

# Milk availability

## Trends in production and demand and medium-term outlook

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ESA Working paper No. 12-01

February 2012

Agricultural Development Economics Division

Food and Agriculture Organization of the United Nations

[www.fao.org/economic/esa](http://www.fao.org/economic/esa)



# **Milk availability: trends in production and demand and medium-term outlook**

*Stefano Gerosa and Jakob Skoet<sup>1</sup>*

## **Abstract:**

This paper reviews trends in global production and consumption of dairy products as well as the drivers behind increasing production and consumption. The past decades have seen rapid growth in consumption of dairy products in several parts of – but not all of – the developing world, driven by economic growth and rising income levels. However, large differences in levels of per caput consumption among developing country regions and countries persist. Increasing consumption in developing countries has been accompanied by a major expansion of production in several developing countries, significantly outpacing production growth in the developed country group. In addition to growing demand, production growth has been driven by technological change in the sector, which has permitted major increases in productivity and the emergence of large-scale commercial dairy farms. However, small-scale dairy producers in several developing countries have remained at the margin of these developments. Also trade in dairy products has expanded due to technological development in processing and shipping, which has facilitated product movements. However, due to the perishability of dairy products the bulk of dairy production is consumed domestically without entering international trade. The potential for future expansion of dairy consumption remains significant, as income levels continue to grow in developing countries, especially in countries where levels of per caput consumption are still relatively low. Nevertheless, the rate of growth is expected to slow down somewhat relative to those experienced over the past decades. The rapid expansion and transformation of the global dairy sector contributes to growing threats to the environment and to human and animal health as well as to increasing pressures on the livelihoods of small-scale dairy producers. These issues require attention in order to allow the continued development of the sector in a sustainable and socially balanced way.

**JEL Codes:** O13, Q11 and Q17

**Keywords:** Milk and dairy production, milk and dairy consumption, milk and dairy trade, dairy sector.

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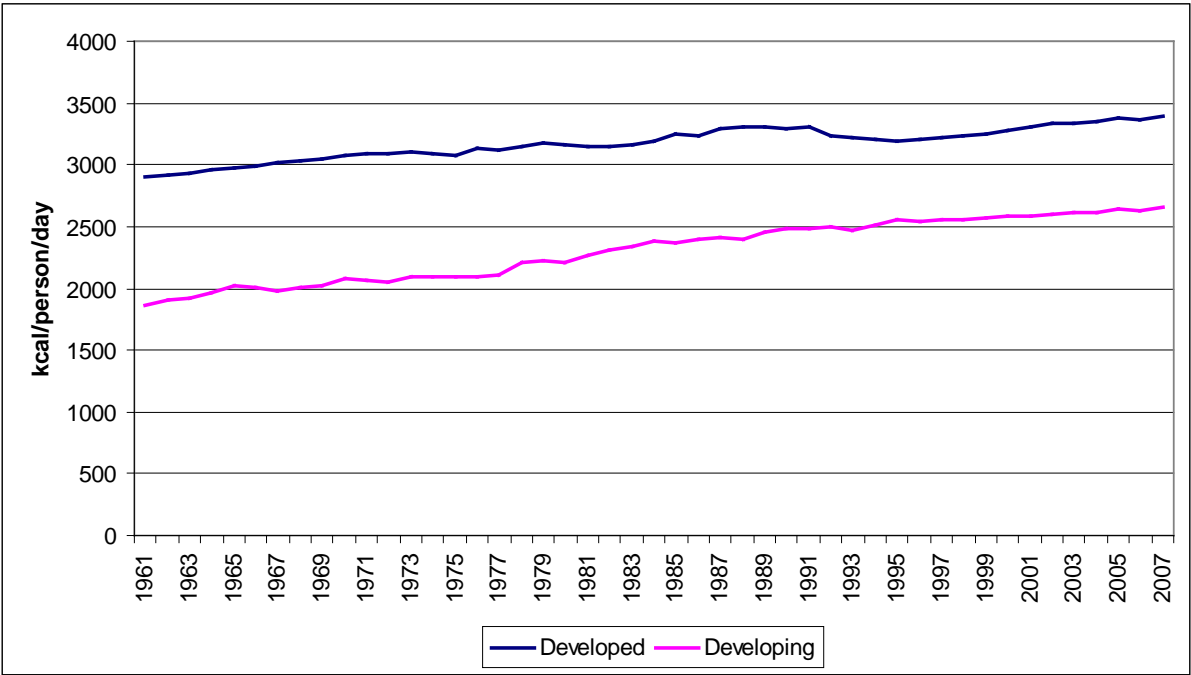
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***Trends in food consumption patterns – the role of livestock and dairy products***

Global food consumption patterns are undergoing change, especially in large parts of the developing world, where income growth and urbanization are leading both to increasing levels of overall food intake as well as changing composition of food consumption, with growing shares of high-value products and of food of animal origin in particular.

Average per capita energy intake in the developing world has been catching up with the levels of the developed country group. In absolute terms, average per caput daily energy intake in the developing country group as a whole went from 1 861 kcal/person/day in 1961 to 2 651 in 2007 or, expressed in relative terms, from 64 to 78 percent of the average energy intake in developed countries (Fig. 1).

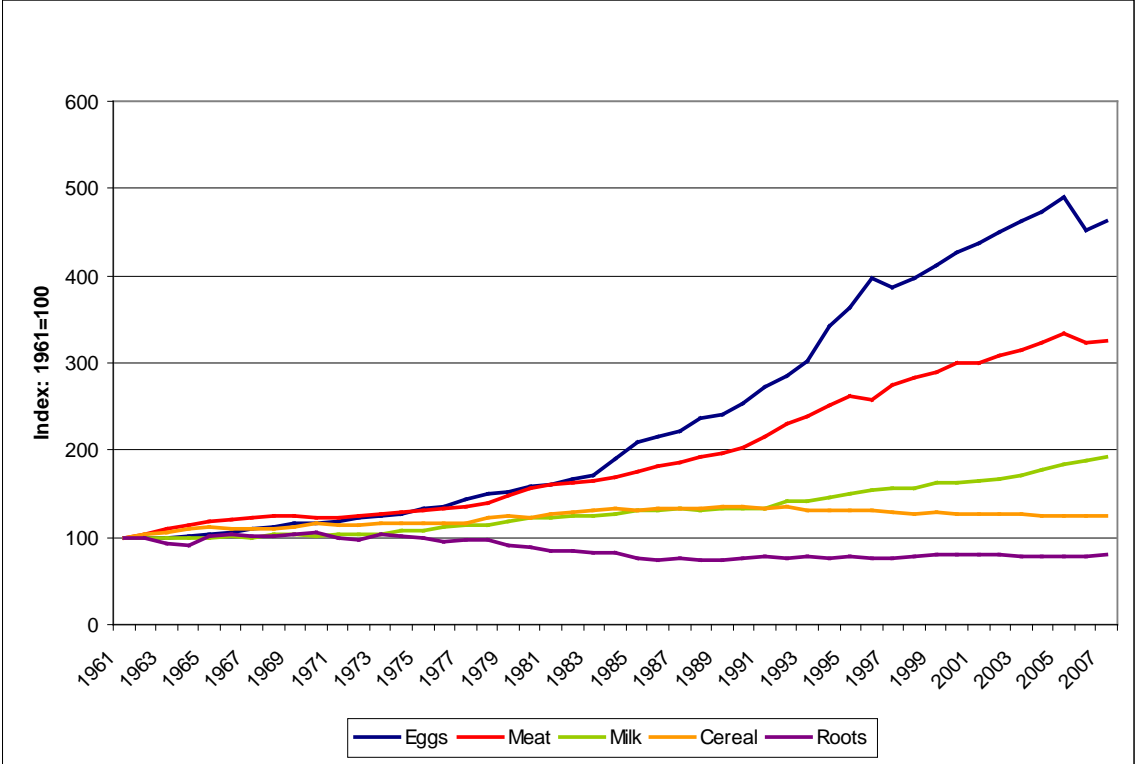
**Figure 1 – Per caput daily energy intake – developed and developing countries (kcal/prson/day)**



