AGRIBUSINESS HANDBOOKS

Agribusiness

Investment Centre

AGRIBUSINESS HANDBOOKS

First Edition

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FOREWORD

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 indications of technical and economical performance in other regions of the world noted for comparison.

The booklet is organized in separate handbooks covering 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 and have an indicative nature. It should therefore be noted that the content of the handbooks does not commit FAO's technical expertise and should be interpreted with caution. It also does not imply the expression of any opinion by FAO concerning the economic situation of countries mentioned.

Many thanks to all who kindly accepted to contribute to the elaboration of this document.

September 1999

Population ('000 people)

	1995	2000[1]	2005[2]	% rural population in 1995
Albania	3 383	3 493	3 616	62.8
Armenia	3 632	3 662	3 773	31.4
Azerbaijan	7 531	7 828	8 116	44.3
Belarus	10 352	10 284	10 169	28.9
Bosnia Herzg	3 569	4 338	4 361	58.9
Bulgaria	8 509	8 306	8 110	31.7
Croatia	4 505	4 485	4 449	44.2
Czech Rep	10 263	10 195	10 126	34.6
Estonia	1 488	1 418	1 374	27.0
Georgia	5 450	5 418	5 424	41.7
Hungary	10 106	9 811	9 541	35.4
Kazakhstan	16 817	16 928	17 311	40.4
Kyrgyzstan	4 460	4 543	4 742	61.2
Latvia	2 536	2 397	2 299	27.2
Lithuania	3 736	3 690	3 645	28.0
Macedonia	2 156	2 233	2 306	40.2
Moldova Rep	4 437	4 458	4 508	48.4
Poland	38 557	38 727	39 000	36.3
Romania	22 728	22 505	22 251	44.1
Russian Fed	148 460	146 196	143 618	24.1
Slovakia	5 338	5 372	5 408	41.2
Slovenia	1 925	1 914	1 894	48.7
Tajikistan	5 828	6 398	7 036	67.8
Turkmenistan	4 075	4 479	4 907	56.1
Ukraine	51 757	50 801	49 903	29.8
Uzbekistan	22 762	25 018	27 402	58.9

source: FAO Stat Database

[1] estimates

[2] projections

Land Use in 1997 ('000 ha)

	Total Area	Agricultural Land[1]	*% of total*	Arable Land	*% of Ag. L.*	Irrigated Land	*% of Ag.L.*
Albania	2875	1126	*39.17*	577	*51.24*	340	*30.2*
Armenia	2980	1280	*42.95*	494	*38.59*	290	*22.66*
Azerbaijan	8660	4270	*49.31*	1672	*39.16*	1455	*34.07*
Belarus	20760	9346	*45.02*	6175	*66.07*	115	*1.23*
Bosnia Herzg	5113	2000	*39.11*	500	*25*	2	*0.1*
Bulgaria	11091	6159	*55.53*	4312	*70.01*	800	*12.99*
Croatia	5654	2312	*40.89*	1317	*56.96*	3	*0.13*
Czech Rep	7886	4276	*54.22*	3095	*72.38*	24	*0.56*
Estonia	4510	1454	*32.24*	1128	*77.58*	4	*0.28*
Georgia	6970	3071	*44.06*	781	*25.43*	470	*15.3*
Hungary	9303	6122	*65.81*	4820	*78.73*	210	*3.43*
Kazakhstan	271730	221801	*81.63*	30000	*13.53*	2149	*0.97*
Kyrgyzstan	19850	10420	*52.49*	1350	*12.96*	1074	*10.31*
Latvia	6460	2540	*39.32*	1800	*70.87*	20	*0.79*
Lithuania	6520	3513	*53.88*	2946	*83.86*	9	*0.26*
Macedonia	2571	1296	*50.41*	609	*46.99*	55	*4.24*
Moldova Rep	3370	2557	*75.88*	1784	*69.77*	309	*12.08*
Poland	32325	18707	*57.87*	14059	*75.15*	100	*0.53*
Romania	23839	14798	*62.07*	9300	*62.85*	3089	*20.87*
Russian Fed	1707540	219609	*12.86*	126024	*57.39*	4990	*2.27*
Slovakia	4901	2446	*49.91*	1478	*60.43*	190	*7.77*
Slovenia	2025	788	*38.91*	231	*29.31*	2	*0.25*
Tajikistan	14310	4480	*31.31*	760	*16.96*	720	*16.07*
Turkmenistan	48810	32364	*66.31*	1630	*5.04*	1800	*5.56*
Ukraine	60370	41861	*69.34*	33081	*79.03*	2466	*5.89*
Uzbekistan	44740	27646	*61.79*	4475	*16.19*	4281	*15.49*

source: FAO Stat Database

[1] data 1994

GDP & GNP per capita

	GDP at market prices (current US$) (mill)		Agriculture, value added (% of GDP)		GNP per capita (current US$)	
	1993	1997	1993	1997	1993	1997
Albania	1221	2460	54.6	62.6	330	760
Armenia	2195	1628	51.4	40.6	340	560
Azerbaijan	4640	4399	20.7	21.9	660	510
Belarus	26958	22629	18.3	14.1	2900	2150
Bosnia Herzg	-	-	-	-	-	--
Bulgaria	10833	10085	10.0	23.3	1250	1170
Croatia	11693	-[1]	12.9	12.4	2370	4060
Czech Rep	31185	52035	6.2	-	2690	5240
Estonia	4011	4682	11.0	7.2	2720	3360
Georgia	3279	5244	58.6	31.6	940	860
Hungary	38610	45725	6.8	6.0	3520	4510
Kazakhstan	25810	22165	17.5	12.0	1590	1350
Kyrgyzstan	4315	1764	41.0	44.6	570	480
Latvia	5315	5527	11.8	7.4	2260	2430
Lithuania	6100	9585	14.9	12.8	2250	2260
Macedonia	1939	2201	10.5	12.0	1020	1100
Moldova Rep	4463	1872	32.5	31.4	-	460
Poland	85995	135659	6.6	6.4	2250	3590
Romania	26359	34843	20.7	19.6	1190	1410
Russian Fed	393449	446982	8.0	8.0	2770	2680
Slovakia	11984	19461	6.1	4.8	2140	3680
Slovenia	12678	18201	5.2	4.6	-	9840
Tajikistan	2950	-[2]	-	-	500	330
Turkmenistan	5708	-[3]	-	-	1290	640
Ukraine	71285	49677	21.7	12.3	1400	1040
Uzbekistan	21962	25047	32.2	30.6	970	1020

source: FAO Stat Database & World Bank

1 18,081 in 1995

2 1,675 in 1995

3 4,302 in 1995

Food and Agriculture Organization of the United Nations

European Bank for Reconstruction and Development

Agribusiness Handbooks

vol. 1

Barley / Malt / Beer

In Mesopotamia, clay bars more than 5 000 years old have been found, explaining brewing process of the time. «Beer's bread» was made out of germinated barley seeds. Brewers prepared SIKARU by crumbling beer's bread into water. After boiling and addition of a few herbs, Sumerians brewers obtained a bacteriologicaly safe drink.

Time after time, the starch used for the brewing process has been originated from maize (Amerindian), soya (Hindoo and Persian), millet and sorghum (African), rice (Far East), but nowadays beer production from barley's malt is the most common worldwide.

1- BARLEY CULTIVATION

1.1. Key production parameters

- Two main types of barley**: winter** (2 or 6 rows) **and spring** (2 rows) **sorts**. Advantage of winter sorts is that the grain is mature earlier, which ensures the brewers with a continuing supplying at a time when they become partially out of stocks from the past year.
- The main risk factors for winter sorts are ears' freezing during growing period and over-warming during maturation. **Temperate** climate is ideal for barley.
- Barley adapts to a wide variety of **soils**, and is for example less sensible than wheat to dryness or poor land. Planting after wheat is particularly convenient.
- **Planting** period runs from mid October until mid December for winter sorts, while spring sorts are generally planted in March - April. Density of grain sown varies from 200 to 350 / m², depending on the density objective for the crop.
- The **growing season** depends a lots of the variety. Winter sorts complete their development cycle with a cumulative temperature over zero between 1900 and 2000°C, while spring sorts need only 1500 - 1700°C.
- **Harvesting** from mid July to mid August for winter barley and during the three last weeks of August for spring varieties.
- According to FAO Statistics, world-wide **yields** averaged 2355 kg/ha in 1996. However, depending on climatic, variety and cultivation conditions, specifics yields can vary as much as between 800 and 7500 kg/ha; irrigation in particular contributes to increased output.

Illustrative Yields in 1995 and 1997 (tons/ha)

	Brazil	*Spain*	*Belgium*	*Russian Fed*	*Bulgaria*	*Romania*	*USA*	*France*
1995	1.69	2.90	7.54	1.64	2.95	3.12	1.09	5.89
1997	2.51	2.23	7,02	1.32	1.58	2.19	1.38	5.87

sources: FAO STAT

NB: spring sorts are generally 10-15% less productive than winter sorts.

1.2. Total world production & main producers

Area Cultivated and Production of Barley in Main Producing Countries and Regions

Country or region	1995			1997		
	Area ('000 ha)	Production ('000 tons)	% world prod.	Area ('000 ha)	Production ('000 tons)	% world prod.
Russian Federation	16 404	27 054	17	12 000	15 900	10
Ukraine	5 092	14 509	9	3 417	5 714	4
Germany	2 070	10 903	7	2 208	12 074	8
France	1 402	7 898	5	1 530	9 163	6
Spain	3 540	7 416	5	3 574	10 660	7
U.K.	1 106	5 950	4	1 267	7 785	5
Denmark	704	3 446	2	783	4 196	3
Other EEC	2 326	11 806	7	2 358	9 764	6
Eastern Europe	2 520	11 459	7	2 213	9 923	6
Among which:						
Bulgaria	*390*	*1 143*		*290*	*459*	
Hungary	*423*	*1 558*		*326*	*930*	
Poland	*1 032*	*2 686*		*1 155*	*3 573*	
Czech Rep.	*640*	*2 419*		*603*	*2 305*	
Romania	*551*	*2 134*		*513*	*1 100*	
Slovakia	*238*	*874*		*240*	*960*	
Canada	4 092	11 690	7	4 928	15 812	10
USA	2 698	8 161	5	2 747	8 640	5,5
Turkey	3 500	7 000	4.5	3 650	8 000	5
Kazakhstan	6 053	6 497	4	3 640	2 696	2
Belarus	1 257	3 012	2	935	2 184	1,5
China	1 600	4 500	3	1 600	4 100	2,5
Morocco	2 582	3 720	2	2 430	3 831	2,5
Others	15 254	16 465	9,5	17 220	24 858	16
World Total	**72 700**	**161 500**	**100**	**66 500**	**155 300**	**100**

source: FAO STAT

Collectively the EU is the largest producing area. Russian, once the world's largest producer, had seen a steady drop in production from 27 million tonnes in 1992 to 15,9 million in 1997.

In FSU and Eastern Europe, the best growing areas are Poland, Czech Rep., Romania, Baltic States, Ukraine, Western Russia.

1.3. Key production costs

For an average yield of 5,3 ton/ha obtained in UK in good cropping condition with availability of all necessary good quality inputs, the variable costs per ha are roughly as follows:

Seeds	Fertilisers	Sprays	Fuel	Machinery	Salaries	Others	**TOTAL**
US$ 75	US$ 90	US$ 150	US$ 105	US$ 230	US$ 40	US$ 20	**US$ 710**

source: Farm Management Pocketbook - John Nix - 29th edition September 1998

Typical breakdown for sprays: herbicides 40%, fungicides 45%, growth regulators 15%.
On the top of those costs must be added operative costs for machinery and its depreciation.

1.4. Barley sale's prices

Malting Barley Quarterly Average Prices / EU - cif - lower Rhine
(US$ per tonnes)

1995-96	1996-97	1997-98
151	134	125

source: Cereals and Oilseeds Review Vol.22, No1

In September 1998, global barley prices dropped to their lowest level in over four years, with French barley falling to US$ 115/tonne Fob.

Malting barley prices assumes a premium over feed of around 10-20%.

US farmer's barley prices US$ 2,25 - 2,65 per bushel in 1997/98
US$ 2,75 per bushel in 1996/97

1.5. Average margins for producers

Average margins for producers highly depend on the level of **subsidies** for sunflower cropping. In the EU for example, the subsidies amount up to US$ 80/tonne. At a grain sale's price of US$ 130 per ton and a yield of 5,3 ton / ha, the general output is (130 + 80) x 5,3 i.e. US$ 1 110 / ha.

Gross margin for production of barley is 1 110 - 710 = **US$ 400 / ha**

In the calculation of producers' margins, **straw** should not be forgotten, as it is an important valuable by-product of major cereal cultivation. Average yield is approximately 2,75 tonnes per ha, value US$ 20 to 80 per tonne according to region and season.
It contributes to **increase producers' gross margin by US$ 100 per ha** cultivated in average.

1.6. Main barley importers and exporters

Major importers 1996	'000 tons
Saudi Arabia	3 900
Japan	1 732
China	1 454
Belgium	1 418
United States	1 044
Netherlands	933
others	9 459
World Total	**19 940**

Major exporters 1996	'000 tons
France	2 920
Germany	2 713
Canada	2 316
Australia	2 030
Russian Federation	1 603
United Kingdom	1 475
others	6 883
World Total	**19 940**

source: FAO STAT

1.6. Other relevant information

- Increasing concern world wide in the food industry today over both the ***pesticide residues*** in raw materials and their effect on the process and quality of end products. In the malting and brewing industry, the ability of residues on malting barley to affect both process performance and quality of malt and beer have been demonstrated. To guarantee final product quality, official evaluations of chemical residues are being introduced in several countries. Accordingly it allows the unique use of those pesticides with no undesirable effect.
- ***13%*** of barley produced world-wide is ***processed into malt*** (20 million tons on a total average production of 160 million tons). The main use of barley is fodder for livestock.
- To be used in the malting / brewing industry, barley must fulfil the following criteria:
  - high germination capacity
  - purity in the variety
  - graded grain
  - low protein content

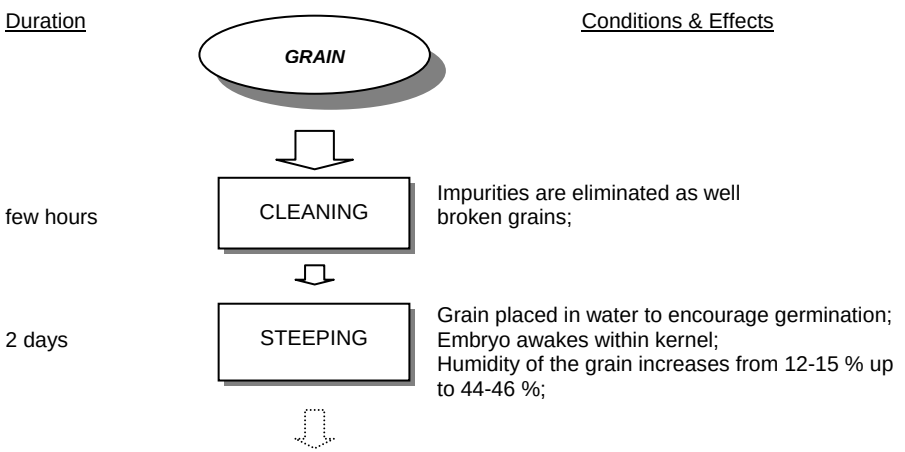
2- PROCESSING INTO MALT

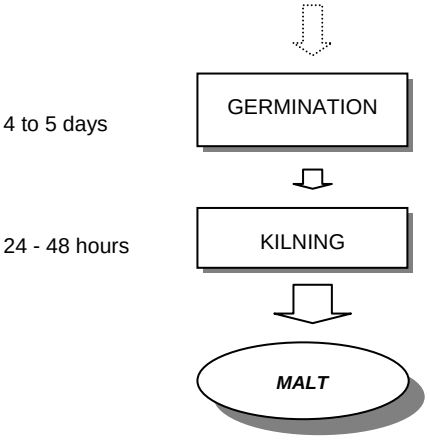
Processing into malt is an essential step which allows the use of barley grains into the brewing process. In bio-chemical terms:

- it disintegrates the envelopes of the small nucleus containing starch chains;
- it produces enzymes (diastase) which will remain inside the germinated grains.

2.1. Process description

The processing cycle is completed in approximately 7 days





2.2. Conversion factors from raw material

Approximately **120 to 130 kg of barley** grains are necessary to obtain **100 kg of malt** (depending on grain quality and purity). The average ratio used is 1,267.

2.3. Key processing costs

The following economic considerations are for illustrative purpose only (European standard plant).

Illustrative Operating Cost for Malt Production
(Assumptions: 8 700 h per year operation - annual processing capacity of 80 000 tons barley)

Item	Ratio per ton barley	Cost US$/ton barley
barley	1 ton	135
fuel energy	750 kWh	22.5
electricity	130 kWh	13
water	7 m^3	7.7
spare parts	lumpsum	3
miscellaneous, analysis	lumpsum	1
labour (50 people)	(USD 20 000/year)	12.5
Total direct operating costs		**194.7**

source: Groupe Souflet

Raw barley amounts for as much as 70% of the global malt production costs.

2.4. Malt sale's price

Malt Quarterly Average Prices

(US$ per ton - basis FOB, bulk, cash payment)

	1995-96	1996-97	1997-98	1998-99
spring	400	300	280	200
winter	375	280	260	180

source: H.M. Gauger monthly market report

The market for malting barley is rather unstable, with large price fluctuations.

Demand for beer, which has been affected by the economic slow down in Asia, Latin America and Russia, should begin to recover as these economies get back on their feet, which provides considerable upside potential for malting barley and malt prices in 1999-2000.

