions may vary greatly from one household to another. Based on specific conditions and endowments of some farms at the start-up stage, as well as specific investment needs, even a farm of five cows could be expected to make a profitable investment.

Investments in improved milk production and quality

As mentioned above, rural households will likely continue being important suppliers for milk dairy processors. The latter have already developed a network of milk collection points in many rural communities in Sumy oblast and good working relationships with the *silradas* (village councils). These councils often facilitate the creation of collection points by providing land and access to infrastructure (water, electricity, etc.).

To test the hypothesis of investment viability for improvement of milk production efficiency and milk quality by rural household dairy farms, and to determine the potential for upscaling rural household dairy farms, four households (pilot farms) were identified in Stepne and Obrazhiyivka villages (two in each village) with the assistance of Bel-Shostka's Milk Procurement Department and village councils. The household heads were 29-46 years old and were willing to improve milk production efficiency, increase their cow headcount and improve milk quality. The identified pilot farms are referred to *Farm 1, Farm 2, Farm 3* and *Farm 4* or as *pilots* in this report.

The minimum individual cow farm size described earlier in this report was not applied, as it was not possible to find farmers who could quickly increase their farm size to the minimum number required of 10-12 cows. Only Farm 4 agreed to consider increasing its farm size to 11 cows.

Based on the individual investment needs of the selected pilot farms, a model was developed to calculate anticipated investment viability, its pay-back period, discounted pay-back period, NPV and IRR for two possible options. Option 1 comprised investment to increase the number of cows per household and improve both the quantity and quality of produced milk. Option 2 comprised the lowest possible investment needed to improve milk quality only. Given that the selected pilot farms were not start-up businesses, only the net incremental income generated after the investment (difference between total net income with the project and without the project situation) was accounted for as a result of both increased milk production/sales and higher milk price due to quality premium (Option 1) and higher milk price only due to quality premium (Option 2).

For both options, an increase in milk price "before and after investment" was tied to the milk price paid by Bel-Shostka – UAH 2.24/L of milk – the average weighted price paid to rural households for second grade milk. It was assumed that after the investment, milk quality at the pilot farms would increase to meet the requirements of first grade milk. Thus, Bel-Shostka would pay household farmers UAH 3.81/L – a price equivalent to that paid to commercial farms for average first grade milk in the same year.

The baseline situation of the pilot farms was as follows: Farm 1 and Farm 2 both had two cows, Farm 3 had three cows and Farm 4 had five cows. None of the pilot farms had any means of mechanization except for Farm 2, which was equipped with a small tractor. During on-farm visits, no farmer could precisely estimate cow yields. On average, they produced 3 500-4 000 litres of second grade milk per year per cow (Table 34).

Pilot farm investment option 1: improvement of quantity and quality of milk

Investment needs were estimated for each of the four pilot farms. However, it was assumed that all would increase their number of cows, purchase machinery and build additional cowshed space. Farms 1 and 2 were expected to add two cows each, Farm 3 was expected to add one, and Farm 4 was expected to add six. All of the farms, except Farm 2, were supposed to purchase a small tractor for feed production/transportation and handling, and a cooling tank. The total investment cost for all four pilot farms was estimated to be UAH 808 650, or about USD 101 081 (Table 11; detailed information on investment is available in Table 32). Investment and other costs were obtained in consultation with farmers, local input, equipment suppliers and Bel-Shotka.

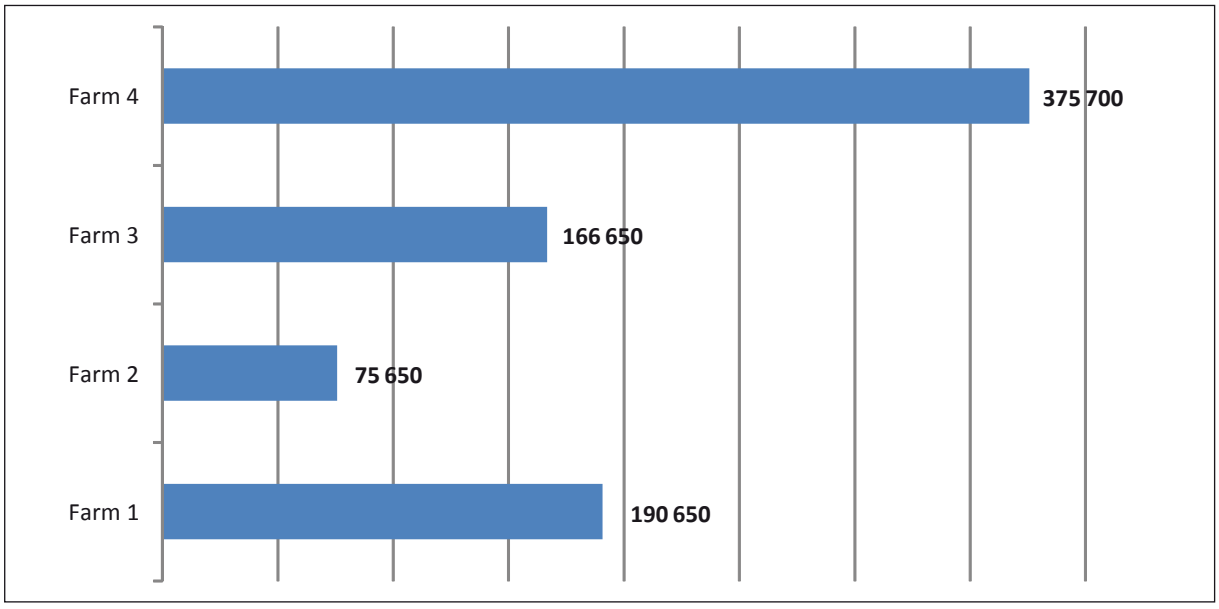
Table 11. Investment needs to improve milk production and quality for four rural household dairy farms in Sumy oblast, Ukraine, UAH

	Investment amount (UAH)	
Purchase of cattle	132 000	16%
Construction	250 500	31%
Equipment	426 150	53%
Total cost	**808 650**	**100%**

Source: Authors' calculations. As of 1 January 2010 the exchange rate was USD 1=UAH 8.

The total investment needs also varied greatly within farms, from UAH 75 650 (equivalent to USD 9 465) for Farm 2, which was already endowed with a tractor, to UAH 375 700 (equivalent to USD 46 963) for Farm 4 (Figure 63).

Figure 63. Investment cost estimates for each farm in Option 1, UAH



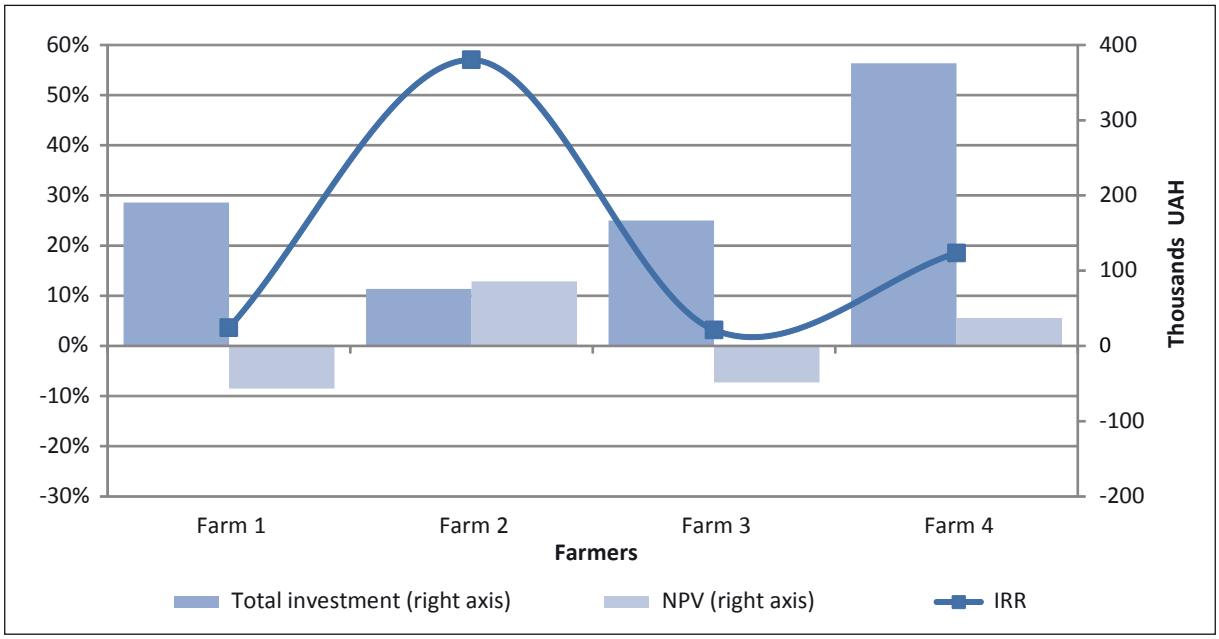
Source: Authors' calculations.

A specific model was developed to assess the above-mentioned investments under the following main assumptions:

- the aim of the investment was to improve an existing business (Table 34);
- the average annual weighted first grade milk price was set at UAH 3.81/L and second grade milk price at UAH 2.24/L increased by 17 percent annual inflation (Table 34);
- a 15 percent interest rate on a local currency loan was set with a discount rate (Table 35);
- shadow labour costs were included to allow for proper consideration of family labour costs (Table 33);
- a six year project duration was set for respective cashflow calculation to reflect the maximum terms of financing available from local financing institutions (Tables 36 and 37).

The anticipated economic efficiency results are provided below (Figure 64). Farms 1 and 3 could not expect to make a viable investment according to the given investment plan. This means that rural households in northern Ukraine cannot really expect solid investment to result in the growth of household farms into mini commercial dairy farms given existing prices and the cost of financing. Farm 2 could expect to make a viable investment only because it already had a tractor at the time of analysis. Farm 4 could also expect to make a viable investment because it increased its cow headcount from five to 11 cows. Their anticipated rate of return on investment (NPV) with a 15 percent interest rate was positive (Figure 64). However, as interest rates on the financing of small farmers at the time of study could reach as high as 25 percent p.a. (this scenario also had to be considered), only Farm 2 could expect to pay back this investment (Figure 64 and Table 39).

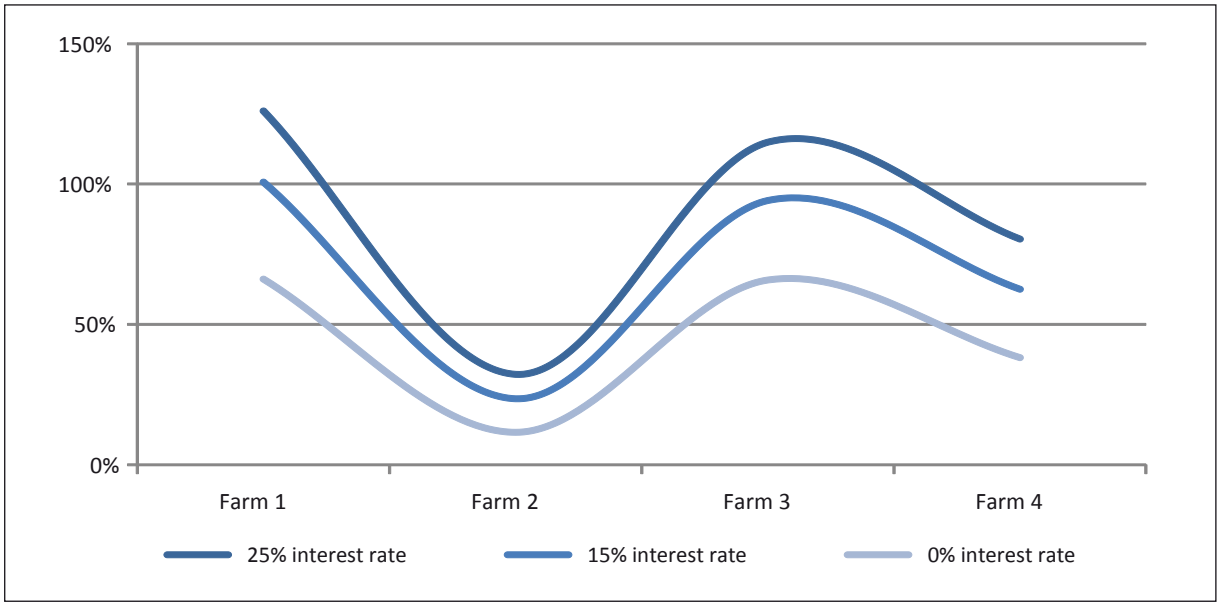
Figure 64. Rate of return on anticipated investment in milk production efficiency and quality (NPV and IRR)



Source: Authors' calculations.

The pilot farm Option 1 investment model was also highly sensitive to changes in two of its variables: cost of financing (interest rate) and premium price paid for milk between the second and first milk grades. The initial assumption was that the pilot farms would receive a 70 percent milk quality premium – the difference between the price paid for second grade milk (UAH 2.24/L) and first grade milk (UAH 3.81/L). A sensitivity analysis (see Annex 1) was used to determine the minimum price incentive needed by each farmer to make a viable investment under three different interest rate scenarios: 25 percent interest (increased interest from the baseline scenario); 15 percent, the baseline scenario; and 0 percent interest (interest-free loan provided by a donor or milk processors interested in financing pilot farms hoping to upscale positive experience). The results of the sensitivity analysis are provided in Figure 65.

Figure 65. Option 1 price incentives/premiums (required difference between second and first grade milk)



Source: Authors' calculations.

Under the three scenarios (25 percent, 15 percent and 0 percent interest rates), the minimum price incentive/premium for the base price of UAH 2.24/L that would allow farmers to pay off the investment exceeded 50-100 percent. This level of price incentive is hardly feasible for milk processors considering market conditions and given the limitations placed on processors' margins by domestic and export market prices and competition. Given that such a price premium cannot be applied widely;[31] such an investment would have limited scaling up value for improved practices among rural households.

Pilot investment Option 2: improvement of milk quality only (minimum investment required)

As only one of the pilot farms in Option 1 could expect to pay back the investment for improving milk production efficiency and quality, the project then considered the minimum investment required to improve milk quality. The underlying assumption was that farmers can improve milk quality using basic hygiene and sanitation requirements in the dairy barn, as opposed to buying a mini milking installation and reconstructing barns, as considered in Option 1. The expectations for improved milk quality even in cases of hand milking were based on available data from Croatia, as outlined in Box 1. Even with cow milking by hand it would be possible to achieve the milk bacteriological safety indicators as per existing state standards in Ukraine.

Given that investment in reconstruction of premises, purchase of new cattle and additional machinery are expensive, as demonstrated in Option 1, only investment in water supply, a mini-cooling tank and antimicrobial chemicals (Table 12, Table 32) were considered for Option 2 with the exception of Farm 4. The latter farm still had to make necessary repairs and purchase a mini

31 - The price offered by the processor to small households is not fully representative of the milk procurement cost. In addition to the milk collection cost and milk purchase price, a 20 percent VAT has to be considered since small households are not tax payers.

milking unit since the farmer already had five cows at the time of data collection. No new purchase of cattle was considered.

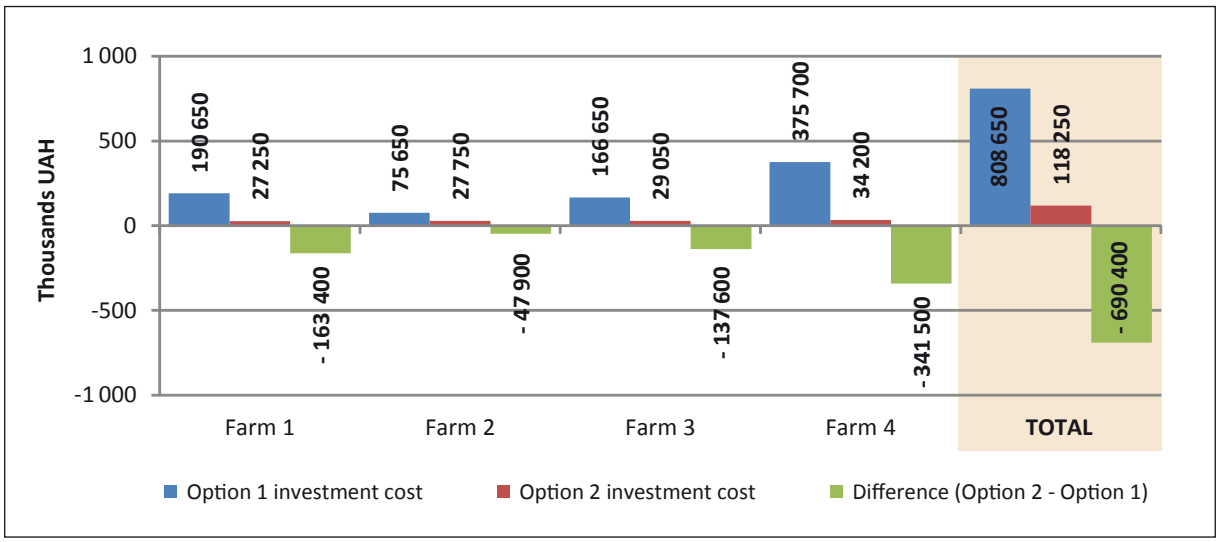
Table 12. Required total investment for improved milk quality

Budget line	UAH	%
Purchase of cattle	0	0%
Construction	16 100	14%
Equipment	102 150	86%
Total	**118 250**	**100%**

Source: Authors' calculations.

Option 2 allowed the reduction of anticipated investment costs from Option 1 for all four farms by 85 percent or by about UAH 690 000 (Figure 66).

Figure 66. Comparing investment costs for two options considered



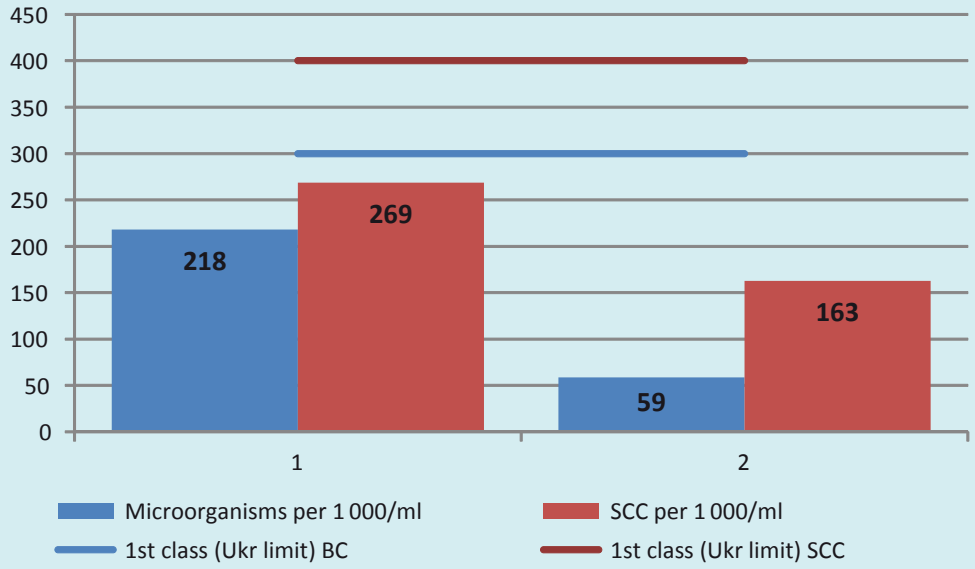
Source: Authors' calculations.

Box 1: Bacteriological quality of milk in case of hand milking in Croatia

The data and findings presented in "The comparison of hand and machine milking on small family dairy farms in central Croatia" by researchers from the University of Zagreb can provide a useful benchmark for expected milk quality improvements in the case of hand cow milking, as the dairy farming setting in Croatia is similar to that in northern Ukraine. Even though hand milking provides lower quality milk than by machine, it can still provide quality milk as per existing state raw milk standards in Ukraine.

The figure below compares hand vs. machine milking for bacteriological quality per 1 000/ml, based on the Croatian experience for two indicators: bacterial count (BC) and SCC. To meet existing standards in Ukraine (marked by lines), rural household farms in Ukraine may need to improve the hygiene of milking and sanitation in the barn.

Figure 67. Hand vs. machine milking, bacteriological quality of milk in 1 000/ml, Croatia



Source: Adapted from Filipovic and Kokaj, "The comparison of hand and machine milking on small family dairy farms in central Croatia", Faculty of Agriculture, University of Zagreb, 2009.

Both Options assumed that milk quality improvements "with the project" would generate a quality premium. Two price premium options of +30 percent and +40 percent over the current level of UAH 2.24/L were considered in Option 2. As farms could improve cow feeding and management without major investment, it was assumed that milk yields would increase from 4 000 L/year to 4 500 L/year per cow. The net incremental income from this higher price was then discounted at a 15 percent annual interest rate over a period of six years to derive the NPV and IRR from investment in milk quality improvements (Table 13). Given the difficulty of tapping capital resources in Ukraine, the authors considered that a reasonable pay-back period should not exceed six years.

According to the model results, only Farm 3 and 4 could expect to make a profitable investment from milk quality improvements at a +30 percent price premium for milk quality (NPV positive and IRR >15 percent).

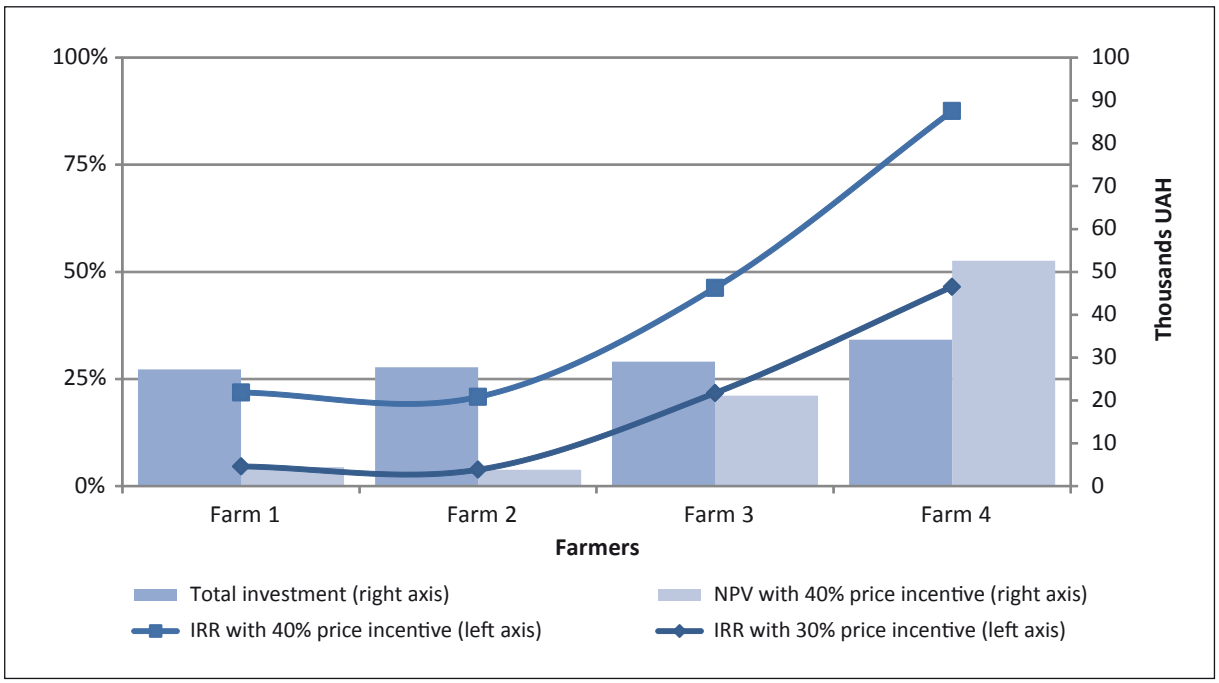
Table 13. Investment in quality: economic results with +30% price incentive and 15% interest rate

Indicator	Farm 1	Farm 2	Farm 3	Farm 4
Pay-off period, years	6	6	5	4
Discounted pay-off period, years	8	8	6	4
NPV	**-USD 6 571.38**	**-USD 7 183.74**	USD 4 625.19	USD 25 120.01
IRR	4.60%	3.82%	21.72%	46.53%
Total investment	27.250	27.750	29.050	34.200

Source: Authors' calculations.

With a 40 percent price incentive for milk quality all pilot farms could expect to make commercially viable improvements in milk quality (Figure 68).

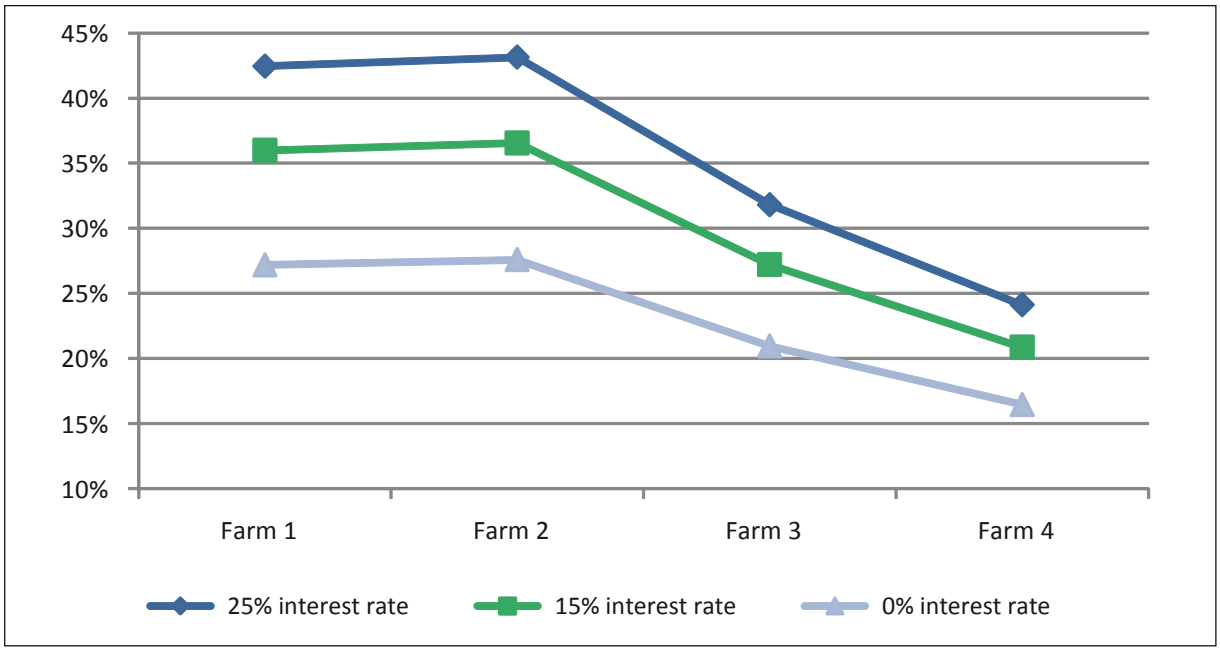
Figure 68. Rate of return on investment in milk quality (Option 2 at 15% interest rate)



Source: Authors' calculations.

As with pilot Option 1 (Figure 65), the minimum price incentives necessary to make investment viable were calculated for pilot Option 2. The results of the simulation at various interest rates and prices are presented here (Figure 69).

Figure 69. Minimum price incentives for viable investment in milk quality, depending on interest rates



Source: Authors' calculations.

Farms 1 and 2 would require about a 35 percent price incentive over the base price used in the model (UAH 2.24/L) assuming a 15 percent annual interest rate. Farms 3 and Farm 4 can expect to make a commercially viable investment by improving milk quality if they obtain at least a 27 and 22 percent price incentive over the base level respectively.

For a more detailed description of the model and an additional sensitivity analysis see Annex 1.