Source: FAOSTAT

The growth in dietary energy intake in the developing country group has been accompanied by no less rapid changes in diet composition, in which consumption of livestock products has been increasing at a rapid pace. This is illustrated by figure 2, which shows trends in per caput consumption in developing countries of major food commodity groups from 1961 onwards. While per caput consumption of roots and tubers actually declined and that of cereals grew only slightly, milk consumption almost doubled, meat consumption more than tripled and egg consumption increased by a factor of 5. Although higher in volume terms (see table 1 below), growth in average per caput milk consumption in developing countries has been slower than for other livestock products.

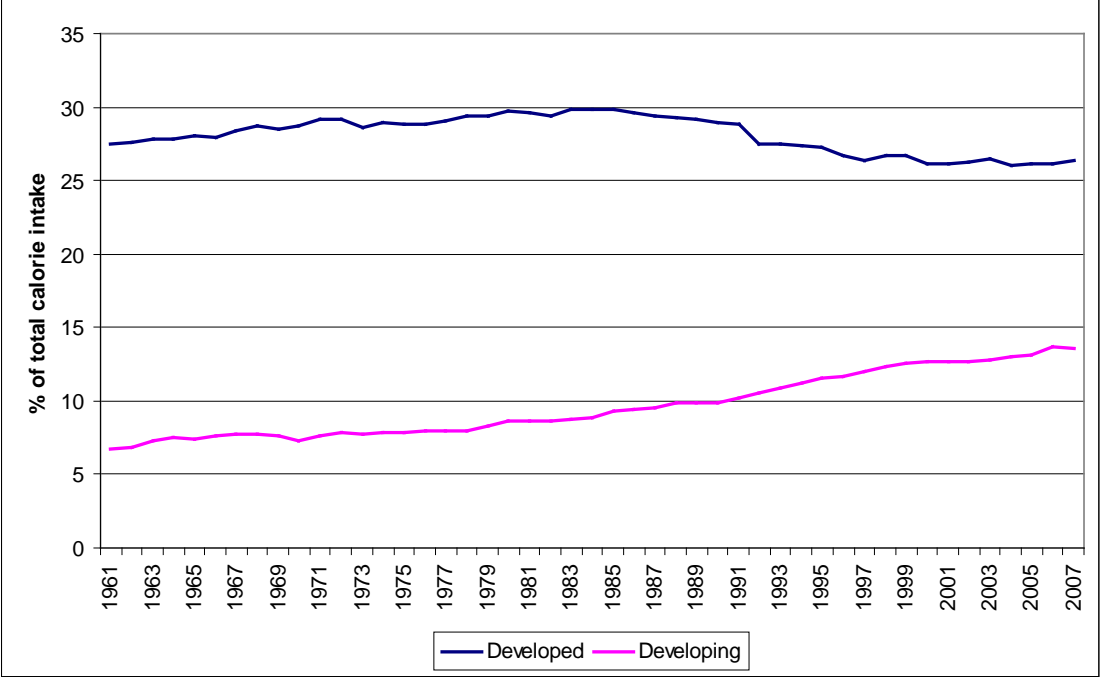
**Figure 2 – Per caput consumption of major food commodities in developing countries (index 1961=100)**



Source: FAOSTAT

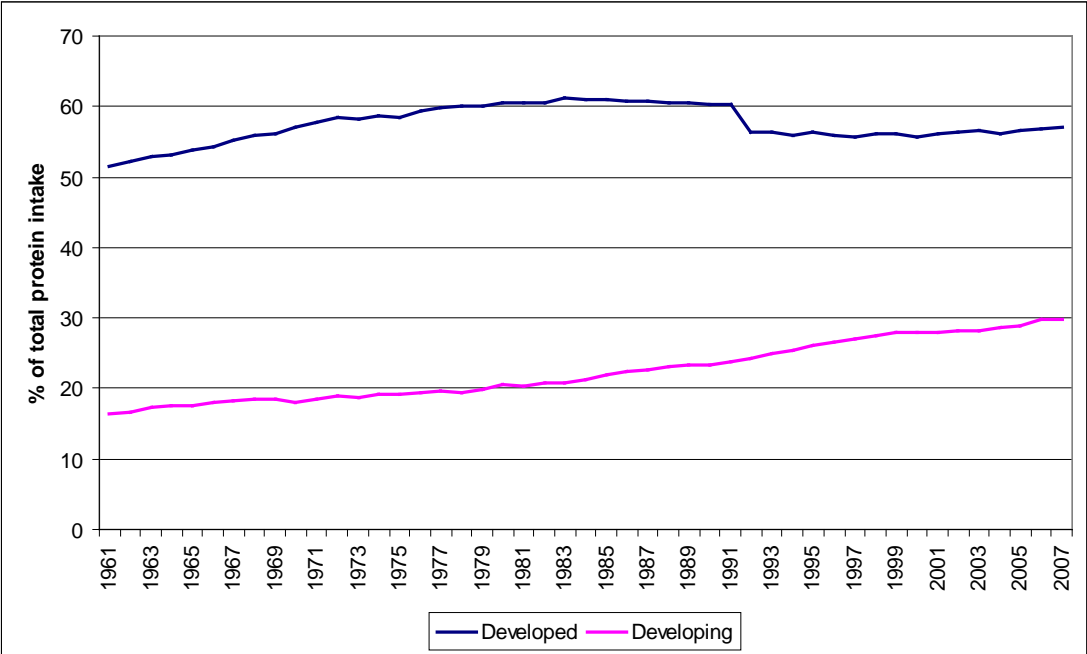
The growth in consumption of livestock products in developing countries has translated into a rising share of livestock products in per caput intake of both dietary energy (Fig. 3) and protein (Fig 4), particularly from the 1980s onwards. Indeed the contribution of livestock products to calorie intake in the developing countries went from 8-9 percent in 1980 to 13-14 percent in 2007. This is still well below the level of the developed countries, where the share of livestock products in calorie intake declined from 30 to 26 percent as consumption levels dropped in the former centrally planned economies in the 1990s as a result of elimination of subsidies and lower incomes as well as reduced waste supply chains. However, it represents a significant narrowing of the gap between the two country groups. This narrowing of the gap is mirrored for protein intake, where in the 1980s the share of livestock products in protein intake of the developing countries starts expanding at an accelerated rate, going from 21 percent in 1980 to 30 percent in 2007. Over the same period the comparable share in the developed countries remains relatively constant, while the former centrally planned economies experienced a drop in the 1990s.

