



Agribusiness Handbooks

vol. 7

Milk Production / Processing

This publication was prepared by the FAO Investment Centre under the FAO/EBRD cooperation agreement to provide quick technical and economical reference material to EBRD's agribusiness team in sub-sectors where they often work. Focus was given to the Bank's countries of operation in Eastern Europe and the Commonwealth of Independent States, with indicators of technical and economical performance in other regions of the world noted for comparison.

The series of handbooks contained in this publication cover specific agribusiness sub-sectors, with information on production and processing techniques, costs and margins, world production, prices and trade trends. Data were collected from a number of official and unofficial sources as indicative information that should be interpreted with caution, and do not imply the expression of any opinion by FAO concerning the economic situation of countries mentioned.

(October 1999)

1- Milk Production

1.1. General information

For humans, the substances in milk provide both energy and the building materials for growth. Milk also contains antibodies that protect against infection. Its main constituents are water and fat. Besides the fat content, the term "Solids Not Fat (SNF)" is used in discussing the composition of milk. SNF is the total solids content less the fat content; mainly proteins, lactose (type of sugar) and minerals (salts). The respective quantities of the constituents can vary considerably between dairy animals of different types and breeds. Milk production from cows is by far the most important worldwide as illustrated in the following table.

1998 Milk Production WorldWide		
(in millions of tons)		
Cows	466.4	85.5%
Bufalo	57.4	10.5%
Goat	12.2	2.2%
Sheep	8.2	1.5%
Camel	1.3	0.2%
Total	545.5	100.0%

Source: FAO Statistics.

For more than 25 years, until the end of the 1980s, world production grew regularly by about 1-1.5% per year. After two years of sharp decline in 1991 and 1992, the production started growing again but at a much lower pace of 0.5% yearly. Production levels are now roughly equivalent to those of 1990 but close to 10% of the total production has changed hands. North America and Europe (at large) are still the main producers but their combined share of the world total has decreased from 75% in 1970 to 60% today. In particular, the aggregated production of the Eastern European, Balkan and CIS countries has decreased by 49 million tons. On the other hand, South America and South Asia have increased their respective shares of the world total. The following table shows the main milk producers in 1998.

Main Milk Producing Countries		
Countries	(millions of tons)	
	1998	
U.S.A.	71.4	13%
India	68.0	12%
Russia (Fed)	32.2	6%
Germany	28.5	5%
France	25.2	5%
Pakistan	22.0	4%
Brazil	21.8	4%
World	545.5	100%

Source: FAO Statistics.

According to FAO estimates, the Eastern European, Balkan and CIS countries account for around 20% of milk production worldwide. Poland is the largest producer in Eastern Europe with around 11,8 million tons in 1998, an increase of slightly more than 3% over 1997 and which is the result of growth in both herd sizes and yields. The number of dairy cows was estimated at 3.5 million heads in 1998, mainly located in the northern and eastern parts of the country where the natural conditions are more favorable to dairy production. It is reported that around 1,665 dairy farms (about 10% of total) have five or more cows and account for close to half the national production. It is also worth noting that as much as a quarter of all the Polish milk produced remains on the farm, of which 80% is reportedly used for auto-consumption and the 20% left for feeding the livestock (see next chapter for yields). In the CIS countries, the two largest milk producers are Russia and Ukraine. In Russia, partly because of the depreciation of the ruble and of the resulting higher prices of the imported dairy products, domestic dairy production has expanded over the last years. The number of dairy cows was estimated at 15 million at the beginning of 1998 and milk production at 32.2 million tons for the whole year, almost half of which reportedly from private farms. In the case of Ukraine, milk production for 1998 was estimated at 12.7 million tons with the share from private farmers increasing while that from former larger-scale state farms decreasing.