2.5. World production & main processors

World processing and Trade of Malt ('000 tons)

Country or region	PROCESSING INTO MALT				EXPORTS		IMPORTS	
	1995	1996	1997	%	1995	1996	1995	1996
China	2 660	2 870	3 225	18.2	9	8	26	37
US	2 231	2 275	2 276	12.9	119	164	45	49
Germany	2 024	2 010	1 999	11.3	402	441	454	429
UK	1 553	1 524	1 452	8.2	393	365	86	88
France	1 277	1 284	1 199	8.6	1 032	1 001	23	42
Canada	633	698	742	4.2	327	357	10	15
Benelux	633	743	722	4.1	473	643	100	74
Australia	547	588	608	3.4	305	324	55	45
Spain	470	453	475	2.7	77	58	18	12
Czech Rep.	434	403	389	2.2	182	205	1	8
Japan	226	289	382	2.2	-	-	720	763
Mexico	263	297	344	1.9	-	-	90	103
Argentina	230	260	307	1.7	80	88	18	7
Slovakia	210	178	236	1.3	56	150	-	-
Russian Fed.	292	192	257	1.4	2	-	36	123
Brazil	290	258	256	1.4	1	3	478	690
Netherlands	228	219	231	1.3	106	110	270	226
Poland	150	163	183	1	-	1	96	108
Others	2 341	2 241	2 422	11.8	642	662	1 695	1 872
World Total	**16 692**	**16 945**	**17705**	**100**	**4 040**	**4 430**	**4 040**	**4 430**

source: FAO Stat

(a) intra EU trade is excluded

Beer consumption growth world-wide is expected 1-2% par annum, which implies JVs creation, acquisitions of local companies and/or construction of own plants in CEE and other new promising markets.

Over the world, there is a large number of malt processing companies. Nevertheless, tendency is for consolidation and mergers, with two top players accounting for 70% of production. Among the largest are:

- Conagra (USA)
- Cargill (USA)

account for 17% of the world production

- Soufflet (France)
- Malteurop (France)
- Lesaffre (France)

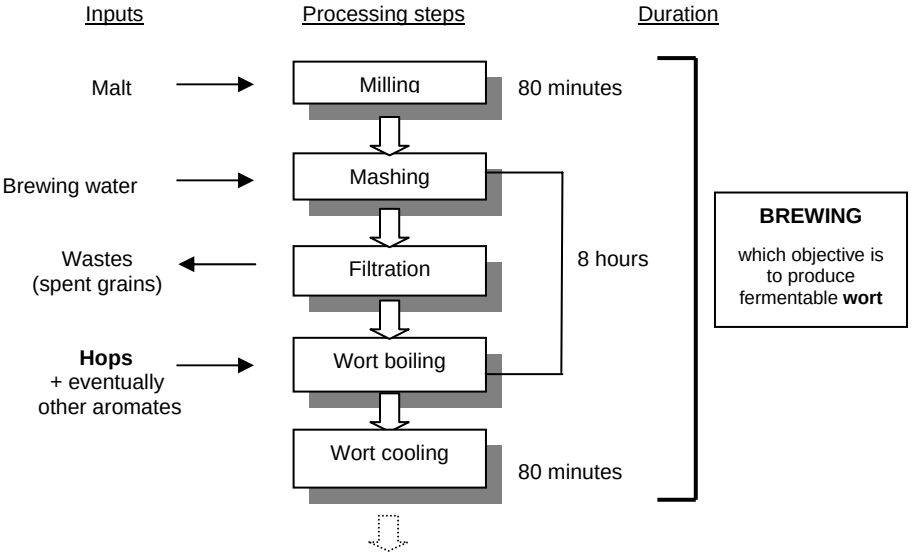
2.7. Other relevant information

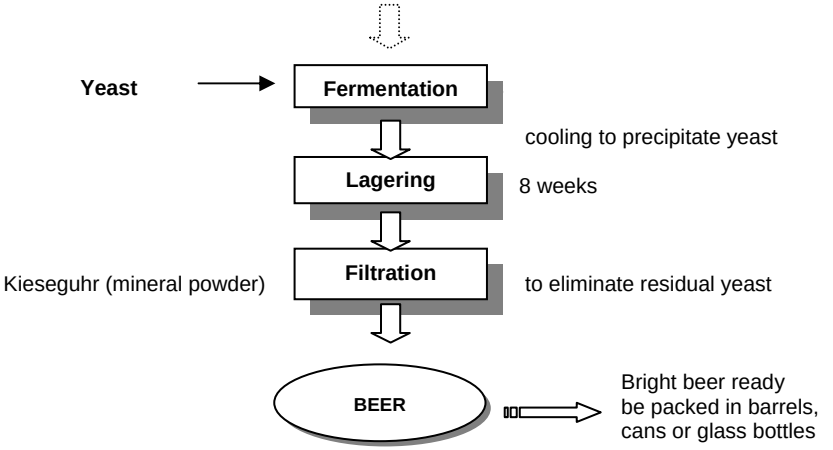
Barley malt is also used in the manufacture of some whisky, snacks, sauces, chocolate powders, etc…

3- BREWERY / BEER PRODUCTION

3.1. Process description

Beer is a fermented beverage. The sugar needed for the fermentation process comes from the transformation of the starch contained into the grain through the effect of specific enzymes contained into the malt





3.2. Conversion factors from raw material

To produce **one hectolitre of beer**, from **12 to 19 kg of malt**, 600 litres water, 200 grams hops and a little yeast are required.

NB: Beer is a fermented beverage. Sugar required for the fermentation comes from the transformation of grains' starch.

3.3. Key processing costs

The following economic considerations are for illustrative purpose only (European standard plant).

Illustrative Operating Cost for Beer Production
(Assumptions: 6 200 h per year operation - annual processing capacity of 400 000 hl)

Item	Ratio per hl beer produced	Cost US$/hl beer produced
malt	18 kg	5.0
hops (cones)	0.15 kg	0.5
yeast (thick)	0.6 l	0
fuel	150 MJ	0.7
electricity	12 kWh	1.2
water	0.7 m^3	0.3
waste water treatment	0.55 m^3	1.1
spare parts	lumpsum	1.2
miscellaneous, analysis	lumpsum	1.3
labour (120 people)	(USD 20 000/year)	6.0
Total direct operating costs		**17.3**

source: private

3.4. Average margins for processors

Breakdown of Mature Brewer's Costs

Sales price	Total variable costs (=32)		Total fixed cost (=48)		Depreciation maintenance	Interest	Taxes	Net Profit
	Raw material	Transport	SG&A	Salaries				
100	28	4	24	24	8	2	4	**6**

source: EBRD

In a lot of countries, alcoholic beverages are subject to State taxes. There are significant differences from one market to another, for example beer taxes versus retail price represent 5% in Argentina, while amount up to 52% in Canada (average). This affects seriously brewers' margins.

3.5. World production & main processors

World Beer Production and Trade ('000 hectolitres)

Country or region	BREWING			EXPORTS		IMPORTS	
	1996	1997	%	1996	1997	1996	1997
USA	234 800	236 430	18.9	6 785	7.848	13 216	16 642
China	163 176	186 600	15	1 313	709	1 889	280
Germany	114 237	114 800	9.2	7 634	9.231	2 776	3 166
Brazil	88 546	66 000	5.3	756	751	1 500	997
Japan	67 903	71 789	5.8	330	603	2 735	1 321
UK	58 448	59 139	4.7	1 862	3 654	4 734	5 483
Mexico	47 179	51 372	4.1	3 846	6 180	225	329
South Africa	24 812	24 900	2	700	391	5	229
Spain	24 716	24 879	2	402	594	2 104	2 001
Netherlands	23 494	24 706	2	10 167	12 166	1 610	940
Canada	22 517	22 355	1.8	859	3 529	3 595	1 017
Russia	20 100	25 200	2	40	-	1 938	-
Colombia	18 500	10 700	0.9	26	26	250	401
Australia	17 424	17 349	1.4	448	463	108	168
France	17 140	19 483	1.5	1 433	2 147	3 480	4 319
Poland	16 528	19 300	1.5	176	115	58	131
Belgium	14 180	14 014	1.1	4 545	4 417	612	646
Romania	8 235	7 538	0.6	10	7	435	58
Hungary	7 259	7 170	0.5	157	59	138	141
Others	256 819	243 326	19.5	20 298	8 948	14 913	18 409
World Total	**1 262 840**	**1 247 050**	**100**	**62 067**	**61 868**	**56 357**	**58 178**

source: Brasseurs de France & FAO Stat.

(a) intra EU trade is excluded

Over the world, there are a very large number of brewery companies. Among the largest are:

	Production 1996 (million hl)	*Production 1997*
• Anheuser Busch (US)	107	121
• Miller (US)	51	53
• Heineken (NL)	42	74
• Brahma (Brazil)	38	41
• SAB (UK)	38	43
• Interbrew (B)	33	37
• Carlsberg (DK)	32	34
• Kirin (Japan)	32	29
• Modelo (Mexico)	27	30

3.6. Other relevant information

Beer in % of global (world-wide) beverage consumption (1994)

	Tea	Liquid dairy products	Carbonated soft drinks	**Beer**	Coffee	Packed Water	Juice nectar	Wine	Spirits
billion litres	230	210	140	115	100	65	55	20	5
%	25%	22%	15%	**12%**	10,5%	7%	6%	2%	0,5%

source: AMS, TLMS estimates

- World beer consumption has more doubled from around 600 million hl in 1970 to over 1.2 billion hl today and is expected to continue to grow by around 1,2% par annum for next several years.

Evolution of beer annual consumption per capita in different regions of the world between 1980 & 1995

Geographic area	**Northern America**		**Europe**		**South America**		**Asia**	
Date	1980	1995	1980	1995	1980	1995	1980	1995
Liters	80	74	62	55	22	52	4	10

source: AMS

- In the past, the mash tuns were made out of copper, but nowadays, they are mostly in stainless.

- Beer coloration (white, blond - Pils -, amber or brown - Lager -) depends on the level of roasting of the malt used in the fabrication process. The more roasted is the malt, the darker the beer is.

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European Bank for Reconstruction and Development

Agribusiness Handbooks

vol. 2

Sunflower / Crude and Refined Oils

1- SUNFLOWER CULTIVATION

Sunflower (*Helianthus annuus* L.) is a composite annual plant. It probably originated in the south-west United Sates-Mexico area. It was introduced into Europe in the 16th century and became established as an oil-seed crop in Eastern Europe. The discovery of cytoplasmic male sterility in 1968 made possible the efficient production of hybrid sunflowers with high oil content. Biotechnological advances also increase productivity significantly.

1.1. Key production parameters

- Mainly produced in warm temperate regions,
- Frost will damage sunflower at all stages of growth. The plant grows well within a **temperature** range of 20-25°C; temperatures above 25°C reduce yields and oil content of the seeds.
- It is drought resistant, but yield and oil content are reduced if plants are exposed to drought stress during the main growing and flowering periods. Sunflower will produce moderate crops with as little as 300 mm of **rain**, while 500-750 mm are required for better yields
- It adapts to a wide variety of **soils**, but performs best on good land with high levels of management inputs. Good maize or wheat land is ideal.
- The average fatty acid composition of oil from temperate sunflower crops is 55-75% linoleic acid and 15-25% oleic acid. Protein content is 15-20%.
- **Planting** in the Eastern Europe and FSU takes place during March and April.
- Sunflower has one of the shortest **growing seasons** of the major cash crops of the world. Early maturing varieties are ready for **harvesting** 90 to 120 days after planting and late maturing varieties 120 to 160 days. Delayed harvesting causes unwelcome changes in oil quality with an increase in free fatty acid content. The seeds are ready to harvest when the heads turn black or brown and the seed moisture content reaches 10-12%. Grain combines are fairly easily adapted for the harvesting of sunflowers by the addition of a head snatcher.
- The average global **yield** is1210 kg/ha. However, depending on climatic and cultivation conditions, specific yields can vary as much as between 600 and 3,000 kg/ha; irrigation under certain conditions contributes substantially to increased output.

Illustrative Yields During the Period 1994-1998 (tons/ha)

	Argentina	*Spain*	*Italy*	*Russian Fed*	*Bulgaria*	*Romania*	*USA*	*France*
1994	1.87	0.72	2.33	0.81	1.21	1.31	1.58	2.08
1996	1.72	1.07	2.13	0.71	1.05	1.19	1.61	2.24
1998	1.59	1.02	2.48	0.72	1.20	1.11	1.57	2.18

sources: FAO STAT

1.2. Total world production & main producers

Area Cultivated and Production of Sunflower Seed in the Main Producing Countries and Regions

Country or region	1996			1998		
	Area (million ha)	Production (million tons)	%	Area (million ha)	Production (million tons)	%
Russian Fed.	3.87	2.76	11	4.17	3.02	12
Argentina	3.23	5.56	23	3.17	5.06	21
EEC countries	2.62	3.92	16	2.48	3.75	15
Other Eastern Eur.	2.31	3.07	12	2.22	2.83	12
Ukraine	2.03	2.12	9	2.43	2.26	9
India	2.09	1.23	5	2.20	1.50	6
United States	1.01	1.63	7	1.34	2.10	8
Turkey	0.58	0.78	3	0.64	0.90	4
China	0.72	1.29	5	0.78	1.20	5
Others	2.19	2.33	9	1.84	1.98	8
World Total	**20.65**	**24.69**	**100**	**21.27**	**24.60**	**100**

sources: FAO STAT

1.3. Key production costs

For an average yield of 2.8 ton/ha obtained in Romania in good cropping condition with availability of all necessary good quality inputs, the variable costs per ha are roughly as follows:

Seeds	Fertilisers	Sparys	Fuel	Machinery	Land Rent	Salaries	Others	**TOTAL**
US$ 30	US$ 70	US$ 55	US$ 35	US$ 190	US$ 100	US$ 30	US$ 10	**US$ 520**

On the top of those costs must be added operative costs for machinery and its depreciation. Drying cost are rather high, approximately US$ 80 / ha or US$ 50 / ton seeds.

1.4. Sunflower seeds sale's prices

Sunflower Seed Quarterly Average Prices / EU - CIF - lower Rhine (US$ per ton)

	Oct/Dec	Jan/Mar	Apr/Jun	Jul/Sep	Oct/Sep
1995-96	334	302	309	304	312
1996-97	262	256	298	249	266
1997-98	294	337	326	279	309
1998-99	293	/	/	/	/

source: Oil World Statistic Update (January 29, 1999)

1.5. Average margins for producers

Average margins for producers highly depend on the level of **subsidies** for sunflower cropping. In the UK for example, the subsidies amount up to US$ 460 / ha. At a seed sale's price of US$ 290 per ton and a yield of 1.7 ton / ha, the general output is (290 x 1.7) + 460, i.e. US$ 950.

Gross margin for production of dried ready to store sunflower seeds is 950 - (520+80) = **US$ 350 / ha**

1.6. Other relevant information

Approximate proportions of shell and kernel, and oil content of whole seed, kernel and shell

		% oil in		
% kernel	% shell	whole seed	kernel	shell
70 - 75	25 - 30	43 - 50	50 - 60	1 - 2

source: Prolea (F) - technical documentation

The average yield of oil obtained by mechanical extraction from sunflower seed is 35 % from unshelled seed of normal moisture content (9%) and 42,5% by pre-press and solvent extraction.

2- SUNFLOWER SEEDS PROCESSING: CRUDE & REFINED OILS

2.1. Process description

a) **Drying and storage**

- Seeds dry easily and once dried (i.e. with less than 9% moisture content) store well. Storage time increases with seed dryness.
- It is liable to damage by insects and other storage pests. On-farm storage must take these factors into account, otherwise losses can be extremely high. Drying temperatures of 50-70°C are suitable and do not affect the oil content.
- Because of its light weight, sunflower seed requires more storage volume than heavier crops. For the same reason, transportation equipment must be voluminous enough, in order to achieve economic transport in bulk. (A truck holding 24 tons of wheat, for example, will hold only 14 tons of sunflower seeds.)

b) **Crude oil extraction**

- Cleaning and drying in large dryers/coolers, which reduce moisture content to about 9% and cooling

- Shelling and separation of shells in a series of crackers and bed screens, leaving about 8-12% shells in the kernels and a maximum of 1.5% kernels in the shells. Shells are generally compacted and used as fuel for boilers.
- Secondary drying, after which the kernels are flaked in order to break the seed cells and increase the oil extraction yield.
- Crude oil can be obtained through pressing only (mechanical), or by solvent (hexane) extraction. In the practise, the combination of those two methods exits, but tends to disappear. Pressing is effected in an expeller or a large screw press, which extracts up to 80% of the oil, while through solvent, extraction reaches up to 99%. Pressing, as well as solvent extraction, can be practised either on decorticated or non decorticated seeds.
- The meal which is the by-product of the extraction process, is constituted of the defatted matter and is fairly rich in protein: 30 to 40 %. In the case of a solvent extraction, it contains less than 1% residual oil, while it is much fatter when resulting from pressing. The meals are used in animal feed to balance the proteïn content. To this purpose, they are generally pelletised and named sunpellets.

