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Economic aspects of dairy development policy: issues and options

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ABSTRACT - The Mediterranean region is globally an importer of dairy products. Opposite to Northern Europe, there is no surplus, France excepted. Dairy production development is an important element of market strategy in industrialized countries. Dairy products demand is quite variable according to countries and feeding habits. It varies from over 300 kg. per person and year in Northern Europe to less than 10 kg towards East Asia. The increase in demand in mediterranean countries is rather linked to population growth than to a change in nutritional habits. The policy to develop the dairy sector may oscillate between a low price objective and securing food supply. There is a choice between a system based on specialized highly performing costly breeds to rapidly increase production or the use of dual purpose breeds, milk and beef. The type of milk animal should also be taken into account. Buffaloes for example seem to be a good solution for Egypt. Small ruminants, namely sheep and goats, seem to be well adapted to environmental conditions. The feeding system could be based either on forages or on concentrate. Milk is a seasonal and perishable product that must be processed for good preservation, which requires collective action to group a very fragmented production sector.

Key words: *Milk, market, development, production factors.*

RESUME - «Aspects economiques de la politique de developpement laitier. Debouches et options». La zone méditerranéenne est globalement importatrice de produits laitiers. Contrairement à l'Europe du Nord, il n'y a pas de surplus sauf en France. Le développement de la production laitière constitue un élément important dans la stratégie des marchés des pays industrialisés. La demande en produits laitiers est très variable selon les pays et les habitudes alimentaires, de plus de 300 kg. par habitant et par an en Europe du Nord, à moins de 10 kg. vers l'est asiatique. L'augmentation de la demande dans les pays de la Méditerranée est plus liée à l'augmentation de la population qu'à la modification des habitudes alimentaires. La politique de développement du secteur laitier peut osciller entre un objectif de prix bas ou la recherche de la sécurité alimentaire. Il existe un choix entre un système basé sur des races spécialisées à haut rendement augmentant rapidement la production mais très coûteux et l'utilisation de races à deux fins, lait et viande. Le type d'animal laitier doit aussi être pris en considération. Les buffles par exemple paraissent une bonne solution en Egypte. Les petits ruminants, ovins et caprins apparaissent bien adaptés aux conditions du milieu. Le système d'alimentation peut reposer sur les fourrages ou les concentrés. Le lait est un produit saisonnier et périssable qui doit être transformé pour une bonne conservation ce qui nécessite des actions collectives pour regrouper un secteur productif très fragmenté.

Mots-clés: *Lait, marché, développement, facteurs de production.*

Introduction

The purpose of this paper is to discuss the economic aspects of dairy policy in developing countries in general and in the Mediterranean region in particular. Despite several differences, the countries of the region share a common characteristic, namely a relatively less developed milk sector. All countries, with the exception perhaps, of France, are net importers in milk and dairy products. The milk sector of the countries in the region that are also members of the EC (except France) is not characterized by a surplus situation, as in other EC countries, North America and Oceania, but, rather, by a growing disparity of milk demand and supply. Hence, dairy development is a valid policy objective for all countries in the region as part of their food, nutrition, and agricultural policy. The success in grain production that has enabled developing countries in general to meet their demand for staple food, has set a precedent for satisfying also needs of developing countries for milk and other livestock products.

Dairy development is a rather broad policy objective. Dairy development is an important component of strategies to expand agricultural output in many developing countries. It is a strategy suitable also for some hilly or semi-arid countries or regions where animal raising is well suited to the ecological base. Finally, it is suitable for more favored regions where the proximity of urban markets provides a strong demand for dairy products. Milk animal raising is also a component of many farming systems that are not mainly livestock oriented, since ruminants utilize crop by-products and provide a store of capital and a source of draft power. Raising of milk animals is labor-intensive and may be well-suited to small farms with otherwise surplus labor, especially female and child labor. Hence, programs for dairy development are often presented as employment and income generation mechanisms for poor people, poor

regions or both. In this paper, without ignoring such wider issues, we concentrate on the dairy sector per se and discuss a strategy that aims to satisfy the growing demand for milk in the most appropriate, from the economic point of view, way.

The growing disparity between demand and supply of milk in the countries of the Mediterranean region implies that governments, sooner or later, will need to make the choice among alternative ways of satisfying this incremental consumer demand for milk. Commercial imports v. domestic production is one of the options. Domestic production, on the other hand, leads to difficult choices among production systems and institutional structures. The purpose of this paper is to clarify some of the issues that a country faces and also to present the options that are available for policy.