Milk production in Croatia has always been based on small farmers keeping less than five cows. During the 1991-95 war with Yugoslavia, more than 100,000 cows (out of 450,000) were killed and most of the few former state farms were destroyed. In 1997, the number of dairy cows was estimated at 304,000 and production at 669,000 tons. In Romania for the same year, the number of dairy cows was estimated at 1.8 million and the production at 5.1 million tons. In both countries, the small size of the dairy farms is holding back development. Sanitary control and supply collection are probably the most important issues to be resolved.

In the Czech Republic, milk production was estimated at 2.7 million tons in 1997 which resulted in an oversupply (given the stagnating domestic demand) and a crisis in the dairy sector. The Government tried unsuccessfully to set minimum prices and production decreased to 2.6 million in 1998. In Bulgaria, cow milk production was estimated at 1.2 million tons in 1997. The recovery from the low levels of 1995-97 is constrained by the small size of the dairy farms and the limited possibilities for the development of pluri-annual fodder crops due to still incomplete land restitution process.

1.2. Milk yields

The following table shows the average cow milk yields in selected countries for 1996. Milk yields in Central and Eastern Europe were about 60% of the Western European average. However, these yields are expected to increase to around 4,000 kg/cow by Year 2005 due to growth in both herd sizes and yield. For 1997, the average yields in Croatia and Romania were estimated at 2,200 and 2,833 kg/cow respectively. In Russia, the average yield for 1998 is estimated at 2,146 kg/cow, resulting in an annual growth rate of slightly more than 4.5% over 1996. For Ukraine, the yield deteriorated to 2,082 kg/cow in 1997 from its 1996 level. In several of the CIS countries, milk producers are struggling to sustain their herds as state support for the dairy sector is deteriorating steadily due to a chronic lack of public finance. Moreover, the market prices paid to the producers are often too low to justify reinvesting in dairy activities (see later).

Average Cow Milk Yields	
(kg/cow/year)	
Countries	1996
U.S.A.	7,483
European Union	5,432
Australia	4,582
Central/Eastern Europe	3,400
Poland	3,225
Russia	1,960
Ukraine	2,198

Source: "Centre national interprofessionnel de l'économie laitière" and European Union.
N.B.: One kg of milk is equivalent to one liter.

1.3. Milk prices

The following table shows selected producer price ranges for various countries. A large part of the price variations are due to differences in the fat content of the milk delivered. There are also large price variations within any given year because both the supply and demand are highly seasonal. Moreover, the prices paid by the market can vary substantially according to hygiene considerations as well as the compositional quality. For instance, the dairies in Poland started paying bonuses - and also applying deductions - when a system of four grades of milk was introduced at the beginning of 1998 (see later). Finally, exchange rate fluctuations can lead to incorrect conclusions. Consequently, straight comparisons between countries and types of milk are extremely difficult.

Current Producer Prices in Various Countries	
Countries	US¢/kg
Japan	61 - 70
European Union	26 - 55
Croatia, Czech Rep	26 - 35
Bulgaria, Slovakia	21 - 25
Poland, Romania, Russia Fed	16 - 20
Australia/New Zealand	10 - 15

Source: Country Reports from the European Commission.

In Portugal, milk payments to producers are based on composition, volume and bacteriological quality. The payments at the collecting points (see later) can range from 27 to 30 US¢/kg, depending mainly on the quantities delivered, for milk with 3.7% fat content. In Poland, the average producer price in 1998 was in a range of 17 - 20 US¢/kg (3.7% of fat content). Only small price increases have been reported so far in 1999. In the case of Croatia, the average price paid by the dairies to producers is equivalent to 27 US¢/kg for milk with 3.6% fat content. This includes a state subsidy equivalent to 9 US¢ and is clearly not sustainable over time from a public finance viewpoint.

1.4. Key production costs

The production costs can vary substantially depending on the structure of the dairy herds (holdings). For example, in 1993, the average herd size in the European Union (Community of 12 members then) ranged from four cows in Portugal and nine in Spain to 40 in Denmark and 69 in the U.K. The average herd size is now seven cows in Portugal and less than five cows in Croatia and Poland. Generally speaking, dairy development in the Eastern European countries is constrained by the limited size of the herds but there is a clear evolution towards larger holdings in order to maximize economies of scale and minimize production costs. Ultimately, the profit margins to producers depend in large part on the milk yields obtained and the producer prices paid.