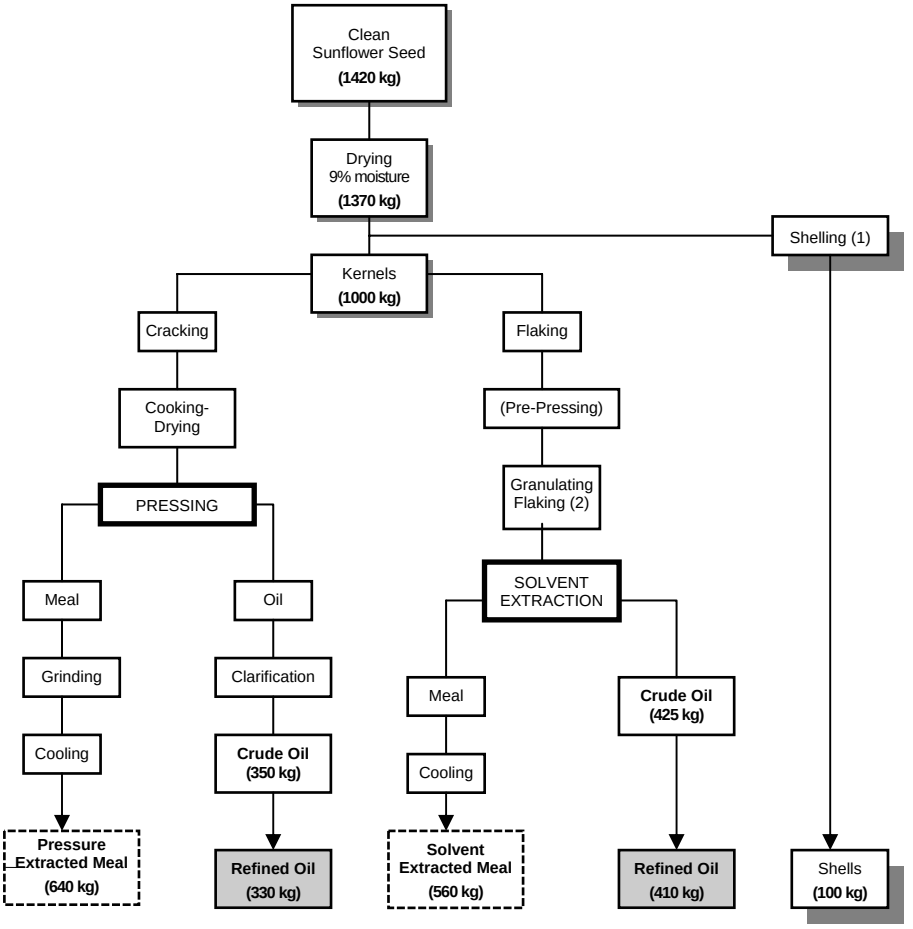
c) **Refining**

- Sunflower seed oil obtained by solvent extraction is easy to refine; the basic refining steps are: degumming, neutralising, drying, bleaching, deodorising and dewaxing. Oil obtained only through pressing just needs dewaxing.
- Degumming is effected by the addition of hot water and centrifugation.
- Sunflower oil is commonly neutralised by addition and mixing of caustic soda under controlled conditions, which neutralises the free fatty acids.
- Bleaching (colour removal and purification of the oil) is usually achieved with neutral clay or bentonite (acid-activated earth), while deodorisation consists of a steam-stripping of the oil at high temperature and under high vacuum.
- Dewaxing is made by a winterisation process which cools the oil to crystallise the wax and removes the wax crystals by filtration.
- If not dewaxed, the oil may appear cloudy and wax may settle out. For consumer-grade cooking and the manufacture of food products oil must be fully refined and winterised.

2.2. Conversion factors from raw material

The figures in the diagram next page illustrate the average processing conditions in the E.U. for 44% oil content seeds.

(see next page)



(1) Shelling is optional. When carried out, 1/2 of the shells only can be removed, which implies a loss in weight by 10%.
(2) Granulating or Flaking are optional.

2.3. Key processing costs

The following economic considerations are for illustrative purpose only (European standard plant).

- A 1000t/day sunflower **oil extraction plant** costs approximately US$ 50 million; it represents a relatively high capital investment because highly explosive hexane vapours, always present in the process area, require that all electrical equipment be of explosion-proof design. Key factors that will affect profitability of the operation are: price of sunflower seeds and cost of fuel.

- The average toll fee for crushing non decorticated seeds in the E.U. is about 30 US$/ton, of which 7 US$ are for variable costs (salaries, depreciation, operation & maintenance).

Illustrative Operating Cost for Extraction
(Assumptions: 7 200 h per year operation - annual processing capacity of 300,000 tons sunflower seeds)

Item	Consumption per hour	Cost '000 US$/yr.	Cost (1987) US$/ton sunflower seeds
sunflower seeds	41.7 tons	87,000	290.0
fuel energy	33,360 Mj	2,400	8.0
electricity	1,500 kW	1,080	3.6
water	30 m3	220	0.7
hexane	50 kg	110	0.3
spare parts		450	1.5
waste water treatment		300	1.0
miscellaneous, analysis		150	0.5
labour (60 people)		1,050	3.5
Total direct operating costs		**92,760**	**309.1**

source: Food factories: processes, equipment, costs - Bartholomai, A. - 1987

- A 50 t/day sunflower **oil refinery** costs approximately 20 cents/kg of product (annual capacity); it also represents a relatively high capital investment, because most of the equipment is of sanitary, stainless steel construction, and requires a building designed to meet high standards of hygiene. It also requires trained operators and good quality control to ensure a product of acceptable flavour, stability, odour and colour.

For example, the average toll fee for fully refined and winterised sunflower crude oil in EU ranges between 80 and 100 US$/ton (refined oil).

Illustrative Operating Cost for Refinery
(Assumptions: 6000 h per year operation - annual production capacity of 10,800 tons of cooking oil)

Item	Consumption per hour	Cost '000 US$/yr.	Cost (1987) cents/kg product
crude oil	2 tons	6,900	63.9
caustic soda	2 kg	22	0.2
bleaching earth	40 kg	132	1.2
filter aid	10 kg	22	0.2
fuel energy	320 MJ	192	1.8
electricity	70 kW	42	0.4
water	3 m^3	18	0.2
chemicals	1 kg	7	0.1
spare parts		35	0.3
miscellaneous		10	0.1
labour (35 people)		305	2.6
Total direct operating costs		**7,685**	**71**

source: Food factories: processes, equipment, costs - Bartholomai, A. - 1987

2.4. Sunflower crude oil and meal sale's prices

Sunflower Crude Oil Quarterly Average Prices / any origin - ex tank Rotterdam (US$ per ton)

	Oct/Dec	Jan/Mar	Apr/Jun	Jul/Sep	Oct/Sep
1995-96	688	593	603	583	617
1996-97	525	519	584	551	545
1997-98	672	707	820	720	730
1998-99	666	/	/	/	/

source: Oil World Statistic Update (January 29, 1999)

As an example, sunflower seed oil exported from the USA is traded under the American Fats and Oils Association Rule No. 14, which provides that:
"Crude Sunflower seed oil shall be pure and produced only from sunflower seed of fair and average quality by mechanic or solvent extraction processes. The buyer shall receive an allowance of 0.1 per cent of the invoice value for each 0.1 per cent of free fatty acid in excess of 2 per cent; fraction in proportion".

Sunflower Meal Quarterly Average Prices / pellets 37/38% protein, Arg./Urug. - CIF Rotterdam (US$ per ton)

	Oct/Dec	Jan/Mar	Apr/Jun	Jul/Sep	Oct/Sep
1995-96	146	145	161	152	151
1996-97	154	136	138	123	138
1997-98	139	108	86	78	103
1998-99	83	/	/	/	/

source: Oil World Statistic Update (January 29, 1999)

Sunflower seed meal values are mainly classified by their protein content. The Grain and Free Trade Association (GATFA) Trading Rule No. 100 is the rule most frequently applied in the world trade in sunflower seed meal; it specifies a minimum protein-plus-fat content, with the specific level of protein/fat designated at the time of sale. Other characteristics are negotiated on an individual contract basis.

2.5. Average margins for processors

It is not very meaningful to calculate average margins for processors, since margins vary a lot from case to case. For the purpose of that calculation, the following price data should be collected:

- seed delivered to the factory
- the crude oil ex tank factory
- the meal ex factory
- the refined oil

Once these data are collected, one should apply the following yields:

- 42.5% of crude oil in the seeds
- 56% of meal in seed
- loss of 5% of crude oil for refining

2.6. World production & main processors

More than 90% of sunflower seeds produced are processed into edible oil. Nevertheless, one type of edible sunflower seed is used directly for confectionery purposes. This seed is usually black with white stripes and is larger than the seed cultivated for oil extraction; the hull is heavier and less firmly attached to the kernel, and its oil content rarely exceeds 35%. In Eastern European countries as well as in FSU, edible seeds are used in the manufacture of a large number of food products, including desserts, cereals, ice creams, salad toppings and snacks. Part of the production of confectionery sunflower seeds (25% in the USA) is used as birdfeed.

World Crushings and Trade of Sunflower Seeds ('000 tons)

Country or region	CRUSHINGS			EXPORTS		IMPORTS	
	1998	1997	%	1998	1997	1998	1997
Argentina	5,501	5,408	24	499	65	25	4
EU countries (a)	5,223	5,921	26	104	105	2,007	2,313
Eastern Europe	2,121	2,509	11	225	349	96	66
Russian Federation	2,060	1,946	8	1,180	1,605	n.a.	n.a.
Ukraine	988	967	4	517	780	n.a.	n.a.
India	1,155	1,230	5	n.a.	n.a.	n.a.	n.a.
United States	1,007	906	4	265	117	30	19
Turkey	1,230	1,169	5	n.a.	n.a.	528	532
China	495	675	3	10	22	n.a.	n.a.
Others	1,860	1,947	10	162	192	286	339
World Total	**21,640**	**22,678**	**100**	**2,962**	**3,235**	**2,972**	**3,273**

source: Oil World Statistic Update (January 29, 1999)

(a) intra EU trade is excluded

In FSU and Eastern Europe, Rape, Flax Sunflower are cultivated as oil seed plants. The best growing areas are Moldavia, the southern Ukraine, the northern Caucasus, the central region of the Russian Federation, Bulgaria, Romania, Hungary and former Yugoslavia.
Over the world, there are a very large number of oil processing companies. Among the largest are:

- CARGILL (USA)
- ADM (USA)
- BUNGE & BORN (Argentina-Brazil)
- Erydiana / Béghin-Say (Italy)
- Louis DREYFUS (France)
- Continental Grain (USA)
- …

2.7. Other relevant information

Annual consumption of cooking oil (from various oil seed plants) ranges from 0,5 kg/capita in China through 10 kg/capita in Central America up to 35 kg/capita in Europe and the USA

Comparative importance of sunflower seed oil in the total world-wide vegetable seed oil production (cooking and industrial) / 1990-98

Soya beans	Cotton seed	Ground -nuts	Rape seed	**Sunflower seed**	Olive	Copra	Other (1)	TOTAL
45%	14%	10%	10%	**9%**	5%	3%	4%	100%

source: United State Department of Agriculture, World Seed Situation and Market Highlights (February 1988)

(1) Linseed, Sesame, Castor beans

Food and Agriculture Organization of the United Nations

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Wheat / Flour

1- WHEAT CULTIVATION

Wheat is grown in most parts of the world, from near-arctic to near-equatorial latitudes. It is unique among cereals since the total area under wheat cultivation world-wide is larger than for any other cereal and the amount of wheat traded internationally exceeds that of all other grains. Furthermore, the protein and caloric content of wheat is greater than in any other food crop. Most wheat is consumed in the form of baked goods, mainly bread. Hence, wheat grains must be milled to produce flour prior to consumption.

1.1. Key production parameters

- Although grown in various areas, wheat is best acclimated between 30 to 60° North and 27 to 40° South latitudes. While high-yield varieties respond best to controlled water conditions, optimal levels of rainfall for rainfed wheats are from 20" to 35" annually, with 4" to 6" falling during the two months prior to harvest.
- Wheat can be cultivated at elevations ranging from sea level to 10,000 feet. Although well-drained silt and clay loam soils are optimal, a wide range of soil types can be tolerated. Slightly acid soils (6.0 to 6.5 pH) are ideal. An average growing season temperature of 77° F (25°C) is optimal, although a range of 38 to 90° F (3.3 to 32°C) is acceptable.
- All wheats are annual plants. Spring wheats are planted in the spring, have a short growing season, less than 100 days, and are harvested in the fall. In contrast, winter wheats are planted in the fall, in areas with no excessive freezing. Following germination and development of an extensive root system, growth is halted in winter and revived in the spring. Harvest takes place in early summer.
- The main wheat types represent all possible combinations of hard and soft, red and white, and spring and winter categories. They all belong to the genus *Triticum aestivum*, subspecies *vulgare*. In addition, three other species are significantly represented in commerce; the *Triticum durum, compactum* and *spelta*.
- Average wheat yields range from around 6.0 tons per ha in Western Europe to 3.5 tons in Eastern Europe; with Croatia, the Czech Republic, Hungary, Slovakia and Slovenia registering yields of slightly more than four tons. Average yields are lower in Eastern Europe mainly because of the smaller size of the farms (less economies of scale), the low quality of seeds and the outdated farm machinery available. In addition, 1996 was a particularly bad year because of adverse weather conditions. The yields in CIS countries (ex: Georgia and Russia) are generally even lower than in Eastern Europe; although 1998 was a particularly bad year, weather-wise, for Russia.

Indicative Yields for the Period 1994-1998
(tons/ha)

	European Union	*China*	*Eastern Europe*	*Bulgaria*	*Romania*	*Georgia*	*Russia*
1994	5.4	3.4	3.3	2.8	2.5	1.3	1.4
1996	5.9	3.7	2.7	1.9	1.8	1.3	1.4
1998	6.0	3.7	3.5	3.0	2.6	1.3	1.0

Sources: FAO Statistics. The European Union comprising 15 countries.

1.2. Total world production & main producers

The following table shows the respective areas cultivated and the wheat production in the main producing countries of the word as well as in the European Union as a block. It is worth noting that the relative importance of the producing countries in the total has barely changed since 1994. France is the dominant producer within the European Union with close to 40% of the total production, followed by Germany with around 20%.

Wheat Production in Main Producing Countries

Country/ region	1994			1996			1998		
	Area (million ha)	Production (million tons)	%	Area (million ha)	Production (million tons)	%	Area (million ha)	Production (million tons)	%
China	29.0	99.3	19	29.6	110.6	19	30.0	110.0	19
E.U.	15.9	85.6	16	16.9	99.7	17	17.2	103.8	18
US	25.0	63.2	12	25.5	62.0	11	23.9	69.4	12
India	25.1	60.0	11	25.1	62.1	11	25.6	66.0	11
Canada	10.8	22.9	4	12.3	29.8	5	10.8	24.4	4
Australia	7.9	9.0	2	10.9	22.9	4	11.5	21.8	4
Others	101.7	187.5	36	110.7	195.6	33	105.4	193.4	32
World Total	**215.4**	**527.5**	**100**	**231.0**	**582.7**	**100**	**224.4**	**588.8**	**100**

Sources: FAO Statistics.

In Eastern Europe, as well as in the FSU, increased wheat production will mainly come from yield improvements in the existing largest producing areas.

- In Eastern Europe, the wheat areas with most potentials are in Romania, Bulgaria and Hungary. Poland has the largest wheat production but is closer to achieving potential yields – i.e. fewer possibilities in terms of improvements. In Romania, wheat cultivation is concentrated on the Moldavian Plateau, the Danube River flood plain, and the Central Romanian Plain. The land is flat and the soils potentially good to very good. The financing by the EBRD of a ship loading facility on the Black Sea cost, as well as the expansion by the WB of the berthing facilities in Constanza, should greatly improve the export possibilities. In Bulgaria, some 30% of the wheat production come from the Dobrogea region of the Danube flood plain, in the SouthEast of the country, where land suitability for wheat cultivation is excellent. It is estimated that wheat exports could double over the next five years.

- In the FSU, the wheat areas with most potentials are in the black and brown soils of a large belt formed by the central and southern parts of Ukraine plus the Central Chernozen, Povalzhsky, North Caucasus and Urals regions of the Russian Federation. It must be remembered that the federation has a vast territory and yield levels can be very different from one part to another. For instance, the Tatar registers yields of around 3.5 tons/ha whereas the NorthWest has yields of less than one ton/ha. Nevertheless, generally speaking, yields in the producing areas could at least be brought back to their historical levels of the Soviet period.

1.3. Key production costs

For illustrative purposes, it is assumed an average yield of 3.5 tons/ha of winter wheat grown in Eastern Europe under good cropping conditions with irrigation and a sufficient availability of quality inputs. On this basis, it is estimated that the total production cost per ton was in the range of US$ 70 - 100 per ton in 1998, depending on the country, the farm size and the level of mechanization. Generally speaking, the relative importance of the main production costs to the total could be as follows:

Structure of average variable costs for wheat production

Machinery Rental	Seeds	Fertilisers	Sprays	Water Charges	Labour	Others	**TOTAL**
15-20%	5-10%	30-35%	0-5%	5-10%	10-15%	35-5%	**100%**

Source: Farm Management Pocketbook - John Nix - September 1998

The necessary machinery for land preparation – and perhaps harvesting – could be owned by the farmer or, more often, rented from others. Labour comprises mainly hired manual workers although family members could perhaps substitute for part of it, say 20% of labour cost. Other costs could include a land tax as well as an annual amortization for small farm equipment. Obviously, the US$ equivalent of these costs could vary substantially from one year to another due to the evolution of the national currency in the country considered.

1.4. Wheat sale's prices

The following table shows the FOB prices of the main wheats for international export as well as the overall average FOB price of the various wheats exported by the European Union.

Export (FOB) Prices of Wheat
(US$ per ton)

	U.S. No.2 Hard Winter	U.S. No.2 Soft Red Winter	Argentina Trigo Pan	Average from European Union
1996-97	181	158	157	190
1997-98	142	129	137	158
March 1999	119	107	118	-

Source: International Grain Council and FAO Statistics.

Eastern Europe – taken as a block – both exports and imports wheat. The next table shows the overall average export (FOB) and import (CIF) prices for 1996 and 1997. Most of the imported wheat – total of 2.5 million tons in 1997 – originated from the European Union and Turkey. On the other hand, the exported wheat – total of 1.6 million tons and of lower quality – was delivered to various European and North African countries. Wheat exports from Eastern Europe are normally sold at a discount over Western Europe, mainly because of the quality risks and higher port/handling charges.

Average Prices of Wheat in Eastern Europe
(US$ per ton)

	Export (FOB) Price	Import (CIF) Prices
1996	184	203
1997	127	173

Source: FAO Statistics.

