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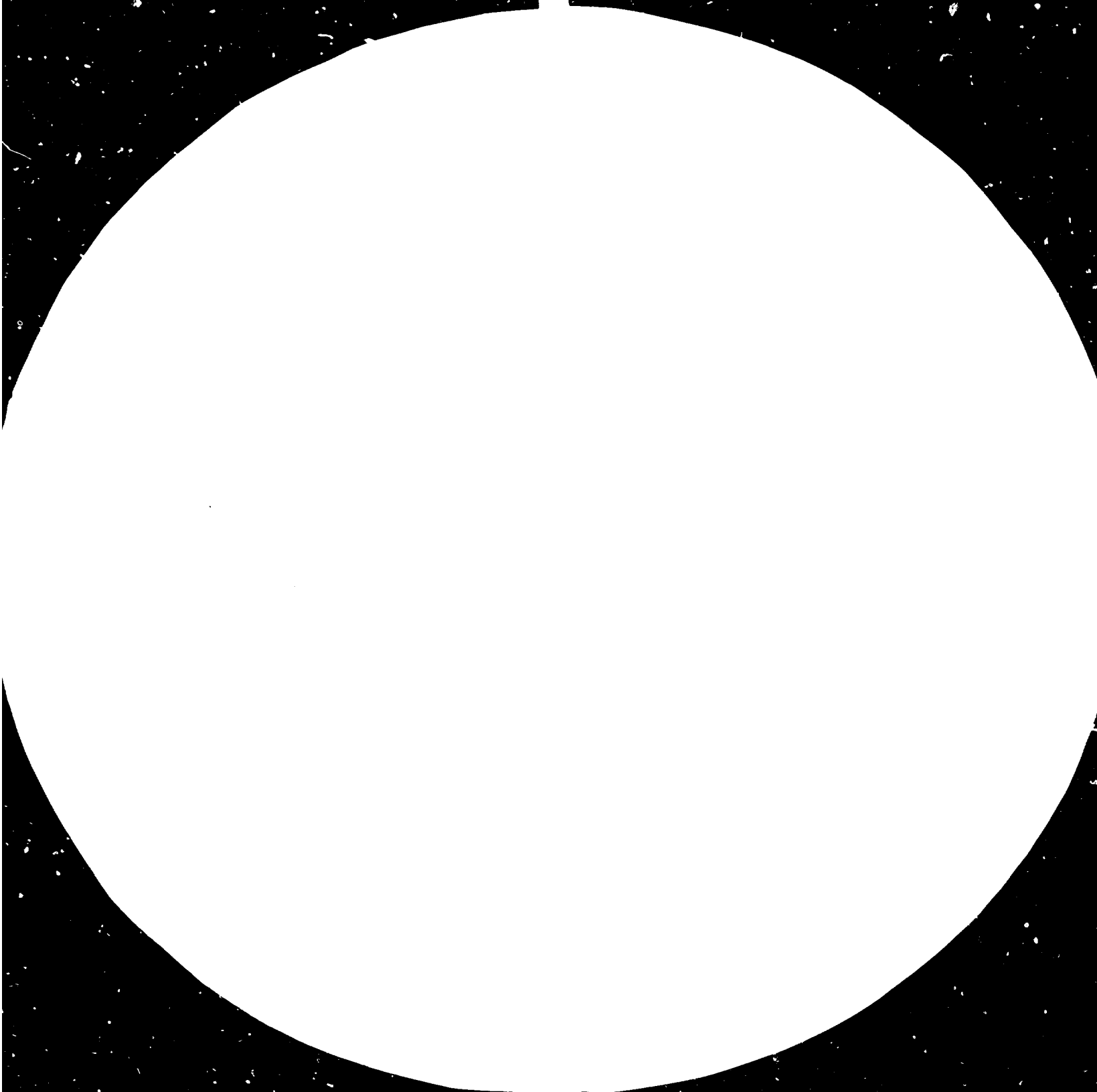
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PROBLEMS OF DEVELOPMENT OF THE DAIRY INDUSTRY
IN DEVELOPING COUNTRIES *

Information paper

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CONTENTS

	<u>Page</u>
Summary	3
1. Existing structure of production and international trade of dairy products in the world and trends in development of production and trade (P.R.)	7
1.1. Structure and development of production during the last 20 years	7
1.2. Development of trade during the last 20 years	8
2. Influences on demand for dairy products (P.R.)	9
3. International aspects of the milk market policies and the feed markets (P.R.)	10
4. Existing types of dairy industry in the world and in developing countries (M.R.B.)	12
4.1. Type of today's dairy industry in developed countries	12
4.2. Origin and type of dairy industry in developing countries	13
5. Key factors for successful development of the dairy industry in developing countries (M.R.B.)	14
5.1. Food strategy and politics of the country	14
5.2. Extension of animal husbandry and efficient animal feeding	16
5.3. Adequate scale of industry, suitable technologies and range of possible dairy products	17
5.4. Conditions for expansion of domestic markets for dairy products	20
5.5. Access to external markets	21
6. Fields of international co-operation for dairy industry promotion in developing countries (M.R.B.)	21
6.1. Animal husbandry	22
6.2. Research and technology	23
6.3. Training of personnel	23
6.4. Setting up industrial plants	24
<u>Annexes</u>	
Figure 1	26
Tables 1-8	27
References	35

Summary

1. Looking at the trends of production of trade in the dairy industry over the last 20 years, an increase in production and trade can be noticed. Three quarters of the world's milk supply is produced in developed countries. Dairy products are exported mainly by developed countries. Whereas the butter and cheese trade remains in developed countries, developing countries are the main importers of condensed and dried milk. World markets for dairy products are characterized by unstable conditions, low price levels and a search for markets for surpluses in the Third World.

2. In many developing countries a poor supply of dairy products prevails. Growth of population, income, prices of the product and the needs of the population have an impact on demand. The most important factor in developing countries is the missing purchasing power as a consequence of low income levels. Because of this many governments in developing countries try to keep consumer prices at a low level. This is possible using cheap imports of dairy products, which are surpluses from market economy developed countries. Those surpluses result from agricultural policy guaranteeing supporting prices to the farmers, who apply technological progresses. Because of this situation no incentives exist in developing countries for farmers to increase production, and therefore it stays at a low level. Improvement of technology and organization makes sense only if the agricultural policy framework is changed. Developed countries should limit their exports on the world market under current conditions, so that the Governments of developing countries might introduce incentives to encourage the farmer to produce more.

