

November 1991

# Wheys-Permeates and Lactose Derivatives

Strategic study of future utilization  
in non-food applications  
(1990-2000)

Multi-client study aimed at operators of:

- the dairy sector
- the animal feed sector
- the relevant chemical industries
- the manufacturers of separation and fermentation devices destined to the agro-food industries, particularly the dairy industries
- the environment market
- the public and private organizations related to the dairy sector

by

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## 1. INTRODUCTION

It is henceforth admitted that the dry matter obtained from whey, via the various lactose derivatives at the EC level, lies near 2 mios tons (some say 2.2 mios), 1.3 mios of which are apparently really processed; the difference of about 0.9 mio tons going directly to animal feeding (porcine and bovine essentially) or being just rejected.

The arising ecological pressure (together with the related environmental legislative constraints) joined with the occurring companies concentration, implies henceforth to take into consideration the progressive utilization of these 900 000 tons.

It is consequently foreseen that, at relatively short term, the European production should increase from 1.3 up to a minimum of 1.7 mios tons.

These figures (summarized in Table 1) put into relief the size of the problem which the lactose derivatives manufacturers will be facing, who are in first instance concerned by the potential markets of whey, the essential objectives of the producers being the stability of the prices at a reasonable level.

\* \* \*

The products really processed are presently broken down approximately between:

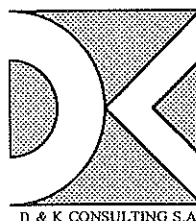
- whey powders: 80-85%,
- lactose (Codex, food grade and standard): 15-20%.

At the present stage of the production, the supply in whey powder is already larger than the demand... At 1 700 000 tons the situation become catastrophic (not taking into consideration what happens in Eastern Europe). The "safety -valve" consists, for the French producers, in selling below cost every year to third countries non negligible volumes of whey powders at a price covering just the technical costs (FF/kg 1.60-1.70- about 15 000 tons in 1990 sold off in Far East).

\* \* \*

It is quite clear that the solution to this problem cannot be found in food end-uses (human or animal), but that **only a prospective and active approach amongst the non-food ways of utilization will open an eventual further "last hope"**.

- What are the possible ways of utilization?
- In what consists the "products-portfolio" which may reasonably be considered?
- What are the economically acceptable processes to use?
- At what price may these products be put on the market?
- In which end-use sectors may these products be considered?
- Which present products may they replace?
- What are the acceptable prices of substitution?



- What is the competitive situation which will arise?
- What are the volumes of use which may be envisaged for the "markets" concerned in the medium-term?

This is the core of the study that D & K Consulting proposes to realize, combining its prospective methodological approach together with foreground technical competences in this field.

### The whey availabilities will continue to increase

Cheese production is the major amongst milk uses. Whereas milk, butter and milk powder consumption are regularly decreasing, cheese consumption (fresh cheese included) is increasing (+3.9% in 1989 in France - average of +1.6% in the EC in the long term).

The volumes of wheys originated from cheese-makers represent in 1989 both at the French and at the EC level more than 87% of the total native whey availabilities (against 84% in 1988 - estimated over 90% in 1990!).

The EC availability in liquid whey is estimated in 1990 over 30 bios litres and to reach (if not go over) the threshold of 40 bios litres by the year 2000. At the world level, this availability (which was 72 bios litres in 1989) is estimated around 75 bios litres in 1990/91. Some sources were estimating already in 1987 the real availability around 95 bios litres!

Despite a decrease of the casein production, the total production of wheys will continue to grow owing to the continuing progression of the cheese production.

### At the moment two thirds only of the dry matter equivalent of the available whey are converted in lactose derivatives

In France, there are presently 425 000 tons (out of 510 000 tons) and at the EC level 1 300 000 tons (out of 2 000 000 tons) which are actually converted in lactose derivatives. Considering the potential foreseeable overproduction, the utilized share will decrease if new outlets are not quickly found outside the food sector. In 1989 the breakdown by end-use (430 000 tons out of the 500 000 tons really available) was as indicated in the Table hereafter.