**Figure 3 – Share of livestock products in calorie intake – developed and developing countries (percent)**



Source: FAOSTAT

**Figure 4 – Share of livestock products in protein intake – developed and developing countries (percent)**

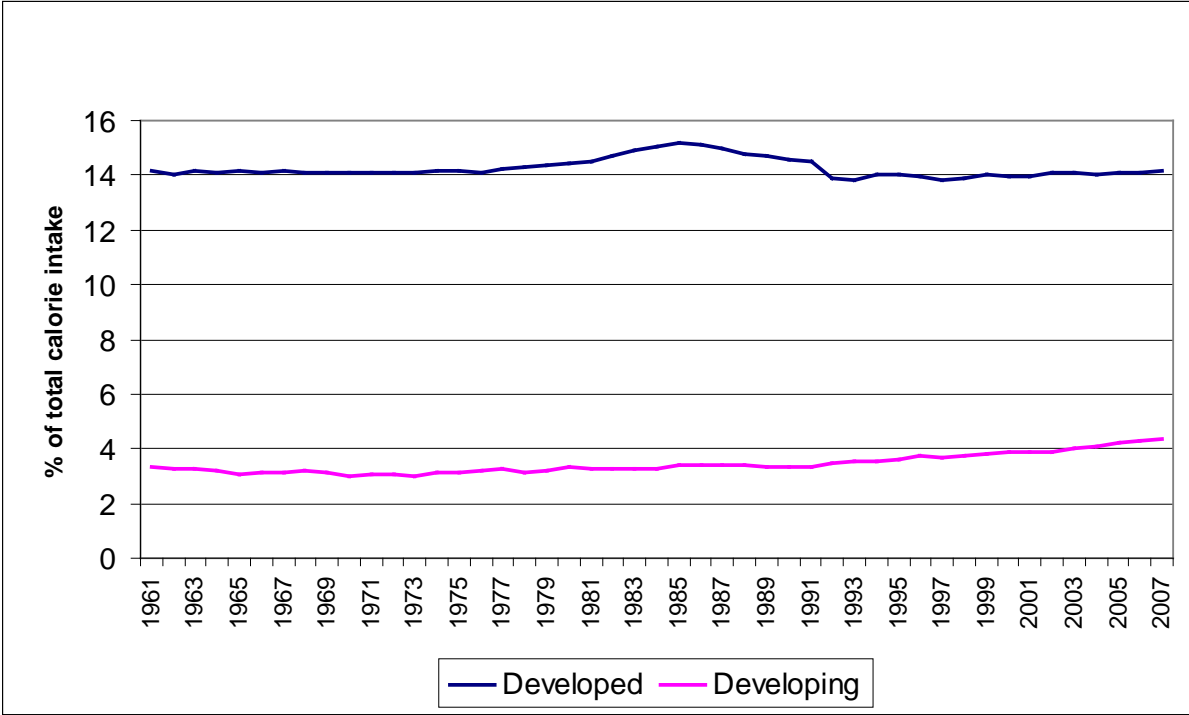


Source: FAOSTAT

Overall, the developing countries thus appear to be gradually converging towards the developed ones both in terms of food consumption levels and in terms of dietary patterns,

increasing at the same time daily energy intake and the share of livestock products in human diets. The latter pattern applies also more specifically to dairy products, as illustrated by figure 5 although the convergence appears slower than for livestock products in general. Indeed, in the developing countries, the total share of dietary energy intake coming from dairy products increased slightly from 3.4 percent in 1960 to 4.4 percent in 2000, while the comparative share was stagnating in the developed countries. Both the trend and level of the share of dairy differs markedly between developing country regions as illustrated by figure 6. The bulk of the growth has come from Southern Asia, which –along Latin America and the Caribbean - is the region where dairy products play the largest relative role in dietary energy intake. The recent growth in East and Southeast Asia has been significant but from a low base, and the contribution of dairy to diets remain less significant than in the other regions.

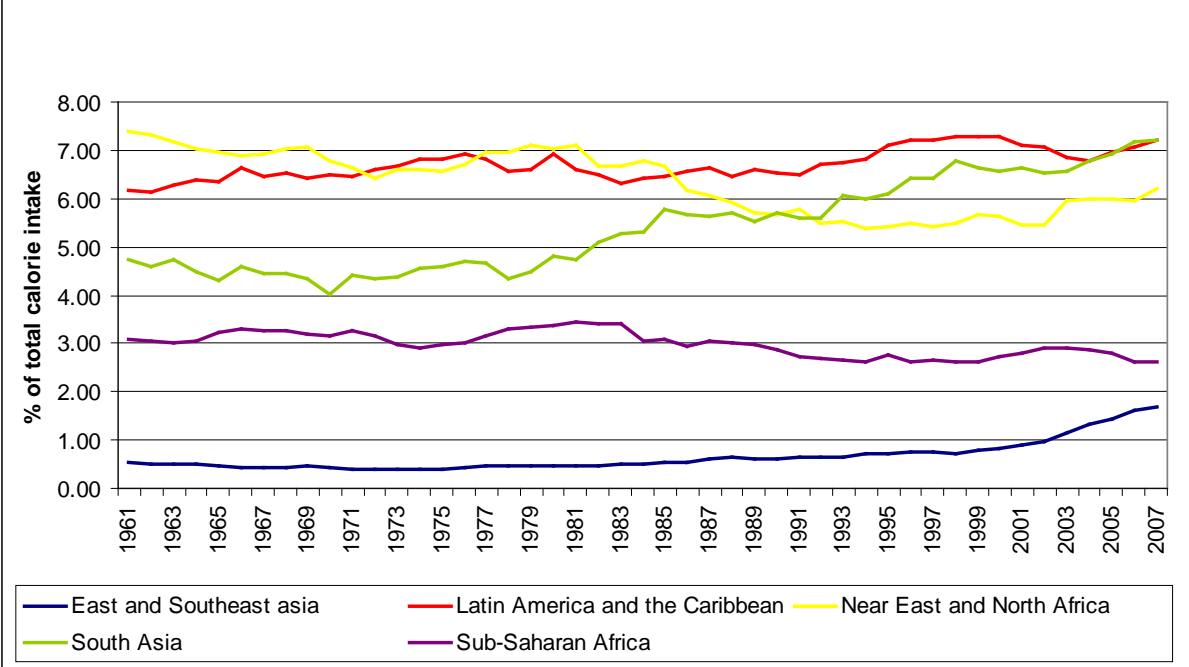
**Fig. 5 - Share of total dietary energy intake coming from dairy products\* in developed and developing countries - 1961-2007 (percent)**



\* Milk, butter and ghee, cheese.