3. The dairy industry in industrialized countries is centralized. Daily, specialized plants process hundreds of thousands to several million kgs of milk into milk powder, evaporated milk, cheese, butter and different types of liquid milk. Modern dairy factories are fully automated and computerized. A result of the centralized processing is the milk collection over long distances with the help of insulated road tankers and a chain of farm chilling stations or regional chilling centres. Another consequence of the centralization is the storage of milk on the farms and the collection only every second or third day. In the alpine countries of Europe there are a few exceptions to this general pattern of milk collection and processing. Small dairy factories still exist transforming from one thousand to several thousand

kgs of milk a day. These factories produce mainly cheese. They compete favourably with the big factories because of the high quality of their products. Most dairy products are marketed in disposable packages. In certain countries glass bottles are still used for liquid dairy products.

4. Dairying and the production of various milk products played a big role in developing countries long before dairying was known in Europe. Traditional dairying still exists in most developing countries. Milk is transformed by members of the herdsman's family into butter, dehydrated butter, fermented milks, cheese and various other products. These dairy products are sold at nearby markets. Modern dairy factories have been established in several developing countries since the beginning of this century, above all in Latin America, Asia and in North and East Africa. European and American companies manufacture milk powder and evaporated milk in Latin America and the Far East.

5. The food strategy and the politics of the government have a big influence on dairy development. Cheap imports of milk powder and butteroil, and the export of the protein rich by-products of the oil- and fat industry, tend to paralyse dairy development in many developing countries. Indigenous dairy development, however, could lead to more intensive agricultural production where no further land resources exist. It could also create additional job opportunities, as milk is one of the agricultural raw materials on which associated industries can be built. The task of the government is not the collection and processing of milk, but the setting up of legal standards for milk processing and marketing. Other governmental activities could embrace the creation of training facilities for dairy specialists, the organization of advisory services and the financing of dairy research. The government, through its organs, must create a favourable environment for dairy development.

6. Governments must also encourage dissemination of improved animal husbandry and efficient animal feeding. Through assistance in setting up and running agricultural schools and training centres, advisory services and effective veterinary and artificial insemination services. All these services have to be organized in such a way, as to ensure that there is real co-operation with the government and the farmers in all areas of the country. No development is possible without a permanent and well-functioning link between the individual farmers and the supporting governmental services. It is the task of these services that the protein-rich by-products of the oil and fat industry are accessible to the dairy farmers.

7. The choice of technology is of the highest importance for the success of dairy development. Milk is a costly and highly perishable raw material. The equipment of a dairy factory, therefore, must be extremely reliable. Processing of milk into products with good shelf life should take place in the area where it is produced. In a hot climate, milk processing should be decentralized in order to allow the collection of milk from factories without an unreliable and expensive chilling system. Tools and equipment should be adjusted to the capabilities and level of training of the local workers. The equipment should be manufactured in the country in order to provide additional working opportunities to other sectors of the national economy. The possibilities of transfer of technology in the field of dairying are limited. The modern dairy technology of the "North" needs an extremely reliable infrastructure. It has been made with the aim to replace labour and not to create working and earning opportunities for marginally trained labour.

8. Besides the processing methods, the milk products have to be adapted to the prevailing conditions of the developing country. The milk products meant for the low income group of the population must be preserved in such a way, that they can be marketed without a "cold chain" and without expensive disposable packages. Some of the traditional dairy products of the developing countries answer these demands and are well accepted by the population. The expansion of the domestic market depends on the level of income of the local population. If the average income is low, the dairy industry must produce inexpensive products. Such products can be made either by subsidizing milk production or, if it is possible, by lowering the price of certain dairy products through the sale of luxury products at high prices. The access to external markets is needed in order to procure the necessary inputs for dairying, such as improved genetic material for fodder plants and dairy animals, glass, chemicals, laboratory equipment and metal sheets and bars for manufacturing equipment. The sale of dairy products on external markets is possible only in exceptional cases and is not a prerequisite for dairy development.

9. The most pressing needs for international co-operation exist in the fields of professional training and the procurement of some basic goods such as steel, non-ferrous metals, oil, fertilizers and genetic material. The research potential of developing countries should be improved by combining postgraduate training of students abroad with research work which must be

carried out in the student's home country. Such a system would also counteract the "brain drain" from developing countries.

10. Training of personnel from the developing countries' industry should as much as possible take place in the developing country. Courses organized by regional dairy training centres under conditions of a developing country are much more useful than the training of personnel in an industrialized country. Future dairy training must be orientated towards a "national" rather than a "western" dairy technology. It should help to reduce the dependency on foreign inputs and encourage the development of an autonomous dairy industry.

11. Instead of setting up dairy factories, international co-operation should help to train people and set up workshops and industries which construct and build the necessary equipment for a "home-grown" dairy industry.

1. Existing structure of production and international trade of dairy products in the world and trends in development of production and trade

1.1. Structure and development of production during the last 20 years

12. From 1960/62 and 1980/82 the milk production in the world has increased from 353.4 mio t to 474.9 mio t.^{1/} This corresponds to an annual growth rate of 1.7%. Buffaloes, as the most important milk animals in developing countries,^{2/} showed a much higher growth rate (3.8% per year). Nevertheless, in 1980/82 only one quarter of the world milk production was produced in the developing countries. Taking into consideration the animal population, a great difference is found in the per head production. Whereas in the developed countries in 1980/82 0.309 t per head were produced, the same figure for the Third World is about ten times less.

13. Although buffaloes are showing an increase in milk productivity, cows still produce ten times more milk. Therefore, the poor conditions for milk production in developing countries have to be considered:

- double use (milking animal and draught animal)
- difficult climatic conditions
- poor fodder quality

14. Therefore we find a much higher absolute growth rate for milk production in the developed countries than in the developing countries during the last 20 years.

15. Milk is processed accordingly. In 1960/62 most of the processed products (butter and ghee, cheese, dry milk, condensed milk) were produced in the developed countries. Since then we find the following changes:

Butter production increased in Eastern European Socialist countries, where an annual growth rate of 1.5% was realized. In Western industrialized countries there was only a small growth as a consequence of the agricultural policy considering butter as an expensive way to get rid of surplus milk. Among the group of developing countries India is the most important producer of buffalo butter (ghee). Nevertheless, in 1982, only one quarter of the total world production (7.156 mio t) came from the developing countries.

1/ World milk production FAO, 4 animal categories (cows, buffaloes, sheep and goats).

2/ To simplify matters FAO classification is used for countries into Developing and Developed.

Cheese production in the developed countries more than doubled from 1960/62 to 1980/82. Most of that increase was realized in Western countries in consequence of their agricultural policy stipulating that milk surpluses can be marketed in form of cheese at lower costs. One quarter of the total world production is produced in the developing countries.

Manufacture of condensed and dry milk demands considerable investments in processing plants. In the sixties, therefore, these products were produced practically only in the developed countries. Today there are also some plants in Latin America and South East Asia, but they are of low importance in comparison to world production.

16. Summarizing it can be said that the high amount of manufactured dairy products is a result of the agricultural policy in the developed countries. By guaranteeing high prices to their farmers, those countries produce milk surpluses which have to be processed. In developing countries the production of dairy products is still low due to low milk production and poor channels of marketing and processing.