In Croatia, it is estimated that the total production cost of one kg of milk with 3.6 fat content is the equivalent of 28 - 26 US¢ for a holding (farm) of five cows with yields of 2,600 - 3,500 kg/cow. This cost declines to 27 - 24 US¢ in the case of ten cows. Since the average price paid to producers is equivalent to 27 US¢/kg, including 9 US¢ in state subsidy (see earlier), only the producers with ten cows and yields of 3,500 kg/cow can hope to make some profit. Without the subsidy (which is unsustainable), the situation is even more precarious. Only the progressive producers with large herds (perhaps 20 cows) and good yields (perhaps 3,500 kg/cow) can get attractive financial returns, at least until cow milk yields and/or the overall purchasing power of the Croatians have substantially improved. This overall situation is fairly representative of dairy production in most of the Eastern European countries. It is somewhat more critical in the CIS countries because of the often worse economic conditions.

For illustrative purposes, the following table shows the breakdown of various production costs in Croatia for 1997. The most important costs are related to the provision of animal feeds and to the necessary farm labor. The originators of this table (see source) concluded that milk production is not financially viable for farms that have not developed their own forage production and with yields below 3,500 liter/cow.

Breakdown of Production Costs for Milk Holdings in Croatia						
Farm size	(in HRK/kg)					
	5 cows		10 cows		20 cows	
Material costs						
Purchased animal feed	0.02	1.0%	0.06	3.4%	0.11	6.6%
Animal feed produced on farm	1.06	55.2%	1.05	59.3%	1.02	61.4%
Other	0.04	2.1%	0.06	3.4%	0.05	3.0%
Farm labour	0.23	12.0%	0.18	10.2%	0.12	7.2%
Hired labour/services	0.21	10.9%	0.14	7.9%	0.16	9.6%
Total	1.56	81.3%	1.49	84.2%	1.46	88.0%
Fixed costs						
Amortization	0.15	7.8%	0.12	6.8%	0.08	4.8%
Insurance	-		0.05	2.8%	0.06	3.6%
General expenses	0.21	10.9%	0.11	6.2%	0.06	3.6%
Total	0.36	18.8%	0.28	15.8%	0.2	12.0%
Grand total	1.92	100.0%	1.77	100.0%	1.66	100.0%

Source: Croatian Faculty of Agronomy, 1997.

2- Milk Collection

2.1. Collection systems

In former times, the dairy was close to the farm and milk was delivered twice a day. But as the dairies grew larger, their catchment areas grew wider and the average distance from farm to dairy grew longer. Now, collection every two or three days is not uncommon. Milk should be handled in a closed system to minimize the risk of infection. It must be chilled quickly to a maximum of 4°C as soon as it is produced and then kept at that temperature until processed. If not, the micro-organisms in the milk will start to multiply and the quality of the end product will be adversely affected. All equipment coming into contact with milk must therefore be thoroughly cleaned and disinfected.

For illustrative purposes, the following table shows the quantities of cow milk collected in various countries for 1997. The European Union, as a block, collects/markets by far the largest quantities of milk in the world. The average tonnage of milk collected by dairy plant was 17,000 tons for the Union in 1994 (12 members then). This average varied from 1,200 tons in Greece to 552,400 tons in the Netherlands.