Source: FAOSTAT

**Fig. 6 - Share of total dietary energy intake coming from dairy products\* by region - 1961-2007 (percent)**



\* Milk, butter and ghee, cheese.

Source: FAOSTAT

While there is an overall trend toward convergence in per capita consumption of livestock products in general and dairy products in particular between developing and developed countries, there are also large differences across regions both in consumption levels and in the observed speed of convergence (Table 1). The developing countries are far from homogeneous in this respect. There are major cross-regional and cross-country differences both in the levels and trends of consumption of livestock products and in the relative importance of dairy products.

**Table 1 – Per caput consumption of livestock product by region – 1987 and 2007**

| Region                             | Meat                  |             |               | Milk                  |              |               | Eggs                  |             |               |
|------------------------------------|-----------------------|-------------|---------------|-----------------------|--------------|---------------|-----------------------|-------------|---------------|
|                                    | Per caput consumption |             | Annual growth | Per caput consumption |              | Annual growth | Per caput consumption |             | Annual growth |
|                                    | 1987                  | 2007        | 1987-2007     | 1987                  | 2007         | 1987-2007     | 1987                  | 2007        | 1987-2007     |
|                                    | Kg/capita/year        |             | Percent       | Kg/capita/year        |              | Percent       | Kg/capita/year        |             | Percent       |
| <b>Developed</b>                   | <b>81.0</b>           | <b>86.6</b> | <b>0.3</b>    | <b>208.7</b>          | <b>213.7</b> | <b>0.1</b>    | <b>14.6</b>           | <b>13.7</b> | <b>-0.3</b>   |
| Former centrally planned economies | 69.1                  | 56.5        | -1.0          | 182.9                 | 179.8        | -0.1          | 14.7                  | 11.6        | -1.2          |
| Other developed countries          | 86.5                  | 95.8        | 0.5           | 221.0                 | 224.1        | 0.1           | 14.5                  | 13.9        | -0.2          |
| <b>Developing</b>                  | <b>16.9</b>           | <b>29.6</b> | <b>2.8</b>    | <b>37.5</b>           | <b>55.2</b>  | <b>2.0</b>    | <b>3.6</b>            | <b>7.4</b>  | <b>3.7</b>    |
| East and Southeast Asia            | 18.4                  | 44.7        | 4.6           | 6.4                   | 24.9         | 7.0           | 4.5                   | 13.6        | 5.6           |
| - China                            | 20.4                  | 53.5        | 4.9           | 4.5                   | 28.7         | 9.7           | 4.9                   | 17.4        | 6.5           |
| - Rest of East and Southeast Asia  | 13.6                  | 26.6        | 3.4           | 10.7                  | 17.0         | 2.4           | 3.7                   | 5.8         | 2.3           |
| Latin America and the Caribbean    | 41.8                  | 64.1        | 2.2           | 96.1                  | 113.3        | 0.8           | 7.5                   | 9.5         | 1.2           |
| - Brazil                           | 45.9                  | 80.5        | 2.9           | 88.7                  | 124.6        | 1.7           | 7.9                   | 7.5         | -0.3          |
| - Rest of Latin America            | 39.6                  | 55.7        | 1.7           | 99.9                  | 107.4        | 0.4           | 7.3                   | 10.5        | 1.8           |
| South Asia                         | 4.7                   | 4.6         | -0.1          | 52.3                  | 72.0         | 1.6           | 1.1                   | 2.0         | 3.2           |
| - India                            | 4.1                   | 3.3         | -1.1          | 51.0                  | 68.7         | 1.5           | 1.1                   | 2.1         | 3.4           |
| - Rest of South Asia               | 6.8                   | 8.6         | 1.2           | 56.7                  | 82.0         | 1.9           | 1.1                   | 1.8         | 2.5           |
| Near East and North Africa         | 21.0                  | 28.4        | 1.5           | 80.8                  | 87.1         | 0.4           | 4.2                   | 6.0         | 1.8           |
| Sub-Saharan Africa                 | 13.5                  | 14.0        | 0.2           | 31.4                  | 30.2         | -0.2          | 1.6                   | 1.7         | 0.3           |
| <b>World</b>                       | <b>32.0</b>           | <b>40.3</b> | <b>1.2</b>    | <b>77.9</b>           | <b>84.9</b>  | <b>0.4</b>    | <b>6.2</b>            | <b>8.6</b>  | <b>1.7</b>    |

**Table 1 (continued) – Per caput consumption of dairy products by region – 1987 and 2007**

| Region                             | Butter and ghee       |            |               | Cheese                |              |               | Cream                 |             |               |
|------------------------------------|-----------------------|------------|---------------|-----------------------|--------------|---------------|-----------------------|-------------|---------------|
|                                    | Per caput consumption |            | Annual growth | Per caput consumption |              | Annual growth | Per caput consumption |             | Annual growth |
|                                    | 1987                  | 2007       | 1987-2007     | 1987                  | 2007         | 1987-2007     | 1987                  | 2007        | 1987-2007     |
|                                    | Kg/capita/year        |            | Percent       | Kg/capita/year        |              | Percent       | Kg/capita/year        |             | Percent       |
| <b>Developed</b>                   | <b>4.6</b>            | <b>2.8</b> | <b>-2.5</b>   | <b>9.91</b>           | <b>12.44</b> | <b>1.1</b>    | <b>2.83</b>           | <b>2.18</b> | <b>-1.3</b>   |
| Former centrally planned economies | 6.5                   | 2.1        | -5.5          | 7.57                  | 6.00         | -1.2          | 5.48                  | 1.88        | -5.2          |
| Other developed countries          | 3.7                   | 3.0        | -1.1          | 11.14                 | 14.43        | 1.3           | 1.46                  | 2.16        | 2.0           |
| <b>Developing</b>                  | <b>0.6</b>            | <b>1.0</b> | <b>2.7</b>    | <b>0.54</b>           | <b>0.64</b>  | <b>0.9</b>    | <b>0.00</b>           | <b>0.04</b> | <b>15.1</b>   |
| East and Southeast Asia            | 0.1                   | 0.1        | 1.8           | 0.11                  | 0.24         | 3.8           | 0.00                  | 0.02        | 10.2          |
| - China                            | 0.1                   | 0.1        | 2.3           | 0.12                  | 0.23         | 3.3           | 0.00                  | 0.01        |               |
| - Rest of East and Southeast Asia  | 0.2                   | 0.2        | 1.2           | 0.10                  | 0.26         | 4.9           | 0.01                  | 0.03        | 7.0           |
| Latin America and the Caribbean    | 0.7                   | 0.5        | -1.3          | 1.79                  | 1.92         | 0.3           | 0.00                  | 0.06        | 14.6          |
| - Brazil                           | 0.8                   | 0.5        | -2.5          | 0.45                  | 0.21         | -3.7          | 0.00                  | 0.00        |               |
| - Rest of Latin America            | 0.6                   | 0.5        | -0.7          | 2.49                  | 2.80         | 0.6           | 0.01                  | 0.09        | 14.6          |
| South Asia                         | 1.0                   | 2.4        | 4.4           | 0.00                  | 0.00         | 4.3           | 0.00                  | 0.00        |               |
| - India                            | 1.0                   | 2.7        | 5.2           | 0.00                  | 0.00         |               |                       |             |               |
| - Rest of South Asia               | 1.2                   | 1.6        | 1.6           | 0.01                  | 0.01         | 3.8           | 0.00                  | 0.00        |               |
| Near East and North Africa         | 2.1                   | 1.9        | -0.6          | 3.33                  | 3.42         | 0.1           | 0.01                  | 0.12        | 17.3          |
| Sub-Saharan Africa                 | 0.2                   | 0.1        | -1.1          | 0.31                  | 0.34         | 0.4           | 0.00                  | 0.05        | 22.4          |
| <b>World</b>                       | <b>1.5</b>            | <b>1.3</b> | <b>-0.8</b>   | <b>2.80</b>           | <b>2.86</b>  | <b>0.1</b>    | <b>0.85</b>           | <b>0.55</b> | <b>-2.2</b>   |

Source: Elaboration on data from FAOSTAT for consumption and the UN for population data.