The paper looks first into the demand side examining the differences of consumption patterns among countries, and the evolution, and change of consumption patterns over time. Next, the paper addresses the question of alternative sources of supply (local and imports), namely what factors are important in a decision on growing demand for milk should be satisfied from local sources or trade. The available options on the choice of production systems are then presented and the economic viability of each option is discussed. Finally, the need for a specific institutional framework of dairy sector development is discussed and examples of choices followed by different countries are presented.

The structure of demand for milk and dairy products

Differences of milk consumption patterns

Milk consumption patterns differ widely between countries. On the one extreme are countries such as these of North Europe where milk and dairy products are considered a main food item. On the other extreme are some East Asian countries where consumption of milk is very low or almost inexistent. Table 1 attempts to present the broad spectrum of milk consumption in selected countries and groups of countries[1].

Developed countries on average consume about 300 kg. of milk equivalent per capita per year, or about ten times more than average consumption in developing countries, whereas average consumption for all countries is about 115 kg. per capita per year.

No doubt some of the difference can be attributed to cultural differences, traditional food habits or, perhaps, to biological reasons[2]. For instance, Pakistan, India and China, with broadly similar development levels, have vastly different milk consumption levels. In South Asia, milk has an important position in the diet and consumption of milk reflects this importance. On the other hand, in East Asia, milk consumption lacks a similar tradition, although consumption in recent years is growing rapidly (see below).

Table 1

MILK AVAILABILITY PER CAPITA, 1986
Selected countries (Kg/cap/year)

India	55
Pakistan	94
China	3
Morocco	54
Developing Countries	35
Developed Countries	300
World	115
FAO/WHO recommended	75

Source: FAO Production Yearbook.

Because of low consumption in countries of East Asia, average consumption in Asia is lower than average consumption in Sub-Saharan Africa, as shown in Table 2, a fact that is not explained by their respective income levels.

Countries of the Near East and North Africa regions, on the other hand, show a significant consumption of milk, much higher than in the rest of Asia and Africa, but less than in Latin America. In these countries, milk is traditionally part of the diet either as fluid milk or in its preserved form cheese.

Notwithstanding differences in milk consumption due to culture and traditional food habits, the important question is whether consumption patterns change over time in all countries. Projections for 2,000 given in Table 2, show that over the 15 year period milk consumption in all developing countries is expected to increase by about 20 percent, whereas in Asia (including China) by 33 percent. The challenge for governments is to find the most economical way of satisfying this growing milk demand.

Determinants of the growing milk demand

The main factor in increasing food consumption in developing countries has been *population.* In order to maintain consumption levels of different food items, milk included, availability of these food items should increase with a rate at least equal to the rate of increase of the population.

However, even adjusting for population growth, an

1. Milk availability per capita is not equivalent to milk consumption per capita since it is not adjusted for trade. However, since trade accounts for small part of consumption, the broad difference that the paper attempts to show is maintained even in availability figures.

2. It is claimed that East Asian people, especially these of the Han nationality do not have the ability to digest lactose and hence intake of milk leads to problems of digestion.

Table 2

CONSUMPTION PATTERNS IN DEVELOPING COUNTRIES
(Kg/cap/year - direct consumption only)

	Actual: Average 1983/1985					
	Cereals[1]	Roots, Tubers	Veg. oil[2]	Sugar	Meat[3]	Milk[4]
All Developing Countries	173	63	7	18	14	34
Sub-Saharan Africa	113	192	8	9	10	27
N. East/N. Africa	212	28	12	33	21	72
Asia	184	44	6	14	10	21
Asia (excl. China)	159	30	7	19	5	34
Latin America	136	73	9	44	37	94
Low Income Countries	179	57	6	13	10	24
Middle Income Countries	160	78	10	30	22	54

	Projected: 2000					
	Cereals[1]	Roots, Tubers	Veg. oil[2]	Sugar	Meat[3]	Milk[4]
All Developing Countries	174	60	9	22	18	41
Sub-Saharan Africa	121	196	8	11	11	27
N. East/N. Africa	204	28	14	37	24	77
Asia	187	32	9	18	15	28
Asia (excl. China)	173	28	9	23	7	39
Latin America	143	71	11	49	41	107
Low Income Countries	179	50	8	16	15	30
Middle Income Countries	163	78	12	35	25	62

1. Rice is included in milled terms.
2. Oil equivalent.
3. Carcass weight, excluding offals.
4. Milk and dairy products excluding butter in fresh milk equivalent.