Environmental, animal welfare and zoning considerations of cattle raising in rural communities

Ukraine has a regulatory framework for the activities of household dairy farms, in particular the Order of the State Department of Veterinary Medicine No. 17 dated 21 March 2002, which regulates the Approval of Veterinary and Sanitary Requirements to Rural Households–Producers of Raw Milk.[32] Although this order is not endorsed by local administrations, it stipulates the following major requirements that may be difficult to meet for some rural households. In particular:

- cows' stalls should have a minimum width of 1.2-1.5 m and length of 1.8-2.0 m – the manger should be 0.75-0.9 m wide in order to allow access to feed;
- there must be at least 1 m between the manure canal and the wall to allow access to animals;
- the manure canal must be made from concrete or other water-resistant material.

32 - See: http://zakon2.rada.gov.ua/laws/show/z0336-02 (in Ukrainian only).

There are also strict environmental and spacing requirements on the premises of the rural household:

- there must be at least 25 m from barn's manure pit/storage to the house;
- the outside toilet of a household should be at least 15 m away from the cattle barn.

In reality, household dairy farming, including the four pilot farms, would face difficulty in complying with these regulatory limits. None of the farmers were aware of applicable national sanitary norms and hygiene requirements.

The situation observed during field visits revealed that while the cow barn at Farm 2 had proper dimensions for its two cows, the manure canal was close to the wall and the manure pit was about 20 m from the house, as compared with the 25 m required. Farm 3 had a toilet too close to the barn and no concrete manure canal in the barn. None of the farms had access to running water. These compliance issues also raise concerns regarding the possible expansion of existing household dairy farming in the future.

From a practical perspective, it was not possible to design and implement a viable commercial project to stimulate a rural household dairy farm to improve milk production efficiency and quality. According to discussion with local banks, none of the four pilot farms could reasonably expect to receive financing for terms exceeding 36 months. In other words, no pilot farm could conduct required improvements without external financial assistance on concessional/subsidized terms.

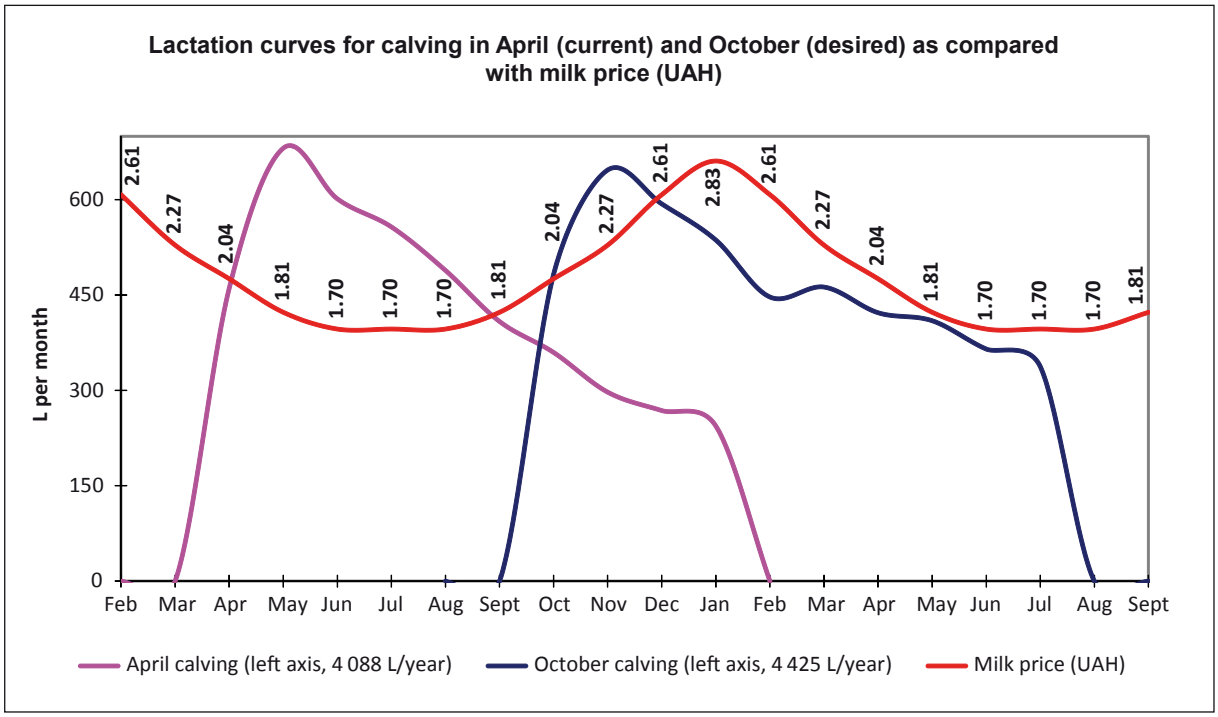
Assistance from milk processors to households can help to improve their relations with rural communities. However, while milk processors in Ukraine seem prepared to pay price premiums for better quality milk received from household dairy farms, separation of various milk grades would require further investment in the milk collection system. If only one or two households with two cows each produce better quality milk, out of 100 cows in the village, there is little incentive for milk processors to invest in additional milk tanks.

Addressing milk production seasonality in Sumy oblast of Ukraine: seasonal milk price vs. feed costs from a farmer's perspective

In 2008, the amount of milk collected by Shostka Dairy Factory in December (lowest month) was less than 50 percent of that for the highest milk supply in May. The household sector was the major contributor to this difference, due largely to the fact that an estimated 70 percent of cows calve around April in this region of Ukraine.

From the milk processors' perspective, it would be highly desirable that farmers shift the currently prevailing calving period from March–April (pink line, Figure 70) to September–October (blue line). Farmers could potentially benefit from higher prices during the October–March period as the average weighted milk price for the entire lactation increases from UAH 2.24 in the case of March–April calving to UAH 2.48 per litre in case of the October calving.

Figure 70. Lactation curves as compared with farm-gate milk prices in northern Ukraine, 2009



Source: Authors' presentation with prices provided by Bel-Shostka.

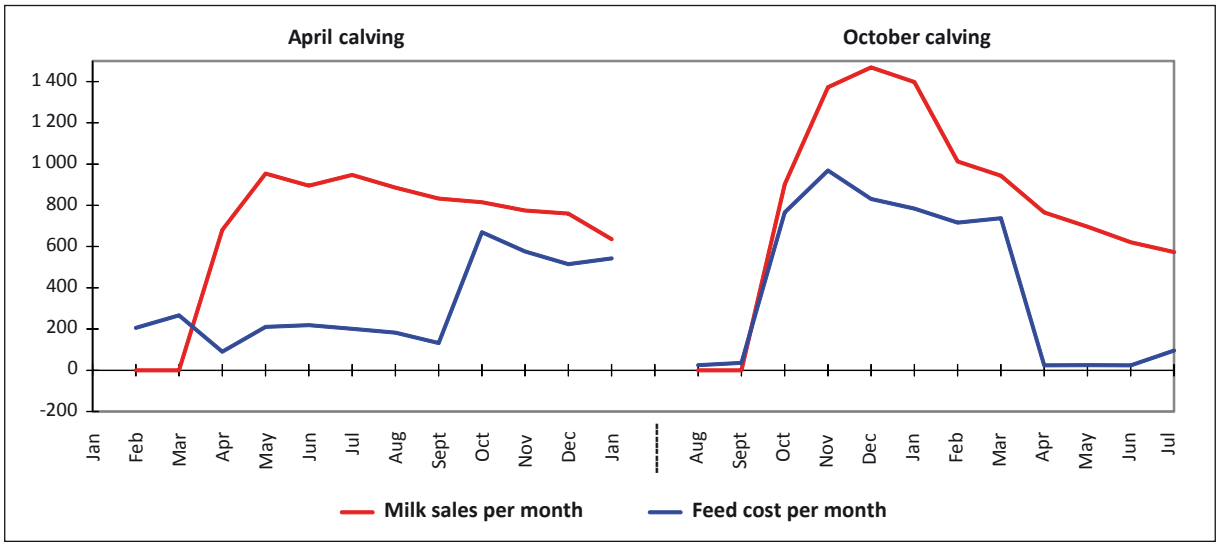
Limited availability of feed in winter is believed to the main reason preventing rural households from shifting the terms of calving to October. Consequently, dairy cows now reach the peak of milk production in May–June when farmers receive low milk prices (UAH 1.7/L in 2009).

Switching the calving period from April to October also means that farmers would have to spend more in feed costs. According to calculations, the incremental increase in feed cost is estimated at +UAH 946/lactation/cow or +23 percent to the current feed cost situation. It would also mean a change in the daily routine for rural households. They would have to work more in summer to stockpile the rough feeds (grain, hay, fodder beets, silage) and in winter to care for cows at the peak of their milk production cycle. The latter would involve more feeding, milking and removing manure in the coldest winter months,[33] as all these dairy farm operations are mostly performed manually at households.

33 - In January-February, average low temperatures for Shostka in Sumy oblast of Ukraine are about -10-12 C and average high temperatures do not exceed -4-7 C.

Figure 71 illustrates the revenues from milk sales and cow feeding costs an average rural household in Sumy oblast incurs now (April calving) and would incur by switching the cow-calving period to October.

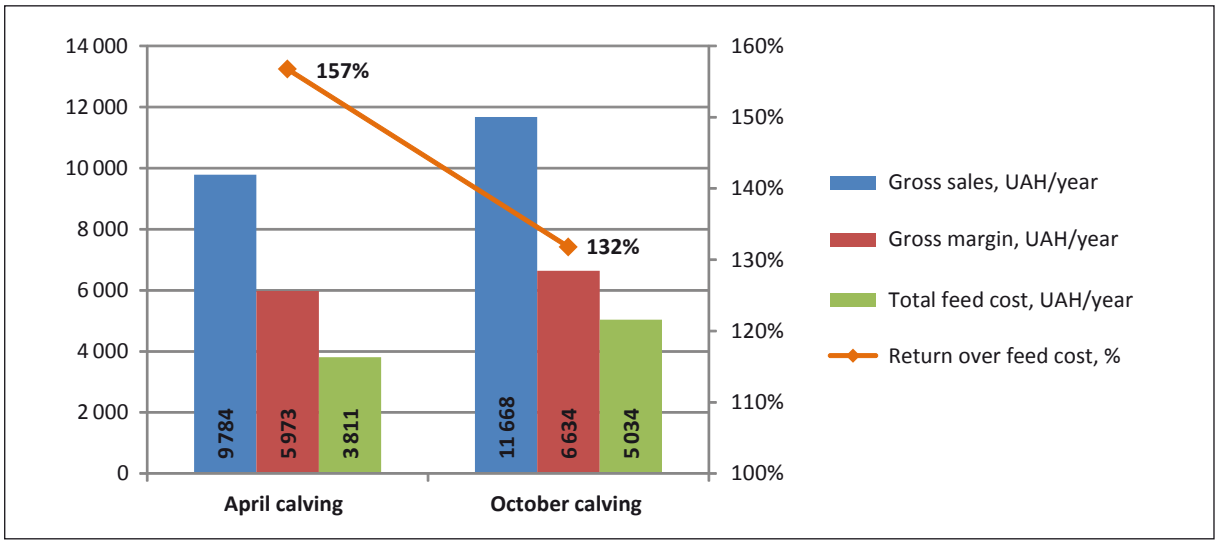
Figure 71. Comparison of milk sale revenues with cost of feeding for spring and autumn calving periods in Sumy oblast, Ukraine



Source: Authors' calculations.

The October calving would probably allow for a higher gross margin (milk sales minus feed cost) compared with that farmers make now: UAH 6 634 vs. UAH 5 973. However, according to calculations, the return on feed cost is still higher with the currently prevailing calving: 157 percent in April as compared with 132 percent in the case of October calving (Figure 72).

Figure 72. Estimated feeding cost and gross margin per cow for April and October calving in Sumy oblast, Ukraine



Source: Authors' calculations.

This is a clear indication that current higher milk prices paid in winter months do not offer rural household farmers sufficient monetary incentives to change the existing calving period, related farming and daily life routines, and thus address the seasonality of milk production from the perspective of processors.

In the case of calving in October, it would appear that the average weighted annual milk price has to increase by an additional 20 percent from UAH 2.48 to 2.98/L (Table 14). This price incentive would allow farmers to gain an additional 20 percent return on feed cost as compared to the return at current milk prices and April calving. At the same time, this price increase would translate into an additional UAH 2 334 expenditure on purchasing milk from the same cow (assuming that cow yield would remain at about 4 705 L milk a year for both October and April calving). This can be considered the price Ukrainian milk processors need to pay to address milk production seasonality.

Table 14. Additional milk price incentives required to address milk production seasonality

Price situation	Calving period	Gross margin, UAH/cow/Y	Total feed cost, UAH/cow/Y	Return over feed cost, %	Annual av. weighted price, UAH/L
At current prices	April	5 973	3 811	157%	2.24
	October	6 634	5 034	123%	2.48
With additional incentives	October	8 968	5 034	178%	2.98

Source: Authors' calculations.

Investment in milk production by commercial farms

With the aim of determining the investment potential of commercial dairy farmers in Ukraine, the project developed a universal model which calculates the main investment efficiency indicators for dairy farms of two different sizes: 250 and 500 cows. This model adapts to various commercial dairy herd sizes by changing the investment plan, operating expenditures and dairy herd rotation. It can also determine the sensitivity of the main investment efficiency indicators, such as pay-back period, discounted pay-back period, NPV and IRR variations to changes in different variables such as inflation, cow yield, operational costs and milk price.

The potential investment in commercial dairy farms was designed as a start-up business (Table 44). The average weighted annual price of first grade milk was set at UAH 3.81/L and second grade milk price at UAH 2.24/L in line with prices currently paid by processors to commercial dairy farms. The cow yields were prudently estimated at 6 500 litres of milk per year (Table 48). The quarterly cashflow was constructed based on the herd rotation scheme (Table 53) and milk production seasonality scheme (Table 54). The discount rate was set at 20 percent and the interest rate on local currency loans at 15 percent per annum (Table 47). It was assumed that commercial dairy producers are able to borrow directly from commercial banks. The main results of the investment are provided in Table 15 and more detailed information can be found in Annex 1.

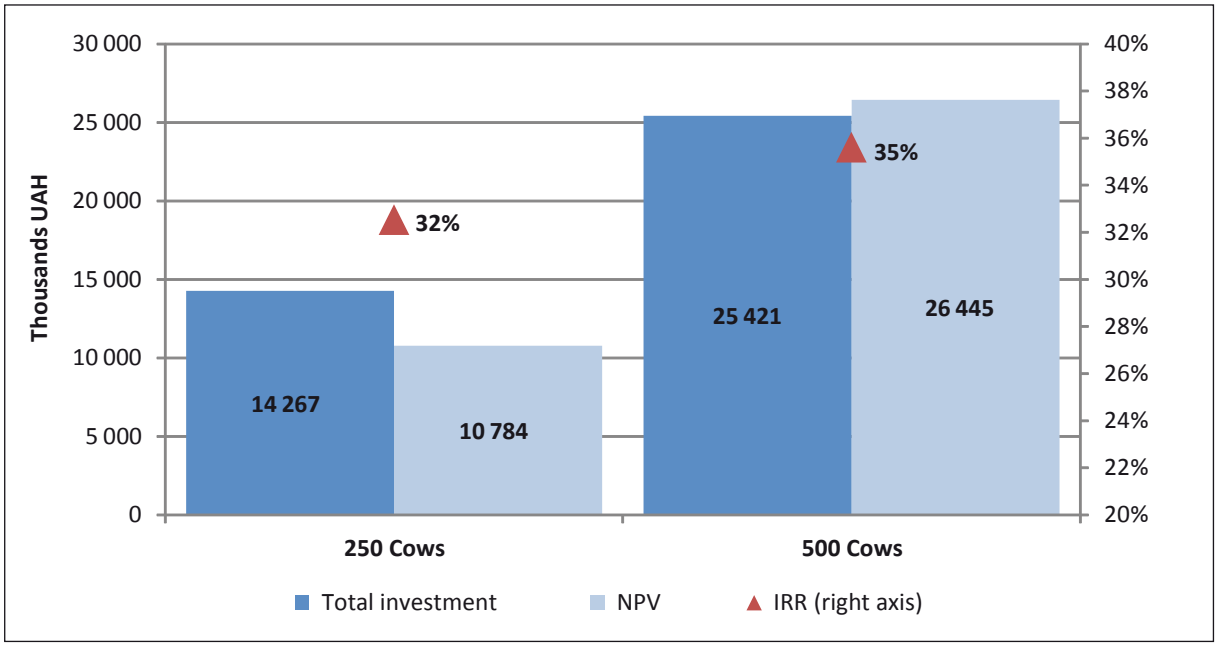
Table 15. Main investment and efficiency indicators (250 and 500-cows dairy farms)

Indicator	250 cows	500 cows
Pay-back period, quarters	17	16
Discounted pay-back period, quarters	25	22
Average return rate, %	46%	62%
Net present value, UAH	10 783 673	26 445 000
Internal rate of return, %	32%	35%
Total investment, UAH	14 266 950	25 421 083
Total credit, UAH	17 646 352	31 304 196
Credit for operative capital, UAH	3 379 402	5 883 114
Operational costs per cow, UAH/Year	5 082.48	4 677.27
Net cash availability at the end of the project, UAH	58 310 310	132 955 302

Source: Authors' calculations.

Synthesis data on project investment costs, discounted incomes (NPV) and profitability levels (IRR) are presented here (Figure 73).

Figure 73. Investment profitability (250 and 500-cow dairy farms)



Source: Authors' calculations.

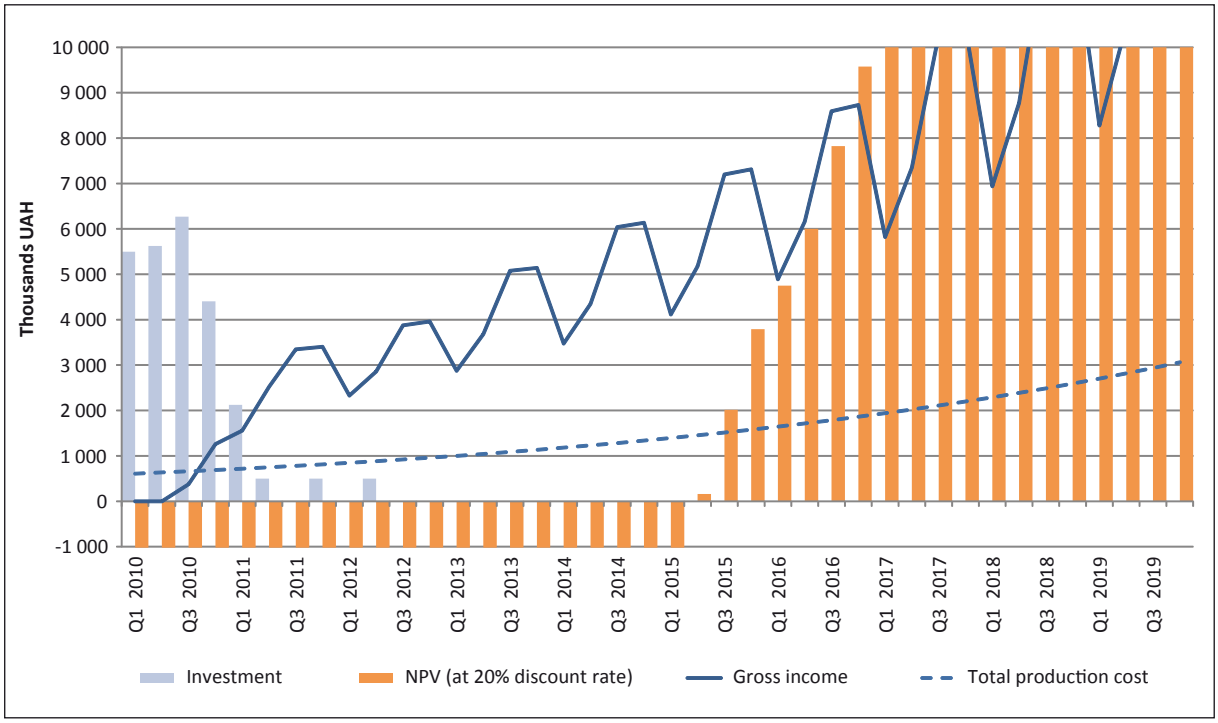
According to Figure 73, investments in 250 and 500-cow dairy farms can be considered as a profitable investment under standard market assumptions in Ukraine. Each farm can pay back the investment in about four years. A sensitivity analysis was carried out to test the dependence of project profitability on major input variables changes (inflation, cow yield, operational costs

and milk price) and is provided in Table 52. The investment was shown to be sustainable with a +/- 20 percent fluctuation in the major input variables listed above.

Good profitability levels for large-scale dairy farms in Ukraine may be more difficult to realize in practice due to their complicated operational and economic management. Large-scale dairy farms are characterized by explicit income seasonality, reflecting that of milk production, which is not sufficiently compensated by seasonal price incentives. It is noted, though, that costs are rather equally distributed along the year (Figure 75 and Figure 76). From the point of finance planning, the negative cashflows in the first project years have to be compensated with short-term credit for operating capital and medium-long term loans for investment capital. In the models used here, the operating capital credits were calculated automatically together with the credit for investment needs. For instance, for a 250 cow dairy farm, the operating capital credit was UAH 3 379 402 equivalent to almost 24 percent of the total capital investment. For a 500 cow dairy farm it amounts to UAH 5 883 114, or almost 23 percent of the total investment.

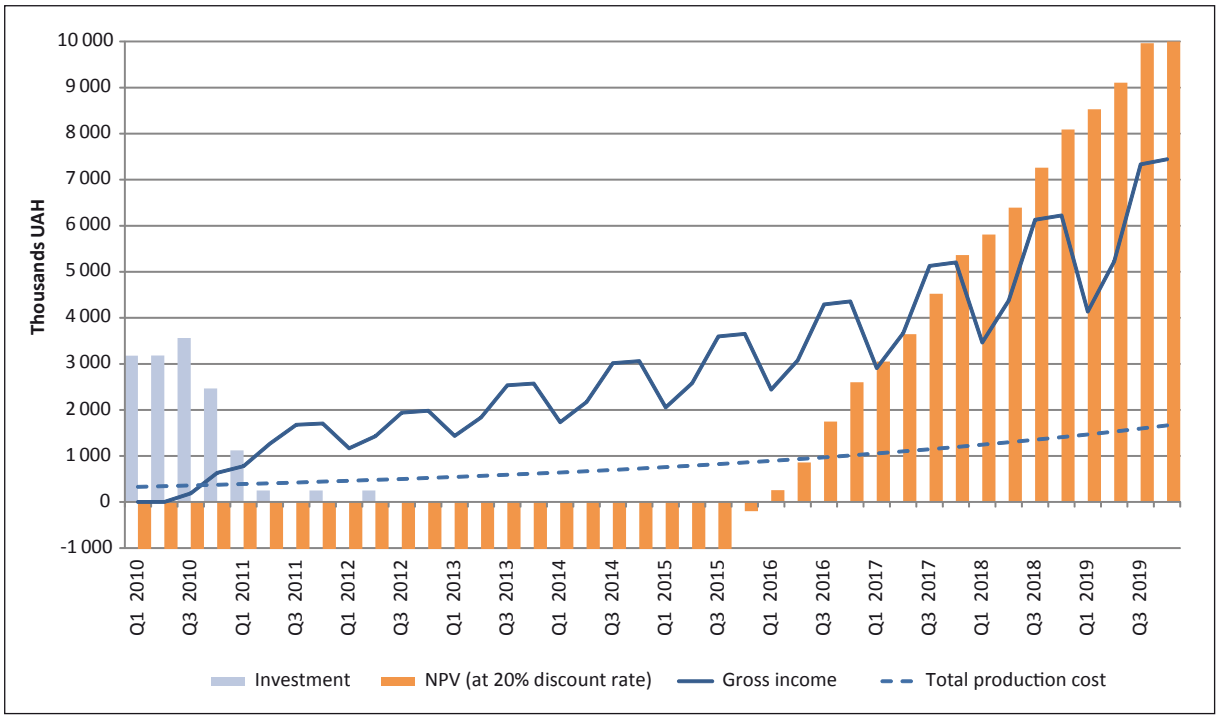
Figures 74 and 75 below present the evolution of some of the investment parameters. Per each of the farms, investments were anticipated in the first three project years (Table 45). The gross income includes the income from milk and meat sales increased by state subsidies (if any). Total production costs are representative of all costs that can be attributed to the specific activity of milk production and cow management plus labour costs (Table 46). Total production costs are not inclusive of amortization or other financial costs (such as loan service).

Figure 74. Anticipated monthly income and expenditures for a 500 cow dairy farm in Ukraine over a 10 year period, UAH



Note: Q1 corresponds to the first quarter of the fiscal year and Q3 to the third quarter.
Source: Authors' calculations.

Figure 75. Anticipated monthly income and expenditures for a 250 cow dairy farm in Ukraine over a 10 year period, UAH



Source: Authors' calculations.

Based on a specifically designed cashflow and profit-loss analysis (Table 50), the NPV for each specific quarter of the project was calculated. For this purpose, anticipated incomes and expenses were discounted at a 20 percent discount rate. As can be seen from Figure 74, the NPV is negative for the 500 cow dairy farm for over five years. It turns positive in the second quarter of the fifth project year, which can be considered as a discounted pay-back break-even point. For the 250 cow dairy farm, the NPV is negative for over six years and turns positive in the first quarter of the sixth project year. Such a long pay-back period is also a substantial risk for banks willing to finance primary dairy production.

3. Training of rural household dairy farmers and knowledge dissemination in Sumy oblast, Ukraine

FAO partnered with the Sumy National Agricultural University (SNAU) to develop practical recommendations to improve milk production efficiency and quality, taking into consideration local conditions, feed cost and their availability at rural households. The joint activities were carried out in the following phases:

The preparation phase consisted of:

(i) a review of the demographic situation in the villages of Obrazhiyivka, Stepne and Bilogryve in the northern part of Sumy oblast in order to determine the age of household farmers who have dairy cattle (questionnaire-based);
(ii) a study of existing feeding, herd management, milking, insemination, veterinary service and other milk production elements and raw milk-handling practices (questionnaire-based);
(iii) quality examination of local feedstuffs and forages through visual examination and laboratory tests to determine protein, fibre, metabolized energy content and other data needed for dairy ration balancing;
(iv) discussion of milk-quality testing protocols and monitoring arrangements with Bel-Shostka and milk-quality testing at certified laboratories;
(v) based on activities i-iv, preparation of training materials on dairy cattle feeding, management, cow milking and milk handling; and
(vi) preparation of an education video with recommendations on dairy feeding, milking and hygiene.

The training phase consisted of:

(i) organizational meetings with local village councils, agricultural officials and Bel-Shostka in the three villages;
(ii) daily seminars focused on dairy feeding, milking hygiene, veterinary issues, management and economics in each village, involving local officials, agricultural departments and Bel Shostka;
(iii) individual practical consultations from SNAU specialists upon completion of training to interested household dairy farmers; and
(iv) milk-quality control checks before and after training to record and process testing results in order to assess training impact.

The dissemination phase consisted of:

(i) targeted distribution (mailing) of training handouts and leaflets to agricultural departments in all raions (districts) in Sumy and Chernihiv oblasts, selected village councils and dairy processors;
(ii) circulation in local printed media of recommendations on dairy cattle feeding, management and hygiene;
(iii) preparation and screening of an educational video on dairy cattle feeding, management and hygiene; and
(iv) discussion of training results involving the local and national media, dairy processors and local agricultural officials at the dissemination workshop.

During the preparation phase, the SNAU team conducted a comprehensive sample survey in three villages in Sumy oblast: Obrazhiyivka in Shostka district, Bilogryve in Krolevets district and Stepne in Yampil district. Official village council records were used to determine the age structure of the population. Table 16 describes population size, age, employment and involvement in milk production in the three villages.