1.2. Development of trade during the last 20 years

17. Regarding the trade of dairy products the following trends for the different products can be observed:

Cheese is a traditional export product of certain developed countries. Since 1960/62 exports have tripled, but the share of developing countries has remained with little change. Trade between developed countries is important, although oil exporting countries in the Near East became new customers during the seventies (1980/82: 15% of world imports).

The world market for butter has principally the same structure as that for cheese. Most trade takes place within the European Economic Community (EEC), but two differences may be noted:

- (a) The developing countries' imports of butter amount to 30%. Therefore their importance as importers of cheese has increased. Nearly all regions of the Third World contribute to this increase of imports.
- (b) The demand of some Eastern European Socialist countries - especially the USSR - varies depending on their own supply situation.

Dry and condensed milk shows a parallel development. Already in 1960/62 developed countries were exporters of these products and the developing countries were importers. In 1980/82 the developing countries imported 60% of dried milk and 75% of condensed milk. In many developing countries these imports are used for the production of recombined milk. Very often these plants belong to multinational companies.

18. Summarizing it can be said that most of the milk is produced in the Western developed countries. The agricultural policy of those countries stimulates the farmers to use technical progress. The resulting surpluses have to be sold on the world market. Consequently the world market for dairy products can be characterized in the following way:

- irregular offer of developed countries
- low price levels
- search of markets in developing countries.

2. Influences on demand for dairy products

19. After discussing the production, the influences on demand for dairy products should be considered. One should concentrate on the special situation prevailing in the developing countries on a theoretical basis, which will be illustrated by some examples (Zurek 1984).

20. By economic theory the following factors influence the demand:

- population
- income
- prices
- structure of needs.

21. Each population has a certain structure concerning age and social classes. This structure varies between countries and regions. Different groups have different requirements.

22. Changing income changes demand. Increasing or decreasing income affects the consumption of other groups of food. For example, with an increased income basic food is replaced by more expensive and better food, such as meat and certain dairy products.

23. In general higher prices decrease demand and vice versa. In addition one must take into consideration the prices of substitutes and of new products, which could appear on the market in the future. If substitutes or new products are cheaper, they replace traditional products.

24. If one wants to learn about specific development of the demand, the changes of these four factors must be analysed. This is illustrated with the

help of a Peruvian example. These demand factors are now specified for the situation prevailing in developing countries:

25. A low consumption level of dairy products in developing countries can be observed. Considering the poor food supply in most of those countries, there is a need for dairy products. For a large part of the population, however, this need cannot be satisfied due to lack of purchasing power. The existing income is used for basic foods. In the immediate future a noticeable change of that situation cannot be expected. Another important aspect is the unequal distribution of income in developing countries; only a relatively small part of the population can afford dairy products. As a third point one must consider the trend of growing urban areas in the developing countries resulting in a decrease in the population able to produce its own food (subsistence-agriculture). Without sufficient purchasing power the increasing demand for dairy products cannot be realized on the market.

26. An investigation into the demand for dairy products in an urban region in the Department of ICA in Peru (1984) showed the following:

- (a) Most children drink milk daily. They would drink more, if the income of their parents would allow it.
- (b) Middle and lower classes would consume more milk if their income increased (income elasticity \approx 0.8 - 1.4).
- (c) Pasteurized milk and canned milk are highly competitive, but high quality fresh milk is preferred. Low prices of fresh milk with low quality do not effect higher consumption.
- (d) Dried milk has a special position depending on changing prices.

27. An economically better situation would lead to an increase in demand for dairy products, especially the middle class (Amat y León 1983).

3. International aspects of the milk market policies and the feed markets

28. Exploring milk production and feeding systems for dairy industry in a developing process is a many-layered matter. Therefore a scheme is used showing the many-fold interrelations and influences (Figure 1).

29. In the centre of the scheme are the milk production systems and the oilseed production in the developing countries. Usually one finds simultaneously small, middle-sized and large farms (haciendas, co-operatives, state farms, etc.) in developing countries. Small farms produce mainly for home consumption, middle-sized farms for local markets and the large farms for the milk-processing industry (Jahnke 1982).

30. Whereas on local markets purchasing power is lacking, the milk processing industry faces a hard price competition on the world market with its surpluses. Consequently, milk processing industries prefer to buy subsidized milk powder, imported from the developed countries. By recombining imported milk powder with water and other ingredients a substitute for the indigenous dairy products is obtained.

31. There exists on the world market a strong link between the milk policy of the developed countries and developing countries. Governments of the developed countries guarantee their farmers high milk prices. All market developed countries produce in relation to their own consumption surpluses, which are exported with the help of governmental subsidies. Consequently world market prices are very low. Milk powder is also given as food aid to the developing countries.

32. The developing governments face a difficult situation. As the poor population can afford to buy only cheap dairy products, they prefer to import subsidized milk products instead of guaranteeing a milk price to their own domestic milk producers (FAO 1980).

33. With the lack of stable and minimum prices for milk, the milk producer has no incentives to enhance milk production and to make use of technical and biological progress. For instance, in Peru, there has been a decrease in milk production and an increase in imported substitutes (CNUCED 1982).

34. The feeding products of the oilmeal industry are usually sold on a free world market. Milk producers in developing countries are not able to buy these products, nor are the big milk farms because of low producer prices. Furthermore, the available genetic material is not used economically.

35. Independently where the oilmeal plants are sited, the bulk of the oilmeal derivatives are sold to developed countries, where high milk prices make a high use of concentrates economical, leading again to export to developing countries of milk surpluses in the developed countries.

36. In conclusion it is recommended that governments stabilize milk prices by a minimum milk price system.

37. Developed countries should not "help" the developing countries by subsidizing their milk exports. A higher price level on world market creates incentives for farmers in developing countries. Financial aid from developed countries could subsidize milk products for poor people. In this way production would increase and more people would be able to buy milk products.

4. Existing types of dairy industry in the world and in developing countries

4.1. Type of today's dairy industry in developed countries

38. In the last thirty years, milk transformation in industrialized countries has become more centralized. Dairy factories and the dairies producing condensed milk and milk powder have grown in size, but diminished in number. The result of this development is that milk has to be transported over ever increasing distances to the dairy factories. To prevent it from spoiling, it has to be collected through a system of chilling centres. In Europe, however, there are a few exceptions to this general patterns of milk collection and milk processing. In certain parts of Austria, France, Italy and Switzerland, cheese is still manufactured in small artisanal dairies. Whereas an ordinary cheese factory in Northern Europe (Holland and Germany) or in the United States transforms several hundred thousand kgs of milk a day, these artisanal cheese factories only process between one thousand and ten thousand kgs per day.