Source: F. A. O., Agriculture: Towards 2000, Rome, 1987, p. 64.

upward trend in consumption of milk per capita is observed. For example, consumption of milk per capita in developing countries is expected to increase from 34 kg/cap/year in 1983/1985 to 41 kg/cap/year in 2000. The most important factor in explaining past upward trends and future prospects in milk consumption per capita is *income growth.* This fact is illustrated using data on human consumption of the various agricultural products from 1961 to 1981 in Greece (see Table 3).

During the development process income levels increase and living standards improve. Because income elasticities of demand are close to one or even higher than one, consumption of milk, meat, and dairy products increase at higher rates than consumption of other food items. The consumption of some items such as cereals and starches may even decrease[3] if the income elasticity is negative, as it is the case at higher levels of income.

Prices is another factor that affects consumption. If, however, relative prices remain the same, consumption patterns are not affected. Generally speaking, milk prices did not diverge from average food prices in the past, hence, the impact of this factor on milk consumption has been, and is expected to be in the future, rather small.

Urbanization is considered a factor that shifts the demand for certain food items because people acquire new tastes. Certain changes occur in consumption patterns as

3. Bennett's Law.

Table 3

HUMAN CONSUMPTION OF MAJOR AGRICULTURAL PRODUCTS GREECE, SELECTED YEARS (kg/cap/year)

	1961	1971	1981
Wheat	193.7	156.0	132.0
Rice	5.5	6.5	8.3
Sugar	15.1	23.3	34.4
Potatoes	40.9	55.0	97.4
Vegetables	81.9	149.0	220.4
Citrus fruits	38.9	43.3	48.3
Other fresh fruits	64.2	67.1	84.5
Olive oil	14.5	16.0	18.5
Meat	23.3	51.3	65.1
Meat Beaf	6.4	16.4	18.6
— Sheep/goat meat	10.9	17.9	13.2
— Pig meat	4.6	7.2	18.2
— Poultry	1.4	9.8	15.1
Milk[1]	115.0	236.0	300.0
Eggs	5.6	11.0	12.0

1. Includes dairy products in milk equivalent.
Source: Ministy of Agriculture, Greece.

large parts of the population move to the cities. This is due, to some extent, to the change from a subsistence economic position of the household to one where all food are obtained from the market.

The effect of urbanization can be conceptualized as the separation in space of consumption and production functions, that coincide in subsistence households, to separate ones in households integrated in a market economy. For example, in Pakistan 79 percent of total milk production is consumed by producing households and only 21 percent enters the market, either locally or the market of large cities[4]. As the economy develops, urbanization requires that a larger share of milk needs to be moved over longer distance from production points in rural areas to consumption points in urban areas. Such developments in the milk market imply the need for establishment of processing and marketing facilities and, more importantly, for quality control because of the perishable nature of milk[5].

Production of milk follows in most countries a seasonal pattern for several reasons[6]. In subsistence households consumption follows a similar seasonal pattern by simply adjusting to milk availability. Urbanization, however, makes demand more or less stable around the year, hence increasing demand for milk preservation to even out seasonal availability. Hence, as incomes and urbanization increase, an increase in milk procesing (in the form of milk powder, etc.) is required to even out the seasonal availability of milk.

Change in tastes, due to imitation or other factors, has been in several cases pointed out as an important determinant of the increase in consumption of milk and other livestock products[7]. The main question in this respect is whether the observed increase in milk consumption is the result of changes in tastes (e. g. imitation) or the result of economic forces as they are determined by changes in incomes, prices and urbanization. It seems that the major part of the observed change in milk consumption is due to changes in economic forces and mainly the increase in incomes.

Future prospects

The F.A.O. AT2000 projections imply that consumption in Developing Countries would be 41 kg/cap/year. Production is projected to grow at an annual rate of 3.1 percent, mostly the same rate as for 1970-1985. The net imports of developing countries grew very fast in the past 15 years, by 7.8 percent per year but they are projected to grow by only 2.5 percent up to 2000. A good proportion of imports in the past were concessional, including food aid which in 1983/1985 accounted for 28 percent of all imports of S. M. P., the main dairy commodity imported.

Prospects for the milk market in developed countries are not optimistic about the continuation of present milk surpluses. Under such conditions a key question for the future is whether food aid shipments will be maintained. Furthermore, it is necessary to know what part of the additional deficits in developing countries may be considered as representing normal commercial demand and what part is to be supplied at concesional terms, if food aid is to materialize at all.