Table 16. Population statistics in villages of the project

Village	Population size	Working age* population		Officially employed population		Households engaged in milk production		Working age heads of private subsidiary farms	
	People	People	%	People	%	Plots	%	People	%
Obrazhiyivka	1 257	610	49%	566	93%	104	17 %	25	24%
Stepne	624	312	50%	73	23%	112	47 %	71	63%
Bilogryve	227	129	57%	68	53%	53	61 %	48	70%

* *People aged 16-64 years old.*
Source: SNAU survey.

In Obrazhiyivka village, the number of households involved in milk production was 104, or 17 percent of the total number of households. Only 24 percent of owners are of working age with the remaining population being retirees. Stepne village had a total population of 624 people with 50 percent of working age, a higher proportion. The share of working age people in the village of Bilogryve is even higher at 70 percent, implying that these people can potentially invest in milk production if more opportunities arise. It is important to note the extremely low level of official employment in these villages. In Stepne, official employment accounted for only 23 percent of the total number of working-age people. In Bilogryve, the figure was higher at 53 percent. Only in Obrazhiyivka was high population employment noted (93 percent) due to its proximity (5 km distance) to Shostka city (Table 16).

Milk production practices were also examined using the questionnaire and rural household farm visits. The share of rural household farmers who responded to the survey varied from 20 percent in Obrazhiyivka to 48 percent in Stepne (Table 17).

Table 17. Number of rural households that own cows and number of survey respondents

Village	Engaged in milk production		
	Total number of cow owners	Number of owners who took part in interviews	
	People	People	% of total number
Obrazhiyivka	104	21	20%
Stepne	112	54	48%
Bilogryve	53	23	43%

Source: SNAU survey.

The questionnaire developed by Sumy National Agricultural University and used for this sample survey of rural household milk producers is provided in Annex 2. The summarized results of the main indicators are presented below (Table 18).

Table 18. Summarized questionnaire results for private subsidiary farms, engaged in milk production process

Village	Total number of cows	Number of cows on the farm			Using own land plots for feed production, no. of respondents			Using small-scale mechanization						Source of rough feeds		Source of concentrated fodder	
		1	2	> 3	Yes	No	Lease out land	A tractor	A milking unit	A grain grinder	Fridge	Other installations	Nothing	Buying	Own	Buying	Own
Obrazhiyivka	133	103	25	5	67%	33%	0%	9%	0%	13%	13%	17%	48%	68%	32%	100%	0%
Styepne	153	106	40	8	44%	50%	6%	12%	5%	7%	2%	7%	67%	5%	95%	58%	42%
Bilogryve	76	25	29	3	52%	19%	29%	11%	4%	4%	15%	15%	52%	60%	40%	96%	4%

Source: SNAU survey.

The share of rural household dairy farms that have only one cow accounts for 77 percent of the total number of farms; 19 percent have two cows and only 4 percent have three or more cows (Table 18).

According to the results of the sample survey, 47.6 percent of 103 owners of dairy cows in the village Obrazhiyivka responded that they work only on their private subsidiary/household farms. This may be a sign of hidden unemployment or a seasonal fluctuation in rural labour employment. In either case, it signals that far more households depend on their own food production and income generation than suggested by official village records.

Two family/household members are usually engaged in milk production at 62 percent of households. About 67 percent of respondents used land plots for non-livestock-related purposes (mostly crop production). This indicates a significant potential for the development of own feed production,

which can be realized assuming conditions for the development of dairy farming are favourable. The main factor that would enable rural households to increase milk production, according to respondents, was a rise in milk procurement prices (52.4 percent of respondents).

The average age of people engaged in production was 61 years, although 23 percent of respondents were older than 70. This confirmed the earlier hypothesis that many rural households leave milk production fairly soon. This fact also had to be considered in adapting training recommendations with a preference for those that are simple and practical.

The level of mechanization of rural households was low. In practical terms, 50 percent do not use any machinery.

In Stepne, the number of rural households engaged in milk production accounted for 47 percent of the total number of households; the number of cows totalled 153. The biggest group among owners of cows was people around 55 years of age (63 percent). Out of the total number of farms, 69 percent of those producing milk only have one cow, 26 percent have two cows and 5 percent have three or more (Table 18). The average age of milk producers suggested better labour potential for raising dairy cows than in Obrazhiyivka. About 44 percent of respondents use their own land plots (as opposed to leasing their land out), and about 95 percent of the forage and 42 percent of concentrated feed are grown on these plots. The level of farm mechanization is also very low: 67 percent of respondents do not use any machinery. This can constitute a serious problem for increasing feed and forage production – one of the main conditions for increasing milk production. In Bilogryve, 57 percent of the population were of working age. The number of dairy cows kept by rural households was 76. Face-to-face interviews and farm visits revealed that the majority of cows were kept for more than nine years – a longer period compared with the standard five to seven years of productive cow life. Rural households with two working age members make up a considerable part (50 percent) of all households with dairy cattle. The most promising age group of cow owners (before 55 years old) accounts for 70 percent of the total population and these households keep 72 percent of all cows.

Fifty-two percent of respondents use their own land plots for forage and feed production. Practically all households buy concentrated feed (96 percent). Similar to the other villages, 52 percent of respondents do not use machinery.

Marketing and service cooperation (milk sales, feed procurement, etc.) are often referred to by experts in Ukraine[34] as among the ways to advance the development of dairy farming. Some experts interviewed on this project also suggested production cooperation (sharing of mobile milking units by households, construction of common milking parlours, etc.) as an approach to address issues of milk safety.

However, rural households interviewed at the time of the survey showed little willingness to cooperate. In Bilogryve, only 21.7 percent of respondents responded positively that they were willing to cooperate. In Stepne, 65.2 percent responded negatively to that question. No rural households wanted to cooperate in Obrazhiyivka. Three main reasons are offered for this weak support for cooperation: historical (excessive collectivization of farming during Soviet times), logistical and technical (difficulties in moving cattle or mobile milking units from one household to another in

34 - See: www.nbuv.gov.ua/portal/Soc_Gum/Vbumb/2012_2/8.pdf.

cold winters) and organizational (lack of trust, weak collective action spirit and largely subsidiary nature of milk production, etc.).

Other issues identified in the sample survey included:

(i) Milk delivered by some farmers to common cooling tanks showed signs of falsification (water added, antibiotics, etc.) – see more in the section below.
(ii) Households claimed that purchasing milk prices do not cover reasonable production costs and that there is no price differentiation depending on milk quality. At the same time, processors were not ready to offer higher prices for better quality raw milk produced by households claiming high milk collection costs, poor quality and competition.

Picture 1. Completion of the questionnaire

Conditions of dairy cattle raising

All aspects of milk production and storage technology were studied in surveys conducted between 28 December 2010 and 28 February 2011, through in-person visits to some households, and by laboratory tests of feedstuffs and milk quality. All elements of milk production and storage technologies were found to be nearly the same for all three villages.

Proper keeping and feeding conditions were often found to be absent due to poor barn design and lack of ventilation or illumination, as well as quality of the feeding ration.

Most of the barns were built from wood (46 percent), a smaller proportion was built out of bricks (33 percent), and the remainder (21 percent) were constructed from foam concrete blocks. Pictures of all three types of barns follow.

Picture 2. Wooden barn

Picture 3. Foam concrete block barn

Picture 4. Brick barn

Composition of air can influence cow productivity and behaviour. The highest possible productivity of cows can be achieved at temperatures ranging from 7 to 17 ºC degrees. Decrease in temperatures can lead to higher energy requirements, but excessive temperatures can also cause serious problems.

As a result of both low and high temperatures, cow productivity may decrease by 20 percent, equivalent to 400-500 kg of milk per lactation.

Picture 5. Cows in one of the barns with insufficiently dry and clean bedding

The floor in the barn is a key factor with great importance for the health of animals. In the majority of barns in the villages of the study, the floor was made out of wood (87 percent). Dirt floors were noted in 8 percent of farms and deep bedding in 5 percent of farms. Most of the beddings observed were not sufficiently dry or clean.

Household farms have predominantly used straw for bedding. Survey results indicate that about 66 percent of households used straw, 29 percent used residues of hay and 5 percent used wooden sawdust. Cleanliness of cattle stalls also depends on everyday cleaning, removal of manure and the use of disinfectants. According to the information supplied, in Obrazhiyivka all respondents cleaned their cattle placements daily. In Stepne and Bilogryve, 33 percent and 4 percent of respondents, correspondingly, cleaned cattle premises depending on manure accumulation, and 6 percent of respondents in Stepne cleaned cattle stalls once a week.

Regardless of design, it is necessary to clean stalls twice a day to ensure proper sanitary conditions and dryness. Cows lie in stalls for about 14 hours per day, if they are provided with the necessary comfortable conditions for rest. However, cows may reduce their rest time to 6 hours if conditions are not proper. A reduction in cows' rest time on the floor also decreases cow productivity. Thus, the majority of cow owners in the villages did not provide sufficient conditions for rest, which affected cow productivity.

Animal motion has a great importance for cattle health. While during grazing seasons cows kept by households in Ukraine walk to pastures, during the winter months the animals lack motion. The majority of respondents in the Bilogryve (83 percent), Stepne (78 percent) and Obrazhiyivka

(43 percent) keep their dairy cattle tied. While this may be convenient during cow milking, tied animals do not enjoy physical motion. The project found that in the overwhelming majority of farms in Obrazhiyivka (91 percent) and Bilogryve (96 percent) there were some facilities for walking cows in the yard, but in Stepne almost half of respondents (54 percent) did not have such facilities. During the summer period most cattle (97 percent) are also kept in the barns upon their return from pasture.

Quality of local feeds and forages

Good hay is one of the main sources of protein, sugar, vitamins and mineral substances in the winter rations of cows. Hay consumption by animals depends on its quality and the availability of other roughage feeds in the ration. Animals can eat up to 3 kg of hay per 100 kg of live weight. The addition of root/tuber feeds (fodder beets) into the ration could reduce hay consumption.

Analysis of cow-feeding conditions revealed that the majority of households make their own hay on private plots and meadows. Forbs hay, according to this study, makes up about 78 percent of all hay. Alfalfa hay accounts for 12 percent, and clover and rye-grass hay another 10 percent.

Besides hay, the cows were additionally fed with various kinds of straw. Although the straw of cereals contains 36-42 percent of fibre and 3 percent of protein, it is usually poor in vitamins and mineral substances.

Oat and barley straw are usually considered better than wheat straw. As the survey results showed, oat straw accounted for 78 percent of all straw fed to animals in selected villages. Barley straw accounted for 4 percent, rye straw for 5 percent, wheat straw for 11 percent and other straw for 2 percent.

One of the main methods of increasing milk productivity is the use of proper concentrate feedstuffs. The quantity of concentrates in the ration is determined by several factors: cost, the necessity to balance protein and phosphorus, and the level of cow productivity. In fact, feed for producing milk represents a major monetary cost for the farmer and a major resource cost for society. Reflecting on the high-energy costs of current animal production systems and the need to reduce the carbon and water footprints of livestock production systems, urgent changes are called for in the way that diets are prepared and fed.

Samples of wheat bran and various other types of mixed feedstuffs were provided for testing. The survey demonstrated significant differences in cow feeding in different villages. Twenty percent of cow owners in Stepne have never given cows compound feeds, while in the other two villages all households fed compound feeds to cows. The laboratory tests showed that the compound feed made of predominantly oats contains significant amounts of shaf with a low crude protein content (10.8 percent vs. standard 16 percent). Therefore, it would be highly desirable to add protein meals and pulses to the feeding ration.

The cattle of private subsidiary farms also received the mixed fodder made of ground wheat admixed with oats. Such mixed fodder had the same problem as the above-mentioned samples, a deficit of crude protein, which only accounted for 11.8 percent.

Silage is one of the basic forages in the ration of dairy food. High-quality silage favourably influences the health of animals and raises their productivity, especially in the winter period. Analysis of the possibility of using forages such as haylage and silage showed that a large share of households (74 percent) do not use them at all. Only in Obrazhiyivka are almost 48 percent of cow owners provided with this type of forage. A solution to this problem could lie in the re-introduction of silage production at the village level. This would make it possible to use plant resources that do not compete with human food and could contribute to balancing diet especially during winter. The challenge is that it will require investment in machinery and organization of production, which would need self-organization on the part of farmers into producer groups or cooperatives.

Almost 100 percent of respondents from all three villages fed cattle with fodder beets. Households also use the tops of vegetable and other remnants from private plots for cow feeding. Some farmers also used fruits and carrots. Farmers should make better use of available resources, in particular straw and by-products (e.g. molasses, oilcakes) for the balanced feeding of dairy cows.

When organizing animal feeding, one should ration the content of calcium, phosphorus, sodium, chlorine, magnesium and other mineral substances. Minerals are required for the functionality of numerous structural proteins, enzymes and cellular proteins. The addition of minerals to the ration of dairy animals could be responsible for greater production of IgG, thus affecting cell metabolism and resulting in a better immune status. The survey showed that all private subsidiary farms provided cows with table salt, but other mineral substances were not added to the ration. One person in both Bilogryve and Obrazhiyivka fed animals with forage premixes.

In dairy animal husbandry, the summer pasture period is of great importance for cattle productivity, health and reproductive functions. The northern climatic area of Ukraine coincides with zones of forest and forest steppe, and falls under the influence of wet cyclones. Average temperatures in January range from -6°C to -8°C and in July from +16°C to +20.5°C. Precipitation ranges from 480 mm to 690 mm. The absolute heights of this territory fluctuate from 135 to 500 m. In the forest steppe and forest zones of Ukraine the duration of the pasture period averages 165 days.

Pasture management should improve and focus on small areas of improved pasture. This can greatly increase opportunities for more efficient utilization of unimproved grazing land, most notably in bridging gaps in quantity or quality of forage for grazing at critical times. The use of legumes is an essential element in planning sustainable management of forage resources for grazing. Efficient grazing management is about managing trade-offs between pasture growth and utilization in order to maximize livestock output per hectare. This requires monitoring and management of sward heights to avoid seasonal under-utilization and especially overgrazing.

The survey showed that the households in Bilogryve, Obrazhiyivka and Stepne have access to meadows (17 percent, 100 percent and 83 percent, respectively) and pastures (87 percent, 24 percent and 13 percent, respectively). In the villages of Bilogryve and Stepne some farmers use forest and marshland for cattle pastures (4 percent and 7 percent, respectively).

Water is very important for milk formation. The survey of cow owners showed that cows got as much water as they wanted in 97 percent of all households of the three villages. The remaining 3 percent of cows were able to access water when owners provided it. In the middle of summer a highly productive cow needs up to 180 litres of water per day. Deviation from the recommended norm of water consumption may lead to a decrease in milk production of 15 to 20 percent.

Results of the quality standard survey of dairy herds in the three villages showed that cows kept on private subsidiary farms had live weights mainly in the range of 400-500 kg. Detailed distribution of cows by live weight in three villages is provided below (Table 19).

Table 19. Share of animals by three live weight categories

Village	Under 400 kg	400-500 kg	Above 500 kg
Obrazhiyivka	29%	67%	4%
Bilogryve	25%	61%	14%
Stepne	40%	60%	0%

Thus it is possible to state that the majority of cattle livestock had an average live weight not conducive (considering existing feeding conditions) to high levels of milk productivity. For cows with a live weight of 400-500 kg the expected milk yield is around 3 000-4 000 kg per annum. Animals with a live weight of 500-600 kg have a yield potential of 4 000-5 500 kg.

Table 20. Share of animals by three productivity groups, tonnes/cow/year

Village	Under 3.0 tonnes	3.0-3.5 tonnes	3.5-4.0 tonnes	Above 4.0 tonnes
Obrazhiyivka	4%	29%	57%	10%
Bilogryve	17%	27%	52%	4%
Stepne	36%	44%	20%	0%

The productivity distribution table above clearly demonstrates the close correlation between live weight and milk yield (Table 20).

The study also considered cow-milking technology and milking frequency in the survey. Most of the farms (79 percent) in the three villages milk cows three times a day. The remaining 21 percent milk cows twice per day. The interval between milking should not be less than five or more than 12 hours. The acquired data show that morning milking in all settlements occurs between 5.00 and 7.00 a.m., day milking from midday to 2.00 p.m., and evening milking from 4.00 to 10.00 p.m., which is within the recommended range.

About 89 percent of cow owners from the three villages washed cow udders before milking, mostly with warm water. Another 9 percent of households wiped the udder with a wet towel. Only a very limited number of respondents used disposable napkins to prepare an udder for milking.

As the first trickles of milk always contain more bacteria and somatic cells, it is not recommended to start milking into the main bucket immediately. Unfortunately, 30 percent of respondents in Bilogryve and 26 percent in Stepne milked the first trickles of milk into the general milk container/ bucket.

Based on the results of the survey, SNAU designed training sessions for the households, which were conducted together with training brochures on “Recommendations on Optimization of Milk

Production Technology" and "Feeding and Economic Planning in Milk Production by Households of Sumy Region" (Annex 6). They also prepared an educational video, which was screened at the training sessions and later broadcast on regional television.

Training of rural dairy farmers

FAO and SNAU jointly conducted the training of household dairy farmers in the above villages in June 2011 together with representatives of Bel-Shostka. The training was undertaken with strong support and commitment from the local administration (village councils).

The team of experts explained to dairy cattle owners that with feasible improvements in production techniques they could raise milk production from the current level of 3 500-4 000 kg per cow per year to 5 000 kg with existing genetics. The trainers demonstrated the best practices on dairy cattle feeding, seasonality, management and economics, milking, hygiene and veterinary concerns. The training video and brochures can be consulted in Annexes 5 and 6. The PowerPoint presentations of the seminars are available here: www.eastagri.org/meetings/index.asp?id=55. Annex 5 contains links to the video material produced for the purpose of the training sessions and awareness rising through local media.

Picture 6. FAO-SNAU team of experts after the training seminar in Bilogryve

Notwithstanding the peak fieldwork season, seminar attendance was good (10-30 participants per village). However, the (low) milk procurement price was a dominant question from farmers in all three training sessions.

Picture 7. Dairy farmers during the seminars in Obrazhiyivka and Stepne

Training on the following key thematic topics was delivered by the associated experts:

- *Cows feeding in household conditions* (Viktor Opara, Agricultural Sciences, Associate Professor of Sumy National Agrarian University);
- *Animal health: the key to profitable milk production* (Yurii Baidevlyatov, Associate Professor of Sumy National Agrarian University);
- *Recommendations on optimization of milk production technology* (Aleksandr Sverdlikov, Agricultural Sciences, Associate Professor of Sumy National Agrarian University); and
- *Economic planning in milk production by households of Sumy Region* (Larysa Kalachevskaya, project coordinator, Sergey Guzhvenko, expert consultant, Sumy National Agrarian University).

The training sessions answered a number of important questions from concerned farmers on veterinary issues (the preliminary sampling showed a high content of somatic cells indicating the spread of clinical mastitis), milk purchase prices (questions addressed by Bel-Shostka) and concentrate feeding.

In addition, individual consultations were provided to households who expressed an interest. The main issues raised concerned milk quality, fodder production, feeding and economic analysis.

Milk quality monitoring

One of the goals of the project was to increase the quality of milk produced by rural households. The analysis of milk quality (fat and protein content, somatic cells counting, bacterial contamination, presence of antibiotics) was conducted in certified state laboratories (Table 21).

The main activity undertaken under this project was to train small milk producers in aspects such as: hand milking and milk storage hygiene; economics of milk production and dairy cattle feeding; and organizational/technological aspects.

The following milk supply chain problems affecting smallholders were identified during the project: individual milk deliveries often show features of falsification; some milk samples reacted positive for inhibitory substances; and the raw milk purchasing price does not differentiate according to quality.

Picture 8. Milk sampling

In the course of project implementation regular monitoring of milk quality indices was carried out. The number of people (monitoring clusters) who took part in milk quality monitoring can be considered as representative for further evaluation of reliability of the received results (Table 21).

Table 21. Milk quality monitoring clusters

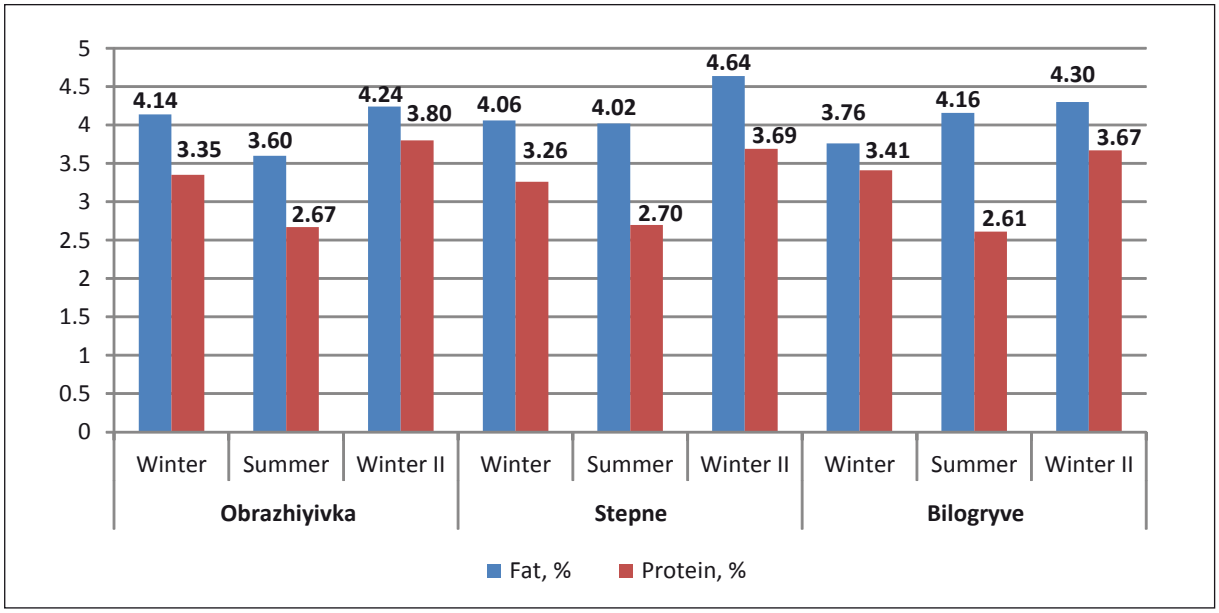
Settlement	Cattle owners		Participation in milk quality monitoring		
	Total	Including those who deliver milk to processors	1st sampling (winter before training)	2nd sampling (summer)	3rd sampling (winter after training)
	Persons				
Obrazhiyivka	104	54	23	19	26
% of total owners	*100%*	*52%*	*42%*	*35%*	*48%*
Stepne	112	98	39	18	17
% of total owners	*100%*	*88%*	*39%*	*18%*	*17%*
Bilogryve	53	44	18	21	14
% of total owners	*100%*	*83%*	*18%*	*21%*	*14%*

Source: SNAU.

However, it should be noted that the milk selected for monitoring during different seasons came from different cows. This was due to the non-coincidence and different lactation periods, as well as irregular delivery of milk by suppliers to milk receiving stations. Therefore, it is difficult to claim with a sufficient degree of confidence, based on the milk testing conducted, that milk quality has improved specifically because of the training.

Milk quality monitoring has shown that the content of fats and proteins in the milk decreases slightly in the summer. This is most likely a seasonality driven fluctuation (the difference in conditions of winter and summer feeding) accompanied by lack of motivation on the part of the population to improve the quality of the milk produced. However, a comparison of milk test data from the winter before the training with that immediately after (Figure 76) showed a slight increase in fat and protein content. This increase can be explained by higher levels of protein components in the diet of animals due to the supply of additional concentrated feed.

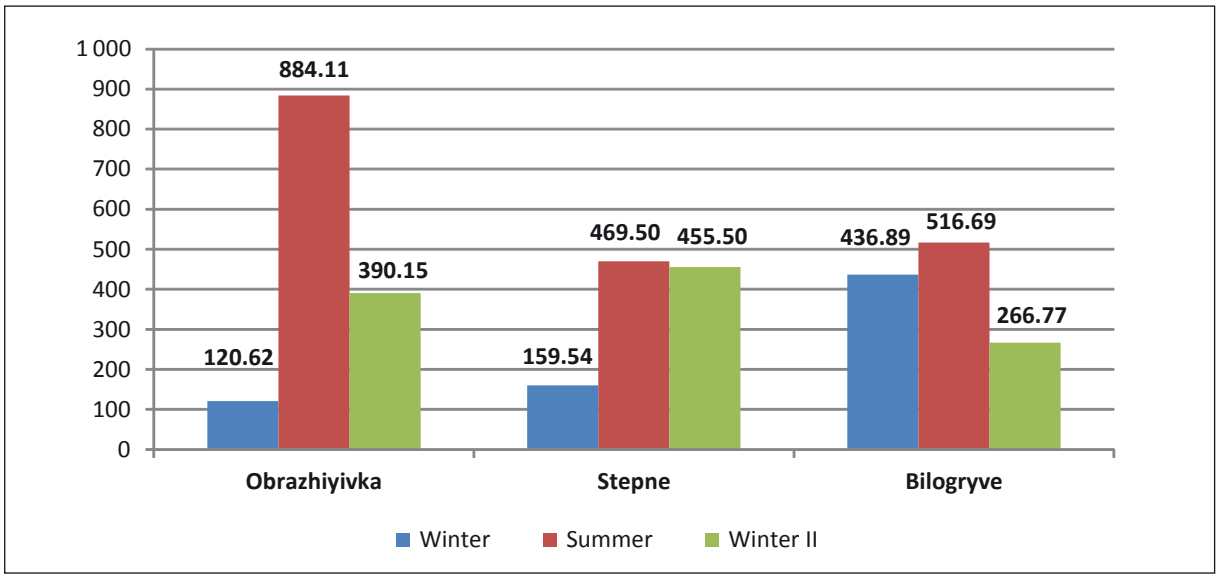
Figure 76. Fat and protein content in the milk before and after training, %



Source: Authors' calculations.

The results of milk somatic cell counts varied greatly between the villages and did not reveal any clear tendency of possible training impact (Figure 77).

Figure 77. Contents of somatic cells in milk (micro-organisms per cm^3)



Source: Authors' calculations.

Lower content of somatic cells in milk during the winter season, as compared to summer, are explained by fewer mastitis diseases and lower general temperatures. The outbreak of mastitis preceding the third milk testing was caused by insufficient quantity and low quality of fodder, improper housing, teat injuries, stresses cased by high temperatures (above 25ºC), high humidity

(above 80 percent) and manure odours. General cleanliness of the environment is a major factor in determining overall exposure to mastitis organisms. High humidity also heightens exposure to airborne organisms and raises the moisture content of bedding materials, thereby increasing the rate of bacterial growth in bedding. More than 500 000 somatic cells in a cubic centimetre of milk indicated a serious health problem during the summer period in all settlements.

The milk quality testing demonstrated that households experience difficulty in producing high-quality milk during the summer period.

The division of milk by official milk classification system according to national quality standards is shown below (Table 22).