Cow Milk Collection in Various Countries	
	(millions of tons)
Countries	1997
European Union	113.2
U.S.A.	70.7
Russia	13.0
New-Zealand	10.5
Australia	9.3
Poland	6.8
Ukraine	4.8
Czech (Rep)	2.7
Hungary	1.6

Source: Centre national interprofessionnel de l'économie laitière

Generally speaking, in Southern and Eastern European countries, there are three main (often coexisting) types of collection systems:

- i) From small farms to cooling points – the farmers bring the raw milk twice a day to a cooling point equipped with a refrigerated tank normally managed by a villager on behalf of a cooperative,
- ii) From farms to collection centers – the farmers brings the raw milk every day to a collection center owned by a cooperative and equipped with refrigeration (and sometimes milking) facilities,
- iii) From large farms directly to dairies – the raw milk is cooled on the farm in a refrigerated tank (owned or rented by the farm owner) and collected daily or every other day by a tanker owned by a dairy,

In Portugal, the tanks at the cooling points are for less than 500 liters at the time. Farmers at a maximum distance of one km of the collection centers bring their cows for milking. The refrigeration facilities can accommodate between 500 and 1,000 liters at the time. The Portuguese cooperatives normally provide a range of services to farmers - ex: technical assistance and training, supply and maintenance of equipment and sometimes financial support. In Poland, milk deliveries were estimated at 8,8 million tons in 1998 of which 79% was collected for the dairies and the remaining 20% sold directly to consumers or to small (street) shops. In the case of the milk collected for the dairies, it is estimated that around 85% of the quantities are handled through collection centers where the milk is sampled, tested, cooled and stored in either an insulated or refrigerated tank. There exist four grades of milk in Poland based on three factors: i) the total viable counts (quantity with no antibiotics), ii) the somatic cell count, and iii) the temperature. The first grade complies with the quality requirements of the European Union and the lowest grade is associated with the very small milk producers.

2.2. Key collection costs

The following table shows indicative investment costs for cooling and milking equipment at a collecting center in two different cases for Poland; i) serving up to 20 cows with very basic milking/cooling, and ii) serving 30 cows and plus with larger-scale milking and refrigeration equipment. The total cost in each case could include all the elements listed or only part of them according to the specific needs. These costs could be up to US\$ 1.2 million in the first case (up to 20 cows) and US\$ 8.4 million in the second case (30 cows and plus).

Indicative Investment Costs					
	Equipment	Capacity	Unit Cost	Number	Total Cost
For up to 20 cows	Refrigerated	550-750 liters	\$3,000	40	\$120,000
	bulk milk tanks	800-1,100 liters	\$4,500	30	\$135,000
	Milking	2-3 unit	\$12,000	40	\$480,000
	equipment	4 unit+	\$15,000	30	\$450,000
For 30 cows and plus	Refrigerated	550-750 liters	\$3,000	300	\$900,000
	bulk milk tanks	800-1,100 liters	\$4,500	200	\$900,000
	Milking	2-3 unit	\$12,000	300	\$3,600,000
	equipment	4 unit+	\$15,000	200	\$3,000,000

Source: ADAS Consulting Limited, England.

The collection costs are directly related to the collection density – i.e. the average number of liters collected by km. For instance, Lacticoop is one of the largest dairy cooperatives in Portugal and collected 180 million liters from 8,149 producers in 1997. The density was 86 liters per km and the collection cost 2 US¢/liter. The Lura Group is by far the largest dairy plant in Croatia. Its own milk collection system is based on 1,576 points equipped with cooling tanks and, in most cases, the farmers bring their own milk to the collection points twice a day. The collection density is estimated to be very low at 60 liters per km. Lura's cost breakdown for milk collection is as follows:

Breakdown of Collection Costs	
(in US¢/liter)	
Base price paid to farmer	20
Quality premium	2
Collection cost	3
Transport cost	3
Total	28

Source: Lura Group

As in the case of the dairy holdings, there is a clear evolution towards an aggregation/consolidation of the collection systems in order to maximize the collection density and minimize the costs. In several Southern and Eastern European countries, there is also a tendency for the dairy plants to integrate vertically (i.e. set up their own collection systems) so that they better control their supply of raw milk in terms of quantity as well as quality.