The analysis presented earlier concluded that whereas milk consumption patterns may differ between countries, there is a strong upward trend in milk consumption in all countries alike, caused mainly by the increase in income and population. Milk consumption in the future is expected to increase in all developing countries by about 5 percent per year, on average, in raw milk equivalent up to 2,000[8]. This rate may be different from country to country but it is still much higher than the population growth rate. The second conclusion is that due to the perishable nature of milk, an

4. See KHAN, A. D., and SCHINZEL, H. U. (1982): «Systems and Channels of Milk Marketing», in *Economics of Village Livestock* by M. J. Khan an H. Rahman (editors), Punjab Economic Research Institute, Lahore, Pakistan, 1982.

5. In constrast to grain that can be stored for long time and can be transported across continents, milk in raw form cannot travel even for a few kilometers without being spoiled. In order to preserve milk it is necessary to change its physical characteristics, whereas in order to transport it over some distance, cooling and hygienic handling are absolutely necessary.

6. Some claim that biology plays an important role in determining the seasonal pattern of calving. Others, however, claim that this is in fact a matter of feed availability and calving can be suitably spaced around the year when feed availability is not a seasonal constraint.

7. This issue has been linked mainly to the increase in consumption of certain kinds of meat, but it applies to milk as well (see, for instance, Lappe, 1971).

8. F. A. O.: *Agriculture Towards 2000,* Rome, 1987.

increase in the share of milk being processed and preserved is expected in developing countries. This last point implies strong investment requirements in milk processing as well as strong organizational requirements in the system of milk production, processing, and distribution. It is expected, therefore, that a growing demand for milk needs to be satisfied and an increasing part of milk demand needs to be processed and marketed.

Macro-economic and Strategic Consideration

The previous section concluded that the increase in milk demand is an inescapable fact for any developing country with a growing economy. Milk demand is increasing as population and incomes grow and if supply dooes not follow apace, an imbalance in the milk market is developed.

Such an imbalance is manifested with changes in milk prices. For example in Paskitan domestic supply did not increase as fast as demand, and despite an increase of milk imports in recent years, fresh milk prices and powder milk prices increased between 1980/1981 to 1985/1986 more than the prices of the other food items as shown in Table 4.

Governments need to consider the best way to satisfy this growing demand for milk increasing milk supplies by either increasing domestic milk production or by allowing more imports. However, dairy sector development, like anything else, exists within a larger framework of social, economic, and political objectives. The decision, therefore, for expansion of the dairy sector, or for importation of milk, is not merely an agricultural or an economic issue. Resources for investment are always limited and planners should try to use available funds in their most productive way. On the other hand, milk imports may not represent the best use of scarce foreign exchange and limits exists, in terms of available foreign exchange, as to how much a country can rely on the international market to augment its domestic milk supply.

The first question to consider is whether it is more appropriate to expand production of milk domestically or to rely on the world market for partly satisfying demand. In principle, and in order to answer this question, border prices of milk are compared to domestic prices in the fashion of the conventional opportunity cost argument. However, governments seldom use this decision rule and are generally reluctant to rely on the international market for substantial parts of their milk supplies. The often cited reasons for such behavior are first a food security or some form of self-sufficiency objective and second that world market prices do not represent true opportunity cost since world market prices are very much affected by distortions in national milk markets of developed countries.

The food security argument puts a value on local milk production, irrespective of its opportunity cost. In this case, for national strategy reasons, the country discounts arguments relative to its comparative advantage. Choices are made on the basis of some food security or self-sufficiency goal in which the objective is to minimize the country's dependence on external food supply sources. This choice is most evident in the development of the dairy industry in the Middle East.

Sometimes, planned dairy development, observing a self-sufficiency objective, aims to satisfy a long-term strategy of improving the nutritional content of the people. For instance, in China the political will is to improve diets by increasing intake of animal protein from domestic sources. In such case expansion of domestic supplies of milk are pursued irrespective of their cost.

Even for food policies that are driven by security or nutritional goals, the extent of dairy sector development that is desired may still vary widely. At the one extreme is the choice of a strict self-sufficiency goal where all, or virtually all dairy products consumed, are supplied by local milk production. Usually countries follow a more moderate strategy that seeks to satisfy some minimal requirements, such as providing sufficent milk to satisfy the local need for fresh milk or other dairy products consumed by children. In other cases a country may choose the more modest goal of simply providing fresh milk supplies to augment less palatable imported products that are typically produced from recombination of dried or concentrated ingredients. This choice may also embody some security element but it is mostly the blending of reconstituted with fresh milk that is desired.