### A wind of panic starts to blow on the sector

France, the Netherlands and Germany represent altogether the major part of the EC production of whey powders: France alone accounts for 40% of the supply.

The situation is still worsening inasmuch as the major operators are not always controlling the totality of the production. This is the case in the Netherlands, where the three majors (BORCULO, NOORD NEDERLAND and DMV-CAMPINA-MELKUNIE) let escape more than 100 000 tons of whey powders produced by cooperatives of lesser importance. These volumes are commercialized by local traders, who are getting their supplies also from other EC countries ... when they do not turn themselves producers.

The climate has become such that the management of the problem starts to be envisaged not only at the European scale by the operators, who begin to meet (French and Dutch operators in Paris at the end of January 1991), but also at the EC level, which starts to close supervision and has just suspended the inward processing release "Trafic de Perfectionnement Actif" (excepting some wheys).

All the operators are concerned. All of them have "in the drawers" some ideas concerning technically possible ways of utilization outside the human food sector. **Nobody, however, has at disposal neither "the economical substitution thresholds" at which technically feasible products may be proposed to the industries concerned, nor the volume quantification of the more promising markets.**

### Present end-uses of lactose cannot allow to envisage to solve the problem of the expected oversupply

The EC production of lactose is estimated in 1989 at 260 000 tons of which 14 000 tons in France. The European production represents approximately 80% of the world lactose production, estimated at 330 000 tons.

#### **Lactose production in the EEC(1989)**

Countries	estimated volumes	
	tons	%
Netherlands	160 000	61.5
Germany	58 000	22.3
France	14 000	5.4
United Kingdom	13 000	5.0
Others	15 000	5.8
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<b>Total EEC</b>	<b>260 000</b>	<b>100.0</b>

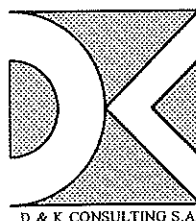
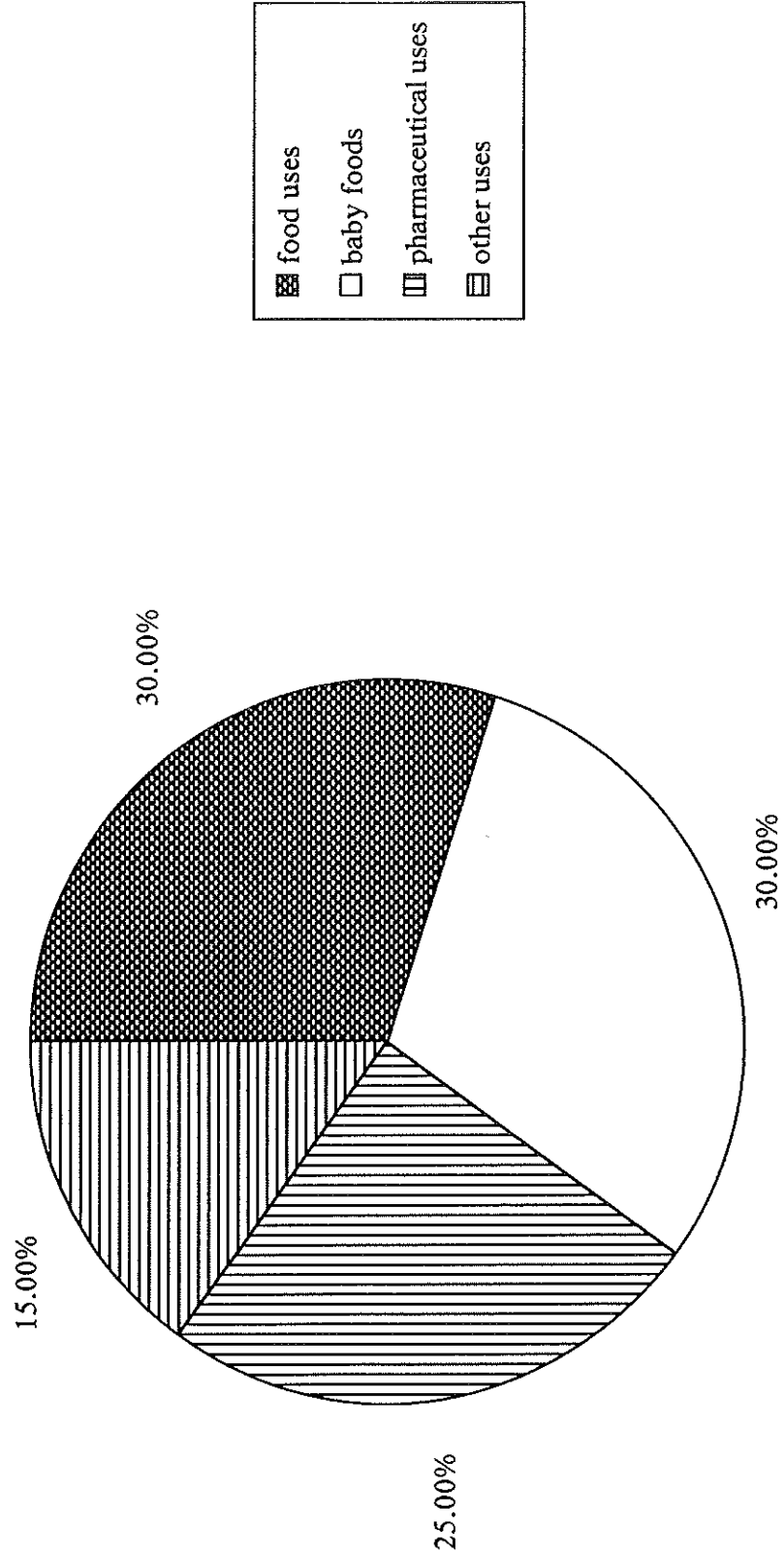