39. The time period laps from milking to milk processing is further increased by the fact that milk is no longer collected from the farms twice a day, but only in intervals of one, two or even 3 days. Between milking and collection, the milk is stored in chilling tanks on the farm. The transport to the processing centre takes place by road tankers with capacity between ten and twenty thousand kgs. The quantity of milk delivered by each farmer is recorded by an automatic flow meter, which may be coupled with a printer.

40. The modern dairy factories of Europe, the United States, New Zealand and Australia are fully automated. The milk is transported to the various storing processing sites by pumping through a closed system of tubes. Most of the operations are electronically controlled and registered. The different milk circuits within the dairy factory are governed by electronically activated valves. The transformation of the milk into the various products takes place according to a computerized processing programme.

41. With a few exceptions the dairy products, especially liquid milk, cream, cultured milks, milk drinks, butter and fresh cheeses are packed in disposable packages. Different food grade plastic materials or cardboard combined with plastic foils are used. In some countries the glass bottle is still used for packing milk.

42. It is true that in Europe and the United States there are still small dairy factories which are not fully automated and where manpower and more qualified dairy specialists for milk processing are required. This is especially true for the small artisanal cheese factories. Recently, there has been a trend in Europe to reverse this centralisation of milk processing. From England and Holland there are reports that the "farm-cheese-factories" are gaining ground. Also in Switzerland, where roughly 50% of all commercialized milk is transformed into cheese, the artisanal cheese factories have a very good chance of survival. The reason for this is their excellent product quality. The small factories, run by well-trained specialists, are able to tailor their products to the wishes of their clients. They, therefore, compete favourably with the big factories.

4.2. Origin and type of dairy industry in developing countries

43. Long before milk processing was practised in Europe and the United States, dairying and the production of various milk products played a big role in today's developing countries. Archaeological proof exists that to several thousands of years B.C. dairying and milk processing played a big role in Asia, especially in the Near East (Mair-Waldburg 1974). Such milk products as cultured milks, dehydrated butter fat, dried buttermilk and white cheese were developed in these countries (Martiny 1895).

44. Milk was always an important food item for the nomads in the tropics, especially in the dry zones. In these areas mankind has kept not only cattle, but also sheep, goats, camels, buffaloes and horses as dairy animals. The traditional dairy products are fermented milks, dehydrated butter fat, dehydrated and sweet milk (Khoa), dried proteins from buttermilk, white cheese kept in brine and several types of cured cheese. These products are traditionally made by the milk producer.

45. The traditional material for milk processing in developing countries is made by the herdsmen themselves or by craftsmen in the area. Even today this traditional dairying is practised by many nomadic tribes in Asia and Africa and by farmers who keep dairy animals. In Nepal the main cash income of many farmers is from ghee (dehydrated butter fat), produced from the milk of buffaloes.

46. With colonialism, a European type of dairying and milk processing was brought to many developing countries. It was introduced in North and East Africa as well as in India, Pakistan and the Far East. Factories for the milk-powder and condensed-milk industry were also set up in Asia and the Latin American countries. The creation of a secure outlet for milk encouraged European and American dairy farmers to settle in many tropical countries. They introduced dairy breeds and advanced breeding and husbandry techniques. This development which started roughly a hundred years ago has led to the present situation, where additional dairying and a modern-type dairying can be found side by side in many developing countries.

5. Key factors for successful development of the dairy industry in developing countries

5.1. Food strategy and politics of the country

47. The influence that governments have on dairy development is very important. There are certain West African countries where dairying plays a very small role and where practically all milk products are imported. On the other hand there are East African countries where dairying has reached a high level of development. These differences cannot be explained by climatical factors only, but are the result of a long term governmental policy. It goes without saying that a governmental policy aiming at food self-sufficiency and

at substituting food imports by national food production is a prerequisite for dairy development.

48. It is true to say that the costs for milk production in many developing countries are much higher than the world market price of milk and its products. However, if one decides to use dairying as a means of development, as has been done in Gujarat-State, India, dairying deserves support and protection by the policy makers of governments. It is a short-sighted policy to profit from low world market prices for milk products to the detriment of an indigenous dairy development. Such a policy does not only disregard dairying as a means of intensifying the existing agricultural production, but also ignores the fact that dairy development creates a large number of additional working opportunities. Additional jobs are created in animal husbandry, in fodder production, in the animal food industry (especially in the processing of by-products from the oil and fat industry and from flour mills), in milk processing, in the marketing of dairy products and in various trades and industries which produce tools and equipment for milk production and processing.

49. The question often arises as to how a government and its organs could best assist dairy development. Should the government itself engage in setting up fodder mills, dairy farms and dairy factories? Should ministries be responsible for milk production, milk transformation and marketing of products? As these activities are carried out more efficiently by the private sector, they should not be the tasks of governments. However, the government has to assist the private sector in carrying out these activities by making the necessary rules and regulations. Government should be the authority, accepted by producers and consumers, that fixes a fair price for milk; a price which encourages production without putting milk and dairy products out of reach of the average consumer. Furthermore, it is the task of the government to set up legal standards for producing, transforming and selling milk and milk products and to enforce the observation of these standards.

50. Other governmental activities which would help dairy development are the assistance in the creation of training facilities for dairy specialists at different levels, organizing an advisory service for milk producers and the dairy industry and organizing and financing dairy research. In other words, governments through their organs must create a favourable environment for

dairy development. They must encourage and support all those private parties who are willing to engage in milk production, processing and marketing of dairy products, and in the fodder industry. If the whole dairy sector, including fodder production, is supported by a favourable governmental policy, it will contribute to an overall development of the national agricultural production.

5.2. Extension of animal husbandry and efficient animal feeding

51. As has been mentioned in the previous paragraph, animal husbandry and efficient animal feeding can very well be encouraged by an adequate governmental policy, including the support of applied research and the setting up of advisory services. Besides these basic activities, governmental support is needed for the organization of services supporting animal husbandry, such as veterinary services and artificial insemination services. The organization of these two services should have high priority. On the other hand they offer direct opportunities to improve the performances of the local herds, and, on the other hand, they establish frequent contacts between the private farmers and the supporting organization. Such links are necessary for the diffusion of new ideas and techniques for better and higher production. In order to establish these essential links between the farmers and the public sector, veterinary services have to be organized throughout the country. Many such services exist in developing countries, but only a small number are engaged in the real work with the farmers.

52. What has been said about veterinary services is equally true for agricultural services. Here again it is a waste of skills and money to keep the trained staff in offices in the cities. Here again, posts and payment should be available above all for those who are willing to work under difficult conditions in rural areas. For both veterinary and agricultural services to be successful in rural areas in developing countries, there has to be an incentive for those willing to work under difficult conditions. This could be in the form of higher posts and payment. Diligence of veterinary surgeons and agricultural specialists is necessary for the extension of animal husbandry and the efficient feeding and utilization of all the food sources of a country.