Over the past two decades, all developing country regions saw an expansion in per caput consumption of dairy products, with the exception of sub-Saharan Africa, although both rates of expansion and levels of consumption differ widely. By far the highest regional consumption levels are observed in Latin America and the Caribbean. On the other hand, per caput consumption growth in the region has been relatively slow, albeit with Brazil showing a rate of growth well above the regional average. Nevertheless, growth in per caput consumption of dairy products has been slower than that of meat products, indicating a growing preference for meat over dairy among livestock products. In this respect, South Asia reveals a sharply different pattern with very low levels of meat consumption and much higher and growing levels of dairy consumption, especially for butter and ghee, revealing a clear preference for dairy products, which represent clearly the most important source of animal protein.

East and Southeast Asia, especially China has seen rapid growth in per caput consumption of dairy products over the last two decades, exceeding the also rapid growth rate in meat consumption. However, the growth has started from a low base and consumption levels remain low and below the averages of the other developing country regions. Both in sub-Saharan Africa and in the Near East and North Africa, growth in dairy consumption has been limited if not stagnant over the last couple of decades, although in the latter region consumption levels remain relatively high, while the former region reveals the lowest levels of per caput consumption second only to East and Southeast Asia.

**Box 1: Differences in patterns of dairy production and consumption in China: north-south, urban-rural**

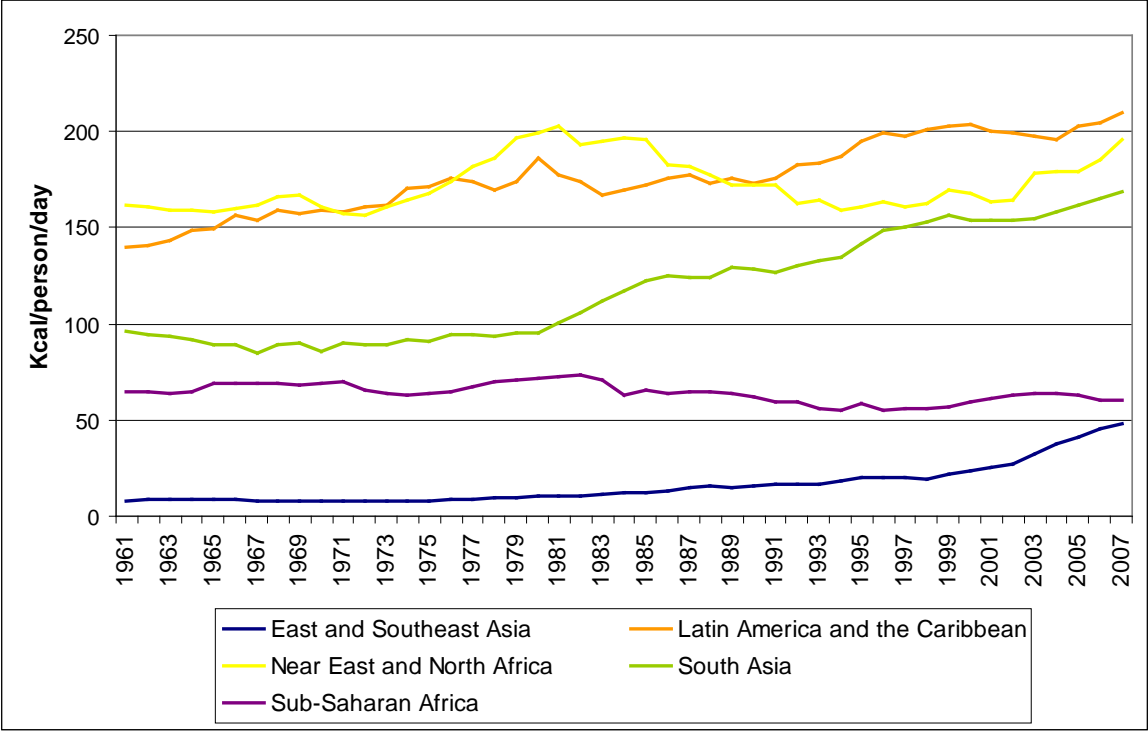
As indicated in the main text, China has displayed rapid growth in dairy production in recent decades. While per capita consumption is increasing rapidly, it still remains comparatively low (Wang and Li, 2008). Since 2000, the Government has put in place a set of policies to promote dairy production and technology development, supported by considerable investments. However, the rapid growth of the sector has led to new challenges and has exceeded the ability of value chains to maintain the safety of the products as illustrated by the melanine scandal in 2008 (Animal Production and Health Commission for Asia and the Pacific and Food and Agriculture Organization of the United Nations, Regional Office for Asia and the Pacific, 2009). Pei et al. (2011) link the problems of melanine contamination to the rapid and unregulated development of the sector.

Traditionally, milk and dairy products were not commonly consumed and were perceived as therapeutic food for the elderly, the infirm and the young, and diets were primarily plant based. Economic growth and urbanisation, along with the more sophisticated marketing channels that have accompanied these trends, have led to significant changes in dietary patterns, and milk and other dairy products are slowly being incorporated into the diet. Current government guidelines that recommend regular milk consumption have further challenged traditional preferences (Fuller *et al.*, 2005; Dong and Fuller, 2007). Although the dietary changes are not consistent across all socio-economic levels and age groups, Fuller *et al.*, (2006) reported that milk consumption doubled between 1996 and 2003 in households in the lowest 10 percent of the income distribution.

Although milk consumption and production have been increasing, there are major disparities between rural and urban areas, as well as between regions. Fuller *et al.*, (2005) reported that a 'typical' rural resident consumed 2.5 kgs per capita of milk in 1990, compared with 7.5 kgs per capita for the urban counterpart, although national levels of per caput of consumption have increased since then. Also, intensive production operations are more common near large cities such as Beijing and Shanghai, thus increasing availability in these urban areas (Yang *et al.*, 2004). At the same time, there are regional variations in production and consumption, which may be attributed partly to historical and cultural preferences (Shono, Suzuki and Kaiser, 2000). Most dairy production occurs in northern China, where approximately 85 percent of milk is produced, within geographical regions with concentrated dairy herds. However, 60 percent of the national population is located in the south. Climatic conditions and feed availability are the main underlying factors for this variation (Wang, Zhou and Shen, 2008). However, the disparities in consumption rates amongst regions and between rural and urban areas are difficult to assess with accuracy. For example, although higher rates of milk consumption are evident in the urban settings there are large differences across socio-economic groups within these settings. At the same time, apparent low consumption patterns in the rural areas raise the question of the possible magnitude of un-recorded home-consumption of milk (Ma *et al.*, 2004; Wang *et al.*, 2008).