3- Milk Processing

3.1. Process description

In the dairy, the raw milk passes through several stages of treatment in various types of processing equipment before reaching the consumer in the form of a finished/refined product. In modern dairies, production usually takes place continuously in a closed process line where the main components are joined together by a system of pipes. The design of a process system always involves compromises between different aspects: i) product-related; mainly the quality of the raw milk and of the end product, ii) process-related; mainly the availability of heating and cooling media, and iii) economic; mainly the various costs of production. Chilling, clarification and pasteurization are compulsory stages for the manufacture of consumer milk products in almost all countries.

Butter is essentially the fat of the milk and its production remains the most important use of the whole milk (around 35% of the total quantity worldwide). Other dairy products, by order of importance, are cheese and fresh products (around 55% of total whole milk), cream, concentrated milk and milk powder. Skimmed milk is released during the process of defatting the whole milk to obtain cream – the starting point for butter production. Subsequently, skimmed milk is used in various ways; in liquid form (returned to farms) as animal feed; in dehydrated form as skimmed milk powder, the bulk of which ends up also in animal feed; in the manufacture of other milk products (together with whole milk) and, after fragmentation into casein, as protein in the agri-food and chemical industry.

3.2. World Exporters / Importers

The world trade of dairy products is dominated by the European Union, New Zealand and Australia. Concerning exports, the Union has gradually lost ground to the benefit of the two others; particularly for butter, cheeses and milk powder. However, each country's dependence

on milk trade varies significantly; New-Zealand exports 90% of its production, Australia 50% and the Union 10%. 1998 was a difficult year with the continuation of the economic crisis in Southeast Asia and Russia. This situation has led to a decline of the overall demand for dairy products in these countries; mainly milk powder in Russia and butter and cheeses in Southeast Asia. The following tables show the main exporting and importing countries of dairy products.

Main Exporting Countries of Dairy Products			
	1997		
Countries	Millions of tons	Billions of US\$	
Germany	4.4	4.6	16%
France	2.4	4.1	14%
Netherlands	1.8	3.8	13%
New-Zealand	1.2	2.5	9%
Benelux	1.6	1.9	7%
Denmark	0.5	1.5	5%
Australia	0.7	1.3	5%
Ireland	0.5	1.3	5%
World	17.9	28.6	100%

Main Importing Countries of Dairy Products			
	1997		
Countries	Millions of tons	Billions of US\$	
Germany	1.6	3.5	12%
Italy	2.8	2.7	10%
Netherlands	1.8	1.9	7%
Benelux	1.2	1.9	7%
France	1.4	1.9	7%
Spain	0.6	0.8	3%
U.K.	0.7	1.6	6%
Mexico	0.3	0.6	2%
Russian (Fed)	0.6	0.6	2%
Hong Kong	0.3	0.5	2%
Greece	0.2	0.5	2%
World	17.3	28.1	100%

Source: FAO Statistics.

The World Trade Organization's Uruguay Round Agreement has had important consequences for the trade in dairy products; mainly an increased access for all members to the major markets and a reduction in the volume/value of subsidized exports. The following tables show the trade balance in 1997 for the main dairy products in selected countries.

1997 Trade Balance for Butter				
Countries	(thousands of tons)			
	Production	Exports	Imports	Consumption
European Union	1742	210	80	1658
Russia (Fed)	250	5	275	510
Poland	176	13	6	169
Ukraine	120	70	3	55
Romania	12	0	2	14

1997 Trade Balance for Cheeses				
Countries	(thousands of tons)			
	Production	Exports	Imports	Consumption
European Union	6506	500	107	6113
Russia (Fed)	150	2	200	344
Poland	145	16	3	133
Ukraine	45	2	1	46
Romania	95	0	0	95

1997 Trade Balance for Skimmed Milk				
Countries	(thousands of tons)			
	Production	Exports	Imports	Consumption
European Union	1193	305	60	938
Russia (Fed)	170	40	60	190
Poland	123	90	3	35
Ukraine	30	0	0	30