53. For milk production, protein rich fodder is necessary. The farmer has to learn how to use and preserve his fodder sources in such a way that they retain as much protein as possible and remain digestible. He also has to learn how to supplement the fodder of his farm with protein-rich by-products from the industry. The by-products of the oil and fat industry have a special role to play as supplements for poor fodder such as straw which is used during the dry or cold season. Agricultural schools and services must ensure the diffusion of that technical knowledge and must inform the producers of these by-products of the local agricultural needs.

54. In many cases the utilization of by-products such as oil-cake, cereal bran, rice polish, bone-meal, fish-meal, cheese whey, fruit pulp from the juice industry etc. help to solve more than one problem. Their utilization not only help animal production, but also solves waste disposal problems. This means that part of the costs involved in drying, milling and marketing such by-products can be balanced by lower costs for waste disposal.

55. Processing of the different by-products is possible in specialized small or large fodder mills. These fodder mills should be set up and operated according to the existing level of development of the country. Similar to the dairy factories, they should be built and operated in order to provide additional working opportunities for local people and they should as far as possible use locally built equipment and machines.

5.3. Adequate scale of industry, suitable technologies and range of possible dairy products

56. In order to make the final dairy products accessible to the population in the low income bracket, collection and processing costs have to be kept as small as possible. Technologies requiring a lot of energy and/or expensive equipment, therefore, risk being inappropriate for developing countries. If, furthermore, such equipment needs highly qualified labour for its operation and maintenance as well as imported spare parts, its usefulness becomes extremely problematic.

57. Milk is a costly and highly perishable raw material and cannot be kept for hours or even days without spoiling. The reliability therefore of the collection system and the processing equipment has to be extremely high.

58. In this context the following basic principles should be observed:

- The processing of milk into a product with better shelf life than raw milk has to take place near the production site of the milk.
- The collection radius for milk should not exceed two hours of transport-time. If milk processing takes place within three hours of milking, collection can be carried out without the use of costly and often unreliable chilling centres.
- Transportation of the milk to the processing plant should be organized by the farmers and they should use their own means of transport. The milk must be paid for, according to its quality which must be assessed by simple, quick and inexpensive methods. The milk producers must understand these controls.
- The size of the milk processing plant depends on the quantity of the available milk within the above mentioned collection radius. In general from 300 to 3000 kg of milk are processed daily in such a plant. These are small plants compared with European dairy factories. However, they are much easier to manage and are usually more economical than big factories operating under the conditions found in developing countries.
- As far as possible buildings have to be constructed with both local materials and local skills.
- Tools and equipment should be adjusted to the capability and level of the local workers.
- As far as possible, the equipment should not be imported, but manufactured in the country in order to provide additional working opportunities to other sectors of the national economy. Local construction also ensures that service, maintenance, repair and replacement of the equipment is possible within the country and with local currency.
- Locally available energy should be used as far as possible. Besides renewable energy sources (solar radiation, wind, water) there should be an adequate supply of easily stockable energy, such as wood or coal.

59. It is evident that in the field of dairying the possibilities of transfer of technologies from industrialized countries to developing countries are limited. With the exception of the small rural or alpine dairy plants of Austria, Italy and Switzerland, the modern dairy plants of industrialized countries cannot be taken as models for dairy plants in countries which have recently started to build up dairying. However, there are exceptions to this general rule. In the so-called threshold-countries, such as India and Brazil, where development has already reached a rather high level and where technological know-how is more readily available than in other developing countries, more sophisticated technologies are possible. The technology must be adapted to the possibilities and requirements of the country.

60. Among the most pressing needs of many developing countries is the need for more working opportunities. In industrialized countries costly human labour is replaced with the help of modern technology. It is obvious that the technology of the "North" was developed to solve the problems of industrialized countries, and not to alleviate the difficulties of the developing countries. Northern technology can, accordingly, help to overcome the problems of the "South" only when it is carefully adapted to the needs and environment of the southern countries.

61. Not only the equipment, buildings and milk processing methods have to be adapted to the prevailing conditions of the developing country, but the milk products themselves. One of the basic principles of traditional food processing is: "To adapt the food to the prevailing climate and not the climate to the food". This principle has been neglected by food technologists of the industrialized countries because of the ready availability of cheap energy and high purchasing power of the consumers. Products have been developed, which have to be kept cold or frozen during the whole storing and marketing period. Such products are for instance pasteurized milk, fresh butter, soft cheese, ice cream. Whereas these products have their place and their market in economically developed countries, they should not become the main milk products in warm developing countries. It is extremely expensive to maintain a "cold-chain" in a tropical country, where there is neither a reliable infrastructure nor enough qualified manpower. Products which need cold storage also become excessively expensive and are not within the reach of the majority of the population. The only justification for producing such luxury products is to use them to cheapen those dairy products which are meant for the poorer population.

62. Milk products such as various types of fermented milk, white cheese in brine, dehydrated butter fat, several types of hard cheese, sterilized liquid milk, sweetened evaporated milk (Khoa) etc., which are adapted to the climatic conditions of developing countries, can be sufficiently well preserved for marketing without expensive refrigeration. Many of them do not even need retail packing which again lowers the manufacturing costs. Many of these products are traditional milk products of the "South" and were developed in hot countries long before they found their way into the dairy industry of the "North". All these traditional products are a much better stepping stone for industrial development than the dairy products of the northern industrialized countries.

63. Another difference between milk products in industrialized countries and developing countries is the utilization and combination of raw materials other than milk for the manufacture of dairy products. The food laws of most industrialized countries do not allow the mixing of milk with other raw materials such as vegetable proteins or fats for the preparation of the classical dairy products. For the build up of a dairy industry in developing countries, such restrictions are an unnecessary hinderance. In developing countries where the production of animal milk varies according to the seasons and availability of fodder, they should be allowed to supplement animal milk with protein extracts from beans (for instance soya milk), milk-like extracts from nuts, various vegetable fats etc. There is evidence in scientific reports that such combinations are not only possible but also have technological and nutritional advantages. Unfortunately in many developing countries the food legislations stem from colonial times.

5.4. Conditions for expansion of domestic markets for dairy products

64. The first aim of development is usually to attain better self-sufficiency in food and an improved nutritional status of the local population. The fact that dairying is an integral part of nearly all agricultural systems and that it is one of the few activities that offer even the landless rural population a small regular income (Bachmann 1978) is usually overlooked but, nevertheless, plays an important role. The most important reason, however, is the fact that dairying creates a variety of additional jobs. All these positive effects can be realized to the advantage of the country if a market exists for dairy products. Milk and milk products are usually enjoyed, even in those countries where the average per capita consumption is extremely low. It is believed that the reason for the low per capita milk consumption in many developing countries is the scarcity of milk and dairy products with their relatively high market price. The best way for expanding a domestic market for milk, therefore, is the production of low cost dairy products. This is possible if the raw material (milk) is available at a reasonably low price or if luxury products such as fresh butter, fresh cream, ice cream and various types of cheese are used to decrease the price of low cost products. Fat standardized or toned liquid milk, various fermented milks, white cheese, milk toffees, fruit milk mixtures and so on are nutritionally valuable and hygienically safe low-cost products.