In a number of Eastern European countries, the State was still trying in 1997 to set official prices and enforce them through public purchases. For instance, the Bulgarian Government bought large quantities of wheat from producers at $87-134 per ton, depending on wheat quality. In 1998, most attempts at official price setting were abandoned and the private markets began to prevail. Farmgate prices paid by traders ranged from $80 per ton in Bulgaria to $120 in Romania.

1.5. Average margins for producers

The private markets for agricultural produce in the Eastern European and CIS countries are in full evolution and prices as well as profit margins tend to swing from one extreme to another from year to year. Moreover, food aid in some countries – for example in Georgia – has a depressive effect on prices. On the basis of various crop models available for a number of the countries, it would seem that the gross profit margins in 1998 for wheat producers were generally within the 10-20% range, excluding some parastatals in quasi-monopolistic situations. These margins are not expected to increase in the coming years, both because competition will intensify and, according to most forecasts, Western European wheat prices will not rise.

1.6. Other relevant information

In the CIS countries; Armenia, Azerbaijan, Georgia, Tajikistan, as well as remote areas of the Russian Federation, continue to need food aid. In Eastern Europe, the unprecedented exodus of refugees from the Kosovo Province to the surrounding countries also necessitate large-scale food aid. If not properly handled, the supply of food aid could have a depressive effect on domestic prices and discourage national production. On the other hand, a number of large exporting countries, such as Hungary, are facing restrictive policies from their neighbors on the basis that their markets are flooded with cheap grains. Tariff and non-tariff barriers in importing countries could become the single most important obstacle to export growth in the Eastern European and FSU countries.

2- PROCESSING INTO FLOUR

2.1. Process description

Most wheat is consumed in the form of bread or other baked goods that use flour as main ingredient. Flour is produced by milling, a gradual reduction process involving cycles of breaking, sifting, sorting and crushing the wheat kernels. In primitive milling operations, pairs of stones were used to reduce the grain to flour or meal. This process was revolutionized when grinding by rollers came into large-scale use in the late 1800s. The development in the

1960s of impact milling (with high-speed grinders) enabled further grinding of flour particles and the use of air classification (with swirling air tunnels) allowed the separation of flour particles that are too fine for sieving. A single flour could then be adapted to meet a variety of needs. Flour mills vary in capacity from 50 tons of wheat per day to 2,000 tons, although there are mills of lower or higher capacity. The latter are normally operated on an industrial basis, located close to a supply source (port or collection areas) and equipped with silos for storage.

Since flour quality depends to a large extent on the requirements of individual consumers, there is no internationally recognized set of standard grades. In Eastern Europe, grading is by mineral (ash) content. The lower the ash content, the purer the flour. For instance, Bulgaria has three official grades of flour: Type 500 (ash content of 0.5%), Type 700 (0.7%) and Type 1500 (1.5%). Principal determinants of flour quality include: protein, moisture and ash content, color, particle size, uniformity and favorable raising/elasticity characteristics. Much of the world production of wheat is used to make aerated breads, in part because wheat contains proteins of which gluten is essential to bread making. When wheat flours are in short supply, breads can be made from composite flours, up to 20% of total content – ex: a combination of wheat flour and rye, barley, bean or potato flours.

2.2. Conversion factors from raw material

Theoretically, a **flour yield** of 83% is possible but more common are yields **between 72 and 77%** (on a clean wheat basis). This can be increased to 90% if whole-wheat flour is produced - i.e. if only the coarsest brans are removed. Factors affecting the yield include the size and shape of the kernels, the thickness of the bran and wheat hardness. Soft wheats have higher flour yields. For instance, in Bulgaria, typical extraction rates are between 60% for small village mills to 75% for large-scale (industrial) ones. It must be remembered that wheat bran, the main by-product from milling, can also have a commercial use – mainly as animal feed – and therefore has a market value in addition to wheat.

2.3. Key production/processing costs

For illustrative purposes, the following table shows a breakdown of the main costs involved in the production of wheat flour at a typical mill in France, a dominant producing/exporting country (see 2.4). The comparable costs in Eastern Europe and CIS countries should eventually approximate this breakdown as the mills established become more active and competitive.

Production Costs for Wheat Flour	US$/100kg
Base price/cost of wheat	20.8
plus cleaning	1.8
Cost of clean wheat	22.6
plus milling costs (see hereafter)	3.0
Cost of flour: before adjustement for extraction	25.6
after adjustement for extraction 1/	33.7
minus sales of by-products	3.7
Flour cost/price at mill gate	**30.0**

Milling Costs	in %
Labor and related charges	40.2
Management/administration/office charges	33.1
Energy costs	7.5
Taxes and duties	6.5
Amortization of equipment/materials	6.0
Insurance	3.2
Maintenance and repairs	2.5
Others	1.0
TOTAL	**100**

Source: *L'Association nationale de la meunerie française* 1/ Extraction rate is 76%. **N.B.:** US$1 = 6FF

2.4. Wheat flour prices

There are no international markets for wheat flour and therefore **no internationally set prices**. The European Union is, by far, the main world producer/exporter (see later) and France the dominant exporter in the Union. In December 1998, the selling price of wheat was about $110 per ton (bulk) in Rouen/France. At the same period, the price of wheat flour (bagged) was $150-155 in Antwerp/Belgium – i.e. 1.38 X Wheat price. This ratio is officially fixed and derived from a European Union's decision that, for all marketing purposes, 0.73 tons of flour should equal one ton of wheat with 0.600% ash in dry substance. At the receiving end, the average import (CIF) price of wheat flour in Eastern Europe was around $181 per ton in 1995, $230 in 1996 and $210 in 1997. At the domestic level in these countries, the wheat supply to the mills is normally achieved through direct purchases from farmers, cooperatives and/or traders; there are no nation-wide markets. For instance, in the case of Bulgaria, the selling price of flour in 1998 varied from $176 per ton for Type 1500 to $203 for Type 500 (see 2.1). Flour imported into Bulgaria is subject to an import duty of 12% and a customs charge of 0.3%.

2.5. Average margins for processors

In Western Europe, mainly due to strong competition, the gross profit margin on wheat processing into flour is a **maximum of 7%**. In the Eastern European and CIS countries, cost accounting is still new and, consequently, clear/reliable cost data are highly fragmented when not contradictory. In most of the countries, there is evidence that small private mills are gradually taking business away from the existing ex-state (partly privatized) large mills. The latter group complains that the former have an unfair advantage because they often simply offer a service – i.e. milling in return for a charge, usually levied as a percentage of the wheat milled (ex: 15%). Consequently, the small mills frequently avoid the payment of the VAT, which is normally in the 20-25% range. It is estimated that the **gross margins in Eastern European countries are generally well above 20%**, suggesting a likely need for more transparent and stronger competition.

2.6. World production & main processors

As indicated in 2.4, the European Union is, by far, the main world producer/exporter of wheat flour with 6.2 million tons in 1996/97. Algeria, Yemen and Libya are the main world importers. As a group, the FSU countries imported 1.2 million tons or 12% of the total. Georgia, Russia and Azerbaijan were the main recipients in this group. In the case of Georgia, around 10% of the 360 thousand tons imported in 1996/97consisted of food aid.

Main Exporting & Importing Countries of Wheat Flour in 1996/97
('000 tons, wheat equivalent)

Countries	EXPORTS
European Union	6,249
Turkey	767
U.S.A.	664
Argentina	616
Canada	188
Australia	148
Others	1,847
World Total	**10,479**

Countries	IMPORTS
Algeria	1,208
Yemen	1,095
Libya	1,000
North Korea	401
Brazil	397
Hong-Kong	370
Vietnam	370
Georgia	360
Albania	355
Sudan	337
Russia	334
Others	4,252
World Total	**10479**

Source: FAO Statistics. Amounts include non-commercial shipments.

2.7. Other relevant information

The world market for wheat and wheat flour is relatively stable at 100 million tons (wheat equivalent) per year, with flour accounting for about 10% of the total. But the market is evolving gradually in terms of quality requirements, under the combined effects of i) higher levels of mechanization in the mills and bakeries and ii) the privatization of the importers. Quality now often commands a substantial premium and the market for flour is becoming segmented by types/varieties. Consequently, exporters must be prepared, more and more, to provide strict guarantees concerning the specificity/quality of their products.

Noise and dust pollution is commonly associated with flourmills. Investments in sound attenuation and air filtration are necessary although they add to the establishment costs of mills. There is a tendency for mill owners – including in Eastern European countries (ex: Romania) – to integrate vertically as a way of gaining economies of scale; i.e. to invest downstream of flour production, mainly in bakery. Proper/efficient management and accounting become then even more crucial than in the case of carrying out a single business, and are reported to be lacking. Moreover, in a number of these countries, the taxation system (ex: VAT) is quite confusing and needs to be improve (mainly made more transparent) before serious private investments can take place.

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Sugar Beets / White Sugar

1- SUGAR BEET CULTIVATION

It is thought that sugar (cane sugar) was first used by man in Polynesia. Sugar was only discovered by western Europeans as a result of the Crusades in the 11th Century. Sugar beet was first identified as a source of sugar around 1750. By 1880 sugar beet had replaced sugar cane as the main source of sugar on continental Europe.

About 30% of the world's supply of sugar is nowadays derived from sugar beet, the vast majority of which is produced in industrialised countries, while the 70% remaining are derived from sugarcane, mainly produced in developing countries, under tropical climates.

Annual consumption is now running at about 120 million tons and is expending at a rate of about 2 million tons per annum. The European Union, Brazil and India are the top three producers and together accounts for some 40% of the annual production.

1.1. Key production parameters

- Sugar beet is a **temperate climate** biennial root crop. It produces sugar during the first year of growth in order to see it over the winter and then flowers and seeds in the second year.
- It is therefore sown in spring and harvested in the first autumn/early winter (relatively long **growing season)**
- Sugar beet is a profitable crop which is always incorporated into a **rotation scheme**.
- A sugar beet factory can only be operated efficiently if the quality of the beet received is suitable for processing. Cultivation techniques and material inputs must therefore be adapted to the climate and soil types of the region.

As the season progresses in the average climatic conditions of Western Europe, changes occur in the crop before lifting, approximately as follows:

	harvest in Sept.	harvest in Oct.	harvest in Nov.	harvest in Dec.
Yield (ton of washed beet/ha)	up 3.75	up 1.9	down 1.25	down 1.25
Sugar content (%)	up 1%	up 0.25%	down 0.25%	down 0.75%
Yield of sugar (kg/ha)	up 1000	up 375	up 190	down 60

source: Farm Management Pocketbook - John Nix - September 1998

- The average global **yield** is 50 tons/ha. However, depending on climatic and cultivation conditions, specific yields can vary as much as between 30 and 70 tons/ha. Maximum yields can only be obtained when the spacing between rows and seeds within the rows has also been optimised.

Illustrative Yields During the Period 1994-1998 (tons/ha)

	Romania	*Poland*	*Ukraine*	*Russian Fed*	*Italy*	*UK*	*USA*	*France*
1996	21	39,4	18,3	15,2	44,9	52,3	45,2	67,8
1998	20,7	37,7	16	13,4	43,5	51,8	50,4	76

sources: FAO STAT

- Average composition of sugar beet:

	sugar (sucrose)	molasses (48% sucrose)	fibre (pulp)	water
(root without aerial leaves)	14,0%	3,7%	5,5 %	76,8%

1.2. Total world production & main producers

Area Cultivated and Production of Sugar Beets in the Main Producing Countries and Regions

Country or region	1996			1998		
	Area ('000 ha)	Production ('000 tons)	%	Area ('000 ha)	Production ('000 tons)	%
EEC (total)	*2 108*	*113 976*	*43*	*2 037*	*114 400*	*44*
France	460	31 211	12	413	31 407	12
Germany	515	26 064	10	503	26 940	10.5
Italy	273	12 250	5	287	12 521	5
UK	199	10 420	4	189	9 802	4
Spain	157	8 236	3	153	8 918	3.5
Other European (total)	*963*	*35 267*	*14*	*809*	*30 220*	*12*
Poland	452	17 845	7	401	15 100	6
Czech republic	104	4 315	1.5	85	3 722	1.5
Hungary	118	4 677	1.5	79	3 200	1.5
USA	535	24 204	10	587	29 628	11.5
Ukraine	1 260	23 008	9	1 000	16 000	6
China	656	16 726	7	510	14 000	5.5
Russian Federation	1 060	16 166	7	806	10 800	4
Turkey	422	14 543	5	500	20 000	8
Iran	149	3 686	2	191	4 754	2
Others	**498**	**7491**	**3**	**514**	**19 060**	**7**
World Total	**7 651**	**265 924**	**100**	**6 954**	**258 860**	**100**

sources: FAO STAT

Brazil, India, China and Australia are dominant in sugar cane production while Europe is dominant in sugar beet production with yearly 45-50% of total world production.

1.3. Key production costs

For an average yield of 50 ton/ha obtained in in good cropping condition with availability of all necessary good quality inputs, the variable costs per ha are roughly as follows:

Seeds	Fertilisers	Sprays	Machinery (contract)	Transport	Salaries	Others	**TOTAL**
US$ 190	US$ 200	US$ 245	US$ 230	US$ 300	US$ 130	US$ 50	**US$ 1 345**

source: Farm Management Pocketbook - John Nix - September 1998

On the top of those cost must be added operative cost and maintenance for machinery as well as its depreciation (average US$ 240 / ha).

The relatively high prices the farmers receive justify the important level of resources required to obtain good yields up to 50-60 tons/ha.

1.4. Sugar beets sale's prices

Sugar Beet Average Sale's Prices (US$ per clean tonne)

EU - Quota A

1995-96	1996-97	1997-98
60.1	55.8	57.2

World Prices

1995-96	1996-97	1997-98
22.3	13.5	10.6

source: Economics of the UK Sugar Beet Industry - University of Cambridge, 1998

Prices which European farmers receive for their beets are largely **subsidised**. Processors pay only a part of the market value, the remaining amount being paid partly by the profession and partly by the consumers themselves. A short calculation illustrates quite well what happens:

To produce one ton beet sugar, one needs about 7.7 tons sugar beets (ref. page 6), which represents an amount of 7.7 x 55 = US$ 423, to which must be added all other production costs, whereas world market price for white sugar varied only from US$ 400 down to US$ 250 during the four past years (ref. page 7).

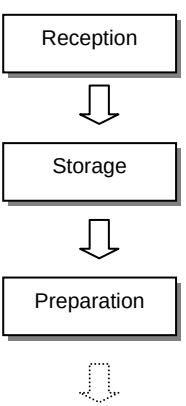
1.5. Average margins for producers

Assuming that the average sale's price of clean ton of sugar beet at standard 16% sugar content is US$ 55 per ton and average yield around 50 tons / ha, the general output is 55 x 50, i.e. US$ 2 750.

Gross margin for production of sugar beets is 2 750 - (1 345 + 240) = **US$ 1 165 / ha**

2- SUGAR BEETS PROCESSING INTO WHITE SUGAR

2.1. Process description



Sophisticated sampling and analysis systems have been developed to determine the sugar and impurities content (beet leaves, stones and other trash material) in each load so that accurate payment methods are applied.

Necessity for storage at the factory will depend mainly on climatic conditions but can require several weeks' supply where harvesting disruption occur.

Beets are thoroughly washed and separated from any remaining impurities.
They are then cut into chevron shaped slices (cossettes) with the view of increasing the surface area of the beets.

The cossettes are introduced into a diffuser for about one hour. Diffusion is achieved with water at about 70°C in a counter-current process. Strict temperature control and hygiene are required in order to achieve maximum extraction.

The exhausted beet slices from the diffuser are still very wet and the water in them still holds some useful sugar. They are therefore pressed in screw presses to squeeze as much juice as possible out of them.

Diffusion Juice (liquor)

The juice is cleaned up in a process known as carbonation, which is achieved by adding milk of lime (calcium hydroxide) to the liquor and bubling carbon dioxyde through the mixture. Filtration then eliminate as many impurities as possible.

The liquor is ready for sugar production except that it is very dilute. Next stage consists therefore in a concentration of the juice in a multi-stage evaporator. This technique is used as it is an efficient way of using steam and it also generates another, lower pressure, steam, which can be used for next step.

Sugar rich syrup

The syrup is boiled in large vacuum pans (typically holding 60 tons or more), and thus concentrated to obtain saturation which allows for crystallisation.

Masse-cuit

Once the crystals have grown, the resulting mixture of crystals and mother liquor is spun in in centrifuges to separate the two.

The sugar is dried in drum dryers with hot air current. It is then cooled down to temperature around it.

WHITE SUGAR (ready to use)

Storage must be to the highest quality if the products, usually produced in a relatively short campaign, are to remain market ready throughout the year.

A typical factory will be capable of producing a range of sugars from icing through cubes to liquid products and a range of packages from 8 gm sachets to bulk road / rail tanker.

[1] Molasses is often added to the pressed pulp before drying in order to provide a higher sugar content animal feed. Typically, two tons of pressed pulp and 0.4 tons of molasses are dried to make one ton of dried pulp at 10% moisture content. The dried pulp in then extruded into pellets to increase the density of the product and make it easier to store and handle.

2.2. Conversion factors from raw material

- Sugar beets contain in average **16 % sugar**, 80 % of which can be recovered by the extraction process. One tonne sugar beets gives therefore a maximum of 130 kg white sugar. remaining sugar (non-crystallised) are left with the molasses, which contain 50% sugar
- With yields ranging from 55 to 65 tons/ha, the expected sugar production would reach **7.8 tons per hectare of sugar beets** in ideal conditions.

2.3. Key processing costs

Sugar manufacture is a heavy industry which requires substantial investment in a product for which the international market price is rather low. It is of utmost importance to have a competitive raw material (high and regular output and low transportation costs) as well as sufficient technical means to ensure continuous functioning of a large unit which immobilisation is rather costly.
The following economic considerations are for illustrative purpose only (European standard plant).

