A GUIDE FOR A PROCESSED CHEESE PRODUCTION UNIT

1 - PRESENTATION

1-1 Nature of Activity

Processed cheese results from melting one or several cheeses, with addition of other dairy products (such as liquid or powdered milk, butter, casein, or milk serum), spices and flavouring. This is done in the presence of melting salts that keep elements from separating after processing.

Processed cheese is characterized by :

- particular organoleptic qualities,
- perfect stability, adapted to distribution in areas without refrigeration.

1-2 Alternatives

* Raw Materials :

- Cheeses : hard, semi-hard, blue and cottage-cheeses.
- Melting salts : sodium orthophosphate, sodium citrate, citric acid.

* Finished Products :

there are two main types, in accordance with European regulations :

- processed cheeses with more than 50 % dry matter content (in slices or blocks),
- processed cheeses, called spreads, with at least 44 % dry matter content.

* Technological Options :

A single process with varying parameters, depending on the raw materials and the desired finished products.

- Temperature of treatment :
  - . high (up to 145°C) for spreads,
  - . low (around 80°C) for sliced or block cheeses.
- Homogenization and churning speed :
  - . both rapid for spreads,
  - . slow churning, no homogenization for sliced or blocks cheeses.
- Cooling : from slow (room temperature) to very fast (plunging in cold water)
- Packaging : after melting, the product is generally packaged hot in its primary container : pouring operation, the complexity is linked to the volume and form of final product.

Pouring in portions :

- Small portions (as in "La vache qui rit") poured into aluminium foil, in low volumes.
- Large portions (to be sliced) poured into a plastic-lined mould in volumes up to several kilos.

Pouring in bands :

- For certain products (cheese slices), continuous pouring is possible, according to the thickness of the band required. This is then cut into portions and packaged in flexible primary wrapping.

1-3 Types of Possible Units

We will consider 3 types of units, producing different finished products :

- **Line A** : 1 t/day, producing spreads : very refined products which are extremely stable.

- **Line B** : same capacity (1 t/day), producing cheese slices : not very refined products (we are considering two units with the same capacity because it is the packaging which is the principal investment).

- **Line C** : 500 kg/day, artisanal production of block cheeses.

2 - TECHNICAL AND ECONOMIC GUIDE

2-1 Description of the Unit

2-1-1 Finished Products

LINE	A 1 t/day spreads	B 1 t/day cheese slices	C 500 Kg/day block cheese
Products	spreads	cheese slices	block cheese
Packaging	10 g portion in aluminium foil (with external carboard box wrapping)	10-15 g slices (band pouring) in plastic wrapping	150-200 g blocks in plastic wrapping
Production - daily - annual	100 000 portions 200 to 300 t	100 000 slices 200 to 300 t	2500 blocks 10 to 150 t

2-1-2 Technological Choices

OPERATIONS	TECHNOLOGICAL OPTIONS	SOLUTIONS		
		LINE A 1 t/day spread	LINE B 1 t/day cheese slices	LINE C 0.5 t/day blocks
Reception Cleaning Trimming	Manual or semi-automatic Steam or water cleaning	Semi-automatic Steam cleaning	Semi-automatic Steam cleaning	Manual Water cleaning
Fragmentation - primary - secondary	Manual or semi-automatic Cutter-crusher or semi-automatic cutting	Semi-automatic, pre-cutting with string Heated cutter to premelt	Semi-automatic, pre-cutting with string Non-heated cutter	Manual cutting
Incorporation of additives	- Directly in the trough - Preparation in dissolving vats, continuous incorporation	- Preparing workshop. - Continuous incorporation in the trough	Preparing workshop	Manual non continuous incorporation in the trough
Kneading heating	- Non continuous kneading heating in trough. - Continuous kneading thermic treatment by smooth surface heat exchanger	- Spiral kneading - 10 min. processing time - smooth surface heat exchanger for UHT treatment	- Spiral kneading - 8 min. processing time - Smooth surface heat exchanger for pasteurization	- 3 parallel kneading troughs - Double envelope with cover - Slow-speed grater - Multiple-speed beater
Homogenization	For smooth cheeses	yes	no	no
Portioning	Volumetric - in portion (individual) - in block band pouring	Volumetric portioning	- Band pouring - Cutting into portions - Thermo-sealing	Volumetric in blocks (boxes)
Packaging	- In portions, blocks or slices - In plastic or aluminium foil	- In mini-portions in aluminum foil (automated machine) - Exterior wrapping : cardboard box	- In slices, in thermo-sealed plastic (automated machine) - Packaged together in plastic	- In blocks, in plastic wrapping
Cooling	- Slow at room temperature - Medium speed in cold rooms - Rapid through cold air exposure or cold water	- Rapid through cold air exposure	In cold rooms	- Slow at room temperature