65. The availability of traditional dairy products is another prerequisite for the extension of a domestic market. New dairy products are usually rejected by the majority of the population. In many Asian countries it is for instance very difficult to introduce cured cheese, whereas liquid milk or sweetened dairy products find a ready market. The product which is probably the best accepted worldwide is fermented milk or fresh curd. The strategy for expanding a domestic milk market, therefore, must be based on low cost dairy products and on traditionally accepted products. At a later stage of development the market can be expanded to include new or less-known products.

5.5. Access to external markets

66. Only in exceptional cases is the access to external markets a prerequisite for dairy development in Third World countries. Only if there is a very important dairy potential and, at the same time, an extremely small internal market, can the export of dairy products help to build up a dairy industry. Such a situation for example exists between India and some of the small Himalayan states at its northern border. Ghee for instance was for a long time one of the most important export products of Nepal.

67. Another question is whether access to external markets is necessary for procuring the necessary inputs for dairying. The answer depends on the internal availability of those necessary inputs. A certain amount such as glass, chemicals, laboratory equipment, metal sheets and metal bars for manufacturing equipment usually have to be imported, as to improved dairy cattle or other dairy animals for crossbreeding. Access to external markets and the availability of foreign exchange for procuring those goods are necessary for dairy development. However, besides such basic imports others must be limited in favour of an internal production of inputs.

6. Fields of international co-operation for dairy industry promotion in developing countries

68. Development cannot be bought or simply transferred. One has to accept that only changes of behaviour lead to real development. International co-operation often ignores those basic facts. It often aims at transferring methods and systems from northern industrialized countries to the South without looking at the real needs of the recipients and their human and physical environment.

69. The most pressing areas for international co-operation with developing countries are in the fields of basic schooling and professional training. Many countries lack the necessary know-how for their technical and economical development. As a result of unfavourable terms of trade, they are also short of the necessary, foreign exchange for buying basic goods, such as steel, non-ferrous metals, oil, fertilizers (especially phosphate and nitrogen) and genetic material for plant and animal breeding. International co-operation should, above all, help the developing countries to procure the technical know-how and basic goods.

6.1. Animal husbandry

70. Co-operation in the training of field staff for veterinary and artificial insemination services, as well as agricultural advisors, should be intensified. In order to make sure that the trained staff is familiar with the local conditions and is willing to work in rural areas, such training should be organized as far as possible in the developing country concerned.

71. A second area of international co-operation is the provision of genetic material for improving the local dairy herds. This can best be done by helping to organize an artificial insemination service and by providing the necessary high quality sperm or by giving assistance to set up bull stations.

72. One should always try to improve the local cattle by crossbreeding and not by importing dairy cows to replace the original female stock. Importing dairy animals from industrialized countries to tropics is still a very risky and expensive operation. The development of improved herds through crossbreeding allows the use of the existing female production potential, preserves the resistance and hardiness of the local breed and gives the farmers sufficient time to adapt their fodder base and their husbandry practices to the new demands. A good example for such co-operation is the Indo-Swiss-Project in Kerala and in the Punjab (India). During the past 20 years this joint cattle breeding project has led to the creation of four bull stations, five semen banks and 1000 insemination centres throughout the state of Kerala. The number of crossbred calves born per year is 300,000 and the availability of milk per inhabitant has more than doubled over the past 15 years (Wilhelm, 1983).

6.2. Research and technology

73. While discussing the key factors of successful development of a dairy industry the need for adapting the technology to the prevailing conditions has been stressed. The same applies to research. Research carried out in and for the profit of industrialized countries has very limited influence on the development in the Third World. However, if research is carried out on subjects which are directly related to basic problems of the developing countries and in close collaboration with research institutions in those countries (universities, experimental stations etc.), its influence on development can be important. In this connection it should be mentioned that the training in industrialized countries of research workers from developing countries is often contraproductive. The well-known "brain drain" which results to the detriment of the developing countries has to be stopped. The programmes for training in many universities, therefore, have to be revised. In order to avoid alienation postgraduate training should always be combined with thesis work which has to be carried out in the home country of the trainee. This would not only counteract the brain drain, but would also increase the research potential of the developing countries. The Swiss Federal Institute of Technology in Zürich has been collaborating in this way with the University of Nairobi for the past ten years. The results of such training of food scientists are very encouraging.

6.3. Training of personnel

74. The usefulness of training personnel from developing countries in industrialized countries is usually over-emphasized. The best training seems to be a combination of in-job training and course work at specialized training centres located in the developing country itself. For the training of personnel for the dairy industry, several regional dairy training centres have been set up by DANIDA and FAO. Such centres, training people under similar conditions to those at home, are much more useful than programmes organized in industrialized countries. An "adapted" dairy training is an important factor in successful dairy development and must, therefore, take into account the conditions, traditions and standards of a country.

75. Future dairy training must be orientated towards a "national" rather than a "western" dairy technology. It should help to reduce the dependency on foreign inputs and encourage the development of an autonomous dairy industry.

76. For training to be successful, the selection of trainees is very important. For the operation of small dairy farms the trainees should be familiar with the area and therefore selected from the vicinity of the plant. Selecting staff for rural dairies from unemployed academics or from the urban population is risky because of their lack of identification with and assimilation to the rural society among which and for which they are supposed to work. In training, level of schooling has to be considered and generally training abroad is hardly possible. International collaboration for such individual and tailor-made training programmes would be highly appreciated. If a well-conceived practical and theoretical training programme were applied, three to four dairy specialists, stationed in a rural dairy, would be able to train the staff for a similar dairy within two to three years. The training in an ordinary rural dairy plant has the advantage that the trainee learns to work under similar conditions to those he will have to work with later.

77. The training of staff for urban factories follows more or less the same pattern. Also here it is very important that the personnel are trained under the same conditions as those with which they will later have to deal.

6.4. Setting up industrial plants

78. Setting up industrial dairy plants in developing countries with international co-operation has been practised for the last 30 years. However, that co-operation has been only partly successful. Due to insufficient training and technical know-how, many of those industrial plants are no longer operational, and those that are, rely heavily on outside technical and economic assistance and government subsidies. The exception is the small factory which is mainly equipped with locally-made tools and equipment.

79. It is apparent, therefore, that the developing countries would benefit to a far greater extent from international co-operation and assistance in on-the-spot training and in the creation of workshops and plants to construct the necessary tools and equipment for a home-grown dairy.