The argument against using the international milk market price as indicator of the opportunity cost of alternative sources of milk supplies has some validity. There are claims that price fluctuations in the international market are often wide, while prices of internationally traded commodities represent, in certain cases, the result of distortions of national policies in domestic markets of the developed countries. The extent of distortions of domestic milk prices is substantial as shown in Table 5. It is argued, that it would be hardly wise to base long term development

Table 4

PAKISTAN WHOLESALE PRICE INDEX BY COMMODITY (1980/1981 = 100)

	Wheat	Rice	Fresh milk	Powe-dered milk	Ghee	Chicken
1980-1981	100	100	100	100	100	100
1981-1982	117	115	114	115	103	103
1982-1983	122	118	131	136	107	121
1983-1984	129	123	142	152	127	126
1984-1985	141	127	158	158	134	129
1985-1986	149	137	162	167	136	134
Annual Growth Rate						
1981-1986	6.2 %	4.5 %	9.2 %	9.8 %	7.2 %	4.3 %

Source: Monthly Statistical Bulletin. Federal Bureau of Statistics, Pakistan.

of the dairy sector on present world market price since surpluses may disappear if domestic policies in developed countries change.

Another, and perhaps more valid indicator of the efficiency of milk production is a comparison of producer prices across countries as in Table 6. Production costs can be compared across countries and judgement can be made about efficiency of production. One should bear in mind that the use of official exchange rates to convert local prices to a common denominator (US $) may distort true efficiency differences if the exchange rate is overvalued (as it is usually the case) in developing countries. Using shadow prices for foreign exchange would imply a more accurate opportunity cost of domestic production (in terms of US $) and hence a better indicator for the planning of the dairy sector.

Expansion of the dairy sector may also serve more general development objectives, such as providing employment and generating income for poor parts of the population. Dairying is labor intensive and utilizes mostly family labor. The dairy sector consisting mainly of small-holding farm-households with a small number of dairy animals provides excellent employment opportunities to otherwise unused family labor. In this sense dairying provides additional income and employment opportunities to large parts of the rural population, mostly women and children with limited alternative employment opportunities.

Table 5

NOMINAL PROTECTION COEFFICIENTS (NPC) FOR CONSUMER AND PRODUCER PRICES OF DAIRY PRODUCTS IN INDUSTRIAL COUNTRIES (1980-1982)

COUNTRY OR REGION	NOMINAL PROTECTION COEFFICENT	
	Producer	Consumer
Australia	1.30	1.40
Canada	1.95	1.95
EC[1]	1.75	1.80
Other Europe[2]	2.40	2.40
Japan	2.90	2.90
New Zealand	1.00	1.00
United States	2.00	2.00
Weighted Average	1.88	1.93

1. Excludes Greece, Portugal and Spain.
2. Austria, Finland, Norway, Sweden, and Switzerland.

Source: Tyers and Anderson (background paper) in «The World Development Report, 1986» (Washington, D. C.: The World Bank, 1986).

Table 6

COMPARATIVE MILK PRODUCTION COST AND PRICES, 1986 (US $/lt)

Country	Production Cost	Farm gate Price	Consumer Price	(1) : (2)
Pakistan	0.120	0.143	0.346	0.41
India	0.160	0.190	0.27	0.70
New Zealand	0.090	0.180	0.43	0.42
U. S. A.	0.200	0.240	0.47	0.51
E. E. C.	0.220	0.250	0.47	0.53
Japan	0.610	0.610	1.11	0.55
Australia	0.130	0.180	0.43	0.42
China	0.160	0.160	0.26	0.61
Morocco		0.226	0.35	0.64

Source: Information collecte by the author from various sources correpsonding to the period of late 1986.

On the other hand, dairy sector development in a food deficit country may attract resources from food production having an undesirable impact on food prices. This link, that has been pointed out for livestock development in general (food vs feed use of grains), operates in the dairy sector through the diversion of high quality irrigated land away from staple food production into production of green fodder. Since dairy development based on European breeds of cows requires high quality green matter to be used as feed, this link should be considered seriously in planning the dairy sector, since expansion of dairy sector may contribute indirectly to a growing cereal deficit.