Illustrative Operating Cost for Sugar Extraction
(US$/ton sugar produced)

(Assumptions: 2 100 h per year operation - daily processing capacity of 11 000 tons sugar beets)

Item	Cost (1997)
sugar beets	427
fuel energy	19
lime kiln operation	15
capital cost	108
maintenance	21
miscellaneous, other costs	22
labour	55
Total direct operating costs	**667**

source: Beet and Cane Sugar Manufacture, P.W. Van der Poel, ed.Bartens - 1998

One of the big differences between a beet sugar factory and its cane sugar counterpart is with respect to energy. Both factories need steam and electricity to operate and both have co-generation stations where high pressure steam is used to drive turbines which produce the electrical power and create the low pressure steam needed by the process. However the beet factory does not have a suitable by-product to use as fuel for the boilers, it has to burn a fossil fuel such as coal, oil or gas, while in the case of sugar cane factories, the fibre resulting from crushing the cane are burnt.

Given the relatively short period during which sugar beets are harvested and available for processing, a beet sugar factory operates in average only 90 days a year (2 100 hours). A cane sugar factory operates longer since after raw sugar is produced during approximately 5 months, refining process can take place in the same plant for some months.

The production costs of beet sugar are significantly affected by the revenue from the sales of the by-products: molasses, pulp, beet particulate matter and carbonation lime.

2.4. Refined sugar sale's prices

White Sugar Quarterly Average Prices / London D.P. N°5- F.O.B. Europe in bulk (US$ per ton)

	Jan/Mar	Apr/Jun	Jul/Sep	Oct/Dec	Jan/Dec
1995	399	385	417	386	**396**
1996	392	395	363	314	**366**
1997	308	321	332	321	**316**
1998	283	260	244	233	**255**

source: F.O. Licht

- Sugar world market price is one of the most volatile of all commodity prices because of the residual nature of the world market, made up of two closely related but differing products: raw and refined sugar. Prices may fluctuate significantly from one region of the world to another. For example, the wholesale price of white sugar from sugar beets in Russia, traded by processing plants, was about 440 dollars per ton in May 1998, while the world prices of sugar were much less. Therefore, Russia represented an attractive market for white sugar traders.
- Sugar prices collapsed in January 1998 due to the Brazilian currency devaluation, the large Brazilian sugar crop, and the increasing surplus of world sugar stocks. Since then prices do not cease declining.
- Forecasts predict that sugar world prices will reach their bottom level in year 2000, at around 170 US$/ton, and that a slow increase will be initiated from 2001.

2.5. Average margins for processors

- Factory profitability often relies on the efficient utilisation of the molasses and animal feed by-products. The importance of the feed products to the factory is such that uniform, high quality products must be produced at all times. Efficiency also depends substantially on the use of multiple effect evaporation. It is of utmost importance for the beet factories because there is no surplus fibre available to provide fuel for the power generation.

2.6. World production & main processors

World Production and Trade of Refined Sugar ('000 tons) [(a)]

Country or region	PRODUCTION ('000 tons)			EXPORTS ('000 tons)		IMPORTS ('000 tons)	
	1996/97	1997/98	%	1996/97	1997/98	1996/97	1997/98
EU	18 756	19 275	15	5 064	5 450	1 902	1 825
Brazil	15 269	18 134	14	5 995	8 483	-	-
India	14 030	13 900	11	-	-	-	-
China	7 323	8 747	7	-	-	-	-
USA	6 537	7 274	6	-	-	2 620	2 106
Australia	5 793	5 480	4.5	4 415	4 222	-	-
Mexico	4 822	5 675	4.5	742	775	-	-
Thailand	6 099	4 325	3.5	4 129	2 570	-	-
Pakistan	2 460	3 800	3	-	500	-	-
Cuba	4 316	3 200	2.5	3 597	2 500	-	-
Russian Fed.	3 219	3 755	3	-	-	3 060	4 850
Ukraine	3 497	2 102	1.5	-	-	-	-
Japan	2 232	2 372	2	-	-	1 726	1 605
Colombia	1 454	1 479	1	808	945	-	-
South Africa	1 531	1 977	1.5	939	1 078	-	-
Korea Rep.	1 165	1 190	1	-	-	1 446	1 380
Malaysia	1 255	1 176	1	-	-	1 122	1 010
Canada	1 130	1 150	1	-	-	1 064	1 068
Others	22 944	22 474	17	9 892	8 394	22 641	21 073
World Total	**123,832**	**127,485**	**100**	**35,581**	**34,917**	**35,581**	**34,917**

source: International Sugar Organisation & FAO Stat

(a) data relative to both cane (raw sugar) and beet (white sugar) mixed together
the world sugar year runs from September to August

- When collecting data for the production of sugar from sugar beets only, one could draft the following table (figure for 1997/98):

Country	EU	USA	Turkey	Poland	Ukraine	Russia	China	Czech Rep
'000 tons	19 130	3 901	2 556	2 261	2 207	1 453	1 461	558

source: Centre d'Etudes et de Documentation du Sucre - France

- Most of the sugar produced is consumed within the country of production and only approximately 25% is traded internationally. Moreover, the free world market accounts for only 18% of world exports while 7% is traded on the basis of bilateral trade agreements.
- The CEE and NIS represent together 10% of the world sugar production (13,7% of world consumption in 1993).

- Over the world, there are a very large number of sugar extraction and refining companies. Among the largest are:

Europe	Yearly production ('000 tons)	% sugar in total sales
- Sudzuker (D)	2 400	74
- Eridania Béghin-Say (I)	1 950	26
- British Sugar (UK)	1 150	85
- Danisco (DK)	900	46
- Sucre et Denrées (F)		
USA		
- Domino/Western	2 400	19
- Savannah	1 500	90
- BC Sugar	950	100

2.7. Other relevant information

- Although beet is physically different from its tropical counter-part, sugar cane, the factory processes are surprisingly similar. Two major differences are the lower juice colour levels with beet - which allows direct production of white sugar - and a cane factory's self sufficiency in fuel.
- Over the world, 115 countries are producing sugar, 9 grow cane and sugar beets, 39 grow only sugar beets while 67 grow only cane. It represents as a whole some 2 520 industrial sugar factories, 820 processing sugar beets and 1 700 for cane transformation.
- One can notice a recent shift in consumption from direct to indirect sugar intake with the industrial sector now accounting for 70% of sugar use.
- The major sugar users among food processors are soft drink and chocolate/confectionery manufacturers. In France, direct sales to consumers represented 22.5% of the total amount of sugar used in 1998.
- Most of the world's sugar production is consumed in the countries of origin and levels of consumption vary a lot depending on the countries/regions.

Sugar consumption (kg/head/year)

Brazil	EU	Australia	Cuba	South Africa	Thailand	USA
51	35	45	44	19	27	30

- List of relevant web sites visited:

  http://www.fao.org

  http://www.illovosugar.com

  http://www.sucrose.com

  http://www.fas.usda.gov/htp/sugar

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Agribusiness Handbooks

vol. 5

Grapes / Wine

Wine, a beverage made from the partial or complete fermentation of fresh grapes, is as old as documented history. Over time a relatively simple process has evolved a complex technology with its own distinct and immensely diversified "viniculture".

In terms of variations in the composition and condition of raw materials; in terms of the nuances introduced over several centuries into processing parameters and their control, replete with many options for the winemaker; and in terms of the scores of variations of the final products, the making of wine is probably not rivalled by any other commodity in the field of food and beverages.

1- GRAPES CULTIVATION

1.1. Key production parameters

Climate

More than 90% of the grapes grown today are varieties of just one vine species, *Vitis vinifera*. This species is also known as the Old World or European grape. As a consequence most grapes are markedly limited by certain climatic conditions:

- reasonably long growing season (150 - 180 days)
- relatively low humidity but sufficient soil moisture
- mild winters - frosts occurring after vine growth starts in spring will kill off most of the fruitful shoots
- variations in the microclimate, location and topography of individual vineyards contributes to the diversity of wines and their respective quality

Soils

Grapes can be produced on a number of soils - fertility is not as important as soil structure:

- sandy or gravelly clay loams are most desired, differing soil attributes are reflected in wine diversity
- alkaline soils must be avoided
- good drainage is very important

Viticulture

Parameters of growing grapes (depending also on the use for wine, table grapes and raisins) include:

- *spacing of vines* in uniform rows for easy cultivation
- *propagation* by cuttings, buds or grafts (propagation from seeds usually just for producing new varieties)
- *planting*, usually of 1-year old vines of desired fruiting variety and *vine support* essential for satisfactory vine growth
- *pruning* and *thinning,* removal of vegetative parts to establish and maintain the vine in a form that will save labour, facilitate cultivation and helps to control insects and diseases, expedites harvesting and improves quality
- *cultivation and irrigation*, depending on climate topography and soils

Grape Production and Use in 1997 (in '000 quintals of fresh grapes)

	Wine	Table	Raisins	TOTAL
Italy	66,218	15,300	0	81,518
France	70,872	1,036	0	71,908
Spain	51,856	3,108	68	55,032
Argentina	24,263	283	273	24,819
Chile	5,456	9,353	1,882	16,691
South Africa	11,206	1,777	1,640	14,623
Romania	10,613	1,177	0	11,790
Australia	7,434	622	1,364	9,420

Source: Office International de la Vigne et du Vin (O.I.V.) 1998

1.2. Total world production & main producers

The period from 1986-1990 was characterised by a decline of world wine production compared to the preceding period 1981-1985: The annual average shifted from 333,552,000 hl to 303,793,000 hl (minus 9%). During 1991-1995 this trend continued with an annual average of 261,279,000 hl representing a reduction of 14% compared to the previous five-year period. Since 1995, this trend has been reversed. With 251,576,000 hl in 1995, 269,970,000 hl in 1996 and 264,422,000 hl in 1997 world production follows an upward trend for which the explanations range from strong demand for Reds and expansion of vineyard area, the "millenium - effect", to increased consumption of wine in Asia, the United States and the United Kingdom.

The world market for wine has changed from its traditional regional orientation to a highly international commodity. Wine producers, processors and traders expect continued growth in wine consumption, with the main increases in countries outside Europe (Japan and emerging economies) and in those European countries without own production. Europe as the centre of the wine culture, of production and consumption faces increasing competition from the "new" wine world in North and South America, in Australia and South Africa. The Wine sector in these countries is characterised by concentration in relatively few globally active companies with their own production and marketing.

Biggest Producers Globally and in Eastern Europe (in '000 hl)

	Italy	France	Spain	USA	Romania	Hungary	Bulgaria	Moldova
1998	56,912	51,632	29,600	20,000	6,688	4,180	2,470	2,193
1997	50,847	53,612	33,887	25,000	6,688	4,472	2,377	3,598
91-95	60,768	52,886	26,438	17,619	5,529	3,823	2,194	4,356
86-90	65,881	64,641	33,519	18,167	7,133	10,974	3,205	n.a.
81-85	72,146	67,462	33,964	17,710	8,700	4,985	4,361	n.a.

Source: FAO, O.I.V

In the second half of the 1990ies, the big European Wine producers, although still world market leaders (Italy and France in particular) have lost part of their traditional European markets United Kingdom, Germany and Scandinavia due to small harvests and strong competition.

At the same time countries of south-eastern Europe have continued quality improvement and gained market access (i.e. UK and Germany) financed to a large extent by Western wine companies. Romania has been particularly successful in increasing its exports in 1994 and 97 (see table below). Hungary and Bulgaria are also expected to increase their market share with relatively low prices for good qualities and packaging at international standard. Poland bottles and re-exports imported bulk wines. Countries of the Former Soviet Union have had their planted areas substantially reduced. Georgia has lost 10,000 ha and Ukraine 9,000 ha between 1995 and 1997.

Wine Exporting Countries in Eastern Europe

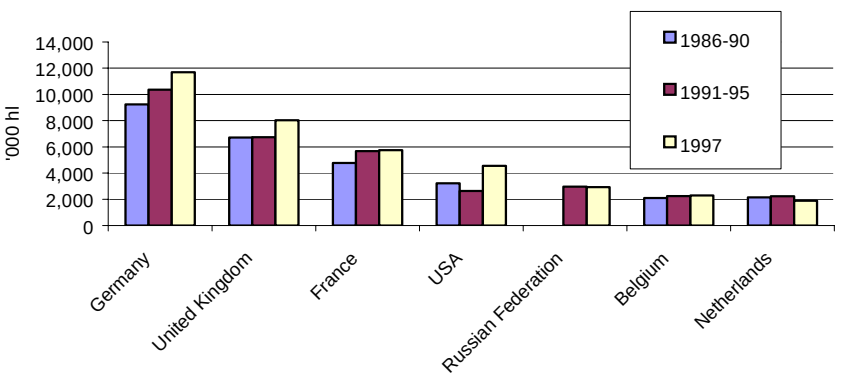
	Development of Exports from 1994 to 1997	Exports as share of local production in 1997
Bulgaria	10.7%	72.5%
Romania	188.3%	12.8%
Poland (incl. re-export)	9.5%	-
Hungary	56.5%	29.0%
Russia	9.5%	2.9%

Source: Vertumne International & Associés 1998

Wine Imports

Per capita consumption in 1997 was highest in Luxemburg (63 litres/year), France (60), Italy (59) and Portugal (56). With around 30 litres Romania is the country with the highest per capita consumption in Eastern Europe. The biggest wine importers were Germany, United Kingdom, France, USA, Russia, Belgium and the Netherlands who together account for 70% of all wine imports. France on third place for imports has to be qualified: Most imported wines are relatively low quality bulk wines from Italy or Spain that are used as basis for table wines "d'origine communautaire".

Seven Biggest Wine Importing Countries (O.I.V. 1998)



1.3. Key production costs

The following table is the result of a nonrepresentative survey of 220 wineries in various wine regions of Germany over five years and is supposed to give an indication of the costs of wine growing, processing and marketing in successful operations.

Cost Structure of Top Wineries in Germany

Input Costs	92/93	93/94	94/95	95/96	Average
	DM/ha share/total	DM/ha share/total	DM/ha share/total	DM/ha share/total	DM/ha share/total
1. Specialized Inputs	22,093 **36.5%**	22,474 **38.4%**	21,900 **38.9%**	23,504 **39.7%**	22,577 **38.4%**
- of which for Grape Prod.	1,424	1,655	1,777	2,845	1,981
- for Wine Processing	8,905	8,955	9,502	8,624	9.011
- for Marketing	2,111	2,442	3,405	4,048	3,134
- for Other	4,928	4,946	3,541	2.059	3.687
Hired Labour and Equipm.	1,231	804	888	1088	1002
Goods and Services	2,197	2,448	1.624	3.621	2.539
Electricity, Water	1,027	942	982	943	972
Lubricants	269	282	182	277	251
2. Labour	10,956 **18.1%**	11,389 **19.4%**	10,882 **19.3%**	11,201 **18.9%**	11,106 **18.9%**
3. Maintenance Equipment	1,008 **3.5%**	931 **1.6%**	843 **1.5%**	1,049 **1.8%**	956 **2.1%**
4. Depreciation Equipment	2,981 **4.9%**	3,094 **5.3%**	2,637 **4.7%**	3,014 **5.1%**	2,925 **5.0%**
5. Maintenance Structures/ Buildings	1,738 **2.9%**	1,419 **2.4%**	1,775 **3.2%**	2,245 **3.8%**	1,838 **3.1%**
6. Depreciation Structures/ Buildings	2,299 **3.8%**	2,298 **3.9%**	2,029 **3.6%**	2,166 **3.7%**	2.188 **3.7%**
7. Other: Land rent,Transp., Insurance	12,044 **19.9%**	10,654 **18.2%**	10,328 **18.3%**	10,447 **17.6%**	10,804 **18.5%**
8. Taxes	2,210 **3.7%**	3,015 **5.2%**	2,801 **4.9%**	2,860 **4.8%**	2,754 **4.7%**
9. Financing	3,592 **5.9%**	2,406 **4.2%**	2,429 **4.3%**	2,020 **3.4%**	2,538 **4.5%**
10. Other Costs	528 **0.9%**	523 **0.9%**	309 **0.6%**	428 **0.7%**	438 **0.8%**
Total Costs (DM/ha)	**60,606**	**58,478**	**56,330**	**59,203**	**58,607**

Source: Haupt, Unternehmensanalyse für Weingüter, Geisenheim 1998

Profitability of Conventional versus Organic Wine Production in Germany

		Production Type	
		Conventional	**Organic**
Productivity	hl/ha	80.1	62.4
Vineyard area	ha	8.7	7.3
Labour (person)	full-time	4.5	4.0
Labour Intensity	hrs/ha	1,045	1,119
Average Costs	DM/Litre	6.47	7.82
Average Prices	DM/Litre	7.74	9.01
Total Costs	DM/ha	51,800	48.800
Revenue	DM/ha	62,000	58.200
Profit	DM/year	103,000	74.300
Cost Type		'000/ha	'000 ha
- Material Inputs	DM/ha	20.3	17.9
- Labour	DM/ha	8.8	7.7
- Depreciation	DM/ha	4.7	5.8
- Interest	DM/ha	2.5	2.9

Source: Forschungsanstalt Geisenheim, Germany 1999

In a direct comparison of 119 conventional with 41 organic wineries in Germany, the conventionally managed ones were found to be more profitable. This is mainly due to substantially lower yields in organic production that are not sufficiently compensated by higher prices. Like in Germany, grape and wine production in the main producing countries is an integrated operation particularly in the field of quality wines.

1.4. Average margins for producers

In a non-representative study 220 wine producers/vineyards (with direct marketing) of different wine-growing regions in Germany were analysed over five years for the correlation between structural characteristics and economic performance. The results are used as an indication for the factors governing economic success. Obviously, these vary immensely between countries and types of production. Labour productivity and profit margins indicate that it is not necessarily the bigger producers who are producing more profitably. The survey shows that it is rather the ability to move into the high quality segments of the market while keeping costs under control than pure cost minimisation strategies that seem promising under the structural parameters of Germany.