Table 22. Distribution of milk by quality grade in single settlements

Settlement	Season	Highest grade	Grade I	Grade II	Low-grade	Average grade
Obrazhiyivka	Winter	-	50%	50%	-	II
	Summer	-	-	100%	-	II
	Winter II	-	-	100%	-	II
Stepne	Winter	20%	80%	-	-	I
	Summer	-	-	89%	11%	II
	Winter II	-	-	100%	-	II
Bilogryve	Winter	-	60%	40%	-	II
	Summer	-	32%	30%	38%	I
	Winter II	-	60%	40%	-	I

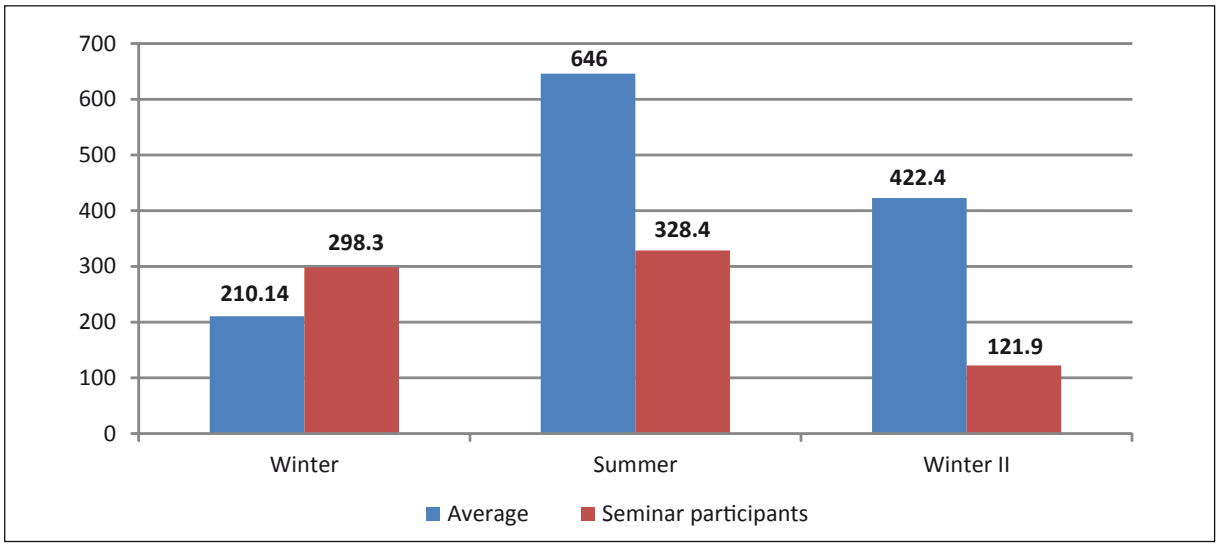
Source: SNAU.

Only Bilogryve village was able to produce first grade milk in the summer and produced the same amount during the winters before and after the project. The other two villages were not able to produce first grade milk in the summer and performed worse after training as compared with milk testing before training.

In order to make the sampling and monitoring as representative as possible, the monitoring clusters in the winter after the project comprised cow owners who did and who did not participate in the training. This form of sampling enabled the elimination of environmental and other factors that could affect milk quality monitoring results.

As shown below (Figure 78), rural households that participated in training seminars increased their milk quality performance. Despite the general tendency of milk quality decline due to negative externalities, the rural households that participated in training showed positive changes in the second winter (after training) as compared to the winter before training.

Figure 78. Somatic cell content in milk (seminar participants vs. average for village), thousands cm^3

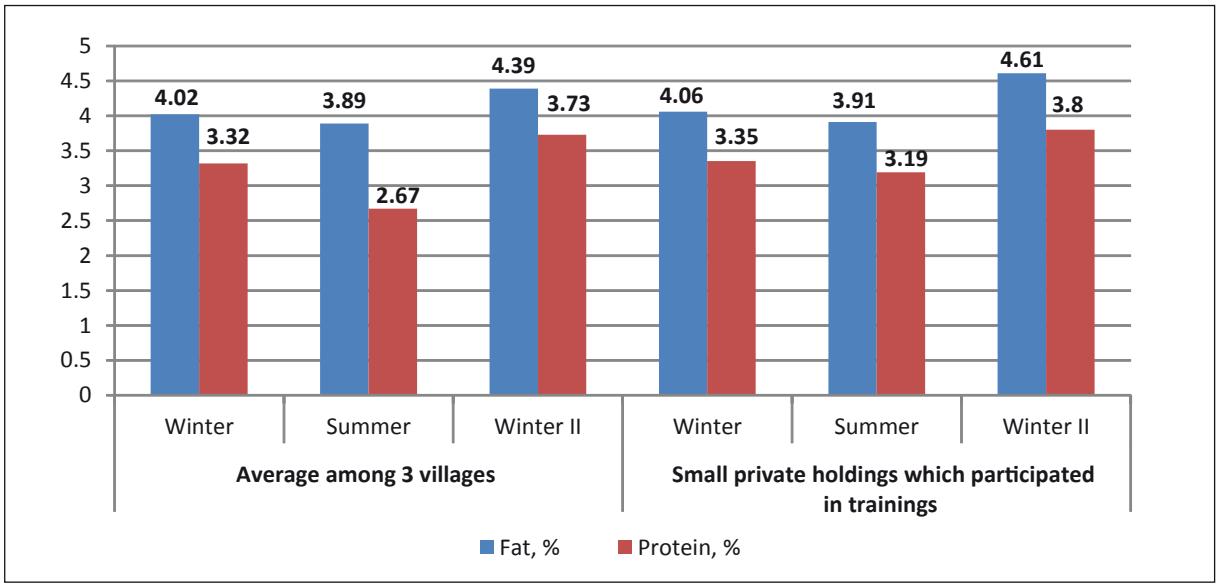


Source: Authors' calculations.

The average SCC in milk samples gathered before training by future seminar participants was 298 300 per cm^3 – above the average sample (Figure 78). Then, according to the laboratory test results, the seminar participants more than halved the SCC from 298 300 to 122 000 cells per cm^3. At the same time, the cell count of the average sample increased considerably, arriving at 422 400 cells per cm^3.

Training activities were also believed to facilitate higher protein and fat content in the milk. The households that participated in the seminars demonstrated actual increases in fat and protein content of 0.56 percent and 0.45 percent respectively (Figure 79).

Figure 79. Fat and protein content in milk (seminar participants vs. average)



Source: SNAU.

This is explained by the fact that seminar participants probably took better care of the health of cow udders after the training, a supposition confirmed through visits to the observed households. The training activities for dairy households had a positive impact on milk quality improvement within the group of training participants.

It should be possible for rural households in Ukraine to produce first grade quality milk to dairy processors. However, improvements are also needed along the milk collection and transportation chain so that this milk can reach the processors.

Dissemination

A media campaign and distribution of educational materials were also necessary to raise public awareness of milk production and handling, so as to improve milk quality among rural households in other villages. Therefore, knowledge dissemination has taken place in other villages with the support of local administration.

In particular, the SNAU team prepared four articles, which were published in the leading Ukrainian Agribusiness magazine *Propozytsiia* and in the regional paper *Sumshchyna* (Annex 5)

Project materials were shared with all district administrations dealing with agriculture and rural development, as well as with the processing enterprises of Sumy and Chernigov regions.

Two roundtable meetings were conducted on "Quality of milk produced by households" with the active participation of: JSC "Bel Shostka Ukraine"; the head of Stepne village council (Yampil district); representatives of the main agro-industrial development department of Sumy Region State Administration, "Vim-Bil-Dan"; representatives of the distribution network "Billa"; and the Director-General of the agricultural products manufacturers and processors association in Sumy region. An extended report about the event made by a regional company was broadcast on television and radio.

The SNAU team also participated in the international forum "Complex support of laboratories" to disseminate project results. As a side-event of this forum, a roundtable meeting "High-quality milk produced by small private holdings: is it possible?" was conducted on 27-30 September 2011 in Kiev (organized by project Agrolviv), and during the fourth all-Ukrainian conference with international participation "Dairy business 2011", held on 24-25 November 2011 in Kiev (organized by the Ukrainian Union of Dairy Enterprises and Infoagro).

On 24-25 November 2011, the key findings of a study outlining trends in the Ukrainian dairy market were presented in Kiev at the fourth National Dairy Business conference. Seventy-six dairy companies and more than 100 participants from seven countries were in attendance.[35]

35 - For details on this and other events see the EastAgri website: www.eastagri.org/meetings/index.asp?id=62.

ANNEXES

ANNEX 1
Modelling of investment in rural household dairy farms

The following models were all created in Microsoft Excel: (i) the minimum dairy farm size model, (ii) the pilot investments model in milk production and quality improvement, (iii) the investment model in commercial dairy farms, and (iv) the dairy farms classification model.

The models are based on data obtained from official statistics, the Shostka Milk Factory (Bel Group), the research company ProAgro and interviews with key milk market specialists. Investment plan data are based on analysis of commercial offers of manufacturers/sellers of equipment for the dairy industry in Ukraine, and information delivered by specialized consultants. All project data is presented in UAH.

For small rural households, the estimated duration of the project is six years, which reflects the maximum period for long-term financing in Ukraine. For investments in commercial farms (250 and 500 cows) the project duration was extended to ten years.

All the calculations were performed according to the theoretical framework given below.[36]

Theoretical framework for calculating main indicators

The main efficiency indicators for investments in new start-up activities (the minimum dairy farm size model and the 250 and 500-cow dairy farm models) were calculated based on standard cashflow assumptions. Efficiency indicators for investments in existing activities (the pilot Option 1 and 2 models) were calculated based on incremental cashflow (the difference between cashflow after project implementation and cashflow before project implementation).

The methodology used to calculate main efficiency indicators and process the sensitivity analysis was as follows:

Pay-back period: the year (t) when the cumulated net cashflow is equal to zero:

$$0 = \sum_{t=1}^{B} NCFt$$

Where NCFt = net cashflow of the year t; and PB = pay-back period (in years).

Or in alternative the year (t) when the cumulated cashflow is equal to the total investment:

$$Total\_Investment = \sum_{t=1}^{PB} CF_t$$

Where CF_t = cashflow of the year t; and PB = pay-back period.

36 - More information on the methodological aspects can be found in publications such as: the *EU Guide to cost-benefit analysis of investment projects* (http://ec.europa.eu/regional_policy/sources/docgener/guides/cost/guide02_en.pdf) and P. Belli, J.R. Anderson, H.N. Barnum, J.A. Dixon, J-P. Tan, 2001, *Economic analysis of investment operations. analytical tools and practical applications,* WBI, World Bank, Washington, DC, (www.scribd.com/fullscreen/16060308?access_key=key-xnj0ioos8yc8qjbqjtu).

Discounted pay-back period

The discounted pay-back period is the year (*t*) when the cumulated discounted cash-flow is equal to zero:

$$0 = \sum_{t=1}^{DPB} DNCFt$$

Where DNCFt = discounted net cashflow of the year t; and DPB = discounted pay-back period.

Or alternatively, the year (*t*) when the cumulated discounted cashflow is equal to the total investment can be expressed as:

$$Total\_Investment = \sum_{t=1}^{DPB} DCF_t$$

Where DCF_t = discounted cashflow of the year t; and DPB = discounted pay-back period.

Net present value (NPV)

The NPV is the difference between the present value of cash inflows and the present value of cash outflows:

$$NPV = -CF_0 + \sum_{t=1}^{n} DCF_t$$

Where CF_0 = cashflow of the year 0 (initial investment); and DCF_t = discounted cashflow of the year t.

While the initial investment in the model is included in the cashflow, the formula used for the NPV calculation is:

$$NPV = \sum_{t=1}^{n} DCF_t$$

Internal rate of return (IRR)

The IRR is the discount rate that makes the net present value of all cashflows (both positive and negative) from a particular investment equal to zero:

$$NPV = \sum_{t=1}^{n} \frac{t}{(1 + IRR)^t}$$

Average rate of return is calculated by:

$$Av.ROR = \frac{\sum CF_t}{Tot.Investments} \times \frac{1}{N}$$

Where N = project duration (years).

The sensitivity analysis is performed using specially designed macros. It analyses the dependence of efficiency indicators on main input variables such as variable costs, sales prices and amounts of investments, among others. To update the sensitivity tables (e.g. to change input data) the user clicks the button "Calculate all" on the "EI" or "AC" worksheet.

Main sensitivity analysis indicators are calculated as follows:

- **Minimal price (NPV = 0)** – the Grade 1 milk price per farm size that makes this farm a viable business (break-even price);
- **Max interest rate (NPV=0)** – calculated using the following algorithm: Ceteris Paribus if parameter is X than Goal Seek NPV to 0 by modifying Interest rate;
- **Min price incentive (NPV=0)** – calculated using the following algorithm: Ceteris Paribus if parameter is X than Goal Seek NPV to 0 by modifying Price incentive;
- **Max Investment (NPV=0)** – calculated using the following algorithm: Ceteris Paribus if parameter is X than Goal Seek NPV to 0 by modifying investment.

The algorithms of the sensitivity analysis macros are linked with input parameters that can be personalized by the user.

Since the dairy farms classification model is a statistics data-handling model that does not deal with investment, the referring methodology differs from other models. For instance, points used to farms classification and weighted by preference parameters set by the user are attributed in the following way. Points from positive inputs (like cow yield) are calculated as the percentage from the maximum value of the data series ***(Single Indicator Point = Indicator Value ÷ Max Indicator Value of the Series × Indicator Weight In Composite Rating × Indicator Range Weight)***. Points from negative inputs are calculated with the following procedure: first calculate the ***Negative Single Indicator Point*** as ***(–1 × Indicator Value ÷ Max Indicator Value of the Series);*** then identify the ***Single Indicator Point*** as ***(Negative Single Indicator Point + Absolute Value of the Smallest Negative Single Indicator Point of the series) × Indicator Weight In Composite Rating × Indicator Range Weight)***. The composite point attributed to each farm is the sum of all the Single Indicator Points.

Getting started with the Excel model

The system requirement to run any of the models is MS Excel 2003 or later. Execution of macros should be enabled. All Excel models are available for free download from the EastAgri website (http://eastagri.org/meetings/index.asp?id=85).

The minimum dairy farm size model

Model structure: the model is divided into eight worksheets structured as follows:

A. General information worksheets:
(i) Content
B. Input data worksheets:
(ii) Start project data ("Start")
(iii) Investment plan ("IP")
(iv) Operational expenditures ("OZ")
(v) Sales plan ("PS")
(vi) Financial plan ("FP")
C. Calculations and results worksheets:
(vii) Cashflow ("KF")
(viii) Efficiency indicators and sensitivity analysis ("EI")

Data input tables: the input data should be inserted into tables as shown below.

Table 23. Minimum dairy farm size model: starting project data

Project starting year	2010
Taxation system	Single tax for private entrepreneurs
Amount of monthly tax payment	0
Business registration cost, UAH	0
Inflation (outputs), %	17.0%
Inflation (inputs), %	16.0%
Discount rate, %	15.0%
Do you have an in-house feed production?	Yes
Depreciation time, years	5
Do you start a new business?	Yes

Table 24. Minimum dairy farm size model: investment plan

Project year	**1**	**2**	**1**	**2**	**1**	**2**
UAH	**2 cows**		**4 cows**		**6 cows**	
Premises construction/reconstruction	40 000	0	72 000	0	100 000	0
Calf purchase	0	30 000	0	60 000	0	90 000
Cost of new and value of existing agricultural machinery	0	0	0	100 000	0	116 000
Value of owned lands	0	0	0	0	0	0
Cost of cooling tank	0	27 000	0	27 000	0	27 000
Cost of milking equipment	0	3 000	0	3 000	0	3 000
Business registration	0	0	0	0	0	0
Cost of other machinery	0	0	0	0	0	0
Cost of inventory	400	0	400	0	600	0
Additional Investment 1	0	1 150	0	2 300	0	3 450
Total investment, UAH	**40 400**	**61 150**	**72 400**	**192 300**	**100 600**	**239 450**
Project year	**1**	**2**	**1**	**2**	**1**	**2**
UAH	**8 cows**		**10 cows**		**12 cows**	
Premises construction/reconstruction	122 000	0	150 000	0	180 000	0
Calf purchase	0	120 000	0	150 000	0	180 000
Cost of new and value of existing agricultural machinery	0	116 000	0	116 000	0	116 000
Value of owned lands	0	0	0	0	0	0
Cost of cooling tank	0	54 000	0	54 000	0	54 000
Cost of milking equipment	0	6 000	0	6 000	0	6 000
Business registration	0	0	0	0	0	0
Cost of other machinery	0	0	0	0	0	0
Cost of inventory	600	0	800	0	800	0
Additional Investment 1	0	4 600	0	5750	0	6 900
Total investment, UAH	**122 600**	**300 600**	**150 800**	**331 750**	**180 800**	**362 900**

Table 25. Minimum dairy farm size model: operational expenditures

Variable costs	
	Per cow per month, UAH
Veterinary service	20
Feed cost	50
Electricity cost	120
Machinery service	100
Unpredictable expenditures	50
Expenditures for feed production	170
Napkins	20
Disinfectant	26
Washing liquid	48
No return cap	0
Additional variable cost	0
Total	**603.50**
Fixed costs	
	Monthly, UAH
Electricity cost	
Delivery cost	432
Common production costs	320
Shadow labour	1 206
Total	**1 958**

Table 26. Minimum dairy farm size model: sales plan

Grade 1 milk price in year 2010 UAH/L						3.81
Grade 2 milk price in year 2010 UAH/L						2.24
Is there a slaughter?						Yes
Life weight (meat) price, UAH/kg						14.50
Weight of slaughtered animals, kg						250
No. cows	**2 cows**	**4 cows**	**6 cows**	**8 cows**	**10 cows**	**12 cows**
Cow yield (milk L/year)	5 000	5 000	5 000	5 000	5 000	5 000
Share of sold milk	100%	100%	100%	100%	100%	100%
Share of 1 grade milk	80%	80%	80%	80%	80%	80%

Table 27. Minimum dairy farm size model: financial plan

Own capital	0
Annual interest rate	15.0%
Maturity (years)	5

Calculation and results tables

Calculation of the required amount for the project loan and yearly payments (interests and loan principle repayment) is automatic.

Table 28. Minimum dairy farm size model: cashflow

	2 cows						4 cows					
	2011	**2012**	**2013**	**2014**	**2015**	**2016**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Gross milk sales	0	47 857	55 992	65 511	76 648	89 678	0	95 713	111 985	131 022	153 296	179 356
State subsidies	0	0	0	0	0	0	0	0	0	0	0	0
Gross meat sales	0	9 925	11 612	13 586	15 895	18 597	0	19 849	23 223	27 171	31 790	37 195
Main loan	40 400	61 150	0	0	0	0	72 400	192 300	0	0	0	0
Gross income	40 400	118 931	67 604	79 097	92 543	108 276	72 400	307 863	135 208	158 194	185 086	216 551
Variable cost	16 801	19 490	22 608	26 225	30 421	35 289	33 603	38 979	45 216	52 451	60 843	70 578
Fix cost	20 442	23 712	27 506	31 907	3 7012	42 934	21 804	25 293	29 340	34 034	39 480	45 796
Purchase of assets	40 400	61 150	0	0	0	0	72 400	192 300	0	0	0	0
Main loan payment	5 992	6 891	25 534	29 364	33 769	0	10 738	12 349	69 579	80 016	92 018	0
Loan service	6 060	5 161	13 300	9 470	5 065	0	10 860	9 249	36 242	25 805	13 803	0
Taxes	0	0	0	0	0		0	0	0	0	0	0
Total production cost	**89 695**	**116 404**	**88 948**	**96 967**	**106 268**	**78 223**	**149 405**	**278 170**	**180 377**	**192 306**	**206 143**	**116 374**
Net cash flow	**-49 295**	**2 527**	**-21 344**	**-17 870**	**-13 725**	**30 053**	**-77 005**	**29 692**	**-45 169**	**-34 112**	**-21 057**	**100 177**
	6 cows						**8 cows**					
	2011	**2012**	**2013**	**2014**	**2015**	**2016**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Gross milk sales	0	143 570	167 977	196 533	22 944	269 034	0	191 427	223 970	262 044	306 592	358 713
State subsidies	0	0	0	0	0	0	0	0	0	0	0	0
Gross meat sales	0	29 774	34 835	40 757	47 686	55 792	0	39 698	46 447	54 343	63 581	74 390
Main loan	100 600	239 450	0	0	0	0	122 600	300 600	0	0	0	0
Gross income	100 600	412 794	202 812	237 290	277 630	324 827	122 600	531 725	270 416	316 387	370 173	433 102
Variable cost	50 404	58 469	67 824	78 676	91 264	105866	67 206	77 959	90 432	104 901	121 685	141 155
Fix cost	23 167	26 874	31 174	36 161	41 947	48659	24 530	28 455	33 007	38 289	44 415	51 521
Purchase of assets	100 600	239 450	0	0	0	0	122 600	300 600	0	0	0	0
Main loan payment	14 921	17 159	88 689	101 992	117 291	0	18 183	20 911	110 614	127 206	146 286	0
Loan service	15 090	12 852	46 196	32 892	17 594		18 390	15 662	57 616	41 024	21 943	0
Taxes	0	0	0	0	0	0	0	0	0	0	0	0
Total production cost	**20 4182**	**354 803**	**233 882**	**249 721**	**268 095**	**154 525**	**250 909**	**443 587**	**291 669**	**311 419**	**334 329**	**192 676**
Net cash flow	**-10 3582**	**57 990**	**-31 070**	**-12 431**	**9 534**	**170 302**	**-128 309**	**88 138**	**-21 252**	**4 968**	**35 844**	**240 426**

.../cont.

	10 cows						12 cows					
	2011	2012	2013	2014	2015	2016	2011	2012	2013	2014	2015	2016
Gross milk sales	0	239 284	279 962	327 555	383 240	448 391	0	287 140	335 954	393 067	459 888	538 069
State subsidies	0	0	0	0	0	0	0	0	0	0	0	0
Gross meat sales	0	49 623	58 058	67 928	79 476	92 987	0	59 547	69 670	81 514	95 371	111 585
Main loan	150 800	331 750	0	0	0	0	180 800	362 900	0	0	0	0
Gross income	150 800	620 656	338 020	395 484	462 716	541 378	180 800	709 588	405 625	474 581	555 259	649 653
Variable cost	84 007	97 448	113 040	131 127	152 107	176 444	7 242	116 938	135 648	157 352	182 528	211 733
Fix cost	25 893	30 035	34 841	40 416	46 882	54 383	27 255	31 616	36 675	42 543	49 350	57 246
Purchase of assets	150 800	331 750	0	0	0	0	180 800	362 900	0	0	0	0
Main loan payment	22 366	25 721	125 115	143 883	165 465	0	26 815	30 838	139 970	160 966	185 111	0
Loan service	22 620	19 265	65 169	46 402	24 820	0	27 120	23 098	72 907	51 911	27 767	0
Taxes	0	0	0	0	0	0	0	0	0	0	0	0
Total production cost	**305 686**	**504 220**	**338 166**	**361 827**	**389 274**	**230 827**	**269 233**	**565 390**	**385 200**	**412 772**	**444 755**	**268 978**
Net cash flow	**-154 886**	**116 437**	**-146**	**33 657**	**73 442**	**310 551**	**-88 433**	**144 198**	**20 424**	**61 809**	**110 504**	**380 675**

Based on the above cashflow, the model calculates the main efficiency indicators as per the table below:

Table 29. Minimum dairy farm size model: efficiency indicators

Indicator	Cow numbers					
	2	4	6	8	10	12
Pay-back period, years	8	7	6	6	5	2
Discounted pay-back period, years	---	8	6	6	9	2
NPV	-79 617	-113 312	-63 038	-18 389	46 993	191 533
IRR	-17%	-5%	7%	13%	19%	32%
Total investment	101 550	264 700	340 050	423 200	482 550	543 700
Price to make the NPV=0	5.67	5.13	4.30	3.92	3.59	3.07

Table 30. Minimum dairy farm size model: main indicators sensitivity

		Sensitivity table: main indicators											
Interest rate		25%						15%					
		2	4	6	8	10	12	2	4	6	8	10	12
Grade 1 milk price	Min. grade 1 milk price for viability	6.10	5.65	4.75	4.34	3.98	3.44	5.67	5.13	4.30	3.92	3.59	3.07
2.50	NPV	-154 435	-270 042	-289 544	-314 910	-317 180	-240 763	-135 775	-225 628	-231 512	-243 022	-233 797	-145 415
	IRR	< -30%	< -30%	-25.10%	-19.04%	-13.66%	-6.37%	< -30%	-31%	-18%	-12%	-7%	1%
3.00	NPV	-133 001	-227 174	-225 240	-229 172	-210 008	-112 156	-114 341	-182 760	-167 209	-157 284	-126 625	-16 809
	IRR	< -30%	-26%	-15%	-9%	-3%	5%	< -30%	-20%	-8%	-2%	4%	13%
3.81	NPV	-98 277	-157 726	-121 069	-90 277	-36 390	96 186	-79 617	-113 312	-63 038	-18 389	46 993	191 533
	IRR	-23%	-12%	0%	6%	12%	23%	-17%	-5%	7%	13%	19%	32%
4.00	NPV	-90 132	-141 436	-96 634	-57 697	4 336	145 056	-71 472	-97 022	-38 602	14 191	87 719	240 404
	IRR	-19%	-9%	3%	9%	15%	27%	-13%	-2%	10%	16%	22%	36%

Data entry: the input data should be inserted in tables as shown below.