In spite of the narrowing of the gap, dairy consumption levels in developing regions are still substantially smaller than in the developed world. For dairy, the major regional differences in levels and trends in per caput energy intake from dairy are shown in figures 7 and 8. Since the mid-1980s, most growth in per caput consumption has taken place in the developing countries, as per caput consumption in the developed market economies has been stagnating. The former centrally planned economies saw a sharp contraction in consumption from the late 1980s to the early 1990s, but consumption has since been recovering. Among the developing country regions, most of the growth in consumption levels has been experienced in South Asia and in Latin America and the Caribbean. The latter has the highest level of per caput energy intake from dairy, followed by the Near East and North Africa and South Asia, but the highest rate of growth in per caput consumption has occurring in the latter region. In the Near East and North Africa, consumption growth has resumed since the late 1990s following a decline since around 1980. Consumption levels have stayed low and stagnant in sub-Saharan Africa. In East and South East Asia, consumption has expanded significantly in relative terms, especially over the most recent years, but consumption levels remain remarkably low.

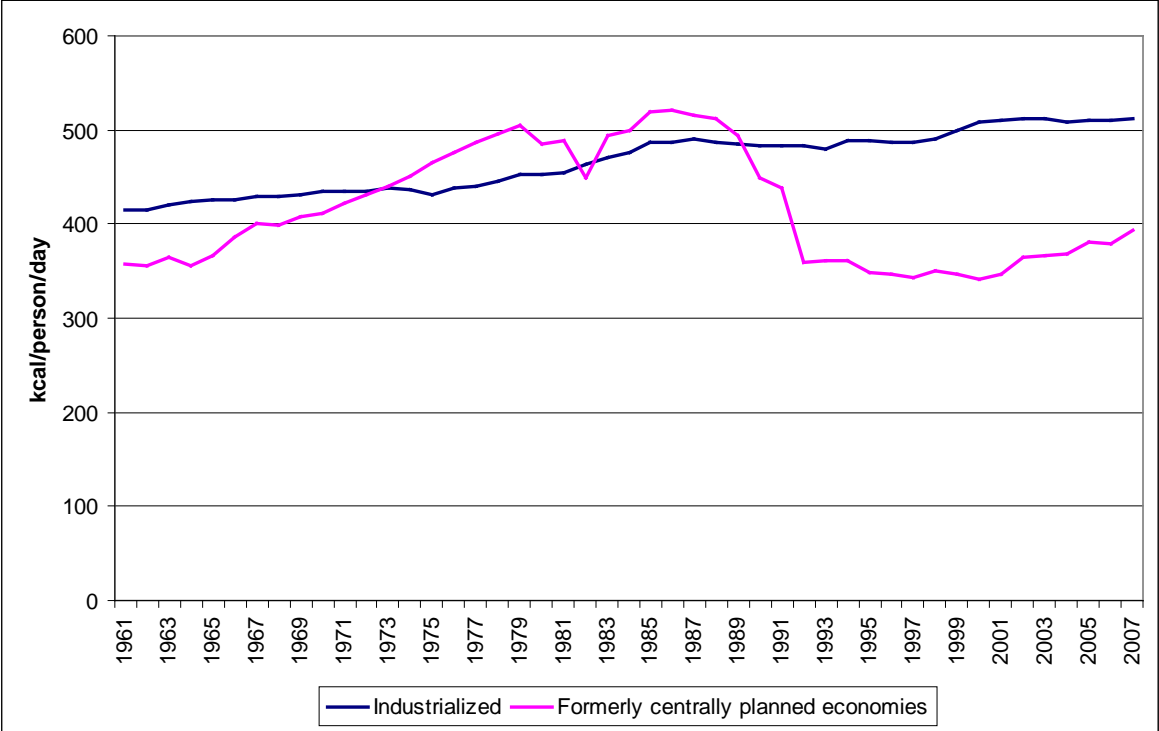
**Figure 7 - Per capita energy intake from dairy products\* in developing countries - 1961-2007 (kcal/person/year)**



\* Milk, butter and ghee, cheese.