Figure 1 Estimated breakdown of the worldwide lactose consumption per end-use



## 2. OBJECTIVES OF THE STUDY

The **major objective of the study** will consist in bringing a clear answer to the dairy operators as to the **actual possibilities of development**, both at the qualitative (technico-economic, profitability,...) and the quantitative (volumes of the downstream markets concerned) levels of a certain number of non-food ways of utilization offered for the use of various types of "available wheys, permeates and lactose derivatives".

From that main objective derive a certain number of intermediary objectives, amongst which:

- to **inventory** qualitatively and quantitatively the various **available types of wheys, permeates and lactose derivatives** and to foresee their evolution at medium term,
- to determine the **minimal economical value** likely to satisfy the dairy operators following the type of product and the way they are made available,
- to **inventory the non-food ways of utilization**, known or in stage of development,
- to **identify the potential "products-portfolio"** to which these ways lead,
- to determine the **positioning of these products** in the sectors where they have to find their **outlets** (both on the functional and on the economical side: price of substitution),
- to determine the **potential volumes** for these products in those sectors which will be retained as the most promising in the medium-long term,
- to make **strategic recommendations**, including the **ways of processing** put foreground as the most promising in terms of faisibility, added value and final non-food outlets, so as to enable the dairy operators clients to this programme to elaborate a coherent strategy aimed at granting their forward survival.

### 3. SCOPE OF THE STUDY

#### 3.1 GEOGRAPHICAL SCOPE

Western-Europe, Japan, U.S.A. and Canada.

#### 3.2 PRODUCTS COVERAGE

**Upstream**, the various available following products will be analyzed:

- wheys,
- milk and whey permeates,
- proteins selective extractions co-products,
- lactose,
- lactose extraction co-products.

**Downstream**, the major products of the non-food utilizations will be covered, such as, by decreasing rank of importance:

- acids (lactic, acetic, propionic, nitric, lactobionic, etc.),
- antibiotics,
- hydrocolloids (xanthan),
- glues, paints and lakes,
- polyurethan foams,
- washings and detergents,
  
- solvents/benzoates, lineolates, etc.
- organo-metallic compounds (phtalates, succinates, etc.)
- aryled compounds (shampoos, etc.)
  
- nitrogen fertilizers,
- etc. (non-exhaustive list, likely to be modified further to the findings of the study).