2-2 Economic Analysis

2-2-1 Investments

	LINE A FOB price in $ US	LINE B FOB price in $ US	LINE C FOB price in $ US
Equipment			
Reception	$ 15 000	$ 15 000	$ 13 000
Cheese preparation	$ 350 000	$ 350 000	$ 160 000
Preparation of additives	$ 30 000	$ 30 000	$ 25 000
Heat treatment	$ 150 000	$ 150 000	$ 100 000
Packaging	$ 415 000	$ 1 200 000	$ 130 000
Cooling	$ 130 000	$ 150 000	
EQUIPMENT TOTAL	$ 1 090 000	$ 1 900 000	$ 428 000
Building	Area : 1000 m2 including 450 m2 for cold room	Area : 1000 m2 including 450 m2 for cold room	Area : 500 m2 including 200 m2 for cold room
Land	Area : 2000 m2	Area : 2000 m2	Area : 1000 m2
Other investments			
- electrical power	200 Kw	200 Kw	100 Kw
- heating	650 Kg/hr	650 Kg/hr	300 Kg/hr
- cold water vat	5 t	5 t	2,5 t
TOTAL INVESTMENTS	$ 2.75 to 3 million	$ 4.5 to 5 million	$ 1 to 1.3 million

2-2-2 Functioning

	LINE A	LINE B	LINE C
Labour			
- Skilled	2	2	2
- Unskilled	12	12	8
Annual consumption			
- cheese	220 t/year	220 t/year	110 t/year
- water process	0	0	0
- packaging			
. primary	22 million units	220 million	111 000 1 Kg units
. secondary	1,8 million boxes	1,8 million boxes	
. tertiary	36 000 cartons	36 000 cartons	11 000 cartons
- energy			
. electricity	300 000 Kwh	300 000 Kwh	100 000 Kwh
. steam	700 tons/year	700 tons/year	350 tons/year

3 - KEY FACTORS TO THIS PROJECT'S SUCCESS

3-1 Supply

* Cheeses : cheese processing is not an activity to recuperate bad cheeses, but can use unsold cheeses (near end of shelf life), as well as those with presentation defects. The unit can :

- be an an annex to a large cheese factory (fresh cheese, ripened or not). In this case, the workshop will be small,
- be supplied by local cheese producers,
- import cheeses.

Any combination of supply methods is possible.

* Packaging : primary wrapping (aluminium foil for portions, plastic for slices) should generally be imported (these materials are specifically adapted to packaging) ; on the other hand, secondary and tertiary wrapping (boxes and cartons) can often be locally made.

3-2 Technology and Equipment

Equipment used is of medium complexity, with two sensitive areas :

- heat treatment in units equipped for such operations,
- packaging : high speed and delicate regulation.

But, high level of competence is necessary for following the process.

3-3 Personnel

Cheese processing calls for precise knowledge, a master melter with a special touch and ability to adjust the process according to the raw materials available.
The chief cheesemaker should be a confirmed technician.
Heat treatment and packaging are regulated and call for specialized technicians.

3-4 Quality Control

Basic controls :

- dry materials,
- pH (acidity),
- casein measurement,
- microbiological analysis.

A laboratory is necessary.

Other controls are "technical controls" on the processing line :

- control of blends (homogenization, texture),
- temperature of treatment (continuously recorded),
- analysis of samples after accelerated aging in heating chamber.

3-5 Distribution and Commercialization

Considering the competition of cheese enterprises in industrial countries, production of processed cheese in developing countries should essentially be for local markets.
Distribution doesn't require cold storage, but to lengthen commercial shelf life, finished products should be stored at 15°C.

3-6 Financing

The investment/turnover ratio (in European countries) for highly mechanized units is higher than 1.
Once a unit plays a significant role in the domestic or local cheese market, a large stock of finished products should be foreseen, and therefore, a high level of working capital.

3-7 Other Specific Problems

Somewhat pollutive activity : treatment of water used for cleaning.

4 - INDUCED ACTIVITIES

* Consolidation of the local industry by regulating its actitivy (opportunity to sell its unsold cheeses to the unit).

* Production of wrapping materials, unit maintenance, substitution for imported processed cheeses.