Source: FAOSTAT

**Figure 8 - Per capita energy intake from dairy products\* in developed countries - 1961-2007 (kcal/person/year)**

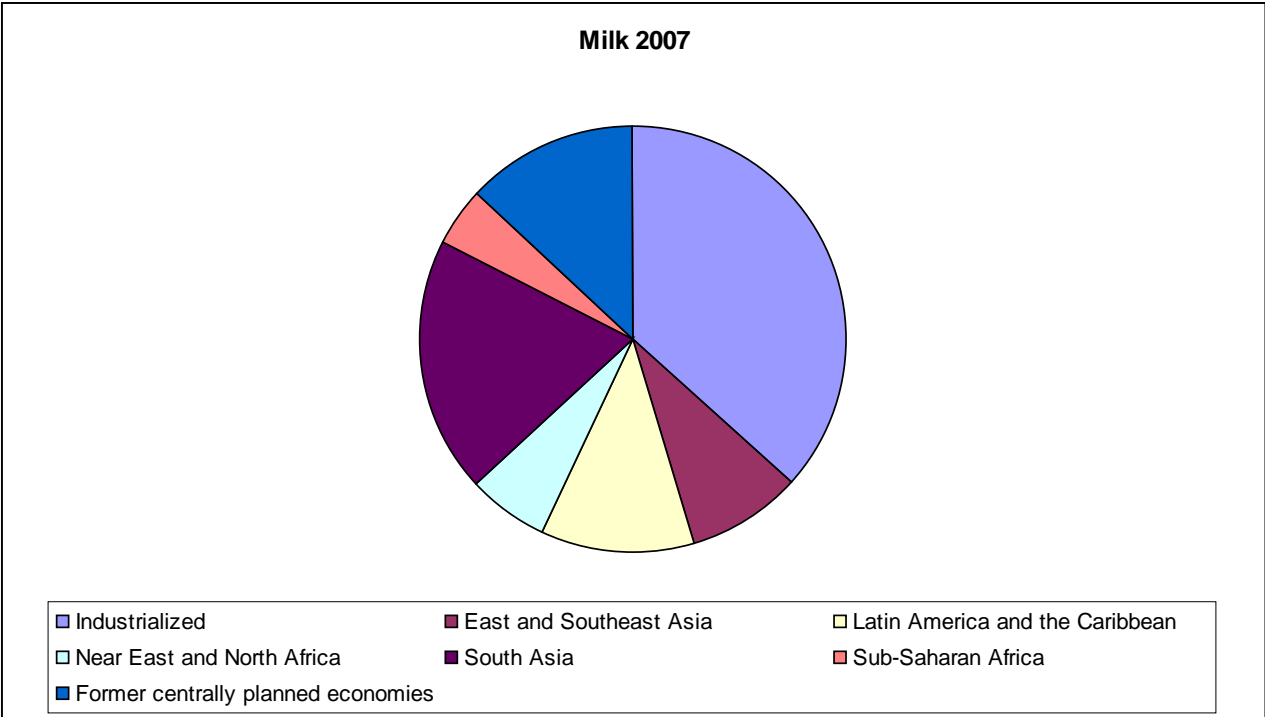
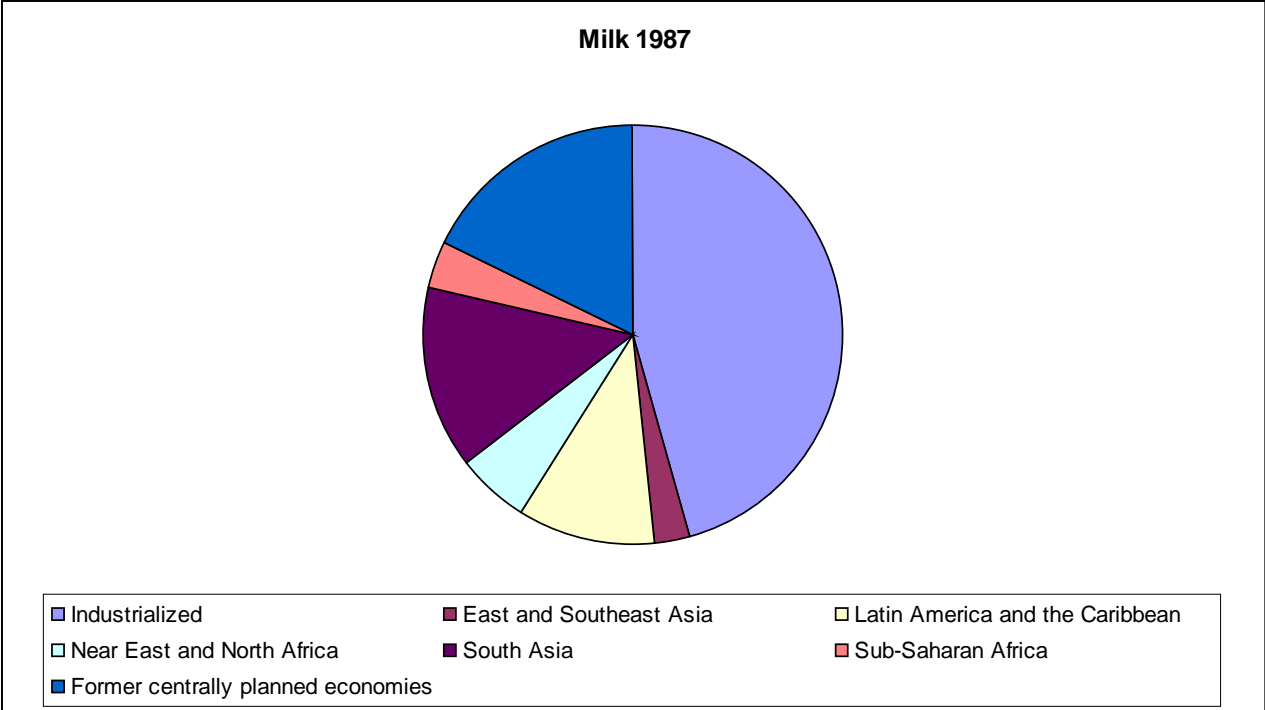


\* Milk, butter and ghee, cheese.

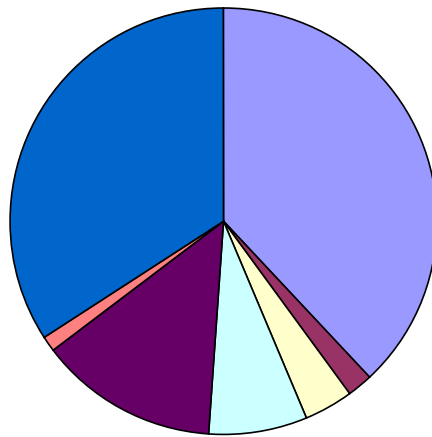
Source: FAOSTAT

Growing per caput consumption of milk and other livestock products in parts of the developing world, combined with population growth, has led to major changes in the locus of consumption at the global level. These changes are illustrated in figure 9, which shows the regional shares in global consumption of milk, butter and ghee and cheese in 1987 and in 2007. A striking feature is the decline in the developed country share in total consumption of milk consumption from almost two-thirds to 50 percent accompanied by an increase in the share, especially of East and Southeast Asia and South Asia. An even more striking feature is the very sharp decline in the developed-country share for consumption of butter and ghee, especially due to sharp contraction in consumption levels in the former centrally planned economy, and the large increase in the share of Southern Asia, which is now responsible for around 40 percent of total consumption.