Table 31. Pilot investments model in milk production and quality improvement: starting project data

Common	
Project starting year	2010
Taxation system	Single tax for private entrepreneurs
Amount of monthly tax payment,	0
Business registration cost, UAH	0
Inflation (outputs), %	17.0%
Inflation (inputs), %	16.0%
Discount rate, %	15.0%
Do you receive state incentives?	No
Depreciation time, years	5

Table 32. Pilot investments model in milk production and quality improvement: investment plan

Option 1

Project year	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**
UAH	**Farm 1**		**Farm 2**		**Farm 3**		**Farm 4**	
Premises construction/reconstruction	40 000		20 000		25 000		155 000	
Calf purchase		24 000		24 000		12 000		72 000
Cost of new and value of existing agricultural machinery	100 000			5 000	100 000		116 000	
Value of owned lands								
Cost of cooling tank	23 000		23 000		23 000		23 000	
Cost of milking equipment					3 000		4 400	
Business registration	1 150		1 150		1 150		2 300	
Cost of other machinery								
Cost of inventory								
Additional investment 1	2 500		2 500		2 500		3 000	
Total investment, UAH	**166 650**	**24 000**	**46 650**	**29 000**	**154 650**	**12 000**	**303 700**	**72 000**

Option 2

Project year	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**
UAH	**Farm 1**		**Farm 2**		**Farm 3**		**Farm 4**	
Premises construction/reconstruction			500		1 000		1 000	
Calf purchase								
Cost of new and value of existing agricultural machinery								
Value of owned lands								
Cost of cooling tank	23 000		23 000		23 000		23 000	
Cost of milking equipment							4 400	
Business registration	1 150		1 150		1 150		2 300	
Cost of other machinery								
Cost of inventory								
Additional Investment 1	2 500		2 500		3 000		2 000	
	600		600		900		1 500	
Total investment, UAH	**27 250**		**27 750**		**29 050**		**34 200**	

Table 33. Pilot investments model in milk production and quality improvement: operational expenditures

Variable costs				
	Option 1		**Option 2**	
Per cow per month, UAH	**Without project**	**With project**	**Without project**	**With project**
Veterinary service	20	20	20	20
Feed cost	300	50	300	300
Electricity cost	20	100	20	90
Machinery service	0	100	0	0
Unpredictable expenditures	70	50	70	50
Expenditures for feed production	0	170	0	0
Napkins	0	20	0	20
Disinfectant	0	26	0	26
Washing liquid	0	48	0	48
No return cap	0	0	0	0
Additional variable cost	0	0	0	0
Total	**410**	**584**	**410**	**554**
Fixed costs				
	Option 1		**Option 2**	
Per month, UAH	**Without project**	**With project**	**Without project**	**With project**
Electricity cost	0	0	0	0
Delivery cost	432	432	432	432
Common production costs	0	0	0	0
Shadow labour	1 206	1 206	1 206	1 206
Total	**1 638**	**1 638**	**1 638**	**1 638**

Table 34. Pilot investments model in milk production and quality improvement: sales plan

Common

Price incentive, %	70%
Grade 1 milk price in year 2010 UAH/L	3.81
Grade 2 milk price in year 2010 UAH/L	2.24
Live weight (meat) price	14.50

Option 1

	Without project*				With project*			
No. cows	**Farm 1**	**Farm 2**	**Farm 3**	**Farm 4**	**Farm 1**	**Farm 2**	**Farm 3**	**Farm 4**
Milk sold per cow/ year (L)	4 000	4 000	4 000	4 000	4 500	4 500	4 500	4 500
Share of sold milk	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Share of grade 1 milk	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%	100.0%	100.0%
Is there a slaughter?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Weight of slaughtered animals	250	250	250	250	250	250	250	250

Option 2

	Without project*				With project*			
No. cows	**Farm 1**	**Farm 2**	**Farm 3**	**Farm 4**	**Farm 1**	**Farm 2**	**Farm 3**	**Farm 4**
Milk sold per cow/ year (L)	4 000	4 000	4 000	4 000	4 500	4 500	4 500	4 500
Share of sold milk	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Share of grade 1 milk	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%	100.0%	100.0%
Is there a slaughter?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Weight of slaughtered animals	250	250	250	250	250	250	250	250

Table 35. Pilot investments model in milk production and quality improvement: financial plan

Common

Own capital	0
Annual interest rate	15.0%
Maturity (years)	5

Calculation and results tables: calculation of the required amount for the project loan and yearly payments (interests and loan principle repayment) is automatic. Main financial flows per each option are presented in the following table:

Table 36. Pilot investments model in milk production and quality improvement: financial flows

Option 1

Farm 1							
	Sum	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**
Financial income	190 650	166 650	24 000	0	0	0	0
Payments	280 106	49 714	49 714	60 226	60 226	60 226	0
Interest on loan (0-100%)	89 456	24 998	21 290	20 626	14 686	7 856	0
Payment of the loan principle	190 650	24 717	28 424	39 599	45 539	52 370	0
Debt at the end of the period	166 650	141 933	137 509	97 910	52 370	0	0
Farm 2							
	Sum	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**
Financial income	75 650	46 650	29 000	0	0	0	0
Payments	107 686	13 916	13 916	26 618	26 618	26 618	0
Interest on loan (0-100%)	32 036	6 998	5 960	9 116	6 491	3 472	0
Payment of the loan principle	75 650	6 919	7 957	17 502	20 127	23 146	0
Debt at the end of the period	46 650	39 731	60 774	43 273	23 146	0	0
Farm 3							
	Sum	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**
Financial income	166 650	154 650	12 000	0	0	0	0
Payments	246 440	46 135	46 135	51 390	51 390	51 390	0
Interest on loan (0-100%)	79 790	23 198	19 757	17 600	12 532	6 703	0
Payment of the loan principle	166 650	22 937	26 378	33 790	38 858	44 687	0
Debt at the end of the period	154 650	131 713	117 335	83 546	44 687	0	0
Farm 4							
	Sum	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**
Financial income	375 700	303 700	72 000	0	0	0	0
Payments	547 595	90 598	90 598	122 133	122 133	122 133	0
Interest on loan (0-100%)	171 895	45 555	38 798	41 828	29 783	15 930	0
Payment of the loan principle	375 700	45 043	51 800	80 304	92 350	106 202	0
Debt at the end of the period	303 700	258 657	278 857	198 552	106 202	0	0

Option 2

Farm 1							
	Sum	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**
Financial income	27 250	27 250	0	0	0	0	0
Payments	40 645	8 129	8 129	8 129	8 129	8 129	0
Interest on loan (0-100%)	13 395	4 088	3 481	2 784	1 982	1 060	0
Payment of the loan principle	27 250	4 042	4 648	5 345	6 147	7 069	0
Debt at the end of the period	27 250	23 208	18 561	13 216	7 069	0	0
Farm 2							
	Sum	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**
Financial income	27 750	27 750	0	0	0	0	0
Payments	41 391	8 278	8 278	8 278	8 278	8 278	0
Interest on loan (0-100%)	13 641	4 163	3 545	2 835	2 019	1 080	0
Payment of the loan principle	27 750	4 116	4 733	5 443	6 260	7 198	0
Debt at the end of the period	27 750	23 634	18 901	13 458	7 198	0	0
Farm 3							
	Sum	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**
Financial income	43 330	8 666	8 666	8 666	8 666	8 666	0
Payments	14 280	4 358	3 711	2 968	2 113	1 130	0
Interest on loan (0-100%)	29 050	4 309	4 955	5 698	6 553	7 536	0
Payment of the loan principle	29 050	24 741	19 787	14 089	7 536	0	0
Debt at the end of the period	29 050	29 050	0	0	0	0	0
Farm 4							
	Sum	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**
Financial income	34 200	34 200	0	0	0	0	0
Payments	51 012	10 202	10 202	10 202	10 202	10 202	0
Interest on loan (0-100%)	16 812	5 130	4 369	3 494	2 488	1 331	0
Payment of the loan principle	34 200	5 072	5 833	6 708	7 714	8 872	0
Debt at the end of the period	34 200	29 128	23 294	16 586	8 872	0	0

The yearly cashflow is generated by formulas in the following table:

Table 37. Pilot investments model in milk production and quality improvement: cashflow

Option 1 (without project)

	Farm 1						Farm 2					
	2011	**2012**	**2013**	**2014**	**2015**	**2016**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Gross milk sales	17 920	20 966	24 531	28 701	33 580	39 289	17 920	20 966	24 531	28 701	33 580	39 289
State subsidies	0	0	0	0	0	0	0	0	0	0	0	0
Gross meat sales	7 250	8 483	9 925	11 612	13 586	15 895	7 250	8 483	9 925	11 612	13 586	15 895
Gross income	**25 170**	**29 449**	**34 455**	**40 313**	**47 166**	**55 184**	**25 170**	**29 449**	**34 455**	**40 313**	**47 166**	**55 184**
Variable cost	9 840	11 414	13 241	15 359	17 817	20 667	9 840	11 414	13 241	15 359	17 817	20 667
Fixed	19 656	22 801	26 449	30 681	35 590	41 284	19 656	22 801	26 449	30 681	35 590	41 284
Taxes	0	0	0	0	0	0	0	0	0	0	0	0
Total expenses	**29 496**	**34 215**	**39 690**	**46 040**	**53 407**	**61 952**	**29 496**	**34 215**	**39 690**	**46 040**	**53 407**	**61 952**
Cashflow	**-4 326**	**-4 766**	**-5 235**	**-5 728**	**-6 241**	**-6 768**	**-4 326**	**-4 766**	**-5 235**	**-5 728**	**-6 241**	**-6 768**
	Farm 3						**Farm 4**					
	2011	**2012**	**2013**	**2014**	**2015**	**2016**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Gross milk sales	26 880	31 450	36 796	43 051	50 370	58 933	44 800	52 416	61 327	71 752	83 950	98 222
State subsidies	0	0	0	0	0	0	0	0	0	0	0	0
Gross meat sales	10 875	12 724	14 887	17 418	20 379	23 843	18 125	21 206	24 811	29 029	33 964	39 738
Gross income	**37 755**	**44 173**	**51 683**	**60 469**	**70 749**	**82 776**	**62 925**	**73 622**	**86 138**	**100 781**	**117 914**	**137 960**
Variable cost	14 760	17 122	19 861	23 039	26 725	31 001	24 600	28 536	33 102	38 398	44 542	51 668
Fixed	19 656	22 801	26 449	30 681	35 590	41 284	19 656	2 2801	26 449	30 681	35 590	41 284
Taxes	0	0	0	0	0	0	0	0	0	0	0	0
Total expenses	**34 416**	**39 923**	**46 310**	**53 720**	**62 315**	**72 285**	**44 256**	**51 337**	**59 551**	**69 079**	**80 132**	**92 953**
Cashflow	**3 339**	**4 251**	**5 373**	**6 749**	**8 434**	**10 491**	**18 669**	**22 285**	**26 587**	**31 702**	**37 783**	**45 007**

Option 1 (with project)

	Farm 1						Farm 2					
	2011	**2012**	**2013**	**2014**	**2015**	**2016**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Gross milk sales	34 272	40 098	93 830	109 781	128 444	150 279	34 272	40 098	93 830	109 781	128 444	150 279
State subsidies	0	0	0	0	0	0	0	0	0	0	0	0
Gross meat sales	7 250	8 483	19 849	23 223	27 171	31 790	7 250	8 483	19 849	23 223	27 171	31 790
Loan	16 6650	24 000	0	0	0	0	46 650	29 000	0	0	0	0
Gross income	**208 172**	**72 581**	**113 679**	**133 004**	**155 615**	**182 070**	**88 172**	**77 581**	**113 679**	**133 004**	**155 615**	**182 070**
Variable cost	14 004	16 245	37 688	43 718	50 712	58 826	14 004	16 245	37 688	43 718	50 712	58 826
Fixed cost	19 656	22 801	26 449	30 681	35 590	41 284	19 656	22 801	26 449	30 681	35 590	41 284
Taxes	0	0	0	0	0	0	0	0	0	0	0	0
Purchase of assets	166 650	24 000	0	0	0	0	46 650	29 000	0	0	0	0
Loan service	24 998	21 290	20 626	14 686	7 856	-0	6 998	5 960	9 116	6 491	3 472	-0
Loan repayment	24 717	28 424	39 599	45 539	52 370	0	6 919	7 957	17 502	20 127	23 146	0
Total expenses	**250 024**	**112 760**	**124 362**	**134 624**	**146 528**	**100 111**	**94 226**	**81 962**	**90 754**	**101 016**	**112 920**	**100 111**
Cashflow	**-41 852**	**-40 179**	**-10 683**	**-1 620**	**9 087**	**81 959**	**-6 054**	**-4 381**	**22 925**	**31 988**	**42 695**	**81 959**
Incremental income with project	**-37 526**	**-35 413**	**-5 449**	**4 108**	**15 328**	**88 727**	**-1 728**	**385**	**28 159**	**37 716**	**48 936**	**88 727**

	Farm 3						Farm 4					
	2011	2012	2013	2014	2015	2016	2011	2012	2013	2014	2015	2016
Gross milk sales	51 408	60 147	93 830	109 781	128 444	150 279	85 680	100 246	258 032	301 898	353 220	413 268
State subsidies	0	0	0	0	0	0	0	0	0	0	0	0
Gross meat sales	10 875	12 724	19 849	23 223	27 171	31 790	18 125	21 206	54 585	63 864	74 721	87 424
Loan	154 650	12 000	0	0	0	0	303 700	72 000	0	0	0	0
Gross Income	**216 933**	**84 871**	**113 679**	**133 004**	**155 615**	**182 070**	**407 505**	**193 452**	**312 617**	**365 762**	**427 941**	**500 692**
Variable cost	21 006	24 367	37 688	43 718	50 712	58 826	35 010	40 612	103 641	120 223	139 459	161 773
Fixed cost	19 656	22 801	26 449	30 681	35 590	41 284	19 656	22 801	26 449	30 681	35 590	41 284
Taxes	0	0	0	0	0	0	0	0	0	0	0	0
Purchase of assets	154 650	12 000	0	0	0	0	303 700	72 000	0	0	0	0
Loan service	23 198	19 757	17 600	12 532	6 703	-0	45 555	38 798	41 828	29 783	15 930	-0
Loan repayment	22 937	26 378	33 790	38 858	44 687	0	45 043	51 800	80 304	92 350	106 202	0
Total expenses	**241 447**	**105 302**	**115 527**	**125 789**	**137 693**	**100 111**	**448 964**	**226 011**	**252 223**	**273 037**	**297 182**	**203 057**
Cashflow	**-24 514**	**-20 431**	**-1 848**	**7 216**	**17 923**	**81 959**	**-41 459**	**-32 559**	**60 394**	**92 725**	**130 760**	**297 635**
Incremental income with project	**-27 853**	**-24 682**	**-7 221**	**466**	**9 489**	**71 468**	**-60 128**	**-54 844**	**33 807**	**61 022**	**92 977**	**252 628**

Option 2 (without project)

	Farm 1						Farm 2					
	2011	2012	2013	2014	2015	2016	2011	2012	2013	2014	2015	2016
Gross milk sales	17 920	20 966	24 531	28 701	33 580	39 289	17 920	20 966	24 531	28 701	33 580	39 289
State subsidies	0	0	0	0	0	0	0	0	0	0	0	0
Gross meat sales	7 250	8 483	9 925	11 612	13 586	15 895	7 250	8 483	9 925	11 612	13 586	15 895
Gross income	**25 170**	**29 449**	**34 455**	**40 313**	**47 166**	**55 184**	**25 170**	**29 449**	**34 455**	**40 313**	**47 166**	**55 184**
Variable cost	9 840	11 414	13 241	15 359	17 817	20 667	9 840	11 414	13 241	15 359	17 817	206 67
Fixed	19 656	22 801	26 449	30 681	35 590	41 284	19 656	22 801	26 449	30 681	35 590	41 284
Taxes	0	0	0	0	0	0	0	0	0	0	0	0
Total expenses	**29 496**	**34 215**	**39 690**	**46 040**	**53 407**	**61 952**	**29 496**	**34 215**	**39 690**	**46 040**	**53 407**	**61 952**
Cashflow	**-4 326**	**-4 766**	**-5 235**	**-5 728**	**-6 241**	**-6 768**	**-4 326**	**-4 766**	**-5 235**	**-5 728**	**-6 241**	**-6 768**
	Farm 3						**Farm 4**					
	2011	**2012**	**2013**	**2014**	**2015**	**2016**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Gross milk sales	26 880	31 450	36 796	43 051	50 370	58 933	44 800	52 416	61 327	71 752	83 950	98 222
State subsidies	0	0	0	0	0	0	0	0	0	0	0	0
Gross meat sales	10 875	12 724	14 887	17 418	20 379	23 843	18 125	21 206	24 811	29 029	33 964	39 738
Gross income	**37 755**	**44 173**	**51 683**	**60 469**	**70 749**	**82 776**	**62 925**	**73 622**	**86 138**	**100 781**	**117 914**	**137 960**
Variable cost	14 760	17 122	19 861	23 039	26 725	31 001	24 600	28 536	33 102	38 398	44 542	51 668
Fixed	19 656	22 801	26 449	30 681	35 590	41 284	19 656	22 801	26 449	30 681	35 590	41 284
Taxes	0	0	0	0	0	0	0	0	0	0	0	0
Total expenses	**34 416**	**39 923**	**46 310**	**53 720**	**62 315**	**72 285**	**44 256**	**51 337**	**59 551**	**69 079**	**80 132**	**92 953**
Cashflow	**3 339**	**4 251**	**5 373**	**6 749**	**8 434**	**10 491**	**18 669**	**22 285**	**26 587**	**31 702**	**37 783**	**45 007**

Option 2 (with project)

	Farm 1						`Farm 2					
	2011	**2012**	**2013**	**2014**	**2015**	**2016**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Gross milk sales	34 272	40 098	46 915	54 890	64 222	75 140	34 272	40 098	46 915	54 890	64 222	75 140
State subsidies	0	0	0	0	0	0	0	0	0	0	0	0
Gross meat sales	7 250	8 483	9 925	11 612	13 586	15 895	7 250	8 483	9 925	11 612	13 586	15 895
Loan	27 250	0	0	0	0	0	27 750	0	0	0	0	0
Gross income	**68 772**	**48 581**	**56 839**	**66 502**	**77 808**	**91 035**	**69 272**	**48 581**	**56 839**	**66 502**	**77 808**	**91 035**
Variable cost	13 284	15 409	17 875	20 735	24 053	27 901	13 284	15 409	17 875	20 735	24 053	27 901
Fixed cost	19 656	22 801	26 449	30 681	35 590	41 284	19 656	22 801	26 449	30 681	35 590	41 284
Taxes	0	0	0	0	0	0	0	0	0	0	0	0
Purchase of assets	27 250	0	0	0	0	0	27 750	0	0	0	0	0
Loan service	4 088	3 481	2 784	1 982	1 060	-0	4 163	3 545	2 835	2 019	1 080	-0
Loan repayment	4 042	4 648	5 345	6 147	7 069	0	4 116	4 733	5 443	6 260	7 198	0
Total expenses	**68 319**	**46 339**	**52 453**	**59 545**	**67 772**	**69 185**	**68 968**	**46 489**	**52 602**	**59 694**	**67 921**	**69 185**
Cashflow	**453**	**2 241**	**4 386**	**6 957**	**10 036**	**21 850**	**304**	**2 092**	**4 237**	**6 808**	**9 887**	**21 850**
Incremental income with project	**4 779**	**7 008**	**9 621**	**12 685**	**16 277**	**28 617**	**4 630**	**6 859**	**9 472**	**12 536**	**16 128**	**28 617**
	Farm 3						**Farm 4**					
	2011	**2012**	**2013**	**2014**	**2015**	**2016**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Gross milk sales	51 408	60 147	70 372	82 336	96 333	112 709	85 680	100 246	117 287	137 226	160 555	187 849
State subsidies	0	0	0	0	0	0	0	0	0	0	0	0
Gross meat sales	10 875	12 724	14 887	17 418	20 379	23 843	18 125	21 206	24 811	29 029	33 964	39 738
Loan	29 050	0	0	0	0	0	34200	0	0	0	0	0
Gross income	**91 333**	**72 871**	**85 259**	**99 753**	**116 711**	**136 552**	**138 005**	**121 452**	**142 099**	**166 255**	**194 519**	**227 587**
Variable cost	19 926	23 114	26 812	31 102	36 079	41 851	33 210	38 524	44 687	51 837	60 131	69 752
Fixed cost	19 656	22 801	26 449	30 681	35 590	41 284	19 656	22 801	26 449	30 681	35 590	41 284
Taxes	0	0	0	0	0	0	0	0	0	0	0	0
Purchase of assets	29 050	0	0	0	0	0	34 200	0	0	0	0	0
Loan service	4 358	3 711	2 968	2 113	1 130	-0	5 130	4 369	3 494	2 488	1 331	-0
Loan repayment	4 309	4 955	5 698	6 553	7 536	0	5 072	5 833	6 708	7 714	8 872	0
Total expenses	**77 298**	**54 581**	**61 928**	**70 449**	**80 335**	**83136**	**97 268**	**71 527**	**81 339**	**92 721**	**105 924**	**111 037**
Cashflow	**14 035**	**18 290**	**23 332**	**29 304**	**36 377**	**53417**	**40 737**	**49 925**	**60 760**	**73 535**	**88 595**	**116 550**
Incremental income with project	**10 696**	**14 039**	**17 959**	**22 555**	**27 943**	**42926**	**22 068**	**27 640**	**34 173**	**41 832**	**50 813**	**71 543**

Based on the above cashflows the model calculates the main efficiency indicators as per the table below:

Table 38. Pilot investments model in milk production and quality improvement: efficiency indicators

Option 1

Indicator	Number of cows			
	Farm 1	Farm 2	Farm 3	Farm 4
Pay-off period, years	6	5	8	7
Discounted pay-of period, years	6	4	6	5
NPV, USD	-56 626.13	85 618.48	-48 757.61	37 017.81
IRR	3.63%	57.02%	3.20%	18.54%
Total investment	190 650	75 650	166 650	375 700
Price to make the NPV=0	6	5	8	7

Option 2

Indicator	Number of cows			
	Farm 1	Farm 2	Farm 3	Farm 4
Pay-off period, years	3	3	2	2
Discounted pay-of period, years	3	3	2	2
NPV, USD	37 373.90	36 761.55	70 543.11	134 983.21
IRR	78.45%	75.88%	155.34%	495.86%
Total investment	27 250	27 750	29 050	34 200
Price to make the NPV=0	3	3	2	2

Sensitivity analysis

Based on the parameters set by the user (see following tables), the model uses embedded macros to produce a sensitivity analysis.

The minimum first grade milk price needed by each farm to pay back investments (break-even price) is automatically generated and shown in the efficiency indicators table (Table 38).

The user can personalize the parameters for the sensitivity analysis by changing the interest rate and the first grade milk price incentive in the main indicators sensitivity table (Table 39) and in the maximum investment sensitivity table (Table 40).

Table 39. Pilot investments model in milk production and quality improvement: main indicators sensitivity

Option 1

Price incentive/ interest rate	25%				15%				0%			
30%	**Farm 1**	**Farm 2**	**Farm 3**	**Farm 4**	**Farm 1**	**Farm 2**	**Farm 3**	**Farm 4**	**Farm 1**	**Farm 2**	**Farm 3**	**Farm 4**
Pay-off period, years	9	7	---	9	8	7	---	9	7	6	10	8
Discounted pay-off period, years	9	6	10	7	8	5	9	7	7	4	7	6
Project NPV	-177 062	-4 152	-171 542	-251 082	-130 370	11 874	-129 575	-162 242	-66 670	33 897	-72 394	-40 841
Project IRR	-21.32%	13.06%	---	-9.30%	-13.89%	20.94%	-20.02%	-1.93%	-1.84%	34.06%	-7.44%	10.17%
Total investment	190 650	75 650	166 650	375 700	190 650	75 650	166 650	375 700	190 650	75 650	166 650	375 700
40%	**Farm 1**	**Farm 2**	**Farm 3**	**Farm 4**	**Farm 1**	**Farm 2**	**Farm 3**	**Farm 4**	**Farm 1**	**Farm 2**	**Farm 3**	**Farm 4**
Pay-off period, years	8	6	---	8	7	6	10	8	6	6	9	7
Discounted pay-off period, years	8	5	9	7	7	5	8	6	6	4	7	5
Project NPV	-158 626	14 284	-151 337	-201 267	-111 934	30 310	-109 371	-112 427	-48 234	52 333	-52 190	8 975
Project IRR	-16.53%	21.56%	-21.25%	-3.93%	-9.06%	29.97%	-13.45%	3.59%	3.17%	44.18%	-0.62%	16.04%
Total investment	190 650	75 650	166 650	375 700	190 650	75 650	166 650	375 700	190 650	75 650	166 650	375 700
50%	**Farm 1**	**Farm 2**	**Farm 3**	**Farm 4**	**Farm 1**	**Farm 2**	**Farm 3**	**Farm 4**	**Farm 1**	**Farm 2**	**Farm 3**	**Farm 4**
Pay-off period, years	8	6	10	8	7	6	9	7	6	5	8	7
Discounted pay-off period, years	8	5	8	6	7	4	7	6	6	4	6	5
Project NPV	-140 190	32 720	-131 133	-151 452	-93 498	48 746	-89 166	-62 612	-29 798	70 769	-31 985	58 790
Project IRR	-12.13%	29.88%	-15.44%	1.09%	-4.58%	38.90%	-7.51%	8.79%	7.87%	54.38%	5.68%	21.64%
Total investment	190 650	75 650	166 650	375 700	190 650	75 650	166 650	375 700	190 650	75 650	166 650	375 700
60%	**Farm 1**	**Farm 2**	**Farm 3**	**Farm 4**	**Farm 1**	**Farm 2**	**Farm 3**	**Farm 4**	**Farm 1**	**Farm 2**	**Farm 3**	**Farm 4**
Pay-off period, years	7	6	9	7	7	5	9	7	5	5	8	6
Discounted pay-off period, years	7	4	7	6	7	4	7	5	5	4	5	5
Project NPV	-121 754	51 156	-110 929	-101 636	-75 062	67 182	-68 962	-12 797	-11 362	89 205	-11 781	108 605
Project IRR	-8.02%	38.15%	-10.11%	5.86%	-0.37%	47.87%	-2.01%	13.76%	12.34%	64.84%	11.64%	27.05%
Total investment	190 650	75 650	166 650	375 700	190 650	75 650	166 650	375 700	190 650	75 650	166 650	375 700
70%	**Farm 1**	**Farm 2**	**Farm 3**	**Farm 4**	**Farm 1**	**Farm 2**	**Farm 3**	**Farm 4**	**Farm 1**	**Farm 2**	**Farm 3**	**Farm 4**
Pay-off period, years	7	5	9	7	6	5	8	7	5	4	7	6
Discounted pay-off period, years	7	4	7	6	6	4	6	5	5	3	5	4
Project NPV	-103 318	69 592	-90 724	-51 821	-56 626	85 618	-48 758	37 018	7 074	107 641	8 423	158 420
Project IRR	-4.15%	46.48%	-5.13%	10.42%	3.63%	57.02%	3.20%	18.54%	16.63%	75.71%	17.37%	32.31%
Total investment	190 650	75 650	166 650	375 700	190 650	75 650	166 650	375 700	190 650	75 650	166 650	375 700

Option 2

Price incentive / interest rate	25%				15%				0%			
30%	**Farm 1**	**Farm 2**	**Farm 3**	**Farm 4**	**Farm 1**	**Farm 2**	**Farm 3**	**Farm 4**	**Farm 1**	**Farm 2**	**Farm 3**	**Farm 4**
Pay-off period, years	9	9	8	6	8	8	7	6	7	7	5	4
Discounted pay-off period, years	---	---	---	---	---	---	9	---	9	9	7	5
Project NPV	-24 672	-25 415	-19 438	-11 274	-17 558	-18 170	-11 854	-2 346	-7 880	-8 315	-1 537	9 800
Project IRR	-23.04%	-23.60%	-11.69%	2.37%	-14.62%	-15.19%	-2.88%	12.10%	-0.52%	-1.12%	12.27%	29.45%
Total investment	27 250	27 750	29 050	34 200	27 250	27 750	29 050	34 200	27 250	27 750	29 050	34 200
40%	**Farm 1**	**Farm 2**	**Farm 3**	**Farm 4**	**Farm 1**	**Farm 2**	**Farm 3**	**Farm 4**	**Farm 1**	**Farm 2**	**Farm 3**	**Farm 4**
Pay-off period, years	6	6	4	3	5	5	4	3	4	4	3	2
Discounted pay-off period, years	7	7	5	4	6	6	4	3	4	4	3	2
Project NPV	-2 699	-3 442	13 521	43 657	4 415	3 803	21 105	52 586	14 093	13 658	31 422	64 732
Project IRR	11.23%	10.27%	32.80%	67.14%	21.86%	20.80%	46.27%	87.55%	41.32%	40.03%	72.49%	131.72%
Total investment	27 250	27 750	29 050	34 200	27 250	27 750	29 050	34 200	27 250	27 750	29 050	34 200
50%	**Farm 1**	**Farm 2**	**Farm 3**	**Farm 4**	**Farm 1**	**Farm 2**	**Farm 3**	**Farm 4**	**Farm 1**	**Farm 2**	**Farm 3**	**Farm 4**
Pay-off period, years	5	5	4	3	4	4	3	2	3	3	3	2
Discounted pay-off period, years	6	6	4	3	5	5	3	2	4	4	3	2
Project NPV	8 287	7 544	30 000	71 123	15 401	14 789	37 584	80 052	25 079	24 644	47 901	92 198
Project IRR	26.59%	25.35%	56.17%	112.04%	39.15%	37.74%	74.06%	146.42%	63.16%	61.33%	111.47%	233.09%
Total investment	27 250	27 750	29 050	34 200	27 250	27 750	29 050	34 200	27 250	27 750	29 050	34 200
60%	**Farm 1**	**Farm 2**	**Farm 3**	**Farm 4**	**Farm 1**	**Farm 2**	**Farm 3**	**Farm 4**	**Farm 1**	**Farm 2**	**Farm 3**	**Farm 4**
Pay-off period, years	4	4	3	2	3	3	3	2	3	3	2	2
Discounted pay-off period, years	5	5	3	2	4	4	3	2	3	3	2	2
Project NPV	19 273	18 531	46 480	98 589	26 388	25 775	54 064	107 517	36 065	35 631	64 381	119 664
Project IRR	42.48%	40.88%	83.62%	181.45%	57.64%	55.75%	108.55%	249.43%	88.04%	85.43%	165.55%	475.47%
Total investment	27 250	27 750	29 050	34 200	27 250	27 750	29 050	34 200	27 250	27 750	29 050	34 200
70%	**Farm 1**	**Farm 2**	**Farm 3**	**Farm 4**	**Farm 1**	**Farm 2**	**Farm 3**	**Farm 4**	**Farm 1**	**Farm 2**	**Farm 3**	**Farm 4**
Pay-off period, years	3	4	3	2	3	3	2	2	2	2	2	2
Discounted pay-off period, years	4	4	3	2	3	3	2	2	3	3	2	2
Project NPV	30 260	29 517	62 959	126 055	37 374	36 762	70 543	134 983	47 052	46 617	80 860	147 129
Project IRR	59.72%	57.63%	118.43%	314.02%	78.45%	75.88%	155.34%	495.86%	118.06%	114.24%	250.65%	1977.99%
Total investment	27 250	27 750	29 050	34 200	27 250	27 750	29 050	34 200	27 250	27 750	29 050	34 200

Table 40. Pilot investments model in milk production and quality improvement: maximum investment sensitivity

Option 1

Interest rate	Price incentive	Farm 1	Farm 2	Farm 3	Farm 4
25%	30%	71 479	72 855	51 195	206 711
	40%	83 888	85 264	64 793	240 239
	50%	96 296	97 672	78 392	273 766
15%	30%	84 200	85 345	60 850	243 226
	50%	114 307	115 452	93 844	324 576
	70%	144 414	145 559	126 839	405 926
0%	30%	113 979	114 631	83 397	328 733
	40%	135 181	135 833	106 632	386 021
	50%	156 382	157 034	129 867	443 308

Option 2

Interest rate	Price incentive	Farm 1	Farm 2	Farm 3	Farm 4
25%	30%	18 039	18 039	27 059	45 098
	40%	25 433	25 433	38 150	63 583
	50%	32 828	32 828	49 241	82 069
15%	30%	21 884	21 884	32 827	54 711
	40%	30 855	30 855	46 282	77 137
	70%	57 766	57 766	86 650	144 416
0%	30%	30 822	30 822	46 234	77 056
	40%	43 457	43 457	65 185	108 642
	50%	56 091	56 091	84 136	140 227

The interest rate required for NPV=0 is dependent on the price incentive (personalized parameter), which is visible in the maximum interest rate sensitivity table (Table 41).