Source: Centre national interprofessionnel de l'économie laitière

In accordance with its obligations under the Uruguay round, the European Union reduced its subsidy rates in 1996 and 97 but raised them again in 1998 mainly due to adverse conditions in world markets. The Union's exports of butter and cheeses declined due to the reduced demand in Russia following the currency depreciation. Nevertheless, dairy products remain a significant part of the Russian diet, even despite the fact that the domestic production (especially whole milk products) is often not pasteurized and must be consumed within a short period of time. There will still be a market for imports in the coming future because Russia is saddled with low technology, aging fixed assets and lacking in sufficient quantities of quality ingredients. The quality of Russian milk is such that the output of milk products per unit of raw milk is about one-half the level of Western Europe. Ukraine, because of its closeness to Russia and the tariff exemptions within the CIS, is Russia's second largest butter supplier (see previous tables).

Within the Eastern and Central European countries, there was a surplus of around two million tons of milk equivalent (over consumption) in 1997. For the coming future, Poland is expected to have the largest quantities of dairy products available for export. In 1997, the Polish net trade surplus of butter, cheeses and skimmed milk was 107 million tons of merchandise (see previous tables). On the other hand, Croatia cannot produce enough to cover its domestic demand and imported around 250 thousand tons of milk equivalent in 1997.

3.3. Prices of dairy products

The following table shows world export prices for butter, cheeses and skimmed milk powder. As reflected in the projections for 1999, the average prices are now lower than those of 1997 because of stock overhangs in exporting countries and reduced purchasing power as a result of currency depreciation in a number of major importing countries, particularly Russia. The relatively optimistic projections for Year 2001, in the case of cheeses and milk powder, are based on the assumption of a gradually growing demand for imports due to improved economic conditions in the importing countries. Retail prices generally vary more markedly than wholesale values, largely because of the wider differences in (mostly in-land) transport and marketing costs. Comparisons, in an international currency, between Eastern and Central European countries can be misleading given the large and sometimes erratic exchange rate fluctuations. In any event, an important consideration for investment is the existing trade barriers in the countries. For instance, Poland was subject to a European Union's ban on milk and milk products in 1998 since two dairy plants inspected did not meet ECU standards for import. In the case of Croatia, a 20% custom duty is levied on imported milk powder as well as a tax of around US\$1/kg. Imported liquid milk is subject to a 10% import tax. For Russia, the depreciation of the ruble may discourage imports but the Government's gradual relaxation of import regulations (non-tariff barriers) has probably limited the extent of the decline.

World Export Prices for Dairy Products			
Products	(US\$/100kg)		
	1997	1999	2001
Butter	179	175	166
Cheeses (mainly cheddar)	220	215	225
Skimmed milk powder	176	172	195

Source: OECD. FOB export prices from Northern Europe. Years 1999 and 2001 are projections.

3.4. Key processing costs

The structure of dairy plants - and therefore of processing costs - can vary substantially depending on the countries. In some cases, ex: Denmark and Uruguay, market concentration is taking place through a consolidation of national dairy companies. In other cases, ex: Venezuela and Chili, international dairy companies acquire and then expand national dairies. A number of dairy companies - especially Western European ones for which domestic milk production is limited by quotas - are investing in low-cost Eastern European and CIS countries. For instance, Ehrmann, Campina and Danone have plans to build dairy-processing facilities in Russia using locally produced ingredients. They are also starting to promote products at more affordable prices and modified to cater for traditional Russian tastes, as well as those of the neighboring countries.

The following two tables illustrate indicative investment and operating costs for two sizes of dairy plants; the first one with an annual throughput of 5,000 tons of raw milk and the second one with a throughput of 50,000 tons. The first one is prefabricated and in modular form. The second one has high capital costs because most of the equipment is of sanitary, stainless steel construction and requires a building designed to meet high standards of hygiene.