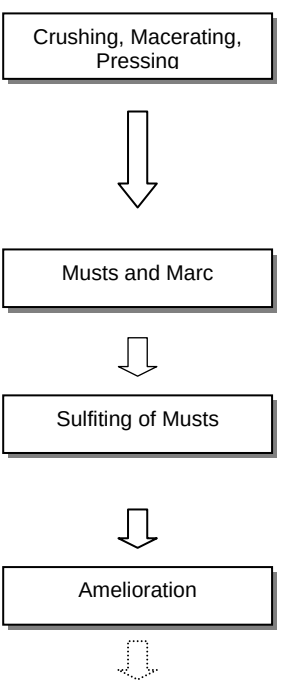
Structural Data and Economic Performance on 220 Vineyards in Germany over five Years (Seasons 1992/93 - 1996/97)

Averages	Labour (person) full time	Family Labour full time	Area under Vines ha	Productive Area ha	Productivity/ Yield hl/ha	Labour Intensity h/ha	Labour Productivity DM/Pers.	Profit Margin %
Top Wineries	4.6	2.0	11.16	10.5	80.0	875	155,903	24.1
Average	4.4	2.1	9.16	8.57	78.1	1,043	109,826	19.1
Underperf.	4.1	2.1	7.01	6.62	77.2	1,269	71,613	12.8
Big Wineries (>15ha)	12.2	2.2	27.7	26.0	62.4	857	128.0	11.5
Mid-scale (7.5 - 15 ha)	4.9	2.1	10.8	10.2	80.1	958	114.8	19.0
Small (< 7.5 ha)	3.3	2.0	5.5	5.1	79.9	1,353	96.5	20.9

Source: Haupt (1999), Forschungsanstalt Geisenheim

2- GRAPES PROCESSING INTO WINE

2.1. Process description (simplified)

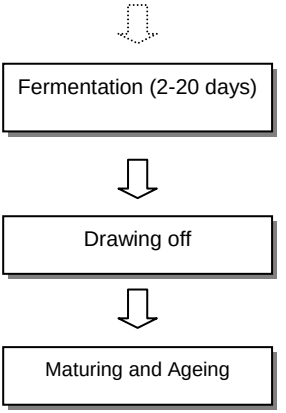


Depending upon the variety of the grape, the water content of a ripe berry will range between 70 and 80%. In any crushing macerating and pressing operation applied to a mass of berries, there is an inevitable mixing of both solid and liquid components. A reasonably complete separation of liquid (juice) components from the grape therefore requires more than one crushing or squeezing operation. The amount of components picked up from skins and stems has a marked effect on the wine's characteristics, sometimes beneficial, sometimes injurious.

Grape juice and/or the mass of crushed grapes on the way to wine production are called must. The grape pressings, i.e. the mass of skins and seeds left after the juice obtained from the first pressing is known as marc or pomace.

Sulphide dioxide is used for its antiseptic and antioxidant properties for treatment of must (dosage usually 100 - 200ppm). For red wines, small quantities are added to fully destroy spoilage bacteria and the presence of unwanted yeast. In white wine, the functions are similar and, SO_2 prevents development of brownish colouring.

In dealing with a lack of uniformity of raw material from one season to the next with regard to sugar content and acidity these factors are sometimes purposefully altered by adding sugar, water or acid. This practice is ether frowned upon or in some regions even outlawed completely if not warranted by natural causes (i.e. disadvantageous weather conditions).



1. Initial slow stage, multiplying yeast cells
2. Vigorous stage : Gas "bubbling", rising temperature
3. "Quiet fermentation" that can proceed for long period at a lower and lower rate.

Depending on the type of wine, size of winery, traditional practices etc. wine may go to large or small storage tanks, casks or it remains in the fermentation tubes for several days.

In various stages "green" wine matures into an acceptable market product: settling of finely divided solid particles and colloidal materials, subtle and slow chemical reactions involving aldehyds, esters etc. that enter into the ultimate bouquet of a wine. Around 90% or more of the wine produced is for the mass market and relatively early consumption. Most of this is pasteurised which inhibits or halts subsequent improvements.

2.2. Conversion factors from raw material

The amount of juice obtained from the first pressing usually will range from 60 to 70% of the ultimately attainable juice and is known as free-run juice. For some wines this juice is processed separately.

Parameter Ranges for Musts

Type of Wine	Degrees Balling	Titrable Acidity	pH
White table wine	19.5-23.0	> 0.70	<3.3
Red table wine	20.5-23.5	> 0.65	< 3.4
Sweet table wine	22.0-25.0	> 0.65	< 3.4
Dessert wine	23.0-26.0	> 0.50	< 3.6

Source: Encyclopedia of Food and Agriculture Production

Degrees Balling = grams of sugar per 100 grams of juice. Multiplication of the Balling reading by 0.55 will give the approximate future alcoholic content by volume of the wine. Thus 22 degrees Balling should give 0.55 x 22 = 12% alc. wine.

2.3. Wine Quality and Prices

The table below shows the variation in the prices of red wine produced in different regions of France, and illustrates how widely prices vary even when one takes only the average for a region. If the prices obtained by individual growers were considered, the variations would be even greater.

Comparing Wine Prices from different Appellations in France (FF/bottle)

	1993	1994	1995
Various VQPRD reds:			
Bordeaux Reds			
- Bordeaux and Bordeaux Supérieur	15.59	15.41	16.72
- Cotes	19.61	19.38	21.16
- Médoc and Graves	35.10	33.97	33.78
- St. Émilion and Pomerol	36.22	30.26	33.61
South West Reds	15.12	14.56	14.50
Val de Loire	20.10	18.48	18.86
Bourgogne	32.85	33.65	41.81
Beaujolais	19.58	20.10	21.00
Vallée Du Rhône	12.78	13.27	13.69
Languedoc-Roussillon	10.59	10.56	11.27

Source: Conseil Interprofessionel du vin de Bordeaux

Premium wines of Bordeaux (Médoc, Graves, St. Emilion, Pomerol) sell at twice or more the average price of wines from the bulk-producing areas of both "ordinary" Bordeaux and other south-west reds, and three times the average price of wine from Languedoc Rossillon.

2.4. Wine types and labels

Champagne, Madeira, Port, Sherry, Sparkling Wine, Vermouth any many more are examples for the special kinds of processes that lead to very different products. These have been ignored in this context in spite of their economic importance in order to be able to concentrate on the main issues of wine production.

To understand the "product" wine on the retail level one has to understand the labels. Generally there are two systems with a large number of variations:

- The **French system** works according to the origin of a wine. The origin and the adherence of a vintner to certain standards and practices in the production of the wine, is documented by the Appellation d'Origine Controlée (A.O.C.). The A.O.C. also sets out standards for the quality of wine which range from Vins Délimités de Qualité Supérieure (VDQS--the best quality) to Vins de pays ("country wines") to Vins ordinaires (ordinary wine). With varitions, the A.O.C. system is used throughout Europe. In Germany, detailed origin, the type of grape and sometimes also reference to the taste of the wine is made on the label. French Bordeaux is made from a blend of grapes. It might contain, for example, Cabernet Sauvignon, Merlot, Cabernet Franc and Malbec. The amounts differ (for example, in the Bordeaux appellations St. Emilion and Pomeral, Merlot tends to be the dominant grape, while in the Medoc (Paulliac, St. Esteph, Margaux, and St. Julien), Cabernet Sauvignon is dominant.

- The **U.S. system** is based on the type of grapes that are used for wine production. In the United States, a wine cannot be called by its varietal name unless that grape is at least 75% of the wine. As a merchandising tool, a new name has reached the marketplace. Producers in the United States creating blend wines (usually with less than

75% of any particular grape) have agreed to use the term Meritage to designate a high quality wine using Bordeaux style blends of grape varieties. Winemakers may also put a very specific area from which their grapes are harvested on the label. Often (but not always), "better" (or at least more expensive) wine comes form a "better" vineyard. In the United States there are places called "Approved Viticultural Areas" or AVA. If 75% of the wine is grown in that AVA the AVA may be placed on the label.

Food and Agriculture Organization of the United Nations

European Bank for Reconstruction and Development

Agribusiness Handbooks

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Poultry / Eggs & Poultry Meat

Poultry represents an important and increasing part of human food consumption, be it through poultry meat (**25% of global meat consumption**) or eggs. **Chicken accounts for about 85%**[1] of all poultry varieties placement world-wide, the 15% remaining being divided mainly between fowls, ducks, pigeons, turkeys, geese and quails. Hen eggs represent 90% of the global eggs primary production.

This handbook will therefore focus on (i) **broilers for meat** production and (ii) **laying hen for eggs** production.

One should clearly differentiate two ways of managing poultry breeding: **intensive** & **extensive** breeding. Extensive breeding largely spreads over developing countries where natural native genetic lines are used, while in industrialised countries, poultry production is largely based on genetic science progresses, with sterile hybrids being used for reproduction purpose. This last way maximises the productivity of breeding activities.

Success of poultry meat during the past 10 years is mainly due to:

- **dietetic quality**, rich in protein with low fat content, and very digest,
- very **large choice of products** for consumers, including elaborated products which have strongly developed during the past 5 years,
- **competitive prices**, important factor in the competition between different meats.

1- BROILERS FOR MEAT PRODUCTION

1.1. Key production parameters

- Specialised firms/institutes obtain chicks from hybrid lines selected for specific characteristics such as resistance to diseases, growth curve, adaptation to certain types of feed, etc… Female chicks are systematically killed.
- Male chicks are sold to breeders. They can be sold vaccinated or not. In the last case, breeders must vaccinate their chicks themselves.
- Production cycles of about 6 weeks. The quicker the growth is, the lower quality meat is obtained. Therefore, a tuned calculation has to be done to establish the best profitability (costs of breeding vs mature broilers sale's prices).
- Feed quality, heat regulation, sanitary control and animal density within breeding houses (in average 10 animals/m²) are the most important factors having an impact on growth.
- After 6 weeks, broilers reach 2 to 3 kg, with an average weight of 2,5 kg.
- They are then gathered into cages and sold to processors for slaughtering.

1.2. Key production costs

Production costs are very volatile. They depend a lot on the final product desired characteristics (brand-named or low quality chicken), but also on feed prices (mainly grain prices), climatic conditions, and genetic lines used. Therefore, they vary a lot from one region to another.
Ref. page # 55

[1] in European Union, Chicken accounts only for 70% of total poultry meat produced and consumed.

1.3. Live broilers sale's prices

Average Prices Paid to Producers for Mature Broilers in Different Regions of the World (farm cost in US$ per kg liveweight - 1994)

China	USA	E.U.	Poland	Thailand	Brazil
0.61	0.56	0.95	0.97	0.69	0.51

source: IFC Global Agribusiness Series - The world poultry industry

Price ranges may vary significantly, influenced by seasonal patterns, input costs and relative costs of competing meats. If for example red meat courses collapse, poultry meat prices will automatically decreased since on the meat market for consumers, it must stay the cheapest choice, as it is one of major poultry sector strengths.

1.4. Average margins for producers

Margins for broilers producers depend a lot on final product characteristics (low or high quality product - brand-named chicken with more tender flesh and more flavour). Indeed, high quality products have a slower and longer growing period, which means higher production costs since more feed is used, but also other miscellaneous variable costs are slightly increased. The choice for final product characteristics is largely determined by how much consumers are ready to pay for high quality broilers.

It is nevertheless possible to draw approximation for the calculation of average margins.

Average Gross Margin for Broilers Producers in UK (bird sold at 43 days)

	US$
Returns: 2.30 kg per bird @ US$ 0.9 per kg	2.07
LESS Cost of chick [(a)]	0.41
OUTPUT	1.66
Variable costs	
Food: 4.35 kg per bird @ US$ 250 per tonne	1.09
Heat, light, labour, miscellaneous [(b)]	0.20
TOTAL VARIABLE COSTS	1.29
GROSS MARGIN PER BIRD	**0.37**

source: Farm Management Pocketbook - John Nix, 1998

[(a)] assumed 3 per cent mortality.

[(b)] excluding transport, but including all vaccination costs.

1.5. Other relevant information

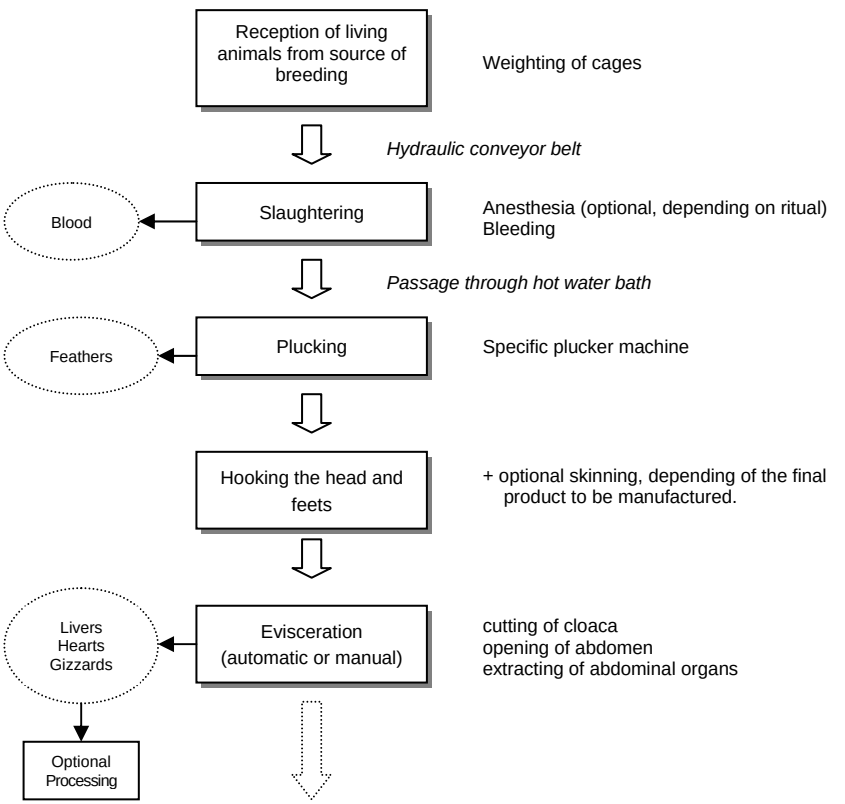
In 1999, returns for producers have become more favourable due to ample soybean and corn supplies resulting in low feed prices. Feed costs typically account for 70% of all production costs.

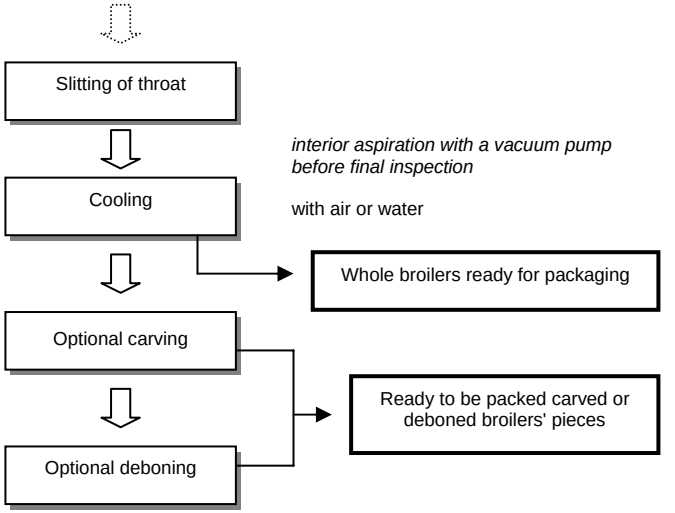
2.1. Process description

The range of finish products depends on

- the raw material processed
- the degree of processing:
  - eviscerated broiler (with head and feet)
  - eviscerated broiler (ready to cook)
  - carved broiler
  - deboned broiler meat pieces
  - prepared meals
- the method of preservation:
  - cold products (refrigerated with air or water)
  - frozen products

A poultry slaughterhouse consists of an aerial conveyor belt, from which the birds hang suspended by the feet. The conveyor belt brings the poultry through certain automatic machines, or in front of manual posts, so as to execute the following operations:





2.2. Conversion factors from live animals

The figure commonly used is the **carcass yield**, which corresponds to carcass weight v.s. weight of the alive animal. This figure varies a lot depending on production conditions - some estimates are given hereafter:

Average Broiler Carcass Yield in Different Regions of the World - 1997

	China	USA	E.U.	Russia	Brazil	World Average
carcass yield	2.2	2.0	1.46	1.5	1.54	1.38 kg
FCR	2.15	2.0	1.85	3.3	2.0	2.2

source: CFCE

The genetic potential for broiler production under ideal conditions can be estimated from the claims of the breeding companies. An example is the standard published by Arbor Acres, which claims the following:

Liveweight	2.57 kgs
Feed Conversion Ratio (FCR)	1.91 (kg feed needed / kg meat produced)
Age at slaughter	49 days
Index value	274.6

The index is a summary indicator of technical performances. It is calculated as:

$$\text{Index} = \frac{\text{liveweight} \times 10{,}000}{\text{feed conversion ratio} \times \text{days of age}}$$

2.3. Key slaughtering and processing costs

Investment costs for a 4 000 chickens/hour slaughterhouse represent around US$ 2.4 million, including equipment (US$ 1 000 000), surface building (around 1 100 m²) and surface land (around 2 500 m²).

Comparative illustrative Operating Cost for Slaughtering and Processing (US$ / kg RTC)
(Assumptions: 1 800 h per year operation - annual processing capacity of 4000 chickens/hour)

Item	USA	France	Poland
Meat cost at plant	0.76	1.23	1.29
Labour	0.15	0.16	0.10
Packaging	0.05	0.06	0.04
Utilities (water, fuel, electricity)	0.02	0.03	-
Office, supplies, misc.	0.03	0.04	0.07
Fixed-cost	0.03	0.03	0.02
non-labour	0.13	0.17	0.13
Total direct operating costs	**1.17**	**1.72**	**1.65**

source: Global Poultry Report - IFC Agribusiness - May 1995

Eastern European countries are characterised by a relatively high cost structure caused by an inadequate bird performance in spite of a rather favourable raw material position.