#### 3.3 END-USE SECTORS

Here as well, non exhaustively and without prejudging of the results of the research, we may cite:

- chemical industries,
- cosmetics industries,
- fermentation industries,
- pharmaceutical industries,
- packaging industries,
- building materials industries,
- wood industries,
- phyto-sanitary products industries, etc.



## 4. PROGRAMME OF RESEARCH AND METHODOLOGY

### 4.1 PROGRAMME OF RESEARCH

The programme of research will consist in several successive phases.

#### 4.11 PRELIMINARY SELECTION OF THE POTENTIAL WAYS OF UTILIZATION

A first series of "face-to-face" in-depth interviews will be carried out near specialists having a centralized view at the crux of the problematic studied (university as well as public and private research centres specialized in the dairy industries, experts in the technologies concerned, etc.) It will allow to have a better overview of the potential ways (economically feasible) of working and of non-food utilization of the lactose containing raw materials.

Beside a qualitative upstream clearing of the ground (raw materials: wheys, permeates, etc. -technologies- potential products) this first series of field interviews will allow a "fine" identification of the current researches and projects at the level of the operators. We foresee at this stage about 10-15 "finely targeted" in-depth interviews, all located in Europe.

#### 4.12 CURRENT PROJECTS OF UTILIZATION OF WHEYS AND PERMEATES

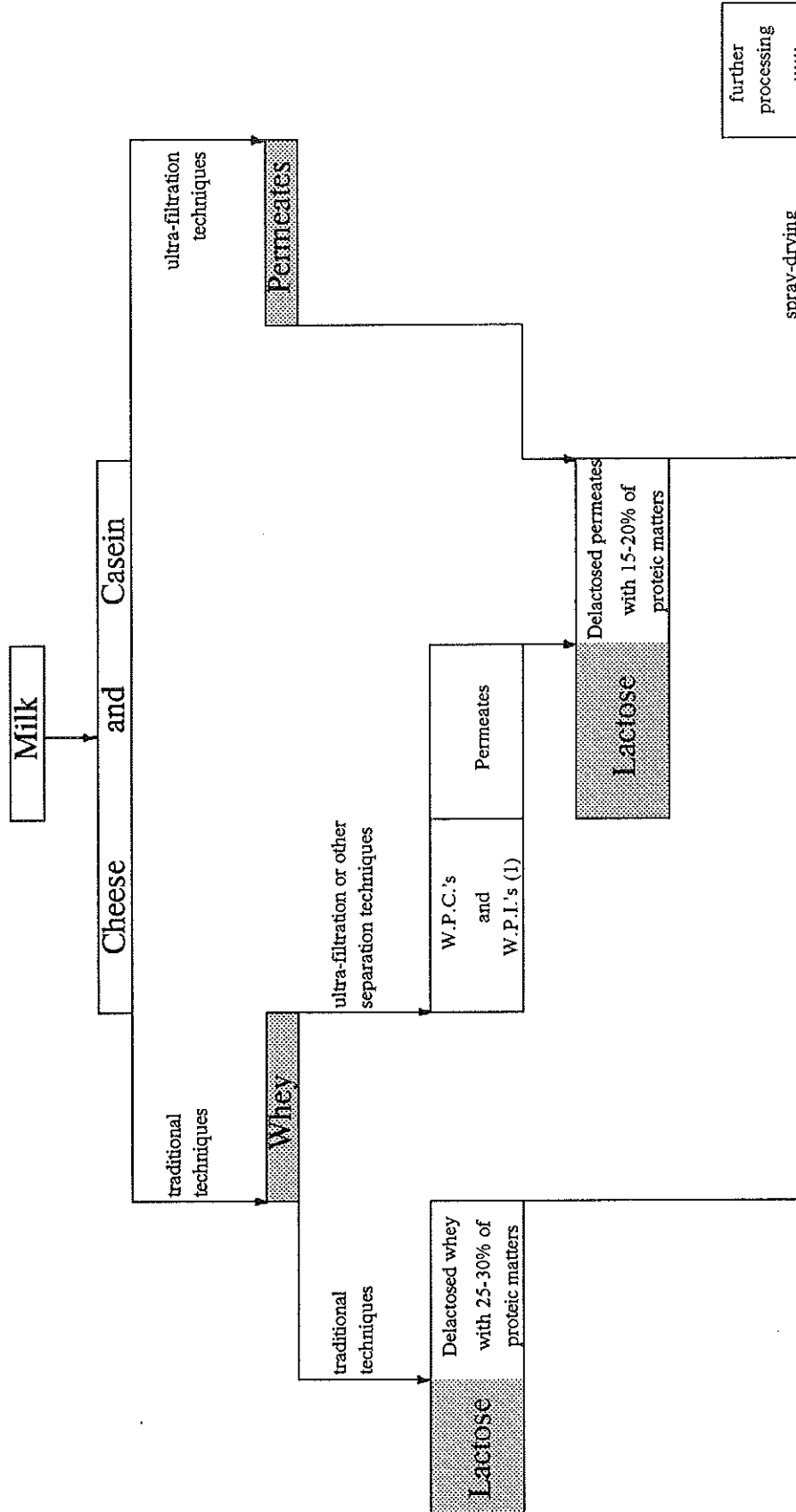
The second series of in-depth interviews will be carried out with operators of the dairy sector being responsible of the economic management of the lactose containing raw materials which they have in charge. These interviews, which will be carried out mainly at the level of R & D but also every time that it will be necessary with the marketing management, will allow to have a finer upstream vision by listing qualitatively and quantitatively the available stocks of raw materials (wheys, permeates, etc.), the possible technologies of non-food utilization, the eventual current projects, the marketing vision of the future, the "products-portfolio" on which these ways of utilization are issuing and the technico-economic feasibilities of these ways and products.