80. Much more research is needed for the development of appropriate equipment. Inexpensive equipment has to be made for the collection and transformation of solar energy, for the production and storage of biogas, for the sterilization and distribution of liquid milk (without retail package),

for the processing and packing of cheese or cheese-like products, for manufacturing sweetened evaporated milk, for making ice cream etc. International assistance is extremely welcome not so much for the setting up of dairies, but for the development of appropriate tools and machines.

Annex

Figure 1: Dairy Production in LDC's and Agricultural Policy in DC's

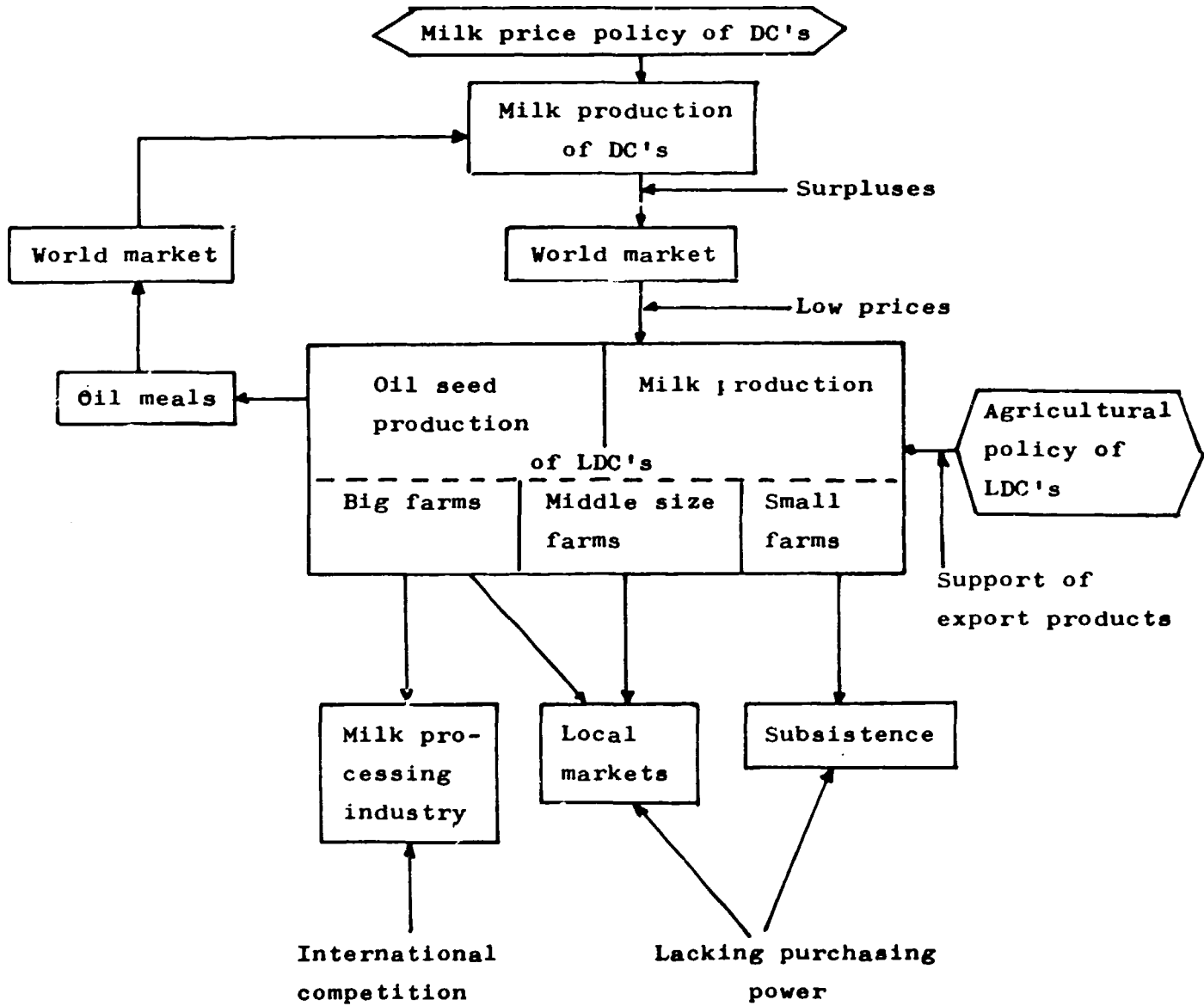


Table 1:

	Cow milk production in mio t			Milk Yield in kg/cow/year	
	60-62	70-72	80-82	70-72	80-82
DC's Market Economies	184.4	198.8	230.14	3488	4060
LDC's Market Economies	51.0	51.5	67.29	628	662
Africa	9.6	5.2	5.88	325	338
Latin America	21.6	24.8	33.97	979	966
Near East	6.3	6.3	9.47	574	648
Far East	13.5	15.1	17.91	512	519
Others	n.a.	0.05	0.06	1428	1197
Centrally Planned countries	n.a.	119.9	134.23	1949	2038
Asia	n.a.	3.4	6.05	506	676
Eastern Europe + USSR	89.5	116.5	128.18	2128	2252
DC's	273.9	315.3	358.32		3154
LDC's	n.a.	54.9	73.34		663
World	n.a.	370.2	431.66		

Source: FAO, Production Yearbook

Table 2:

	Buffalo milk production in 1000t		
	60-62	70-72	80-82
DC's Market Economies	142	16	68
LDC's Market Economies	15567	24065	26284
Africa	-	-	-
Latin America	-	-	-
Near East	1367	1378	1635
Far East	14200	22687	24649
Others	-	-	-
Centrally Planned countries	n.a.	1060	1494
Asia	n.a.	1030	1467
Eastern Europe + USSR	58	30	27
DC's	200	46	95
LDC's	n.a.	25095	27751
World	n.a.	25141	27846

Source: FAO, Production Yearbook

Table 3:

	Cheese Production in 1000t			Butter and Ghee Production in 1000t		
	60-62	70-72	80-82	60-62	70-72	80-82
DC's Market Economies	3233	4958	7433	2920	3049	3326
LDC's Market Economies	n.a.	2412	1371 ¹⁾	n.a.	1219	1527
Africa	n.a.	25	36	n.a.	46	65
Latin Amerika	n.a.	478	622	n.a.	147	217
Near East	n.a.	421	696	n.a.	264	319
Far East	n.a.	1488	17 ¹⁾	n.a.	762	926
Others	-	-	-	-	-	-
Centrally Planned countries	n.a.	1474	2882	n.a.	1791	2299
Asia	n.a.	176	195	n.a.	79	122
Eastern Europe + USSR	667	1298	2687	1335	1711	2177
DC's	3900	6256	10120	4255	4760	5503
LDC's	n.a.	2588	1566 ¹⁾	n.a.	1298	1650
World	n.a.	8844	11686 ¹⁾	n.a.	6058	7153