Because the raw materials are perishable, the conception / organisation of the slaughterhouse must be closely adapted to supply conditions (average weight of animals, age, available quantity per week, seasonality of supplies, …).

2.4. Broiler wholesale's prices

Average wholesale whole bird prices in Different Regions of the World (US$ per kg)

	USA	Poland	France	China	World average
1996	1.35	1.63	1.86	0.97	1.45
1998	1.39	1.72	1.65	1.02	1.37

source: FAO Stat & OFIVAL

Wholesale prices depend a lot on product quality standard (label policy based on feed quality, intensive/extensive production). Farm chicken may be twice more expensive than an industrial one.

2.5. Average margin for processors

Broiler cost and return budgets / USA - 1990 (US$ / kg liveweight)

Feed costs	0.36
Additional production costs	0.23
Total liveweight production costs	0.59
Total production costs - Ready To Cook basis	0.78
Processing and marketing costs	0.31
Total costs - Ready To Cook basis	1.09
Market price	1.17
Net return before overhead and interest	**0.07**

source: Economic Research Services - USDA

A spreading of the global economic contagion to Brazil and the resulting devaluation of the Real in January 1999 is leading to considerable uncertainty about 1999 prospects for the Brazilian poultry industry. **Brazil** continues nevertheless to be **the lowest cost producer of broiler meat** in the world, turning out **live broilers** at a cost of around **US$ 0.64/kg**, thus allowing Brazil to maintain its position as the world's second largest exporter.

2.6. Total world production & main producers

Production of Chicken Meat in the Main Producing Countries and Regions

Country or region	1990 ('000 tons)	%	1994 ('000 tons)	%	1998 ('000 tons)	%
USA	8 667	25	10 965	25.4	12 724	24.8
China	2.200	6.2	4 600	10.6	7 715	15
Brazil	2 356	6.6	3 411	7.9	4 490	8.8
Mexico	750	2.1	1 126	2.6	1 558	3
Japan	1 391	3.8	1 256	2.9	1 225	2.4
France	1 049	3	1 240	2.9	1 240	2.5
UK	790	2.3	1 065	2.5	1 187	2.3
Thailand	575	1.6	740	1.7	960	1.9
Spain	807	2.2	850	2	888	1.7
Italy	823	2.3	818	1.8	863	1.7
Indonesia	473	1.2	803	1.8	807	1.6
Canada	597	1.7	721	1.7	820	1.6
Iran	380	1.1	613	1.4	730	1.4
Russian Fed.	-		1 068	2.4	600	1.2
Argentina	322	1	519	1.2	574	1.1
Australia	385	1.1	468	1.1	550	1.1
India	342	1	467	1.1	526	1
Others	13 451	38	12 502	29	13 773	26.9
World Total	**35 358**	**100**	**43 232**	**100**	**51 230**	**100**

sources: FAO STAT

Russian poultry meat output which increased slightly in 1998 due to low feed prices, increased regional government support and higher levels of investment in the industry is expected to jump 13% to 720 000 tons in 1999. Besides government support, Russian financial groups, foreign companies and meat processing plants are making investments in the poultry industry. This recovery in production is expected to dramatically drop Russia's import dependence on imported poultry meat which reached 70 percent in 1997

Output growth of the **Mexican** poultry industry, the fourth largest in the world, is expected to be constrained in 1999 by high interest rates and the industry's difficulty procuring feed requirements.

The Russian crisis, lower WTO subsidised export commitments, an overburdened pork industry, the return of consumer confidence in beef meat and increasing government pressure for more stringent environmental regulations are setting the stage for a slowdown in **EU** poultry meat production in 1999. Concern about waning export opportunities in 1999 has for example prompted the French and the Dutch industries to limit chicken placements and increase the time between production cycles.

Asia is already the leading area in terms of the number of birds killed, but the average weight at slaughter is considerable below that in North/Central America

2.7. Broiler meat world trade trends

Major Broiler Meat Importers and Exporters ('000 metric tons in Ready-to-Cook equivalent)

Country	EXPORTS			IMPORTS		
	1994	**1998**	**%**	**1994**	**1998**	**%**
USA	1 304	2 119	44	-	2	-
Brazil	481	610	12.7	-	-	-
Hong-Kong	285	572	11.9	498	839	22.5
France	315	346	7.2	7	4	-
China	177	335	7	323	755	20.2
Thailand	168	282	5.9	-	-	-
Netherlands	108	171	3.6	9	18	0.5
Hungary	35	68	1.4	-	-	-
Canada	15	55	1.1	62	75	2
Mexico	-	-	-	102	128	3.4
Russia	-	-	-	475	792	21.2
Japan	3	3	-	444	495	13.2
Saudi Arabia	-	-	-	274	282	7.5
Germany			-	41	35	0.9
Poland	-	-	-	42	52	1.4
Romania	-	-	-	45	20	0.5
Argentina	-	20	0.4	52	70	1.8
Others	*195*	*232*	*4.8*	*121*	*169*	*4.5*
World Total	**3 086**	**4 813**	**100**	**2 488**	**3 736**	**100**

source: USDA - FAS post report and inter-agency analysis

After experiencing double-digit export gains over the past decade, poultry meat exports in 1998 registered an unprecedented decline as the financial crisis in **Russia** put the brakes on the growth in world poultry meat trade in mid-year. The pervasiveness of the economic crisis in Russia is expected to generate a decline in overall poultry meat imports by selected countries in 1999 to 4.4 million tons.

In **Eastern European Countries**, poultry meat consumption per capita should keep growing quickly, while production curve should follow more slowly: quantities available for export should thus decrease globally. Hungary will remain by far the most important exporter within the region.

While continuing to be the world's major poultry meat supplier, **U.S.** exports are expected to drop, benefiting to changing competitive position of major poultry meat exporters due to currency devaluations, such as Brazil and some Asian countries.

China's role in the poultry meat export market is being increasingly challenged by the wave of competitor currency devaluations and product quality concerns. While China continued to be Japan's (the world's fourth largest poultry import market) major poultry meat supplier in 1998, strong competition from Thailand and Brazil arose.

The strong export growth enjoyed by the **EU** poultry meat industry over the past few years came to a halt in 1998. The devaluation of the Brazilian currency in expected to generate extreme price competition in the Middle East for French whole birds, especially in the context of declining subsidised export limits.

Detailed Status of Poultry Meat in Eastern European Countries

	Production ('000t)			Domestic cons ('000t)			Exportations ('000t)			Importations ('000t)		
	1994	1996	1998	1994	1996	1998	1994	1996	1998	1994	1996	1998
Poland	345	410	500	407	430	535	15	20	25	77	40	60
Hungary	320	328	385	241	242	294	80	86	100	2	0	9
Romania	135	180	142	179	186	170	3	1	2	47	7	30
Czech Rep.	124	125	137	121	130	150	8	6	3	5	11	16
Slovakia	35	61	80	45	62	79	1	2	3	3	2	2
Bulgaria	52	102	98	49	100	107	4	6	7	1	4	16
EEC Total	1011	1206	1342	1042	1150	1335	111	121	140	135	64	133

source: OFIVAL

2.8. Other relevant information

Depending on the enforced regulations, a poultry slaughterhouse generally requires the presence of a veterinary services official for the inspection of the viscera. Once pulled out from the carcass, the viscera are hanged

Per Capita Broiler Meat Consumption in Selected Countries- 1997
(kg per year)

China	Japan	USA	France	UK	Poland	Hungary	Russia	Brazil
4.6	13.1	38.3	13.4	20.0	7.3	16.3	8.8	23.0

source: FAS - USDA

3- LAYING HEN BREEDING FOR EGGS PRODUCTION

3.1. Key production parameters

- Specialised firm/institutes obtain chicks from hybrid lines selected for specific characteristics such as yearly number of eggs laid, eggs size, adaptation to certain types of feed, etc… Male chicks are systematically killed.
- Female chicks are sold to breeders. They can be sold vaccinated or not. In the last case, breeders must vaccinate themselves their chicks.
- During the two first weeks of growth there are no differences with male chicks grown to become broilers. Feed quality, heat regulation, sanitary control and animal density within hen-houses are key factors on which depends chicks' mortality.
- Nutrition balance changes from the third week, with the view to ensuring a relatively low development of muscles which will give better laying performances.
- From the 17th week, begins the regulation of the light cycle, which has an important impact on laying frequency. First laying takes place in week 20.
- A laying hen will give from 200 up to 300 eggs during its life. After about 50 weeks, when the laying curve decreases too much, hens are gathered a few weeks out of the regulated light cycle in order to perform the so-called moulting (change of feathers). A second laying cycle can then begin.

- Eggs are to be collected and washed as soon as possible after they are laid, to avoid them getting dirty or broken. Attention should be paid to keep rats, snakes or other predators away from the layer house.
- Before slaughtering, laying hens are given appropriate feed to reconstitute muscles volume. They will be sold to consumers as low quality chickens or carved poultry meat products.

3.2. Hen eggs sale's prices

Average Producers' Prices of Hen Shell Eggs (Large) in different region of the world (local currency per dozen)

	USA (US$)	Russia (Roubles)	Hungary (Florins)	France (Francs)	China (Yuan)	Japan (Yen)
1990	0.73	-	-	-	2.90	139
1994	0.60	-	-	4.03	3.85	101
1996	0.82	4.89	120.10	4.31	3.98	120
1998	0.72	5.81	103.10	3.82	4.11	97
1998 in US$	0.72	0.97	0.47	0.68	0.49	0.84

source: National Agricultural Statistics Service - USDA & FAO Stat & International Egg Commission

3.3. Average margins for breeders

Average Gross Margin for Laying Hen Breeders in UK (yields assumed: 290 eggs / 52 weeks laying period)

US$

	Cages		Free range	
	per bird	*per egg*	*per bird*	*per egg*
Egg returns [a]	17.07	0.059	27.65	0.096
LESS Livestock depreciation [b]	3.92	0.013	4.19	0.014
OUTPUT (per year)	13.15	0.046	23.46	0.082
Variable costs				
Food [c]	8.17	0.028	9.88	0.034
Heat, light, labour, miscellaneous	1.55	0.005	1.49	0.005
TOTAL VARIABLE COSTS	9.72	0.033	11.37	0.039
GROSS MARGIN PER BIRD	**3.43**	**0.013**	**12.09**	**0.043**

source: Farm Management Pocketbook - John Nix, 1998

[a] average price per egg - UK, 1998 - US$ 0.059 for cage production & 0.096 for free range production. Feed cost is dependent on breed, housing and environmental conditions, quatity purchased and type of ration.

[b] the average point of lay pullet is priced at US$ 3.75 (17 weeks old) less US$ 0.03 for culls (forward booking only).

[c] 43 kg @ US$ 190 per tonne for cage production / 47.5 kg @ US$ 208 per tonne for free range production.

3.4. World production & main producers

World Production of Hen Eggs (millions pieces)

Country or region	1990	1994	1998	% 1998
China	158 920	281 010	359 000	48.7
USA	67 987	74 136	78 960	10.7
Japan	40 318	43 047	43 000	5.9
Russia	47 470	37 400	32 500	4.4
Mexico	18 040	25 896	26 100	3.5
France	14 629	16 370	16 450	2.2
Brazil	13 454	13 460	17 735	2.4
Germany	16 800	13 960	13 900	2.0
Italy	11 454	11 599	12 000	1.6
UK	10 658	10 620	10 600	1.4
Spain	10 659	9 670	9 900	1.3
Ukraine	16 287	10 145	7 800	1.1
Others	*99 620*	*97 232*	*110 631*	*14.8*
World Total	**526 296**	**644 545**	**738 576**	**100**

source: Foreign Agricultural Service - USDA

World Total (Mt)	**35 241 395**	**41 281 414**	**48 112 745**

source: FAO Stat

- **China** is by far the world's largest producer and consumer of eggs. China's production has more than doubled since the early 1990's, with nearly a record 400 billion (33.3 billion dozen) produced in 1997, about half of the world's total.
- The **U.S.** is the world's second largest egg producer with 1997 production estimated at 78 billion (6.5 billion dozen). However, a major difference persists between the two nations in respect to usage. Much of China's production is directly consumed as fresh brown eggs whereas in the U.S. about a third of production is processed and white eggs are favored for table use.
- Egg consumption gains in developed countries and China are slowing in 1998 and 1999. Growing at a more sedate pace than the 4 percent yearly gains witnessed since the mid-1980's, egg consumption is expected to slow to a two percent annual increase.

3.5. Hen eggs world trade trends

Major Hen Eggs Importers and Exporters
(million pieces less hatching)

Country or region	EXPORTS			IMPORTS		
	1994	**1998**	**%**	**1994**	**1998**	**%**
USA	2 251	2 625	33.5	44	70	1.4
Netherlands	2 333	1 902	24.3	122	195	3.8
China	647	900	11.5	7	5	-
Turkey	164	600	7.7	2	2	-
India	117	350	4.5	-	-	-
Canada	295	355	4.5	551	700	13.8
France	246	340	4.3	7	212	4.2
Italy	111	185	2.4	87	5	-
Germany	279	125	1.6	220	75	1.5
Thailand	1	99	1.3	-	-	-
Hong Kong	30	6	-	1 691	1 485	29.4
Japan	-	-	-	1 696	1 730	34.2
Mexico	-	-	-	144	253	5
Poland	2	10	-	220	100	2
Russia	50	50	0.6	50	60	1.2
Others	*247*	*291*	*3.7*	*142*	*163*	*3.2*
World Total	**6 773**	**7 838**	**100**	**4 983**	**5 055**	**100**

source: USDA - FAS post report and inter-agency analysis

- Foreign trade in eggs is small. The net total favour exports. The EU generally accounts for about a third of world exports while Asia, paced by Japan and Hong Kong import about 75% of the total.
- **Asia**, which constitutes nearly two-thirds of imports by selected countries (Japan and Hong Kong accounts for more than 60 percent of total imports) encountered concerns about health aspects of egg in 1998. Consequently, imports by selected countries are poised to witness a 8 percent decline in 1997, before recovering to more than 5 billion eggs in 1998.
- The **United States** continues to be the largest shipper of egg products to world markets, supplying nearly 40 percent of imports by selected countries in 1997.
- Despite declining WTO limits on export subsidies, **EU** exports remain surprisingly robust. An oversupply of eggs in most EU countries dropped prices in mid-1997 and 1998. Authorised restitution levels for eggs are moving progressively downward to 109 700 tons in 1998, as restitution levels edge upward to US$ 0.13/dozen. The Netherlands is the EU's leading exporter, exporting nearly 80 percent of production and accounting for nearly 60 percent of EU exports to third countries.
- U.S. and EU egg exports are nevertheless experiencing increasing competition in the **Middle East** from regional competitors such as Turkey, Thailand and India. Turkish egg exports are destined mainly to FSU republics. They are supported through export

subsidies of approximately US$ 0.7 per 1000 eggs, limited to 10 percent of export volume and value. The subsidy is in the form of a tax deduction rather than cash payment.

- Although not showing much movement in recent years, trade in **liquid egg** during the nineties has been well above the levels of 10 years earlier. The bulk (80%) of this trade is conducted between European Union countries. The picture for **dried egg** is similar to that of the liquid product, an upward trend being evident over the past 20 years or so. Again, the majority of the business is between EU member states.

3.6. Other relevant information

Per Capita Table Eggs Consumption in Selected Countries - 1997
(in pieces per year - including egg products)

China	Japan	USA	France	UK	Poland	Romania	Russia	Brazil
274	353	242	255	172	190	105	201	98

source: FAS - USDA

- Hen eggs' weight may vary from 50 up to 70 grams, but the average figure one should use is **55 grams / egg**.
- One of the important by products of poultry production is the **manure**, which has a significant economic value, be it sold or directly used by producers applied to the crops grown, if any.

- List of relevant web sites visited

  - http://www.fas.usda.gov/dlp/circular/1999/99-03LP/pltry1.htm
  - http://europa.eu.int/comm/dg06/publi/peco
  - http://www.canadaegg.ca
  - http://www.internationalegg.com

Food and Agriculture Organization of the United Nations

European Bank for Reconstruction and Development

Agribusiness Handbooks

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Milk Production / Processing

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		
	(millions of tons)	
Countries	**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

	(in HRK/kg)					
Farm size	**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 bulk milk tanks	550-750 liters	$3,000	40	$120,000
		800-1,100 liters	$4,500	30	$135,000
	Milking equipment	2-3 unit	$12,000	40	$480,000
		4 unit+	$15,000	30	$450,000
For 30 cows and plus	Refrigerated bulk milk tanks	550-750 liters	$3,000	300	$900,000
		800-1,100 liters	$4,500	200	$900,000
	Milking equipment	2-3 unit	$12,000	300	$3,600,000
		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 defattening 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 lead 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				
	(thousands of tons)			
Countries	**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				
	(thousands of tons)			
Countries	**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				
	(thousands of tons)			
Countries	**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' 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

	(US$/100kg)		
Products	**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	
Civil Works	$22,000
Building Modules	$335,950
Process, mechanical, electrical works	$783,200
Engineering and project control	$69,000
Total costs (excluding land)	**$1,210,150**

Operating Costs			
	Consumption	Cost	
Inputs	per day	$ per year	
Raw milk	20,000 L	500,000	53%
1/2 L cartons	10,000	148,000	16%
Labor		118,000	12%
1 L cartons	9,300	83,000	9%
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**			
Civil Works	$2,310,000		Consumption	Cost	
Process, mechanical and		Inputs	per hour	$ per year	
electrical works	$9,570,000	Raw milk	20,833 kg	5,000,000	54%
Engineering and project		Packaging materials		2,000,000	22%
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 (in kg)			
Countries	**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).