This phase will have to make also possible to identify the "downstream" industrial sectors where replacement (by these products) are presently studied.

It will also be looked, during this phase, at determining, further to the situations experienced, the economic thresholds likely to satisfy the dairy operators in function of the main types of raw materials (origin, residual composition, specific constraints related to environmental protection, etc.) as well as of the ways they are made available:

- **of classical whey origin:**
  - native whey as such,
  - (pre)concentrates semi-liquids (containing from 50 up to 200-300 g. of total dry matter per litre) obtained by thermal way (and presently essentially used in animal feeding),

Figure 2  
Coverage diagram of the study



Key: (1) W.P.C.'s = Whey Protein Concentrates  
W.P.I.'s = Whey Protein Isolates

Source: D & K Consulting S.A.

#### 4.14 JAPAN - U.S.A. - CANADA

The coverage of these three countries (globally about 45 interviews) will start to be carried out only when will have been "sharpen" enough accurate objectives to be retained for the field interviews. This is especially valid for the "downstream" coverage where it will be necessary to verify on the one hand the European hypothesis and on the other hand to record the "factors of anticipation" enabling to foresee similar evolutions in Europe.

For each of these three countries it is foreseen to have a balanced repartition of the interviews between:

- dairy operators (overall some 12-14 interviews),
- specialized public and private research centres (overall some 10-12 interviews),
- downstream industries being potential end-users in the sectors retained as the most promising (overall about 20-22 interviews).

#### 4.15 RECOMMENDATIONS AND CONCLUSIONS - SYNTHESIS

We will then be in a position to set up an "upstream-downstream" comparative balance confronting:

- the present and foreseeable availabilities,
- the potentialities resulting from the needs by relevant end-uses,

that will allow to put in evidence the most directly realizable non-food ways of utilization with respect to various criteria such as:

- available and foreseeable volumes,
- simplicity of the supply,
- competitive positioning,
- profitability,
- potential of development of the markets concerned.

The conclusions of the study will be put together in a report of synthesis, including strategic recommendations, which will be presented according to the following sequence:

1. Assessment of the present and future availabilities of wheys and permeates
2. Assessment of the non-food ways of utilization
3. Determination of the possible "products-portfolio"
4. Assessment of the potentialities of use of the products obtained (qualitative - quantitative and economical)

## 5. SUBSCRIPTION AND DURATION

### 5.1 SUBSCRIPTION

The price of subscription to this study is of **SFR 40 000.-** (forty thousands swiss francs) for all the companies who will have subscribed before the official start of the research, which is foreseen to take place at the end of November 1991.