Table 41. Pilot investments model in milk production and quality improvement: maximum interest rate sensitivity

Option 1

Price incentive	Farm 1	Farm 2	Farm 3	Farm 4
10%	-33.14%	-2.19%	-45.50%	-21.32%
20%	-25.56%	10.71%	-33.21%	-12.98%
30%	-19.05%	22.46%	-24.02%	-5.59%
40%	-13.23%	33.49%	-16.34%	1.18%
50%	-7.90%	44.03%	-9.56%	7.51%

Option 2

Price incentive	Farm 1	Farm 2	Farm 3	Farm 4
10%	-45.28%	-45.67%	-37.55%	-28.89%
20%	-14.42%	-15.01%	-2.44%	12.25%
30%	5.05%	4.28%	21.17%	41.87%
40%	21.28%	20.33%	41.60%	68.48%
70%	63.11%	61.59%	96.56%	143.00%

The minimum price incentive sensitivity table shows the minimum price incentives required for NPV=0 for each interest rate the user inputs.

Table 42. Pilot investments model in milk production and quality improvement: minimum price incentive sensitivity

Option 1

Interest rate	Farm 1	Farm 2	Farm 3	Farm 4
25%	126.04%	32.25%	114.90%	80.40%
15%	100.71%	23.56%	94.13%	62.57%
0%	66.16%	11.61%	65.83%	38.20%

Option 2

Interest rate	Farm 1	Farm 2	Farm 3	Farm 4
25%	42.46%	43.13%	31.80%	24.10%
15%	35.98%	36.54%	27.19%	20.85%
0%	27.17%	27.57%	20.93%	16.43%

Investment model in commercial dairy farms

Model structure: the model is divided into 11 worksheets structured as follows:

A. Input data:
- (i) Starting project data
- (ii) Investment plan
- (iii) Operational expenditures
- (iv) Sales plan
- (v) Financial plan

B. Calculation results:
- (vi) Cashflow and profit losses
- (vii) Efficiency indicators
- (viii) Sensibility analysis

C. Information data:
- (ix) Recommended cattle rotation
- (x) Seasonality of milk production
- (xi) Investment plan assumptions

Two separate investment scenario were considered: investment in a 250 cow dairy farm and in a 500 cow dairy farm. Both models use the same structure. Data common to both models are given only once and labelled "common". Data not common for the two farm sizes are given in different tables.

Data entry: the input data should be inserted in the tables as shown below.

Table 43. Investment model in commercial dairy farms: starting project data

Common

Project starting year	2010
Taxation system	Single tax for private entrepreneurs
Amount of monthly tax payment	150 000
Business registration cost, UAH	120 000
Inflation (outputs), %	20.0%
Inflation (inputs), %	18.0%
Discount rate, %	16.0%
Do you receive state incentives?	Yes
Do you have in-house feed production?	Yes
Depreciation time, years	20

Table 44. Investment model in commercial dairy farms: investment plan

Common

Will existing premises be reconstructed?	No
Will you buy cattle?	No
Price of 1 calf, UAH	12 000

Table 45. Investment model in commercial dairy farms: investment plan assumptions

500 cows

Type of investment	Q1 2010	Q2 2010	Q3 2010	Q4 2010	Q1 2011	Q2 2011	Q3 2011	Q4 2011	Q1 2012	Q2 2012
Calf purchase		1 500 000	1 500 000	1 500 000	1 500 000	500 000		500 000		500 000
Premises reconstruction	2 033 500									
Purchase of new machinery	1 037 500									
Reconstruction of calf shed		1 178 115	2 280 218							
Construction of walk alleys				518 750						
Reconstruction of calving barn	1 577 000									
Reconstruction of silage trenches		1 120 500								
Hay storage site construction		664 000								
Re/construction of roads and sites					622 500					
Installation of 2 lagoons (4 000 mc^3)				664 000						
Installation of infrastructure				269 750						
Temporary premises	62 250									
Reconstruction of milking parlour				1 452 500						
Project works payment	788 500									
Construction of feed and hay storage premises		1 162 000								
Purchase of feed production equipment			2 490 000							
Total	**5 498 750**	**5 624 615**	**6 270 218**	**4 405 000**	**2 122 500**	**500 000**		**500 000**		**500 000**

.../cont.

250 cows

Type of investment	Q1 2010	Q2 2010	Q3 2010	Q4 2010	Q1 2011	Q2 2011	Q3 2011	Q4 2011	Q1 2012	Q2 2012
Calf purchase		756 000	756 000	756 000	756 000	252 000		252 000		252 000
Premises reconstruction	1 195 000									
Purchase of new machinery	531 000									
Reconstruction of calf shed		693 000	1 341 300							
Construction of walk alleys				305 150						
Reconstruction of calving barn	927 650									
Reconstruction of silage trenches		659 100								
Hay storage site construction		390 600								
Re/construction of roads and sites					366 200					
Installation of 2 lagoons (4 000 mc^3)				390 600						
Installation of infrastructure				158 700						
Temporary premises	62 250									
Reconstruction of milking parlour				854 400						
Project works payment	463 800									
Construction of feed and hay storage premises		683 500								
Purchase of feed production equipment			1 464 700							
Total	**3 179 700**	**3 182 200**	**3 562 000**	**2 464 850**	**1 122 200**	**252 000**		**252 000**		**252 000**

Table 46. Investment model in commercial dairy farms: operational expenditures

500 cows

Operational expenditures	
Veterinary service	5 000
Feed cost	99 170
Salaries	37 500
Electricity cost	3 750
Fuel	8 750
Machinery service cost	6 250
Unpredictable costs	14 000
Common production costs	17 967
Other costs	2 500
Cost of feed production	19 250

250 cows

Veterinary service	3 000
Feed cost	49 585
Salaries	22 000
Electricity cost	2 200
Fuel	5 100
Machinery service cost	3 800
Unpredictable costs	10 500
Common production costs	1 500
Other costs	1 500
Cost of feed production	12 000

Table 47. Investment model in commercial dairy farms: financial plan

500 cows

Total loan needed	31 304 196
Annual interest rate (year)	15%
Postponement of first payment (quarter)	1
Period on payment (quarter)	28

250 cows

Total loan needed	17 646 352
Annual interest rate (year)	15%
Postponement of first payment (quarter)	1
Period on payment (quarter)	34

Table 48. Investment model in commercial dairy farms: sales plan

(Common)

Milk yield, L	6 500
Grade 1 milk price UAH/L in 2010	3.81
Grade 2 milk price UAH/L in 2010	2.24
Share of milk sold	90.0%
Share of grade 1 milk	60.0%
Is there a slaughter?	Yes
Life weight (meat) price	12.60
Weight of slaughtered animals, kg	420

Calculation and results tables: calculation of the amount required for the project loan and yearly payments (interests and loan principle repayment) is automatic. Main quarterly financial flows for each option are presented in Table 49. Data are provided only for the first two project years; for data on other years please refer to the model file.

Table 49. Investment model in commercial dairy farms: financial flows

500 cows

		2010				2011			
	Total	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Financial income	**31 304 196**	6 540 460	6 982 493	7 741 109	5 388 531	3 075 317	600 456		
Payments	**48 793 578**		**389 376**	**814 433**	**1 296 950**	**1 641 379**	**1 843 284**	**1 883 848**	**1 883 848**
Interest on loan (15%)	**17 489 382**		245 267	501 707	780 271	962 965	1 052 849	1 045 725	1 014 296
Payment of the loan principle	**31 304 196**		144 109	312 727	516 679	678 413	790 434	838 122	869 552
Debt at the end of the period			389 376	814 433	1 296 950	1 641 379	1 843 284	1 883 848	1 883 848
Remaining at the end of the period		**6 540 460**	**13 378 844**	**20 807 226**	**25 679 079**	**28 075 983**	**27 886 004**	**27 047 882**	**26 178 330**

250 cows

		2010				2011			
	Total	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Financial income	**17 646 352**	3 813 259	3 918 075	4 356 622	3 003 839	1 635 738	327 600		
Payments	**30 152 091**		**203 338**	**415 624**	**655 676**	**824 154**	**917 637**	**936 734**	**936 734**
Interest on loan (15%)	**12 505 739**		142 997	287 662	446 237	551 027	602 125	602 578	590 047
Payment of the loan principle	**17 646 352**		60 341	127 962	209 439	273 128	315 512	334 156	346 687
Debt at the end of the period			203 338	415 624	655 676	824 154	917 637	936 734	936 734
Remaining at the end of the period		**3 813 259**	**7 670 992**	**11 899 652**	**14 694 052**	**16 056 662**	**16 068 751**	**15 734 595**	**15 387 908**

The yearly cashflow is calculated in the following table:

Table 50. Investment model in commercial dairy farms: cashflow and profit losses

500 cows

Indicators	**Q1 2010**	**Q2 2010**	**Q3 2010**	**Q4 2010**	**Q1 2011**	**Q2 2011**	**Q3 2011**	**Q4 2011**
	1	2	3	4	5	6	7	8
Income from sales	0	0	0	817 839	1 047 405	1 952 443	3 010 334	3 181 592
Grade 1 milk	0	0	0	578 677	733 903	1 373 513	2 123 442	2 243 126
Grade 2 milk	0	0	0	226 813	287 654	538 350	832 285	879 195
Cattle	0	0	0	12 348	25 848	40 580	54 607	59 270
State subsidies	0	0	375 000	442 975	507 544	569 299	337 768	221 400
Total operational income	**0**	**0**	**375 000**	**1 260 814**	**1 554 949**	**2 521 742**	**3 348 102**	**3 402 991**
Common expenditures	492 107	512 896	534 565	557 148	580 686	605 218	630 786	657 435
Personnel cost	117 253	122 206	127 369	132 750	138 358	144 203	150 296	156 645
Total operational expenditures	**609 359**	**635 103**	**661 934**	**689 898**	**719 044**	**749 421**	**781 082**	**814 080**
EBITDA	**-609 359**	**-635 103**	**-286 934**	**570 916**	**835 905**	**1 772 321**	**2 567 021**	**2 588 911**
Amortization	0	0	0	0	0	0	0	0
Net operative profit (EBIT)	**-609 359**	**-635 103**	**-286 934**	**570 916**	**835 905**	**1 772 321**	**2 567 021**	**2 588 911**
Other expenditures	120 000	0						
Loan service	0	245 267	501 707	780 271	962 965	1 052 849	1 045 725	1 014 296
EBT	**-729 359**	**-880 370**	**-788 640**	**-209 355**	**-127 060**	**719 471**	**1 521 295**	**1 574 616**
Taxes	900	900	900	900	900	900	900	900
Net income	**-730 259**	**-881 270**	**-789 540**	**-210 255**	**-127 960**	**718 571**	**1 520 395**	**1 573 716**
Net income (cumulated)	***-730 259***	***-1 611 529***	***-2 401 070***	***-2 611 325***	***-2 739 285***	***-2 020 714***	***-500 319***	***1 073 397***
Investment expenditures	5 498 750	5 624 615	6 270 218	4 405 000	2 122 500	500 000	0	500 000
Cashflow before financing	**-6 229 009**	**-6 260 618**	**-6 558 051**	**-3 834 984**	**-1 287 495**	**1 271 421**	**2 566 121**	**2 088 011**
NPV	**-24 906 039**	**-25 482 913**	**-25 731 554**	**-25 262 601**	**-24 608 353**	**-23 286 491**	**-21 462 797**	**-19 711 129**
IRR							**-103%**	**-74%**
Cashflow out (real costs + investment)	6 229 009	6 649 994	7 747 484	6 392 748	4 483 823	3 093 605	2 665 829	3 198 827
Financing								
Capital at the beginning of the period		311 450	643 950	1 012 574	1 269 171	1 415 615	1 444 208	212 6481
Loans	6 540 460	6 982 493	7 741 109	5 388 531	3 075 317	600 456	0	0
Main loan principle payment	0	144 109	312 727	516 679	678 413	790 434	838 122	869 552
Loan service	0	245 267	501 707	780 271	962 965	1 052 849	1 045 725	1 014 296
Cash flow after financing	**311 450**	**332 500**	**368 624**	**256 597**	**146 444**	**28 593**	**682 273**	**204 164**
Capital at the end of the period	311 450	643 950	1 012 574	1 269 171	1 415 615	1 444 208	2 126 481	2 330 645

250 cows

Indicators	Q1 2010	Q2 2010	Q3 2010	Q4 2010	Q1 2011	Q2 2011	Q3 2011	Q4 2011
Income from sales	0	0	0	412 187	524 664	979 221	1 507 202	1 593 606
Grade 1 milk	0	0	0	291 559	367 377	688 495	1 061 875	1 122 974
Grade 2 milk	0	0	0	114 277	143 994	269 856	416 203	440 151
Cattle	0	0	0	6 350	13 293	20 870	29 124	30 482
State subsidies	0	0	189 000	223 273	255 414	286 488	169 703	110 968
Total operational income	**0**	**0**	**189 000**	**635 460**	**780 077**	**1 265 709**	**1 676 906**	**1 704 575**
Common expenditures	262 287	273 367	284 916	296 953	309 498	322 573	336 201	350 404
Personnel cost	68 788	71 694	74 723	77 880	81 170	84 599	88 173	91 898
Total operational expenditures	**33 1075**	**345 062**	**359 639**	**374 833**	**390 668**	**407 173**	**424 374**	**442 303**
EBITDA	**-331 075**	**-345 062**	**-170 639**	**260 627**	**389 409**	**858 536**	**1 252 531**	**1 262 272**
Amortization	178 337	178 337	178 337	178 337	178 337	178 337	178 337	178 337
Net operative profit (EBIT)	**-509 412**	**-523 399**	**-348 976**	**82 290**	**211 072**	**68 0200**	**1 074 194**	**1 083 935**
Other expenditures	120 000	0						
Loan service	0	142 997	287 662	446 237	551 027	60 2125	60 2578	590 047
EBT	**-629 412**	**-666 396**	**-636 638**	**-363 947**	**-339 955**	**78 075**	**471 616**	**493 888**
Taxes	900	900	900	900	900	900	900	900
Net income	**-630 312**	**-667 296**	**-637 538**	**-364 847**	**-340 855**	**77 175**	**470 716**	**492 988**
Net income (cumulated)	***-630 312***	***-1 297 607***	***-1 935 146***	***-2 299 993***	***-2 640 848***	***-2 563 673***	***-2 092 957***	***-1 599 969***
Investment expenditures	3 179 700	3 182 200	3 562 000	2 464 850	1 122 200	252 000	0	252 000
Cashflow before financing	**-3 631 675**	**-3 528 162**	**-3 733 539**	**-2 205 123**	**-733 691**	**605 636**	**1 251 631**	**1 009 372**
NPV	**-14 018 023**	**-14 331 821**	**-14 480 003**	**-14 266 325**	**-13 961 918**	**-13 321 936**	**-12 432 425**	**-11 578 679**
IRR							**-112%**	**-82%**
Cashflow out (real costs + investment)	**3 631 675**	**3 731 500**	**4 338 164**	**3 496 259**	**2 337 923**	**1 577 709**	**1 362 009**	**1 631 937**
Financing		**181 584**	**368 159**	**575 617**	**718 657**	**796 549**	**812 149**	**1 127 046**
Capital at the beginning of the period	3 813 259	3 918 075	4 356 622	3 003 839	1 635 738	327 600	0	0
Loans	0	60 341	127 962	209 439	273 128	315 512	334 156	346 687
Main loan principle payment	0	142 997	287 662	446 237	551 027	602 125	602 578	590 047
Loan service	181 584	186 575	207 458	143 040	77 892	15 600	314 897	72 638
Cash flow after financing	**181 584**	**368 159**	**575 617**	**718 657**	**796 549**	**812 149**	**1 127 046**	**1 199 684**
Capital at the end of the period	0	0	0	412 187	524 664	979 221	1 507 202	1 593 606

The main indicators are presented as follows:

Table 51. Investment model in commercial dairy farms: efficiency indicators

	250 cows	500 cows
Pay-back period	17	16
Discounted pay-back period	25	22
Average return rate	46%	62%
Net present value	10 783 673	26 445 000
Internal rate of return	32%	35%
Total investment	14 266 950	25 421 083
Total credit	17 646 352	31 304 196
Credit for operative capital	3 379 402	5 883 114
Net cash availability at the end of the project	58 310 310	132 955 302

Sensitivity analysis

The sensitivity analysis of main investment efficiency indicator is presented in the table below. The user cannot change the parameters.

Table 52. Investment model in commercial dairy farms: efficiency indicators sensitivity

500 cows

Indicators	Variation in %	Pay-back period	Discounted pay-back period	Average return rate	Net present value
Inflation (input and output)	-20%	16	24	48.13%	17 814 967
	-10%	16	23	54.80%	21 911 509
	+10%	15	21	70.71%	31 460 688
	+20%	15	20	80.14%	37 008 132
Operational expenditures	-20%	15	20	67.41%	30 477 699
	-10%	15	21	64.86%	28 461 350
	+10%	16	23	59.73%	24 428 650
	+20%	16	24	57.15%	22 412 301
Cow yield	-20%	19	28	43.49%	12 856 814
	-10%	17	25	52.97%	19 650 907
	+10%	15	20	71.54%	33 239 093
	+20%	14	19	80.73%	40 033 186
Milk price	-20%	18	26	49.36%	17 107 834
	-10%	16	24	55.87%	21 776 417
	+10%	15	21	68.71%	31 113 583
	+20%	15	20	75.10%	35 782 166

.../cont.

250 cows

Indicators	Variation in %	Pay-back period	Discounted pay-back period	Average return of rate	Net present value
Inflation (input and output)	-20%	18	28	33.56%	6 594 884
	-10%	18	27	39.37%	8 582 775
	+10%	16	24	53.17%	13 219 705
	+20%	16	23	61.36%	15 915 107
Operational expenditures	-20%	16	23	50.91%	12 974 705
	-10%	16	24	48.40%	11 879 189
	+10%	18	26	43.34%	9 688 158
	+20%	18	27	40.76%	8 592 642
Cow yield	-20%	20	32	28.82%	3 991 161
	-10%	19	28	37.46%	7 387 417
	+10%	16	23	54.17%	14 179 930
	+20%	15	20	62.41%	17 576 186
Milk price	-20%	19	30	34.19%	6 116 238
	-10%	18	27	40.07%	8 449 956
	+10%	16	23	51.63%	13 117 391
	+20%	16	22	57.35%	15 451 109

Information worksheets

Calculations of cashflow are based on assumptions of herd rotation (Table 53) and seasonality of milk production (Table 54).

Table 53. Investment model in commercial dairy farms: herd rotation

500 cows

Calendar period	Q1 2010	Q2 2010	Q3 2010	Q4 2010	Q1 2011	Q2 2011	Q3 2011	Q4 2011	Q1 2012	Q2 2012	Q3 2012	Q4 2012
Purchase of heifers, 7 month sequence			125	125	125	125	42		42		42	
Own reproduction												18
Transition of purchased heifers into cows				123	240	351	457	475	452	471	448	466
Total milked				123	240	351	382	398	378	394	374	390
Sorting out				2	4	6	8	8	8	8	8	8
Capacity utilization, %			25	49	72	94	98	93	97	93	96	95
Herd of cattle on farm at the end of the period			125	246	361	470	491	468	486	463	482	476

250 cows

Calendar period	Q1 2010	Q2 2010	Q3 2010	Q4 2010	Q1 2011	Q2 2011	Q3 2011	Q4 2011	Q1 2012	Q2 2012	Q3 2012	Q4 2012
Purchase of heifers, 7 month sequence			63	63	63	63	21		21		21	
Own reproduction												9
Transition of purchased heifers into cows				62	120	176	228	238	226	235	224	233
Total milked				62	120	176	191	199	189	197	187	195
Sorting out				1	2	3	4	4	4	4	4	4
Capacity utilization, %			25	49	72	94	98	93	97	93	96	95
Herd of cattle on farm at the end of the period			63	123	180	235	245	234	243	232	241	238

Table 54. Investment model in commercial dairy farms: milk production seasonality

Common

Month	Share in yearly production
January	5.75%
February	6.24%
March	6.24%
April	6.71%
May	7.39%
June	8.15%
July	8.73%
August	9.98%
September	11.51%
October	11.03%
November	9.11%
December	9.16%

Quarter	Share in yearly production
1	18.23%
2	22.25%
3	30.22%
4	29.30%

Table 55. Dairy farm classification model: single and composite rating

Share of salaries in production costs	0.41	0.11	0.37	0.21	0.10	0.01	0.31	0.41
Share of feed costs in total production costs	0.07	0.69	0.37	0.29	0.44	0.55	0.35	0.07
Share of inseminated cows that gave birth	0.00	0.00	0.00	0.18	0.29	0.26	0.27	0.00
Part of cows in cattle herd		1.00	0.65	0.57	0.41	0.44	0.44	
Difference in total production costs and cost of production of sold milk	0.03	0.07	0.02	0.02	0.01	0.00	0.03	0.03
Full milk cost (production + sales)	0.30	0.19	0.14	0.11	0.10	0.12	0.21	0.30
Production costs of milk sold	0.27	0.12	0.12	0.09	0.09	0.12	0.18	0.27
Share of milk sold in total milk produced	0.96	1.00	0.97	0.92	1.00	1.00	1.00	0.96
Production costs of all milk produced	0.26	0.12	0.12	0.09	0.10	0.13	0.19	0.26
Compound feed use per 1 cow	0.00	0.00	0.00	0.00	17.75	0.00	26.62	0.00
Feed used per 1 cow	43.89	4.03	51.49	58.00	89.64	66.91	132.99	43.89
Dynamics of feedstocks (year end year beginning)		-0.38	1.20	0.01	-7.16	-5.46	-2.25	
Feed availability (end of year)	8.83	2.38	12.91	14.50	12.96	9.88	36.66	8.83
Feed availability (beginning of year)		2.76	11.71	14.49	20.12	15.34	38.91	
Cow mortality		0.00	0.00	0.00	0.00	0.00	0.00	
Cattle mortality		0.00	0.01	0.01	0.00	0.00	0.00	
Feed conversion rate	2.62	0.11	2.27	1.98	1.86	1.48	1.45	2.62
Share of cows that gave birth in the number of inseminated cows	1.00	1.00	1.00	0.82	0.71	1.00	0.73	1.00
Average annual milk yield per 1 cow	16.74	37.30	22.68	29.31	48.26	45.19	91.83	16.74
Share of milk in farm sales	1.00	0.68	0.70	0.66	0.64	0.46	0.15	1.00
Share of milk in revenues from all livestock and poultry sales	1.00	0.99	0.87	0.84	0.78	0.94	0.88	1.00
Distance from Shostka	40.00	40.00	63.00	40.00	175.00	220.00	200.00	40.00
Cow milk produced by each farm	787.00	118 283.00	2 268.00	5 862.00	33 781.00	5 333.00	47 753.00	787.00
Total points	**6.1813**	**5.4567**	**5.4334**	**5.2164**	**5.1612**	**5.0815**	**5.0324**	**6.1813**
Company number in the state registry of enterprises	*35289259*	*30934805*	*30894621*	*30829421*	*3777290*	*35074961*	*30875436*	*35289259*

ANNEX 2
Questionnaire used by the Sumy National Agricultural University in the survey of rural household milk producers

Sumy National Agrarian University

Questionnaire

Poll of private milk producers in Sumy region

Economic cluster of questions

1. *Indicate the number of family members:*
   2 □ 3 □ 4 □ 5 and more □
2. *How many of your family members are of working age?*
   0-1 □ 2 □ 3 □ 4 and more □
3. *Where do the working age family members work?*
   Household □ State institution □ Employee □
4. *Indicate the number of family members that are involved in milk production:*
   0 □ 1 □ 2 □ 3 □
5. *Do you use a land plot for your own purposes?*
   Yes □ No □ Leased to another person □
6. *Which means of small mechanization do you have in your family?*
   Tractor □ Milking machine □ Mini feed grinder □
   Cooling equipment □ Other □ Nothing □
7. *Do you sell your milk-to-milk processors through intermediaries?*
   Yes □ No □
8. *Indicate the place where you sell the milk:*
   Market □ Shostka milk factory □ Other □
9. *Under which circumstances would you increase the headcount of cows in your own household:*
   Subsidy for cow purchase □ Livestock leasing □ Increased purchasing price for milk □
   Other □ Not willing to increase the headcount of cows □
10. *What are you not satisfied with in the collaboration with Shostka milk factory:*
    Price □ Way they purchase the milk □
    Quality requirements □ Other □
11. *The share of income from milk sales in your overall family income is:*
    Less than 30% □ 30-50% □ 50% and more □
12. *Indicate the procurement source of hay, haylage and silage for your cows:*
    Own land plot □ Other land plots □ Purchase 100% □
    Purchase 50% □ Purchase 25% □

13. *Indicate the procurement source of feed, middlings and other concentrated feeds for your cows:*
Own land plot □ Other land plots □ Purchase 100% □
Purchase 50% □ Purchase 25% □

14. *How much time do you spend in one day for nursing, feeding and milking the cows?*
1 hour □ 1-2 hours □ 2-3 hours □ 3 hours and more □

Zootechnical cluster of questions

1. *What material is the floor of the cowshed made of?*
Wood □ Concrete □ Earth □
The floor is covered with an unchanged layer of straw □
2. *How often do you clean the stalls in the cowshed?*
Every day □ Depends on manure accumulation □
Once a week □ Not more than once in a month □
3. *Do you use litter?*
Yes, straw from grain crops □
Yes, hay that falls from the hay rack □
Yes, sawdust □ No □
4. *If you have two or more cows in one cowshed how are they kept?*
Tethered □ Untethered □
5. *How are your cows kept in summer?*
Open-air □ Indoor □
6. *Which material is your cowshed built from?*
Wood □ Concrete □ Bricks □ Blocks □
7. *In your household, do you have a ground/place for cows to walk?*
Yes □ No □

Feeding

1. *What kind of straw can you use in your household for cow feeding?*
Barley □ Rye □ Wheat □ Oat □ Pulses □
2. *What kind of hay can you use in your household for cow feeding?*
Barley □ Lucerne □ Pulses □
From own homestead lands □
Clover □ Ryegrass □
3. *How and how many concentrated feed and middlings do you give to your cows?*
Depends on cows productivity □ Depends on the biological cycle □
At my own discretion □ I give no concentrated feed □
4. *Do you feed cows with silage and haylage?*
Yes □ No □
5. *With how much hay, silage and haylage do you feed your cows?*
Depends on cows productivity □ At my own discretion □