In conclusion, it is expected that countries will always seek some degree of self-sufficiency in their milk supply. They should consider carefully, however, in defining the desired sector growth target, the total and marginal cost of alternative courses of dairy sector growth against their benefits and sustainability. For instance, a choice that aims to produce some quantity of fresh milk for blending purposes will be less costly and may be justified even if marginal costs of local production exceed the cost of the next best available imported substitute. A choice for complete self-sufficiency, however, will probably be expensive and difficult to sustain in the long run.

Production and Price Policies

Having decided for an expansion of the dairy sector, planers will have to choose between different farming systems, types of dairy animals, and feeding systems. This section outlines this kind of choices pointing out the potential trade-offs.

With the danger of oversimplification we may classify the existing dairy farming systems in two types. One is based on specialized breeds, that have been developed in temperate

countries, capable of producing large quantities of milk and which generally perform best in cool and temperate climates. This specialized dairy system is characteristic of the major milk producing and dairy exporting developed countries. The second system is based on dual purpose breeds, characteristic of the majority of developing countries, that usually produce much lees than specialized breeds, but they are better adapted to the resources and the climate of the countries where they are used. This is a somewhat obvious, nonetheless not easy choice, between strategies seeking to expand the dairy sector relying primarily on the first system or on the second system or on a combination of both.

The technical implementation of a strategy that aims to expand milk production using specialized breeds is also difficult. Transplanting specialized breeds may result in quicker production gains but the cost of its implementation is practically formidable and probably nor sustainable in the long run. The strategy which is based on cross-breeding of native dual-purpose cattle with specialized breeds has given much better results. Within three or four generations, cross-bred cattle have almost all the dairy characteristics of their specialized-breed parents, while they may have maintained some of the adaptability of their native parents. As an example, cross-breeding of local yellow cattle in China with Black and White has produced excellent dairy stock with sufficiently high yields. The production conditions of such dairy stock however, is completely different of those that prevail in peasant farming where dual purpose yellow cattle is the only dairy animal. Requirements in feeding, housing facilities, and cleanliness are well above those prevailing in average peasant households and this strategy is only gradually implemented, taking long time before even a small part of the local cattle population could be replaced by cross-breds.

Cross breeding of *Bos Taurus* with *Bos Indicus* in South Asia has produced rather modest results despite high expectations when it started in a large scale in India some 15 years ago (Mergos and Slade, 1987). The adoption of cross-breeding in India has not been even close to expectations with several factors hypothesized as constraints. Whereas inadequate feed supplies and non-suitability of cross-bred males as draught animals may be valid reasons for non-adoption, it is probably the risk for the farm-household of maintaining such expensive milk animals in a precarious environment that is the main limiting factor to adoption[9]. In this respect, the failure of the strategy that aimed to replace all indigenous cattle with cross-breeds within a very short time, is understandable, especially, when compared to the more cautious and selective expansion of cross-breeding in China where climatic conditions are more suitable for the specialized breeds.

The second major choice for dairy sector expansion concerns choice of the type of the milk animal that is most suitable to the economic and ecological conditions of the country. Using Egypt or India as an example, it can be pointed out that despite an emphasis of the present dairy development strategy on cross-bred cattle, a large part of the increase in domestic milk supply comes from milk buffalo. Looking in a region with much better endowment for fodder production because of irrigation such Pakistan Punjab almost all milk is produced by buffalo. Egypt where all land is irrigated has, also, a high component of its domestic milk supply produced by buffalo. It seems that buffalo can be a good choice as a milk animal producing milk highly desirable by the consumer, at relatively low cost. This advantage should be weighed against the disadvantage of a strong seasonality in calving and in milk production. Some maintain that this seasonality is a consequence of seasonal fodder supplies, but still much research is needed before calving planning for buffalo is feasible as it is at present practiced for cows.

Besides large milk animals, there are small non-bovine milk animals that are efficient milk producers. Goats are used for milk production in South Europe, North Africa and Middle East and large parts of Asia. Goats produce much less milk per head than cows, but they produce milk with higher feed efficiency. Goat milk tends to have higher nutrient density than cow milk. In addition, goats may be easier to handle than cows and more feasible for small farmers to maintain than cows. In addition, goat raising is usually practiced in highly or semi arid regions with low resource base that are probably unsuitable for any other type of livestock raising. In such cases, small ruminants is the only option available and hence an inescapable choice.