The payment terms are the following:

- 50% at the official start of the research,
- 30% two months later,
- 20% at the remittance of the report.

Each client will receive two copies of each report (in English).

### 5.2 DURATION

If the research may start at the end of November 1991, the reports are foreseen to be made available in the course of June 1992.

## 6. QUALIFICATIONS

**D & K Consulting** has been founded at the beginning of 1989 by two associated partners, **Willy Devaux** and **Luciano Kramar**, who have put together more than 20 years of experience in the field of research in industrial and strategic marketing.

Specialized in strategic and forecasting studies, **D & K Consulting** proposes to a wide range of international operators a prospective approach making possible to perceive the evolution of the balance of power in the systems examined.

These studies involve, in the frame of a structured information, strategic recommendations likely to justify the appropriate decisions in terms of investments, diversification, specialisation, etc.

**D & K Consulting** has recently carried out several multi-client studies related to the valorization of by-products in the agro-food industries as well as to the field of food ingredients, especially concerning dietary fibres, bulk sweeteners and products derived from crops alternative to the sugarbeet such as chicory and Jerusalem artichoke (inuline, fructo-oligosaccharides, fructose syrup, etc.).

The present study will be managed and supervised by the two co-founding partners of the company, respectively **Mr. Willy Devaux** and **Luciano Kramar**, who will associate to the project the foreground competences of **Mr Georges Letourneur**, specialist of the subject covered, as Scientific and Technical Adviser.

- **Willy Devaux:** Belgian, born in 1937, chemical engineer, Mr. Devaux has worked for 5 years at the R & D Centre of Union Chimique Belge and for more than 16 years with the Compagnie de St-Gobain in various countries, both in R & D and in marketing positions, before joining GIRA in 1982. He has, as Director of Research, headed many programmes in the agro-food area, concerning among others food ingredients, sweeteners, proteins, starter cultures, hydrocolloïds, emulsifiers, thickeners, stabilizers, natural and synthetic flavours as well as colors. He has supervised many projects concerning the European markets, especially in the context of 1993 with a major specialization on France, Italy, Switzerland, Benelux and Scandinavia. He has also contributed to the realization of studies related to the valorization of biomass. He participated, beginning of 1989, as co-founder with Mr. Kramar, to the establishment of **D & K Consulting**. Mr Devaux has very recently headed an important study related to the problematics of the waste waters treatment in some thirty industrial sectors, amongst which the dairy-industries.  
Languages: French, English, Italian.

- founding member and recently President (1988/90) of AGRILAIT (Association for the research in the dairy industries),
- member of the Scientific Council of the Department of dairy technologies of the INRA (1990/91).

Mr. Letourneur has participated in many studies missions in Japan, in the U.S.A., in Canada and in the major European countries in the sectors of biotechnologies, of the valorization of the dairy co-products, of the organization and of means of R & D as well as of the markets of the ingredients. He joined D & K Consulting as Senior Consultant and Scientific Adviser in 1991.  
Languages: French, English.

- **Bernard S. Horton:** American, Mr. Horton has 24 years of experience in processing wheys by ultrafiltration and reverse osmosis. He was part of the team at Abcor, Inc., which built the world's first commercial whey ultrafiltration and permeate reverse osmosis plants. He was Vice President and General Manager of the Membrane Equipment group at the time he left to set up his own consulting practice in 1977.

Mr. Horton, as President of Horton International, Inc. has performed a wide range of technical and market studies for both dairy products and dairy process equipment companies. These include a comprehensive and detailed study of fractionation and conversion processes for whey and milk and a study of the use of ultrafiltration for cheesemaking.

Mr. Horton has spent much of his time seeking alternatives for permeate utilization and has consulted for companies with important chemical use technologies.

Eight years ago, Mr. Horton organized the only dairy products price forecasting service of its kind in the world. It now covers seven dairy products.

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The four of them will bring together the complementarity of their experiences for giving all the possible interdisciplinary cross-fertilization to a programme of research, the downstream part of which reveals to be particularly polymorphic.

**D & K Consulting** will also make full use of the services of its usual local consultants in North America, in Japan and in major European countries.

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November 1991