6. *Which juicy/wet feed do you give to your cows?*
   Beet □ Carrot □ Shorts from the garden (cabbage and others) □
   Fruits (apple and others) □
7. *Which mineral feed supplements do you give to your cows?*
   Salt □ Premix □ Other □
8. *Where do your cows pasture during summer?*
   Grassland □ Perennial grasses □ Swampy land □
   Fields after grain harvest □ Near forest/wood pastures □
9. *How do you water your cows?*
   On my own discretion □ Unlimited access □
10. *Do you have problems with the insemination and calving of cows?*
    Yes □ No □
11. *How do you inseminate cows in your household?*
    Naturally □ Artificially (technician) □ Artificially (veterinary) □
12. *How much time passes between two neighbouring calvings?*
    1 year □ Up to 15 months □ Up to 1.5 years □ Over 1.5 years □
13. *For how long do you use one cow (productive life)?*
    Up to 3 years □ 3-6 years □ Over 6 years □
14. *How many calves were born from your cow in the last 5 years?*
    5 □ 6-7 □ Over 7 □
15. *How many calves from one cow were born dead or died during the first 14 days?*
    0 □ 1 □ 2 □ 3 □ 4 □
16. *Indicate the approximate weight of your cows:*
    Up to 300 kg □ 300-400 kg □ 400-500 kg □
    500-600 kg □ Precise number □
17. *How much milk do your cows gives in one lactation (cow yield)?*
    Up to 3 000 kg □ 3 000-3 500 kg □ 3 500-4 000 kg □
    4 000-5 000 kg □ 5 000 kg and more □ Precise number □
18. *Indicate what is the fat and protein concentration of your milk*
    Fats, precise number □ Proteins, precise number □
19. *How much milk do you use to feed calves?*
    Precise number □
20. *Do you have the possibility (willingness) to expand your own household (by adding more lends)*
    Yes □ No □
21. *To what extent would you expect your yearly income to be increased due to milk quality improvement?*
    UAH 500 □ UAH 500-1 000 □ Over UAH 1 000 □
22. *When do you start drying off cows?*
    Up to 45-60 days before calving □ 30 days and less before calving □

23. Do you practice "conservation" of the udder during the cows' dry period (introduction of antibiotics into the teat canal)?
Yes □ No □

24. How often do your cows become ill with mastitis?
Often □ Rarely □ Never □

25. Mastitis more often happens:
After the dry period □ First days after calving □
2-3 weeks after calving □ Never □

26. Who provides animal health care to your cows if ill with mastitis?
Veterinary □ By myself □ Nobody □

27. How often are your cows checked for hidden forms (subclinical) mastitis?
Monthly □ Quarterly □ Twice a year □ Once a year □ Never □

28. How often after calving has retention of the placenta occurred?
Yes, almost always □ Very rarely □ Never □

29. How often after calving do your cows have inflammatory processes of the genitals?
Yes, almost always □ Rarely □ Never □

30. How quickly after calving do your cows normally return to heat?
Within the first month □ In up to 60 days □ In more than 60 days □

31. Normally your cows become pregnant:
With one insemination □ With two inseminations □
With three or more inseminations □

32. If your cows remain free after insemination, when does the next heat period occur?
During the first month □ In up to 60 days □ In more than 60 days □

33. By which signs do you establish that your cows are ready for insemination?
When the cow is in heat □ Other □
When the cow shows sign of immobility reflex □

34. Your cows are inseminated:
In your own yard □ At the artificial insemination post □

35. Have your cows ever had an abortion?
Yes □ No □

36. Do you inform the local veterinary medicine expert of any illnesses/suspicions?
Yes □ No □

37. Are you interested in becoming a member of an agricultural production cooperative?
Yes □ No □

38. What do you need to improve in your household with reference to milk production?
Feeding □ Hygiene and sanitary situation □

39. Are you interested in analysis of milk quality and composition?
Yes □ No □

ANNEX 3
Training videos on dairy farming

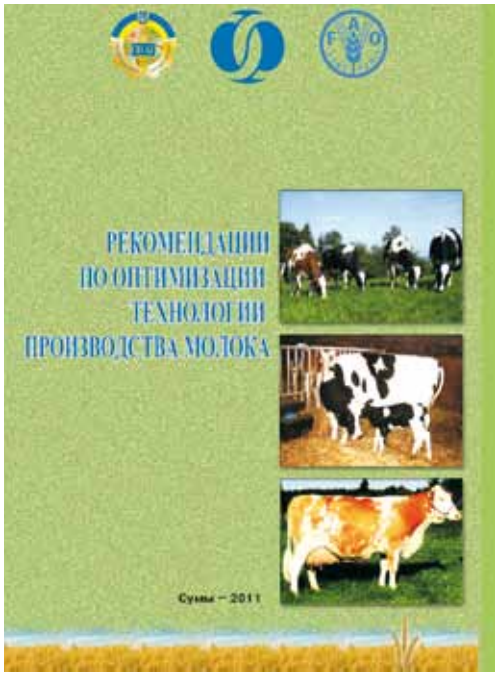
Part 1. www.youtube.com/watch?v=GUOKi0cZS4o (Ukrainian)

Part 2. www.youtube.com/watch?v=m1QauSMhCuo (Ukrainian)

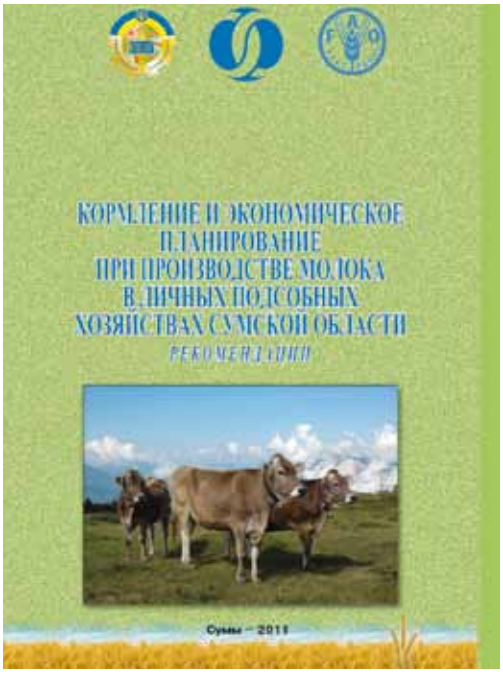
Part 1 and 2. www.youtube.com/watch?v=grzSd8H-0wo (Ukrainian with English subtitles)

ANNEX 4
Training brochures on dairy production and feeding recommendations

Milk Production Technology and Optimization



Milk Production on a Household Farm



Training presentations and brochures are available at the Eastagri website:
www.eastagri.org/meetings/index.asp?id=55

ANNEX 5
Knowledge dissemination

Articles in *Propozitsiya*, Ukrainian Agribusiness Magazine:

September 2011
www.propozitsiya.com/?page=149&itemid=3708&number=125
or
www.eastagri.org/files/ukr%20dairy%20%20The%20reality%20of%20milk%20production%20in%20the%20private%20sector.pdf

October 2011
www.propozitsiya.com/?page=149&itemid=3735&number=126
or
www.eastagri.org/files/ukr%20dairy%20Appropriate%20cow%20maintenance%20in%20private%20households.pdf

November 2011
www.propozitsiya.com/?page=149&itemid=3760&number=127
or
http://www.eastagri.org/files/ukr%20dairy%20How%20own%20cow%20should%20be%20feeded.pdf

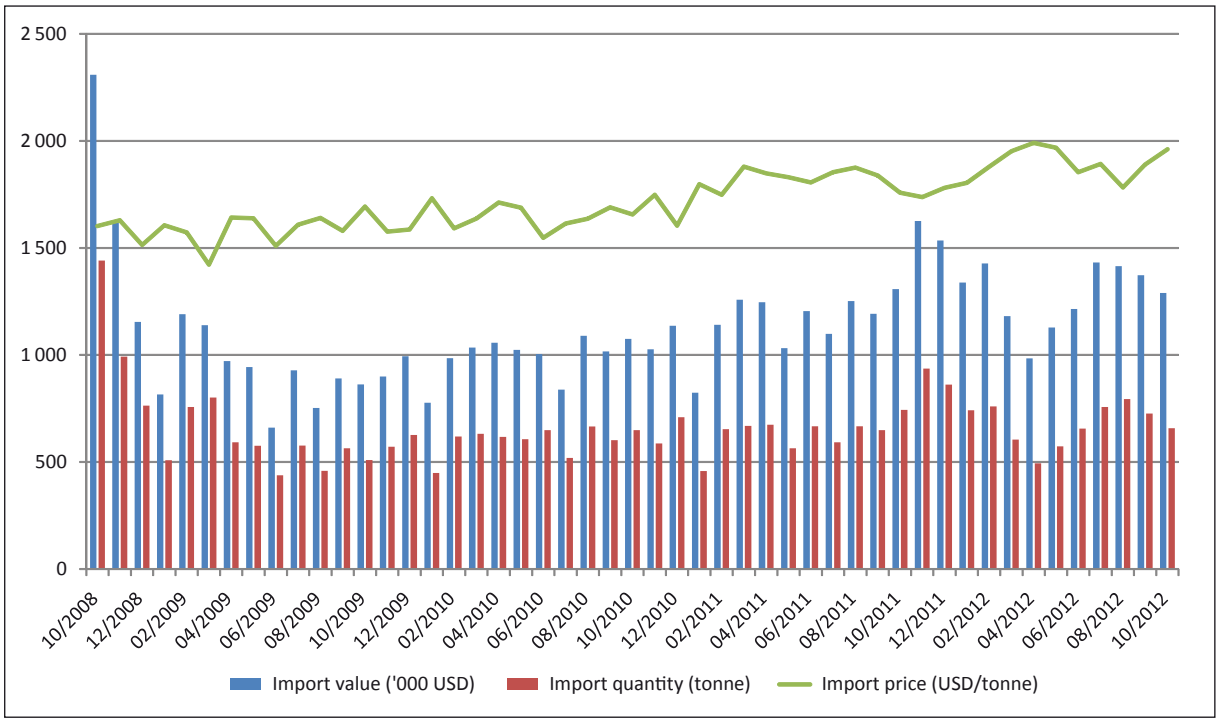
ANNEX 6
Foreign trade statistics on main dairy products in Ukraine

Table 56. Foreign trade statistics: yogurt (yearly, 2007-2012)

Ukraine yearly statistics **Commodity:** 0403, buttermilk, curdled milk and cream, yogurt, kephir etc., whether or not flavoured etc. or containing added fruit or cocoa								
Calendar year: 2007-2011, year to date: 10/2011 & 10/2012								
	Calendar year					**Year to date**		
	2007	2008	2009	2010	2011	10/2011	10/2012	% change
Export (value, 000 USD)	978.2	1 341.3	2 755.4	5 231.9	8 630.2	7 734.8	3 909.1	-49.46
Export (quantity, tonne)	1 143.0	1 334.0	2 985.0	4 626.0	5 811.0	5 192.0	2 696.0	-48.07
Export (price, 000 USD/ tonne)	0.856	1.005	0.923	1.131	1.485	1.490	1.450	-2.67
Import (value, USD)	39 954.8	35 273.7	11 049.2	12 065.9	14 716.6	11 555.8	12 786.4	10.65
Import (quantity, tonne)	33 123.0	23 711.0	6 977.0	7 304.0	8 134.0	6 337.0	6 765.0	6.75
Import (price, 000 USD/ tonne)	1.2	1.5	1.6	1.7	1.8	1.8	1.9	3.65
Import								**Value in thousands USD**
Partner country	**Calendar year**					**Year to date**		
	2007	2008	2009	2010	2011	10/2011	10/2012	% change
World	39 954.8	35 273.7	11 049.2	12 065.9	147 16.6	11 555.8	12 786.4	10.7
Russia	39 486.2	34 646.5	10 692.1	11 194.1	10 644.3	8 884.3	7 820.9	-12.0
Belarus	0.0	0.0	6.7	182.4	2 624.1	1 536.8	3 460.1	125.2
Germany	170.8	388.7	270.8	294.0	639.9	538.4	388.2	-27.9
France	53.1	49.6	32.2	112.2	268.3	210.7	260.0	23.4
Spain	0.0	8.9	3.8	141.0	234.7	165.6	229.8	38.8
Greece	0.0	0.0	0.0	0.0	114.5	68.5	335.4	389.4
Netherlands	0.6	8.4	22.1	109.5	82.6	59.5	93.0	56.2
Finland	0.0	0.0	0.0	0.2	74.2	61.3	150.5	145.4
Austria	26.8	144.4	21.5	18.7	29.6	26.3	28.3	7.5
Armenia	0.0	0.0	0.0	0.0	2.1	2.1	0.0	-100.0
Export								**Value in thousands USD**
Partner country	**Calendar year**					**Year to date**		
	2007	2008	2009	2010	2011	10/2011	10/2012	% change
World	978.23	1 341.27	2 755.41	5 231.92	8 630.178	7 734.836	3 909.073	-49.46
Moldova	904.53	1 280.19	1 461.06	22 74.885	2 980.859	2 471.113	2 287.73	-7.42
Russia	0	1.41	0.579	3.171	2 604.123	2 530.868	10.044	-99.6
Kazakhstan	0	31.4	1 196.31	2 381.961	2415.35	2192.89	1 075.594	-50.95
Azerbaijan	17.87	8.79	58.372	326.22	379.132	343.849	242.683	-29.42
Georgia	55.32	3.93	28.284	35.985	87.689	63.578	118.794	86.85
Armenia	0	0	0	127.135	80.232	60.689	68.281	12.51
United Arab Emirates	0.07	0	0.035	11.404	20.543	17.007	64.524	279.4
Turkmenistan	0	0	0	30.197	10.566	10.566	2.263	-78.58
Panama	0	0.39	0.722	4.309	10.358	7.133	14.918	109.13
Unidentified country	0	2.18	4.565	4.992	9.873	8.743	5.84	-33.19

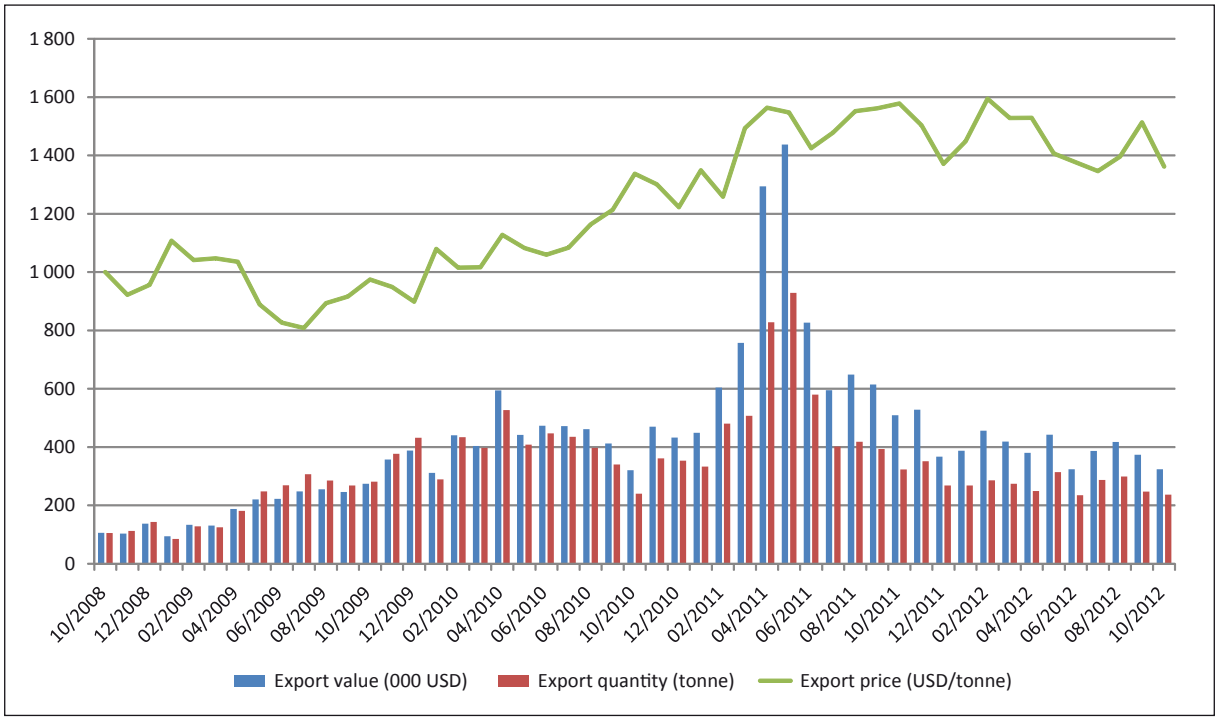
Source: State Customs Committee of the Ukraine; GTIS.

Figure 80. Foreign trade statistics: yogurt import (monthly, 2008-2012)



Source: State Customs Committee of the Ukraine; GTIS.

Figure 81. Foreign trade statistics: yogurt export (monthly, 2008-2012)



Source: State Customs Committee of the Ukraine; GTIS.

Table 57. Foreign trade statistics: butter (yearly, 2007-2012)

Ukraine yearly statistics
Commodity: 0405, butter and other fats and oils derived from milk

Calendar year: 2007 - 2011, year to date: 10/2011 & 10/2012

	Calendar year					Year to date		
	2007	2008	2009	2010	2011	10/2011	10/2012	% change
Export (value, 000 USD)	10 908.3	19 598.2	2 787.7	5 338.3	9 692.4	9 024.8	2 195.7	-75.67
Export (quantity, tonne)	3 902.0	6 097.0	891.0	1 166.0	2 139.0	1 990.0	514.0	-74.15
Export (price, 000 USD/ tonne)	2.795	3.214	3.130	4.577	4.531	4.535	4.268	-5.88
Import (value, USD)	2 406.1	9 379.6	44 532.5	30 729.4	25 784.7	17 207.5	27 451.1	59.53
Import (quantity, tonne)	841.0	2 786.0	16 347.0	6 125.0	4 954.0	3 167.0	6 133.0	93.65
Import (price, 000 USD/ tonne)	2.861	3.367	2.724	5.017	5.205	5.433	4.476	-17.62

Import **Value in thousands USD**

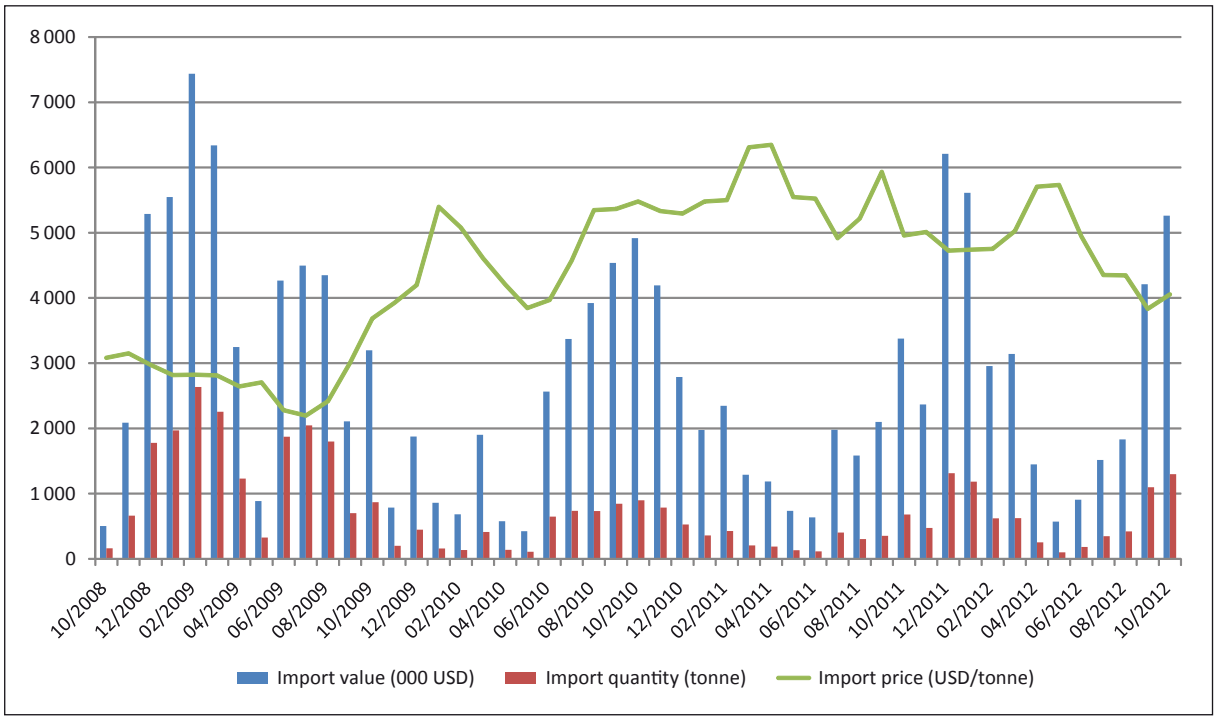
Partner country	Calendar year					Year to date		
	2007	2008	2009	2010	2011	10/2011	10/2012	% change
World	2 406.1	9 379.6	44 532.5	30 729.4	25 784.7	17 207.5	27 451.1	59.53
New Zealand	0.0	0.0	142.7	892.8	7 869.1	4 425.8	14 392.4	225.19
Belarus	1 564.9	7 318.2	39 130.1	13 656.4	6 159.7	2 710.1	6 361.3	134.73
France	64.4	100.4	2 493.6	4 277.9	4 465.5	3 397.0	4 814.0	41.71
United States	0.0	0.0	0.0	3 756.9	2 472.9	2 472.9	0.0	-100
Belgium	81.4	111.4	507.2	3 196.4	1 707.1	1 707.1	280.2	-83.59
Finland	41.9	113.9	848.2	302.6	719.5	627.8	701.6	11.76
Germany	0.0	0.0	0.0	108.4	598.7	453.5	491.2	8.33
Netherlands	0.0	0.0	0.0	67.9	500.6	256.0	210.7	-17.71
Austria	578.9	1 444.5	971.6	1 325.6	447.9	447.9	0.0	-100
Singapore	0.0	0.0	0.0	0.0	409.4	409.4	0.0	-100

Export **Value in thousands USD**

Partner country	Calendar year					Year to date		
	2007	2008	2009	2010	2011	10/2011	10/2012	% change
World	10 908.3	19 598.2	2 787.7	5 338.3	9 692.4	9 024.8	2 195.7	-75.67
Russia	0.1	5.9	5.3	10.1	5 227.9	5 222.0	153.9	-97.05
Moldova	1 439.8	1 584.6	1 327.9	1 433.1	1 900.3	1 575.6	1 061.3	-32.64
Kazakhstan	4 738.2	10 586.6	239.1	3 176.5	1 022.2	820.7	400.0	-51.27
Azerbaijan	1 653.6	2 159.8	1 097.9	589.2	776.7	664.6	529.0	-20.39
Armenia	683.4	1 313.8	0.1	5.8	691.0	691.0	0.0	-100
Kuwait	76.3	0.0	0.0	0.0	25.4	9.5	9.4	-1.75
Panama	0.0	0.2	0.3	4.3	10.5	6.5	15.2	132.27
Georgia	211.8	127.4	51.4	10.6	8.5	8.5	0.0	-99.99
Equatorial Guinea	0.0	0.0	0.0	0.0	5.7	5.7	0.0	-100
Jordan	0.0	0.0	0.0	0.0	4.5	4.5	0.0	-100

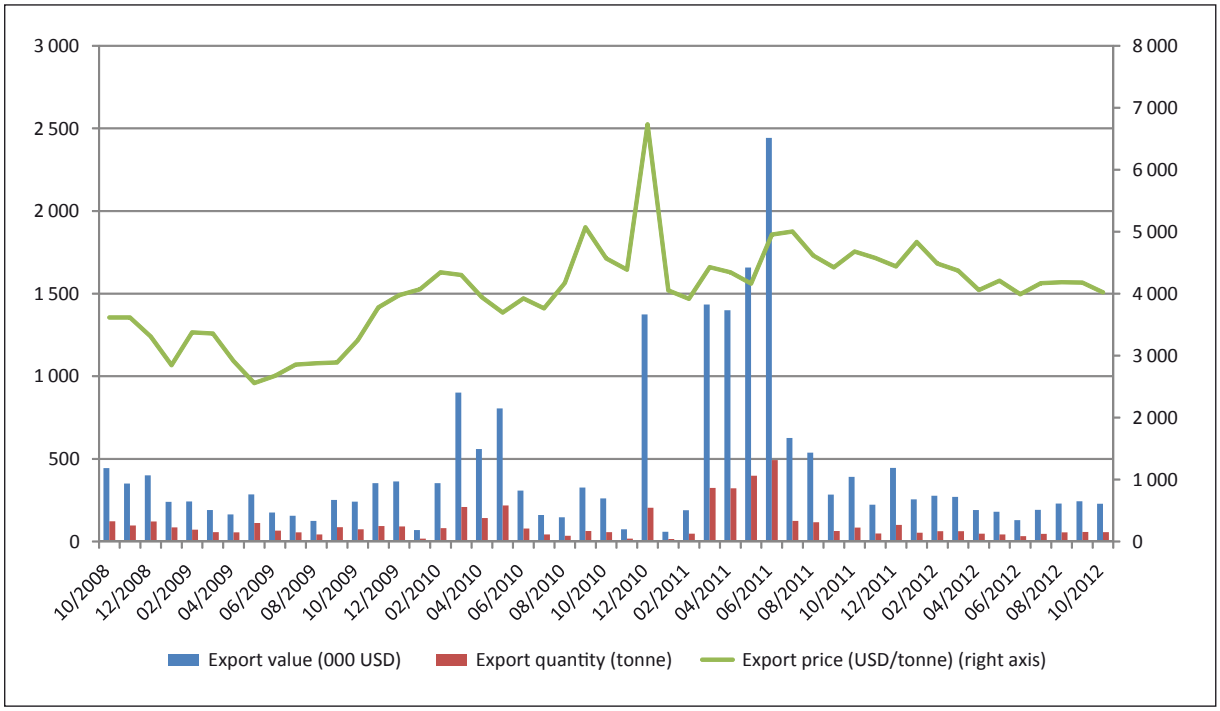
Source: State Customs Committee of the Ukraine; GTIS.

Figure 82. Foreign trade statistics: butter import (monthly, 2008-2012)



Source: State Customs Committee of the Ukraine; GTIS.

Figure 83. Foreign trade statistics: butter export (monthly, 2008-2012)



Source: State Customs Committee of the Ukraine; GTIS.