For the first type of plant, the investment costs are around US\$ 1.2 million and the operating costs close to US\$ 1 million per year. The plant's output could be of the order of 9,300 kg of pasteurized whole milk, 10,000 kg of sour milk and 700 kg of pasteurized cream per day. The investment and operating costs for the second type of plant are around US\$ 13.5 million and US\$ 9 million per year respectively. The plant's output could be 120 tons of whole milk, 40 tons of standardized milk, 2 tons of skim milk, 4 tons of whipping cream and 15 tons of cultured milk per day. In both cases, the most costly production inputs are the raw milk, the packaging materials and the labor. An adequate quantity and quality of these inputs greatly depend on the local conditions in the host country. Another key-factor is the quality of water that is required in large quantities. The respective financial profitability of the two plants is obviously a direct function of the local market costs/prices of the inputs and outputs (FOB prices if exported).

Dairy Plant					
(5,000 tons of raw milk per year)					
Investment Costs		Operating Costs			
		Consumption		Cost	
		Inputs	per day	\$ per year	
Civil Works	\$22,000	Raw milk	20,000 L	500,000	53%
Building Modules	\$335,950	1/2 L cartons	10,000	148,000	16%
Process, mechanical, electrical works	\$783,200	Labor		118,000	12%
Engineering and project control	\$69,000	1 L cartons	9,300	83,000	9%
Total costs (excluding land)	\$1,210,150	Cream cups	700	29,000	3%
		Electricity	1,220 kWh	30,500	3%
		Spare parts		18,000	2%
		Water	56.5 m3	14,125	1%
		Compressed a	490 Nm3	3,700	0%
		Chemicals		1,800	0%
		Waste hauling		2,000	0%
		Miscellaneous		2,000	0%
		Total costs		950,125	100%

Source: Actimon SA, Switzerland.

Dairy Plant					
(50,000 tons of raw milk per year)					
Investment Costs		Operating Costs			
		Inputs	Consumption per hour	Cost	
				\$ per year	
Civil Works	\$2,310,000	Raw milk	20,833 kg	5,000,000	54%
Process, mechanical and electrical works	\$9,570,000	Packaging materials		2,000,000	22%
Engineering and project control	\$1,650,000	Labor		1,058,000	11%
Total costs (excluding land)	\$13,530,000	Water	120 m3	288,000	3%
		Steam	4,000 kg	268,000	3%
		Electricity	1,000 kW	240,000	3%
		Spare parts		100,000	1%
		Refrig. Energy	2,725 MJ	83,000	1%
		Chemicals		50,000	1%
		Waste hauling		50,000	1%
		Compressed air	200 Nm3	14,400	0%
		Miscellaneous		100,000	1%
		Total costs		9,251,400	100%

Source: Alfa-Laval Food Engineering AB, Sweden.

3.5. Other relevant information

The following table shows the consumption per capita in 1996 for milk, butter and cheeses in selected countries. In the Eastern and Central European countries, the average per capita consumption was 164 kg of milk equivalent for 1997. This average is expected to increase to 172 kg in Year 2005. Per capita consumption of milk and milk products in Russia has declined since the beginning of the 1990s. It was estimated at 266 kg in 1997 compared to 385 during Soviet times. But the Russian consumption can vary significantly by regions – for example, European Russia consumes much greater quantities than most of Siberia and of the Russian Far East. Hungary and the Czech Republic reportedly consume around 180-190 kg per capita/year, Croatia 160-170 and Yugoslavia 140.

Consumption per Capita for 1996			
Countries	(in kg)		
	Milk	Butter	Cheeses
U.S.A.	101.8	2.0	13.7
France	75.4	8.3	23.3
Hungary	58.0	1.1	-
Poland	86.4	3.0	9.5
Russia	96.9	3.0	-
Ukraine	-	1.7	1.9

Source: Centre national interprofessionnel de l'économie laitière

Urbanization is normally characterized by the provision of electricity, and hence the potential for developing an extensive refrigeration system, which is of particular importance for a highly perishable product such as milk. This allows households to shift from tinned and dried milk products to the wide range of dairy products that can be found in city supermarkets. In terms of the consumers' preferences, the most important factors are: i) the importance of the brand (known quality and quantity), ii) the positive image of the brand (emphasis on health benefits and service quality), and iii) the range of choices offered (combinations of fat content, enriched or flavored in varying ways).