1) without India

Source: FAO, Production Yearbook

Table 4:

	Condensed Milk Production in 1000t		
	60-62	70-72	80-82
DC's Market Economies	2966	3444	2914
LDC's Market Economies	n.a.	619	925
Africa	-	-	0.2
Latin America	n.a.	263	453
Near East	n.a.	-	1.8
Far East	n.a.	356	470
Others	n.a.	-	-
Centrally Planned countries	n.a.	551	919
Asia	n.a.	52	89
Eastern Europe + USSR	n.a.	499	830
DC's	n.a.	3943	3744
LDC's	n.a.	671	1014
World	n.a.	4614	4758

	Dry Milk Production		
	60-62	70-72	80-82
DC's Market Economies	1810	3369	4580
LDC's Market Economies	n.a.	208	461
Africa	n.a.	3.2	2.8
Latin America	n.a.	202	416
Near East	n.a.	-	-
Far East	n.a.	2.8	46
Others	-	-	-
Centrally Planned countries	n.a.	434	971
Asia	n.a.	18	45
Eastern Europe + USSR	n.a.	416	926
DC's	n.a.	3785	5516
LDC's	n.a.	226	506
World	n.a.	4011	6022

Source: FAO, Production Yearbook

Table: 5

- 31 -

	Butter exports in 1000 t		
	60-62	70-72	80-82
DC's Market Economies	499.2	730.8	1292.2
LDC's Market Economies	24.6	16.1	18.2
Africa	3.9	2.1	0.5
Latin America	16.9	7.9	6.7
Near East	2.1	3.0	3.1
Far East	1.7	3.1	7.8
Others	0	0	0
Centrally Planned countries	n.a.	66.5	81.2
Asia	n.a.	0.6	-
Eastern Europe + USSR	588	65.9	81.2
DC's	347.1	796.7	1373
LDC's	n.a.	16.7	18.2
World	n.a.	813.4	1391.2

	Butter imports in 1000 t		
	60-62	70-72	80-82
DC's Market Economies	483.2	563.1	699.3
LDC's Market Economie	55.3	175.1	433.6
Africa	17.6	34.1	93.7
Latin America	16.3	59.1	79.7
Near East	11.4	36.4	157.9
Far East	10.0	39.7	80.5
Others	0	5.8	6.9
Centrally Planned countries	n.a.	62.2	278.4
Asia	n.a.	0.6	6.2
Eastern Europe + USSR	74.8	61.1	272.2
DC's	558.0	624.7	971.5
LDC's	n.a.	175.7	439.8
World	n.a.	800.4	1411.3

Source: FAO, Trade Yearbook

Table 6:

	Cheese exports in 1000 t		
	60-62	70-72	80-82
DC's Market Economies	467.0	759.4	1439.4
LDC's Market Economies	5.5	9.5	23.6
Africa	0.4	0.8	0.1
Latin America	4.1	6.0	17.8
Near East	0.9	2.4	5.0
Far East	0.1	0.2	0.7
Others	0	-	0
Centrally Planned countries	n.a.	-	59.5
Asia	n.a.	-	0
Eastern Europe + USSR	27.5	56.5	59.5
DC's	494.5	815.9	1499.1
LDC's	n.a.	9.5	23.6
World	n.a.	825.4	1522.7

	Cheese imports in 1000 t		
	60-62	70-72	80-82
DC's Market Economies	410.6	706.3	1139
LDC's Market Economie	51.9	88.8	307
Africa	22.2	22.6	27.0
Latin America	17.0	21.9	50.0
Near East	9.5	34.2	215.0
Far East	3.2	7.8	11.5
Others	0	2.3	3.1
Centrally Planned countries	n.a.	22.6	33.7
Asia	n.a.	0.1	0.2
Eastern Europe + USSR	25.1	22.5	33.5
DC's	435.7	728.8	1173.0
LDC's	n.a.	88.9	307.0
World	n.a.	817.7	1480.0

Source: FAO, Trade Yearbook

Table 7:

	Dry milk exports in 1000t		
	60-62	70-72	80-82
DC's Market Economies	438.8	1446.4	2331.2
LDC's Market Economies	1.8	13.9	34.9
Africa	0.7	2.2	0.1
Latin America	0.6	5.8	12.5
Near East	0	0.7	1.6
Far East	0.5	5.2	20.6
Others	0	0	0
Centrally Planned countries	n.a.	5.0	40.8
Asia	n.a.	1.1	0.2
Eastern Europe + USSR	0.6	3.9	40.6
DC's	439.4	1450.3	2371.9
LDC's	n.a.	15.0	35.1
World	n.a.	1465.3	2407.0

	Dry milk imports in 1000t		
	60-62	70-72	80-82
DC's Market Economies	224.5	685.5	843.4
LDC's Market Economie	426.1	641.0	1410.4
Africa	16.7	75.0	258.9
Latin America	112.6	248.2	443.5
Near East	10.0	53.8	273.1
Far East	285.8	260.5	430.2
Others	0	3.4	4.7
Centrally Planned countries	n.a.	46.5	166.5
Asia	n.a.	18.6	68.9
Eastern Europe + USSR	5.5	27.9	97.6
DC's	230.0	713.4	941.0
LDC's	n.a.	659.6	1479.3
World	n.a.	1373.0	2420.3

Source: FAO, Trade Yearbook

Table 8:

- 34 -

	Condensed milk exports in 1000t		
	60-62	70-72	80-82
DC's Market Economies	524	600.3	963.7
LDC's Market Economies	7.0	34.1	37.4
Africa	0	3.7	1.9
Latin America	1.0	1.7	8.1
Near East	1.0	0.1	1.3
Far East	5.0	28.6	26.0
Others	0	0	0
Centrally Planned countries	n.a.	29.0	44.3
Asia	n.a.	0.6	1.4
Eastern Europe + USSR	18.0	28.4	42.9
DC's	524.0	628.7	1006.6
LDC's	n.a.	34.7	38.8
World	n.a.	663.4	1045.4

	Condensed milk imports in 1000t		
	60-62	70-72	80-82
DC's Market Economies	68.5	208.5	278.3
LDC's Market Economie	402.1	446.5	789.9
Africa	61.3	177.7	423.7
Latin America	53.5	95.2	137.6
Near East	10.7	44.6	150.1
Far East	276.6	118.2	65.4
Others	n.a.	10.8	13.0
Centrally Planned countries	n.a.	6.0	9.0
Asia	n.a.	5.2	7.3
Eastern Europe + USSR	n.a.	0.8	1.7
DC's	n.a.	209.3	280.0
LDC's	n.a.	451.7	797.2
World	n.a.	661.0	1077.2

Source: FAO, Trade Yearbook

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