Table 58. Foreign trade statistics: cheese (yearly, 2007-2012)

Ukraine yearly statistics
Commodity: 0406, cheese and curd

Calendar year: 2007-2011, year to date: 10/2011 & 10/2012

	Calendar year					Year to date		
	2007	2008	2009	2010	2011	10/2011	10/2012	% change
Export (value, 000 USD)	269 636.9	402 597.0	301 118.4	426 814.1	445 042.1	364 636.1	291 243.8	-20.1
Export (quantity, tonne)	61 952.0	77 426.0	76 569.0	79 316.0	80 267.0	66 416.0	55 699.0	-16.1
Export (price, 000 USD/ tonne)	4.352	5.200	3.933	5.381	5.545	5.490	5.229	-4.760
Import (value, USD)	37 083.0	53 040.0	35 981.2	51 121.4	68 048.1	53 958.2	71 482.8	32.5
Import (quantity, tonne)	11 859.0	13 124.0	90 93.0	11 194.0	12 215.0	9 768.0	13 365.0	36.8
Import (price, 000 USD/ tonne)	3.127	4.041	3.957	4.567	5.571	5.524	5.349	-3.180

Import **Value in thousands USD**

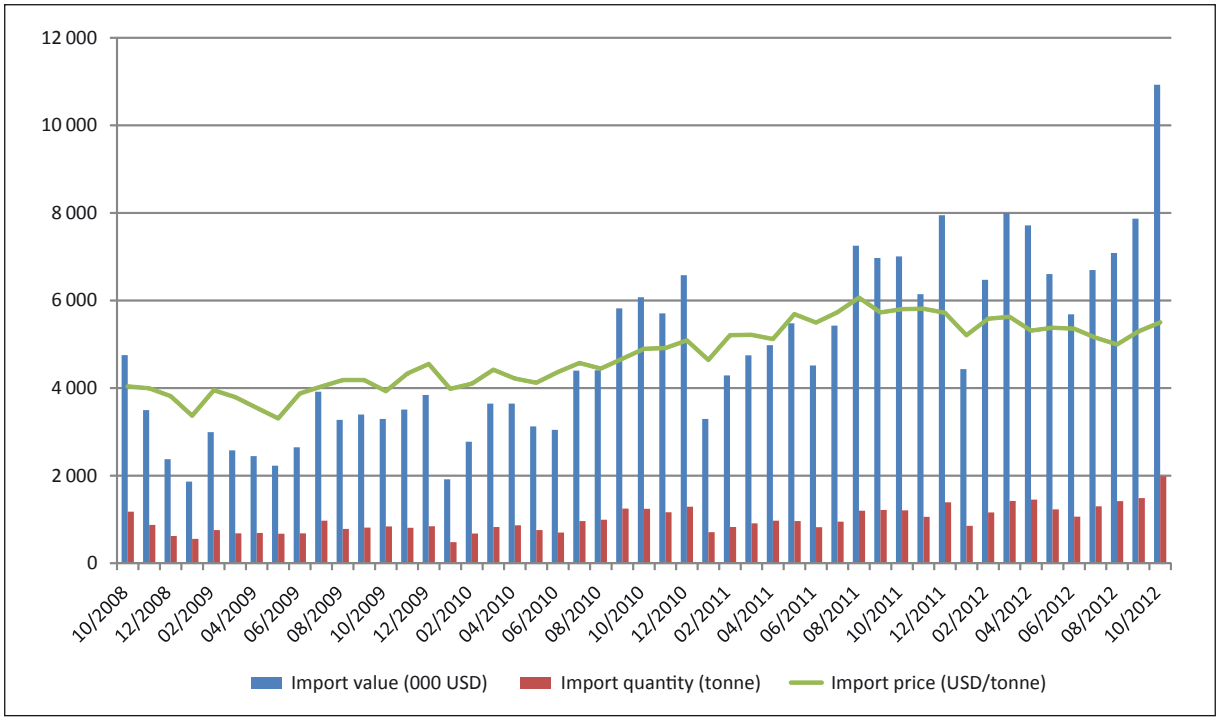
Partner country	Calendar year					Year to date		
	2007	2008	2009	2010	2011	10/2011	10/2012	% change
World	37 083.0	53 040.0	35 981.2	51 121.4	68 048.1	53 958.2	71 482.8	32.48
Russia	23 900.6	29 589.2	23 244.2	25 276.0	26 296.2	21 954.3	19 724.9	-10.15
Poland	1 190.9	3 391.8	2 652.5	7 604.7	12 317.2	9 679.0	18 725.4	93.46
France	3 097.9	7 360.1	3 644.7	4 149.2	5 734.4	4 237.2	5 683.2	34.13
Italy	1 521.7	3 083.5	1 976.2	2 664.7	5 720.5	4 227.7	5 425.0	28.32
Netherlands	1 126.2	1 567.5	630.7	4 895.7	5 266.3	3 905.9	6 051.1	54.92
Germany	1 772.3	3 034.1	1 059.3	2 260.3	4 749.9	3 987.0	6 228.2	56.21
Denmark	1 904.2	2 481.0	1 182.4	907.2	1 400.4	1 066.6	1 403.0	31.54
Belarus	530.8	163.2	7.4	428.7	1 329.1	802.1	1 947.0	142.74
Finland	1 051.7	1 508.9	522.9	798.1	1 156.0	950.4	1 255.0	32.05
Serbia	0.0	0.0	240.8	487.6	1 031.7	726.9	1 082.3	48.89

Export **Value in thousands USD**

Partner country	Calendar year					Year to date		
	2007	2008	2009	2010	2011	10/2011	10/2012	% change
World	269 636.9	402 597.0	301 118.4	426 814.1	445 042.1	364 636.1	291 243.8	-20.13
Russia	221 655.4	331 465.2	250 082.2	367 321.7	390 782.3	320 487.5	250 827.9	-21.74
Kazakhstan	35 729.6	57 969.7	40 096.7	47 648.4	41 106.0	33 391.4	31 247.9	-6.42
Moldova	8 180.0	8 555.5	8 214.9	9 121.4	8 768.7	6 913.1	6 882.3	-0.45
Azerbaijan	1 502.6	2 029.7	1 361.6	756.5	1 128.4	941.4	1 003.1	6.56
Egypt	0.0	0.1	0.0	224.3	1 006.9	1 006.8	0.0	-100
Morocco	310.3	0.0	0.0	40.3	697.5	697.5	0.0	-100
United States	500.5	1048.1	553.3	546.2	571.8	423.5	660.6	55.97
Armenia	444.3	338.0	187.3	152.2	245.3	209.8	48.3	-76.96
Uzbekistan	0.0	0.0	0.0	251.6	206.0	206.0	0.0	-100
Georgia	117.2	459.6	169.1	212.9	152.8	126.4	161.7	27.96

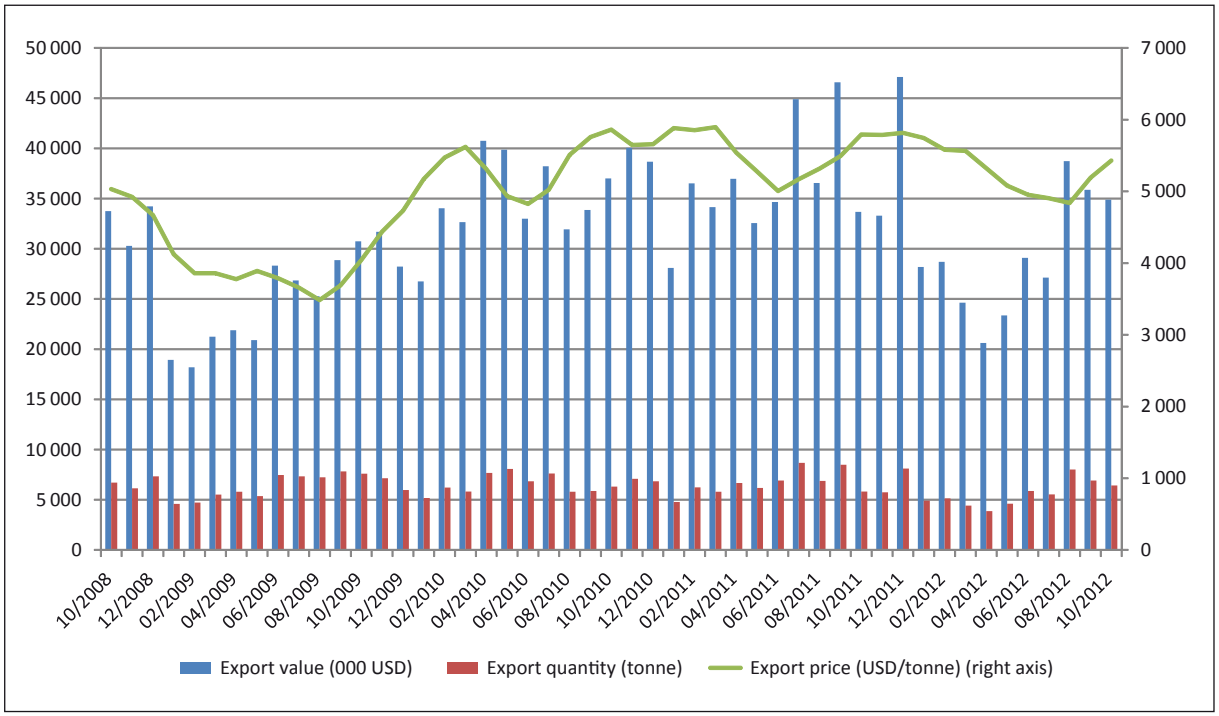
Source: State Customs Committee of the Ukraine; GTIS.

Figure 84. Foreign trade statistics: cheese import (monthly, 2008-2012)



Source: State Customs Committee of the Ukraine; GTIS.

Figure 85. Foreign trade statistics: cheese export (monthly, 2008-2012)



Source: State Customs Committee of the Ukraine; GTIS.

Table 59. Foreign trade statistics: skimmed powder milk (yearly, 2007-2012)

Ukraine yearly statistics
Commodity: 040210, milk and cream, concentrated, whether or not sweetened, in powder, granules or other solid forms, of a fat content, by weight, not exceeding 1.5%

Calendar Year: 2007-2011, year to date: 10/2011 & 10/2012

	Calendar year					Year to date		
	2007	2008	2009	2010	2011	10/2011	10/2012	% change
Export (value, 000 USD)	200 343.5	119 521.0	443 13.4	37 677.4	68 938.1	62 194.6	63 191.3	1.6
Export (quantity, tonne)	57 655.0	43 573.0	26 998.0	13 894.0	22 274.0	20 272.0	23 440.0	15.6
Export (price, 000 USD/ tonne)	3.475	2.743	1.641	2.712	3.095	3.068	2.696	-12.1
Import (value, USD)	1 118.3	911.0	11 937.4	5 410.5	6 019.7	1 289.6	10 853.3	741.6
Import (quantity, tonne)	296.0	144.0	7 664.0	1 606.0	1 842.0	378.0	3 222.0	751.4
Import (price, 000 USD/ tonne)	3.776	6.317	1.558	3.370	3.269	3.407	3.368	-1.1

Import — **Value in thousands USD**

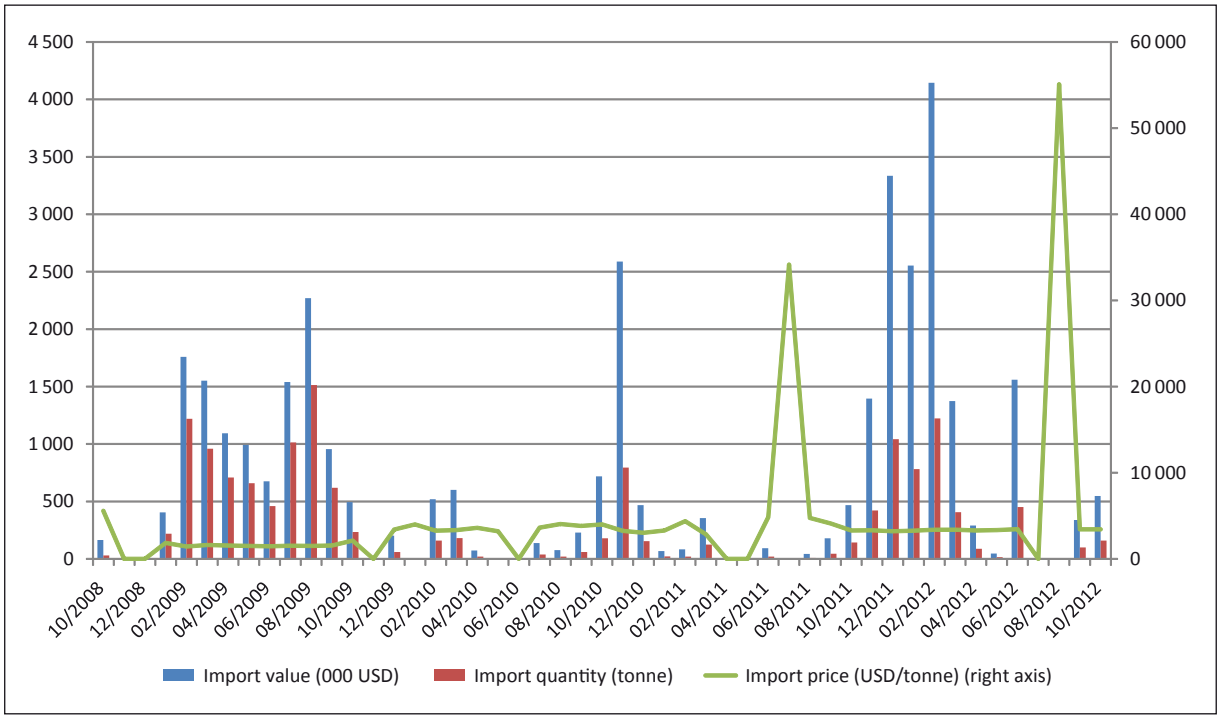
Partner country	Calendar year					Year to date		
	2007	2008	2009	2010	2011	10/2011	10/2012	% change
World	1 118.3	911.0	11 937.4	5 410.5	6 019.7	1 289.6	10 853.3	741.61
Poland	0.0	0.0	0.0	2 323.4	4 563.5	395.4	1 951.8	393.63
Lithuania	0.0	0.0	0.0	162.5	383.7	0.0	1 161.2	n/a
Austria	442.0	783.8	481.5	390.6	383.4	301.0	212.9	-29.29
United States	0.9	0.0	0.0	1786.6	358.8	358.6	7099.0	1 879.89
Belarus	306.5	0.0	11 455.9	73.7	107.0	59.4	59.4	0
France	72.0	11.9	0.0	0.8	78.4	35.4	238.6	573.36
Estonia	0.0	0.0	0.0	0.0	72.3	72.3	0.0	-100
Belgium	0.0	0.0	0.0	290.0	67.4	67.4	0.0	-100
Germany	23.9	0.0	0.0	0.0	5.1	0.0	66.0	n/a
Switzerland	0.0	0.0	0.0	0.0	0.0	0.0	64.3	∞

Export — **Value in thousands USD**

Partner country	Calendar year					Year to date		
	2007	2008	2009	2010	2011	10/2011	10/2012	% change
World	200 343.5	119 521.0	44 313.4	37 677.4	68 938.1	62 194.6	63 191.3	1.6
Russia	23 290.5	14 039.0	0.2	5 314.1	19 379.3	15 395.4	28 909.7	87.78
Kazakhstan	43 73.5	7 628.6	836.6	6 837.8	6 249.5	5 868.4	3 977.4	-32.22
Moldova	91.7	235.1	337.0	768.5	6 201.3	4 698.4	4 882.3	3.91
Egypt	6 109.6	11 293.0	3 316.5	2 525.9	3 991.9	3 991.9	1 317.4	-67
Bangladesh	7 439.6	4791.0	2 918.4	9 639.5	3 626.4	3 552.2	1 740.8	-50.99
Algeria	53 250.4	17 251.4	9 651.3	0.0	3 476.9	3 476.9	3 200.7	-7.94
Azerbaijan	840.7	1 759.8	32.4	2 024.1	3 249.9	3 127.1	1 919.8	-38.61
Syria	4 432.0	4 452.9	9 329.3	2 067.8	2 853.0	2 853.0	3 432.8	20.32
Georgia	4 546.3	4 760.9	1 120.1	1 191.8	2 596.1	2 596.1	1 169.7	-54.94
Armenia	1 666.9	577.6	0.0	1 256.3	2 519.4	2 131.9	1 091.8	-48.78

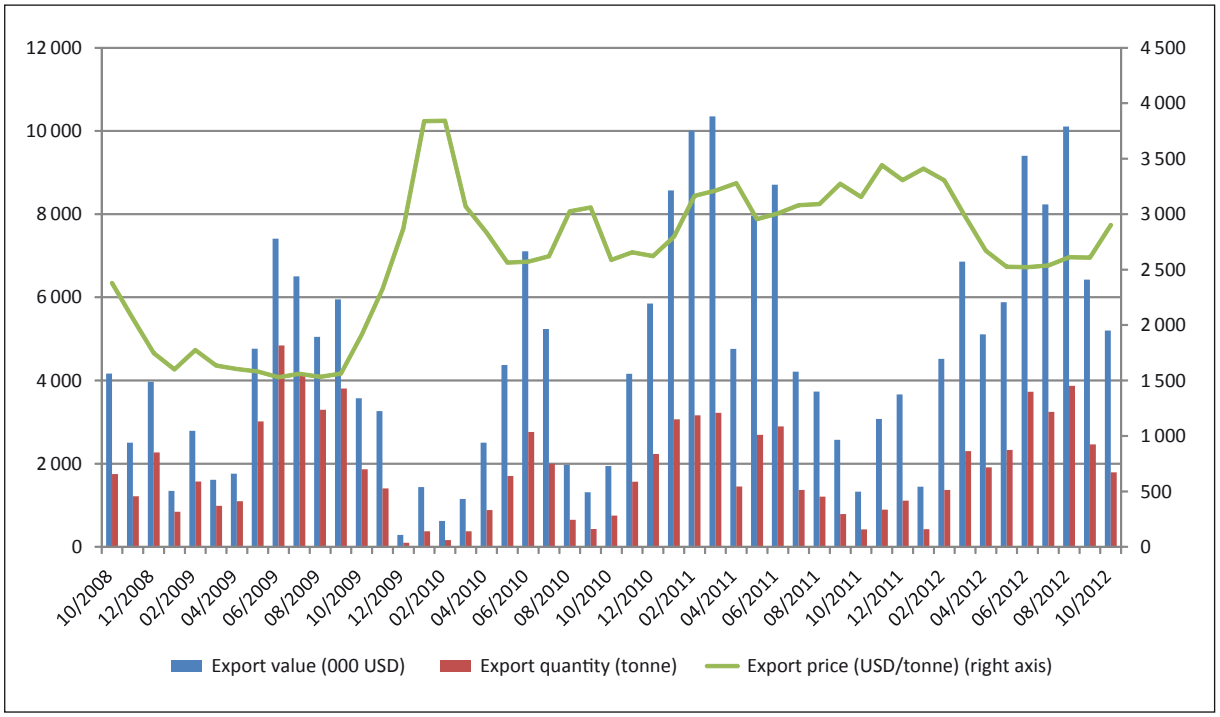
Source: State Customs Committee of the Ukraine; GTIS.

Figure 86. Foreign trade statistics: skimmed powder milk import (monthly, 2008-2012)



Source: State Customs Committee of the Ukraine; GTIS.

Figure 87. Foreign trade statistics: skimmed powder milk export (monthly, 2008-2012)



Source: State Customs Committee of the Ukraine; GTIS.

Table 60. Foreign trade statistics: whole powder milk (yearly, 2007-2012)

Ukraine yearly statistics
Commodity: 040221, milk and cream, concentrated, not sweetened, in powder, granules or other solid forms, of a fat content, by weight, exceeding 1.5%; 040229, milk and cream, concentrated, sweetened, in powder, granules or other solid forms, of a fat content, by weight, exceeding 1.5%

Calendar year: 2007-2011, year to date: 10/2011 & 10/2012

	Calendar year					Year to date		
	2007	2008	2009	2010	2011	10/2011	10/2012	% change
Export (value, 000 USD)	68 281.03	66 789.54	9 877.73	20 502.55	7 949.40	7 783.86	4 896.78	-37.09
Export (quantity, tonne)	18 323	21 092	4 708	6 110	2 122	2 080	1 388	-33.27
Export (price, 000 USD/ tonne)	3.73	3.17	2.10	3.36	3.75	3.74	3.53	-5.73
Import (value, USD)	190.97	198.92	1 242.565	1 292.566	3 506.707	2 208.471	3 280.778	48.55
Import (quantity, tonne)	53	38	685	309	754	469	827	76.33
Import (price, 000 USD/ tonne)	3.60	5.23	1.81	4.18	4.65	4.71	3.97	-15.75

Import — **Value in thousands USD**

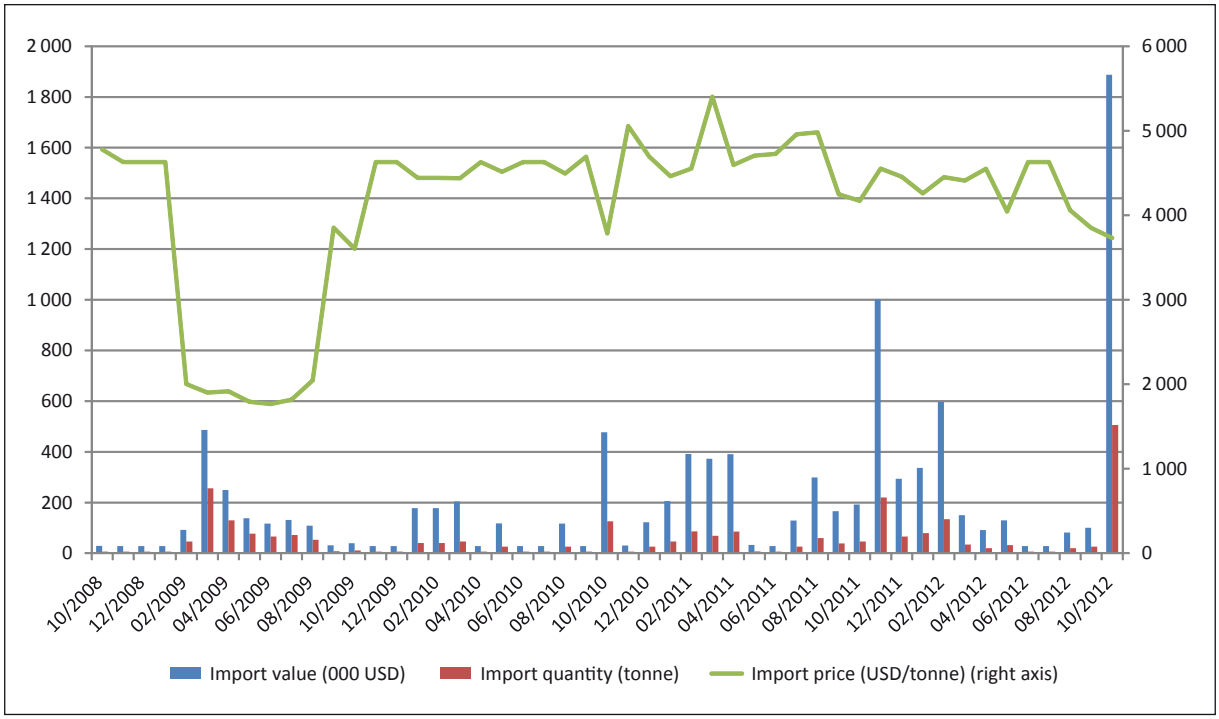
Partner country	Calendar year					Year to date		
	2007	2008	2009	2010	2011	10/2011	10/2012	% change
World	190 970	198 920	1 242 565	1 292 566	3 506 707	2 208 471	3 280 778	48.55
Poland	0	0	2 971	266 010	1 472 937	1 394 345	306 178	-78.04
France	11 380	39 840	0	0	1 067 742	34 508	1 396 397	3946.59
Belarus	50 720	0	1 139 011	575 152	437 601	309 423	116 189	-62.45
Belgium	0	0	0	0	197 743	197 743	214 129	8.29
Austria	0	0	0	0	146 261	146 261	0	-100.00
Czech Republic	0	1 150	0	0	16 024	16 024	1 117 464	6 873.69
Netherlands	0	11 810	331	0	8 816	8 816	0	-100.00
Germany	19 190	102 590	76 832	91 399	159 399	101 169	115 825	14.49
Sweden	0	0	0	0	184	184	0	-100.00
Switzerland	12 300	80	0	0	0	0	14 596	n/a

Export — **Value in thousands USD**

Partner country	Calendar year					Year to date		
	2007	2008	2009	2010	2011	10/2011	10/2012	% change
World	68 281 030	66 789 540	9 877 727	20 502 545	7 949 403	7 783 861	4 896 784	-37.09
Russia	8 793 800	22 275 320	2 010 883	12 656 104	1 931 766	1 931 638	1 693 864	-12.31
Armenia	858 780	1 058 380	0	0	1 457 576	1 457 576	1 340 841	-8.01
Azerbaijan	708 070	1 539 180	0	389 947	956 036	798 531	837 021	4.82
Kazakhstan	1 518 010	5 230 060	266 500	1 480 260	710 853	710 853	0	-100.00
Kuwait	233 100	218 920	162 996	861 364	406 269	406 269	0	-100.00
Algeria	3 0894 860	7 135 240	2 260 638	226 996	323 012	323 012	0	-100.00
Georgia	1 398 290	691 250	140 651	166 217	278 211	278 211	89 251	-67.92
Niger	574 700	1 065 590	136 100	777 821	242 258	242 258	0	-100.00
Bangladesh	0	1 288 320	0	652 074	227 267	227 267	659 998	190.41
Moldova	158 040	259 080	31 866	54 549	200 273	192 533	22 555	-88.29

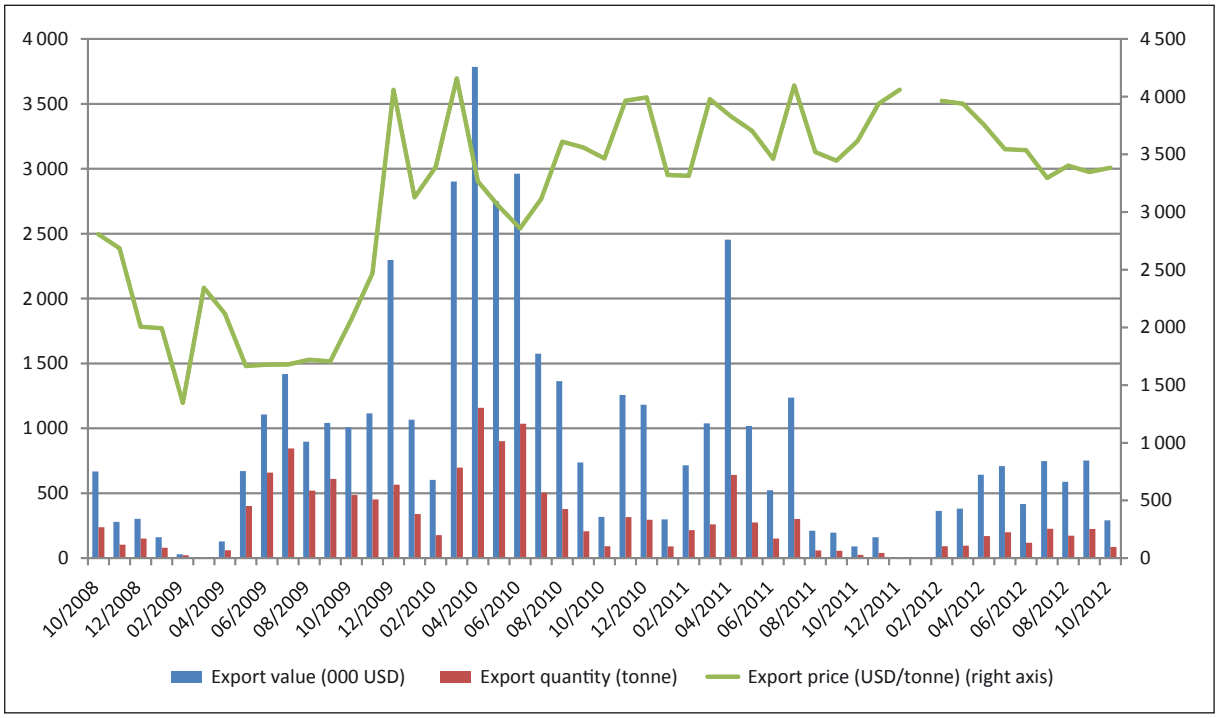
Source: State Customs Committee of the Ukraine; GTIS.

Figure 88. Foreign trade statistics: whole powder milk import (monthly, 2008-2012)



Source: State Customs Committee of the Ukraine; GTIS.

Figure 89. Foreign trade statistics: whole powder milk export (monthly, 2008-2012)



Source: State Customs Committee of the Ukraine; GTIS.

Please address comments and inquiries to:

Investment Centre Division
Food and Agriculture Organization of the United Nations (FAO)

Viale delle Terme di Caracalla - 00153 Rome - ITALY
E-mail: Investment-Centre@fao.org
Web site: www.fao.org/tc/tci
FAO web site: www.fao.org

ISBN 978-92-5-107938-6

9 789251 079386

I3446E/1/09.13