Food and Agriculture Organization of the United Nations

European Bank for Reconstruction and Development

Agribusiness Handbooks

vol. 8

Beef / Red Meat

[This volume will be completed in the next edition]

Red meat comprises a mix constituted mainly of beef/veal, pig and sheep meats. This volume of the Agribusiness Handbooks proposes to focus on beef & veal meat, which nowadays represents in average 55% of the world total red meat production (while red meat accounts itself for 65% of world total meat production, poultry meat accounting for the balance).

1- BEEF RAISING FOR MEAT PRODUCTION

1.1. Key production parameters

1.2. Key production costs

1.3. Live beef sale's prices

Average Prices Paid to Producers for Mature Beefs in Different Regions of the World (farm cost in US$ per kg carcass weight)

	Australia	USA	France	Poland	Russia	China	Brazil
1990	0.68	1.64	3.73		-		
1995	0.72	1.42	3.49		0.90		
1998							

source: FAO Stat

1.4. Average margins for producers

It is nevertheless possible to draw approximation for the calculation of average margins.

Average Gross Margin for Beef Raisers in UK

	US$
Returns:.....	
LESS Cost of	
OUTPUT.....	
Variable costs	
Food:	
.....	
TOTAL VARIABLE COSTS.....	
GROSS MARGIN PER	

source: Farm Management Pocketbook - John Nix, 1998

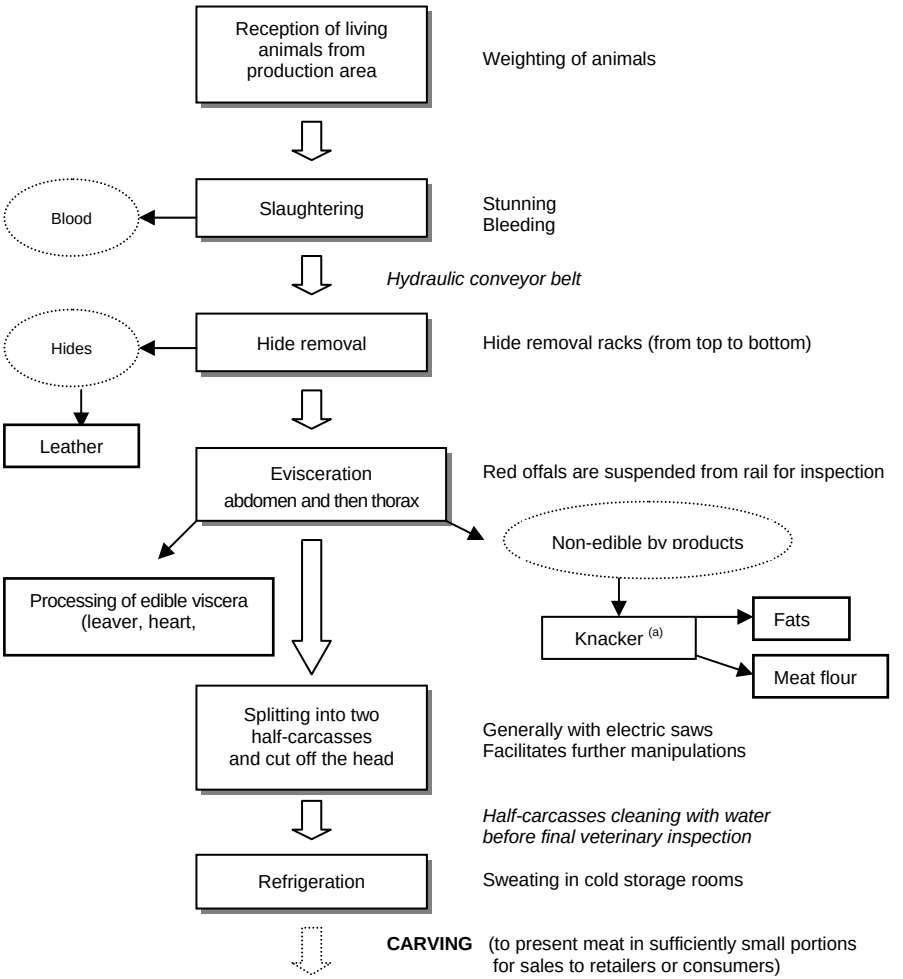
1.5. Other relevant information

- BSE - Bovine Spongiform Encephalopathy ("mad cow") Crisis
  On 20 March 1996, the Government of the United Kingdom announced that there may be a link between several new cases of Creutzfeldt-Jakob disease and beef consumed during the late 1980s which gave rise to widespread fears that BSE can be transmitted through the food chain to humans. Beef consumption in the European Union dropped off immediately and intervention stocks, which were virtually zero at the beginning of the year, have begun to build up again. The EU launched a number of specific measures to restore consumer confidence and to rebalance the beef market. Only in July 1999, ban on UK beef meat export was lifted.
- Some of the consequences of the BSE crisis in industrialised countries are (i) a renewal of the marketing policy in the meat sector with "certification" procedures being set up to guaranty to consumer meat origin and quality, (ii) a deep change in consumption habits, since offal are much less consumed than they used to be, (iii) a modification in the valorisation of slaughtering co-products, since meat flour is forbidden as cattle feed and meat flour plants have gone through standardisation (133°C, 3 bars, 20 min).

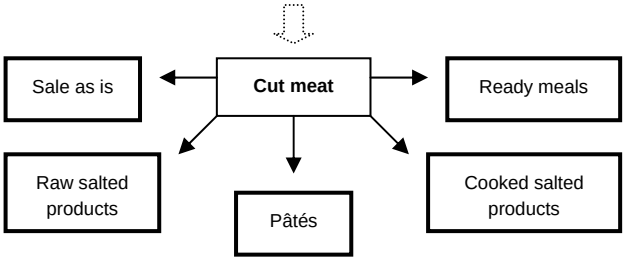
2- BEEF SLAUGHTERING AND MEAT PROCESSING

2.1. Process description

- Slaughtering requires a supply of drinking water of sufficient quality and quantity. If this is not available, "dry" slaughtering is possible. However, great care must be taken to prevent the skin, viscera, etc from "staining" the edible parts.



(a) Knacker valorizes waste from slaughterhouses (animal cadavers which do not conform to sanitary regulations, other waste like bones, non-edible viscera, etc… Utilisation of meat flour for animal feed, fat for industrial fats (soap factory for example, and bones for transformation into gelatin. Hides go to tanneries for leather production



- Carving takes place after quartering half-carcasses (fore quarter and hind quarter) in slaughterhouses. The carving process consists of the cutting into pieces and packaging of the meat, to obtain various sized pieces (from large pieces to individual portions).
- These pieces are destinated for further processing prepared dishes, preserved products, etc…) or to go to butcher's shop or directly to the consumer in the case of individual portions. The weight of the pieces of carved meat varies from less than 100 grams to more than 10 kilos. Carving systems might be pneumatic, electric or entirely manual.

2.2. Conversion factors from live animals

The figure commonly used is the **carcass weight**. This figure varies a lot depending on production conditions - some estimates are given hereafter:

Average Beef Carcass Weight in Different Regions of the World - 1998
(kg / animal)

China	USA	E.U.	Poland	Russia	Australia	Brazil	**World Average**
146	316	275	165	136	210	196	**199**

source: FAO Stat

2.3. Key slaughtering and processing costs

Investment costs for a 11 000 tons carcass / year slaughterhouse represent around US$ 4.5 million, including equipment (US$ 2.1 million), surface building (around 4 000 m²) and surface land (around 1.2 ha).

Illustrative Operating Cost for Slaughtering and Processing
[Assumptions: 1 800 h per year operation - processing capacity of 6 tons carcass (20-25 animals) / hour]

Item	Consumption per hour	Cost '000 US$/yr.	Cost US$/kg meat
cattle	22		
electricity	900 kwh		
water	60 m^3		
cold (negative calories - nc)	200 000 nc		
spare parts			
waste water treatment			
miscellaneous, veterinary			
labour (35 people)			
Total direct operating costs			

source: ONUDI -How to start agro-food industries

The choice of the building site for the slaughterhouse must take into account local criteria (land, geographic location, drainage) and sanitary standards which aim to separate the "unclean" system (evacuation of scraps, delivery of live animals ..) from the "clean" system (carcasses, cleaned and refrigerated offals …)

Waste water treatment is very important in respect of environmental impact of a slaughterhouse.

2.4. Beef meat wholesale's prices

Average wholesale prices in Different Regions of the World
(US$ per kg)

	USA	Russia	Poland	Brazil	France	China
1990						
1995						
1998						

source: OFIVAL

2.5. Average margin for processors

Beef cost and return budgets / USA - 1990 (US$ / kg liveweight)

Feed costs	
Additional production costs	
Total liveweight production costs	
Total production costs	
Processing and marketing costs	
Total costs	
Market price	
Net return before overhead and interest	

source: Economic Research Services - USDA

The insufficiency of the value added gained in the meat industry (slaughtering) do not compensate the financial importance of work force and makes difficult to finance investments. As a consequence, meat industry generally brings out small margins and is one of the food processing sector with the lowest rate of return. Operators have thus been encouraged to invest more in downstream industry (carving and processing) where profitability is higher. Nevertheless, improvements need to be achieved as regard to beef meat processed products since technical and/or marketing innovations are crucially missing.

2.6. Total world production & main producers

Beef and Veal Numbers and Numbers Slaughtered in the Main Producing Countries and Regions ('000 heads)

Country or Region	1994		1996		1998	
	live animals	slaughtered	live animals	slaughtered	live animals	slaughtered
United States	100 988	35 691	103 487	38 575	99 118	36 922
European Union	84 018	29 279	85 180	28 578	83 606	27 528
among which						
France	*20 112*	*5 958*	*20 662*	*6 134*	*20 300*	*5 780*
Germany	*15 897*	*4 844*	*15 890*	*4 985*	*15 650*	*4 591*
Italy	*7 458*	*4 753*	*7 265*	*4 629*	*7 166*	*4 408*
UK	*11 834*	*3 639*	*11 913*	*2 396*	*11 519*	*2 296*
Brazil	144 900	24 600	149 228	25 008	144 500	26 750
China	90 757	18 755	99 305	22 800	96 044	27 850
Argentina	54 875	13 299	53 569	12 917	50 277	11 000
Russian Federation	48 914	19 771	39 696	18 786	31 700	16 200
Australia	25 758	8 282	26 377	7 934	26 710	9 322
Mexico	30 702	6 490	28 140	5 982	25 630	5 973
India	206 501	13 211	208 488	13 299	209 489	13 381
Canada	12 025	3 064	13 402	3 505	13 157	3 650
Ukraine	21 607	8 841	17 526	7 960	13 500	6 850
South Africa	12 583	2 600	13 389	2 330	13 800	2 985
Others	*484 872*	*78 861*	*501 813*	*79 509*	*510 869*	*81 038*
World Total	**1 318 500**	**262 744**	**1 339 600**	**267 183**	**1 318 400**	**269 449**

source: : Foreign Agricultural Services - USDA & FAO Stat

Status of Beef Meat in Eastern European Countries (past, current and prospective figures)

	Production ('000t)			Domestic cons ('000t)			Balance ('000t)			Per capita cons (kg pc)		
	1989	1997	2003	1989	1997	2003	1989	1997	2003	1989	1997	2003
Poland	720	487	527	653	431	455	67	56	72	17	11	11
Hungary	114	72	84	82	72	94	32	0	-10	8	7	9
Czech Rep.	272	153	146	253	142	145	19	10	1	24	14	14
Slovenia	50	50	55	40	57	57	10	-7	-2	20	29	29
Estonia	75	22	23	40	52	23	35	-31	0	25	17	18
Romania	220	229	261	248	234	278	-28	-5	-17	11	10	12
Bulgaria	125	66	77	139	66	82	-14	0	-6	15	8	10
Slovakia	127	58	66	69	54	59	58	4	7	13	10	11
Lithuania	224	83	93	93	83	94	131	0	-1	25	22	25
Latvia	129	28	32	67	37	42	62	-9	-9	23	15	18
EEC	2056	1247	1364	1683	1229	1329	373	18	35	16	12	13
EU	8310	7886	7989	7959	7109	7263	351	777	726	22	19	22

source: European Commission - DG VI

Production of Beef Meat in the Main Producing Countries and Regions

Country or region	1994 ('000 tons)	1994 %	1996 ('000 tons)	1996 %	1998 ('000 tons)	1998 %
United States	11 194	23.67%	11 749	24.75%	11 804	24.19%
European Union	7 753	16.40%	7 789	16.40%	7 486	15.34%
among which						
France	*1 627*	3.44%	*1 735*	3.65%	*1 595*	*3.27%*
Germany	*1 420*	3.00%	*1 482*	3.12%	*1 460*	*2.99%*
Italy	*1 171*	2.48%	*1 181*	2.49%	*1 112*	*2.28%*
UK	*943*	1.99%	*708*	1.49%	*694*	*1.42%*
Brazil	5 730	12.12%	6 150	12.95%	6 140	12.58%
China	3 270	6.92%	3 557	7.49%	4 482	9.18%
Argentina	2 600	5.50%	2 580	5.43%	2 570	5.27%
Russian Federation	3 240	6.85%	2 570	5.41%	2 090	4.28%
Astralia	1 829	3.87%	1 736	3.66%	1 996	4.09%
Mexico	1 810	3.83%	1 800	3.79%	1 810	3.71%
India	1 025	2.17%	925	1.95%	1 593	3.26%
Canada	903	1.91%	998	2.10%	1 170	2.40%
Ukraine	1 427	3.02%	1 037	2.18%	865	1.77%
South Africa	581	1.23%	525	1.11%	676	1.39%
Others	5 921	12.52%	6 064	12.77%	6 117	12.54%
World Total	**47 283**	**100**	**47 480**	**100**	**48 799**	**100**

sources: Foreign Agricultural Services - USDA & FAO Stat

- Since the beginning of the 1990's, large changes have occurred in selected areas, notably the decline in cattle numbers in the former **USSR** and the increase in **China**. Most major cattle producing regions are expected to continue liquidating their herds in 1999, but at a slower pace.
- **China**'s cattle inventory should total 120 million head by the year 2000. **India**, who holds 16 % of the world's total cattle inventory - 210 million head - has shown little cattle number change in recent years.
- As herd liquidation slows in 1999, falling world beef production is expected to result in higher prices for the forthcoming years.
- The **Russian** livestock situation is expected to further deteriorate in 1999 as structural and market inefficiencies continue to hamper the domestic industry. Cattle production continues to shift away from the large collective farms to small farms, but is constrained by poor infrastructure and undeveloped business relations between producers and processors. Beef consumption in Russia dropped 16 percent in 1998 and is expected to fall 13 percent in 1999. After the rubble devaluation in August 1998, retail beef prices rose sharply and consumption tumbled.

2.7. Beef and veal world trade trends

Major Beef Meat Exporters and Importers
('000 metric tons carcass weight equivalent)

Country	EXPORTS			IMPORTS		
	1994	**1998**	**% (98)**	**1994**	**1998**	**% (98)**
Australia	1168	1223	23.3	6	3	-
European Union	1084	744	14.2	426	331	8.0
among which						
Ireland	*334*	*275*	-	*0*	*5*	-
Germany	*196*	*191*	-	*144*	*70*	-
Netherlands	*83*	*100*	-	*35*	*35*	-
France	*235*	*53*	-	*15*	*20*	-
UK	*68*	*1*	-	*122*	*129*	-
United States	731	985	18.8	1075	1198	29.0
New Zealand	466	519	9.9	3	2	-
Canada	220	405	7.7	286	240	5.8
Brazil	383	335	6.4	88	90	2.2
Argentina	376	280	5.4	3	35	0.8
Uruguay	152	255	4.9	-	-	-
India	130	162	3.2	-	-	-
Ukraine	168	80	1.5	0	32	0.8
China	74	66	1.3	3	5	-
Russian Fed.	4	5	-	541	430	10.4
Japan	-	-	-	842	957	23.2
Mexico	1	3	-	90	197	4.8
Korea	-	-	-	165	107	2.6
Egypt	5	0	-	153	80	1.9
Others	*160*	*169*	*3.2*	*438*	*420*	*10.2*
World Total	**5122**	**5231**	**100**	**4119**	**4127**	**100**

source: USDA - FAS post report and inter-agency analysis

- The world beef market during 1997 was considerably more placid than in 1996 when European consumption and trade was disrupted by the "mad cow" disease outbreak. Although the beef safety fears largely eased in 1997, little recovery in world beef usage was expected due largely to a continued contraction in the former USSR republics, from 4.1 billion tonnes in 1997 to 3.8 billion in 1998. Asian beef consumption, however, continues to expand; nearly doubling from the early 1990's to over 8 billion tonnes in 1998, with China setting the place.

- Beef imports are expected to rise modestly in **Japan** and **Mexico**, but imports into Russia will remain weak. Exports fell in 1998 because of sharply lower **EU** exports following the **Russian** rubble crisis in August (Russia absorbed up to 40% of EU exports) and reduced **Argentine** shipments due to high domestic prices. World beef exports are expected to increase about 2 percent in 1999 to 5.3 million tons. The **United States** and **Canada** are projected to expand beef exports in 1999. **Argentine** shipments are expected to rebound due to weakening cattle prices and **Brazilian** beef exports are likely to expand because of

the currency devaluation. Exports from **Australia** and **New-Zealand** are projected to fall 5 percent in 1999.

2.8. Other relevant information

Depending on the enforced regulations, a beef slaughterhouse generally requires the presence of a veterinary services official for the inspection of the viscera. Once pulled out from the carcass, the viscera are hanged

Per Capita Red Meat Consumption in Selected Countries- 1997
(kg per year)

China	Japan	USA	France	UK	Poland	Hungary	Russia	Brazil
4.6	13.1	38.3	13.4	20.0	7.3	16.3	8.8	23.0

source: FAS - USDA