The third production choice is that of a feeding system. Dairy development may be pursued utilizing different production systems. One such system is the one based mostly on grazing and is typical of Northern European countries, of certain parts of the U. S. and of Oceania. This system makes excellent use of the ruminant attribute of the bovine milk animals turning gross into milk with high efficiency.

Another system is the one based on confinement of milk animals with stall feeding. While this system may not be as efficient as the previous system, there are still parts of the world where it is well integrated to the policy objectives. There is no reason to believe that this system is much more expensive. It all comes to what is the cost to produce green matter on land that is withdrawn from the production of other agricultural products. This type of competition is more pronounced when milk production is based on concentrate feeding, i. e. feed grain. Production of feed grain is directly competitive to production of food grain and, hence, expansion of milk production in this case may adversely affect availability and prices of food grain, the food staple of the poor.

The debate on dairy development in the Mediterranean countries is mostly focused on the small-ruminant v. large ruminant choice. Proponents of the small-ruminant option, such as sheep and goats, consider that the hilly, rain-fed

9. See Mergos and Slade (1987) for a case study of adoption of cross-breeding in India.

areas of the Mediterranean region with pastures of insufficient vegetation and small stocking capacity are not suitable for large animals. In addition a number of famous products of the region come from milk of small ruminants (roquefort, pecorino romano, parmigiano reggianno, feta, etc.). On the other hand, large dairy animals (cows) are considered not suitable under the production conditions of the region since they have to be fed mostly on cultivated green fodder produced on irrigated land.

However, the option of large ruminants (cows) cannot be ruled out. The two options can be pursued simultaneously to serve different objectives. Production of famous products from small ruminants could continue along the lines determined by the market for these products. Also, raising of small ruminants in hilly or semi-arid regions unsuitable for other types of livestock development is also a valid option.

Expansion, however, of milk production to satisfy the growing demand for fresh milk by the consumer in the urban centers is probably more economically achieved by large ruminants. Hence, an alternative strategy is for a country to be more selective in the choice of the production system, depending on the pursued objective. Substantial research efforts is, however, necessary on a country-by-country basis before any firm conclusions can be made on the issue.

Institutional support of dairy sector development

The difficulty of linking numerous dispersed small milk producers to major centers of consumption in the cities is a severe logistical diallenge. Like many field crops, milk production is seasonal, but unlike grains, for example, cannot be stored in its raw form. Hence, product trasformation is necessary in order to even out seasonality. Furthermore, the ease with which milk can be adulterated or spoiled, if not handled properly, makes quality control necessary at both the producer and retail levels.

A second characteristic of dairyng is that it resembles tree crops more than subsistence field crops, since there are several years between the birth of a cow and its first lactation. The periods up to the first lactation and between successive lactations are times of considerable cash outlay that provide no immediate pay-off. Furthermore, dairy animals, the major assets in dairying, are mortal. These production risks are somewhat different from those characterising most other forms of capital formation. In addition, dairying requires high quality inputs, technical knowledge and veterinary services so that high yields can be achieved.

A dairy development strategy should explicitly address the above points and an institutional structure should be devised that:

a) will undertake efficient collection, processing and marketing of milk from rural producers to urban consumer,

b) will undertake efficient provision of high quality inputs, extension advice and veterinary services to dairy farmers enhancing their production capacity.

The choice of the appropriate type of institution is a matter of the general socio-economic conditions of the country and it can be one of three possible alternatives: (a) collective action; (b) private sector initiatives; and (c) state planning. Examples of each one of these choices are given next.

In most developed an developing countries, dairy development is promoted through collective action in milk collection, processing and marketing, on the one hand, and input supply and veterinary care on the other. One of the best known arrangements in both developed and developing countries is the Anand Dairy Cooperative (AMUL) in India. The success of this producers' cooperative established by private initiative in preindependence India, has encouraged the Indian Government to attempt wide spread replication with a program known as Operation Flood. Operation Flood aims to improve milk supply on a national scale through the creation of thousands of village milk producers' cooperatives. These cooperatives are grouped into Unions, and the Unions into State Dairy Federations. The Unions serve two functions: (a) they build, own, and operate milk collection and milk marketing networks as well as milk processing plants, and (b) they own and operate delivery systems for veterinary service, input supply and technical advice to cooperative members. The Federation provide central planning and technical assistance to Unions and coordinate with other State Federations and the National Dairy Development Board at the National level[10].

Collective action in milk marketing and input supplies is also characteristic of most developed countries. For example, dairy cooperatives in Northern Europe account for most of the milk market. In the U. K. the same approach has taken the form of a producers' association with the Milk Marketing Board (M. M. B.) of England and Wales and several other similar Boards in other parts of U. K. Unlike cooperative milk marketing in Northern Europe (and in India), the M. M. B. has a monopoly power in marketing of milk.

The second type of institutional arrangement is one that leaves the initiative to the private sector. In such arrangement private entrepreneurs collect, process and market milk for their own account. Sometimes there are several intermediaries between the dairy farmer and the processing plant (for example in Pakistan). Farmers on the other hand rely on entirely different sources for technical advice, veterinary services and A. I. usually provided by different government agencies. Feed supply is also provided mostly through private trade. As examples of this institutional arrangement one could mention Greece or Pakistan. This type of arrangement seems to be much less efficient than the one based on collectives action.

The third institutional arrangement is one that is based

10. See Alderman, Mergos, and Slade (1987) for a review of the discussion on India's dairy development strategy.

on State planning. In such arrangement the State owns the processing facilities as well as collection and marketing networks. Irrespective of whether milk is produced in state, collective or individual farms, planning is done centrally by state agencies. An example ot this institutional arrangement is China.

The issue of the institutional organization of dairy development activities has also been in some cases the subject of an on-going debate, while in other cases (e. g., Greece), the choice has been made be default. The collective institutional arrangement of India has attracted the larger number of proponents and critics alike. The M. M. B. (Britain) has, recently, been named «the pint-sized monopoly that has rigged Britain's milk market since 1933» (Economist, may 7, 1988). In Pakistan, efforts to introduce cooperatives in the milk sector have failed. In contrast, the Kenitra cooperative in Morocco, seems to be quite successful, In China, the recent reforms put an emphasis on milk production by private households that account for a rapidly growing share of milk output. This evidence shows that the choice of the institutional organization of dairy development activities is, perhaps, the most difficult and the most critical for the development of the dairy sector. This issue, however, has not received up to now an adequate research effort.

Conclusions

Mediterranean countries share one common characteristic in their dairy sectors: most of them face a growing disparity between milk demand and supply. A similar trend however is characteristic of almost all developing countries, despite substantial growth in the volume of milk production in the past 20 years. Dairy development has attracted, and continues to attract, substantial efforts of governments and international agencies. Dairy sector development, however, exists, like anything else, within a larger framework of social, economic, and political objectives and, hence, consideration of benefits and costs is a prerequisite of policy choices.

In defining a long term dairy development policy, the first consideration is future demand prospects for milk and dairy products. In all developing countries a high population growth rate and increase in incomes is expected to lead to a rapid growth in demand for milk and dairy products. In addition, substantial resources for an increase in processing and marketing facilities would be required because of urbanization and changes in the economic activity of population. It should be kept in mind that the increase in demand is not due to changes in tastes or imitation but the result of the operation of economic forces, mainly the increase in incomes and the improvement in living standards.

Having said that the increase in milk demand is an inescapable fact for any developing country with a growing economy, governments are faced with the choice between alternative sources of milk supply, local and imports. Considering this choice, countries usually take into account not only their comparative advantage in milk production but also food security, nutrition and other political objectives. Nevertheless, any policy that is followed should be cost effective and sustaintable in the long run. Usually a policy that aims to partly satisfy domestic needs may be less costly and more sustainable. There are also some more general benefits from dairy development such as creation of employment opportunities for female and child labor, income generation for small holders and utilization of otherwise unused resources.

Governments having decided to produce some or all of their milk needs locally, face several choices in production ranging from the kind of dairy farming system (specialized dairy breeds or dual purpose breeds), to the appropriate dairy animal that is suitable for their ecological and economic environment, and to the appopriate feeding system. All the above choices require explicit cost/benefit calculations that go beyond technical considerations. Any choice may be technically feasible, however, the right choice is the one with the best benefit/cost indicator. In most cases this calculation of costs and benefits is so difficult that needs to be based on judgement and experience instead of explicit cost and benefit figures. In addition, a dairy development policy should ensure that price levels of milk and dairy inputs are set in such a way to maintain profitability for the producer. Otherwise, any effort would be futile.

Finally, because of the perishable nature of milk and the difficulty of linking numerous dispersed small milk producers to major consumption centers, certain institutional arrengements are required. Past experience in the dairy sector of various countries has demonstrated the superiority of institutional structures that are based on collective (or cooperative) action. Nevertheless, this choice remains the most difficult and, perhaps, the most critical for the long-term development of the dairy sector of a country.

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