**Figure 9 – Regional distribution in total dairy consumption, 1980 and 2007 (percent share)**

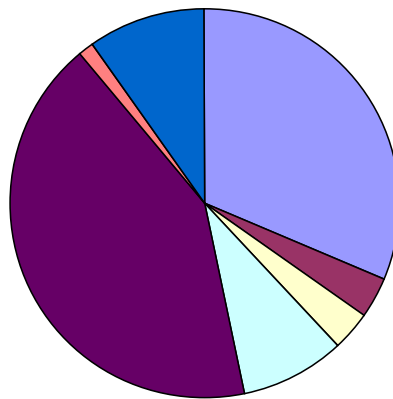


**Butter and ghee 1987**

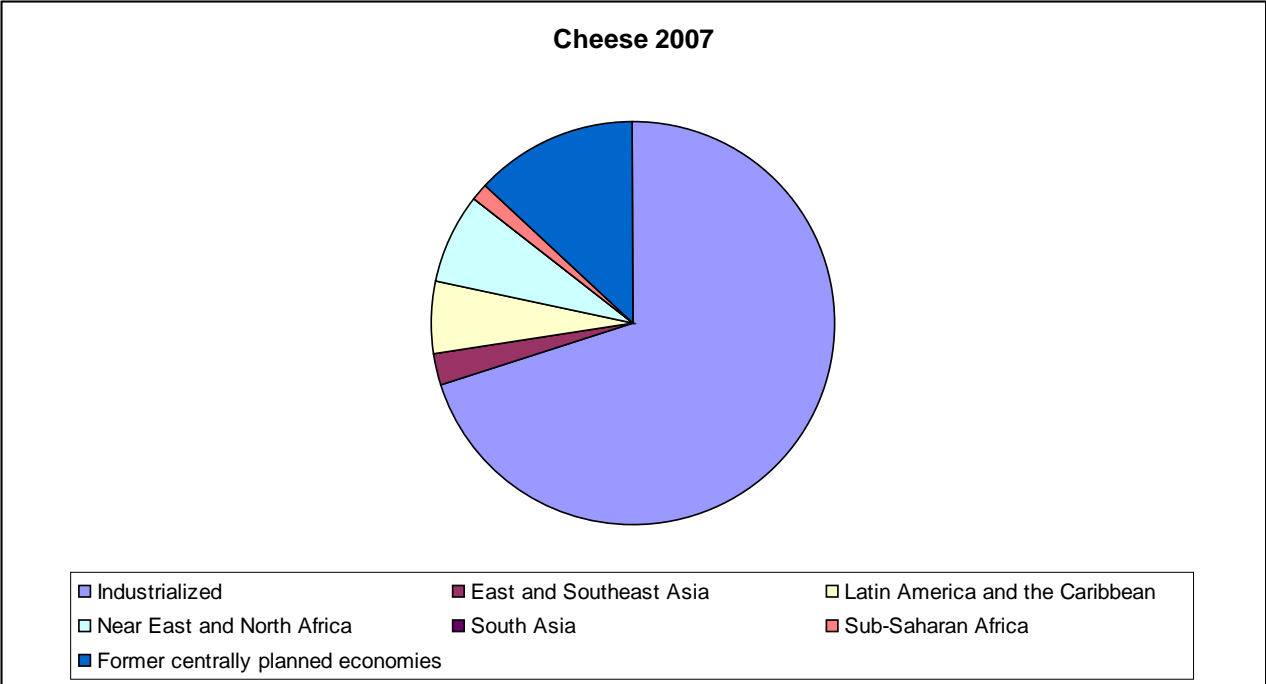
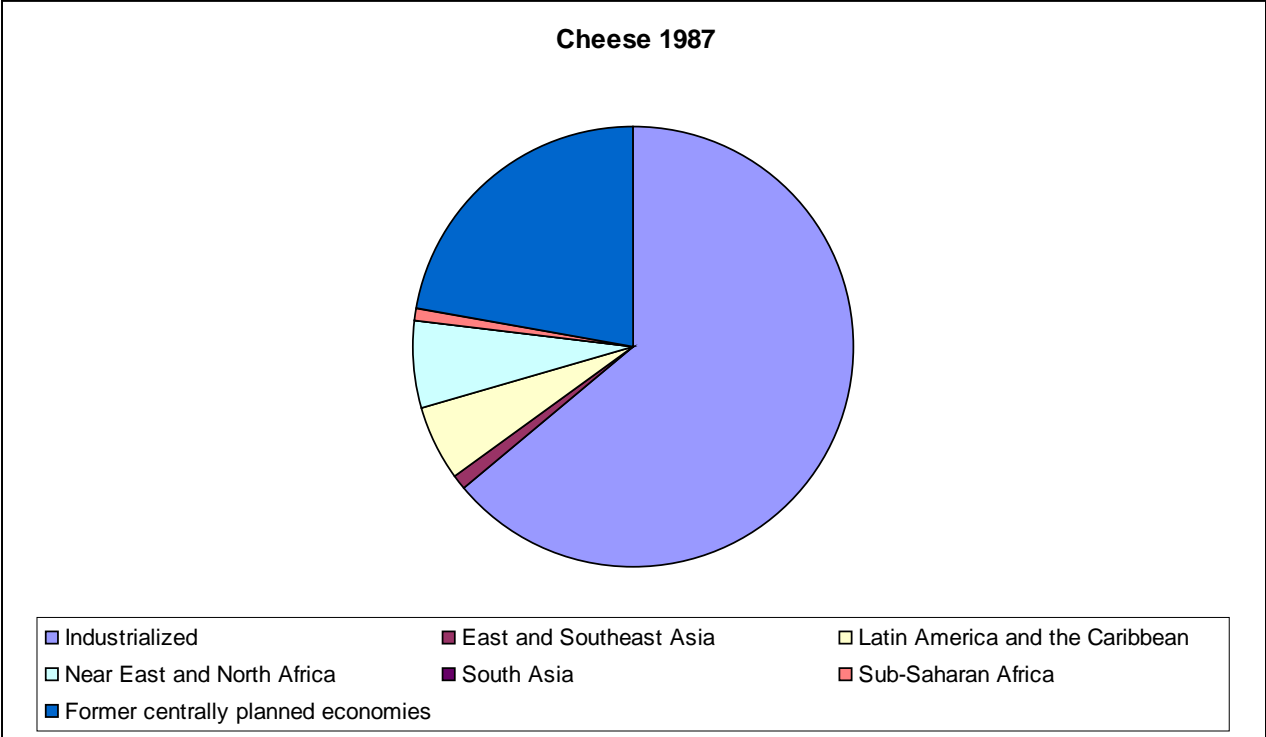


- |                                    |                         |                                 |
|------------------------------------|-------------------------|---------------------------------|
| Industrialized                     | East and Southeast Asia | Latin America and the Caribbean |
| Near East and North Africa         | South Asia              | Sub-Saharan Africa              |
| Former centrally planned economies |                         |                                 |

**Butter and ghee 2007**



- |                                    |                         |                                 |
|------------------------------------|-------------------------|---------------------------------|
| Industrialized                     | East and Southeast Asia | Latin America and the Caribbean |
| Near East and North Africa         | South Asia              | Sub-Saharan Africa              |
| Former centrally planned economies |                         |                                 |



Source: FAOSTAT

***Drivers of growing milk and livestock consumption***

Levels of per caput consumption of dairy and other livestock products are determined by a number of factors, including economic ones such as income levels and relative prices, demographic factors such as urbanization, as well as social and cultural factors. Undoubtedly,

the most significant factor underlying the growing consumption of livestock products in a large portion of the developing world has been economic growth and rising incomes. Over the past decades, the global economy experienced an unparalleled expansion, with per caput incomes in many developing countries narrowing the gap with high-income developed countries.

Both dairy and other livestock products have a high income-elasticity of demand, especially at low income levels. This means that increases in income leads to large increases in demand for livestock products. Thus per capita income growth will translate into particularly significant increases in demand for livestock products.

Table 2 shows average income elasticities of demand for 8 food sub-categories, derived from individual country estimates by the Economic Research Service of the United States Department based on the International Comparison Project. The income elasticity for a category of consumption estimates the percentage increase in expenditure on that category resulting from a 1 percent increase in income. Overall, the elasticities for the expenditure category “food beverages and tobacco” are lower than for other expenditure categories (not shown in table). However, within this category, dairy has higher income elasticities of demand than the expenditure category as a whole and higher than all other sub-categories within the category, with the exception of the residual sub-category of “other foods”. Dairy products are also seen to have slightly higher income elasticities of demand than meat and significantly higher than fish. In other words, as incomes increase, expenditures on dairy products will grow more rapidly in percentage terms than most other food items – especially staple food items as bread and cereal, which indeed have the lowest income elasticities of all. The table also shows that demand for food, including dairy products, is more responsive to change in income in low-income countries, and that the elasticities of demand for all food categories decline with rising income levels. Thus, growth in consumption of dairy products is expected to react strongly to increases in income especially in low- and middle-income countries. In high-come countries economic growth will generally translate into smaller increases in dairy consumption, although higher than for most other food categories..



**Table 2 – Average expenditure elasticities for food sub-categories - 144 countries in 2005**

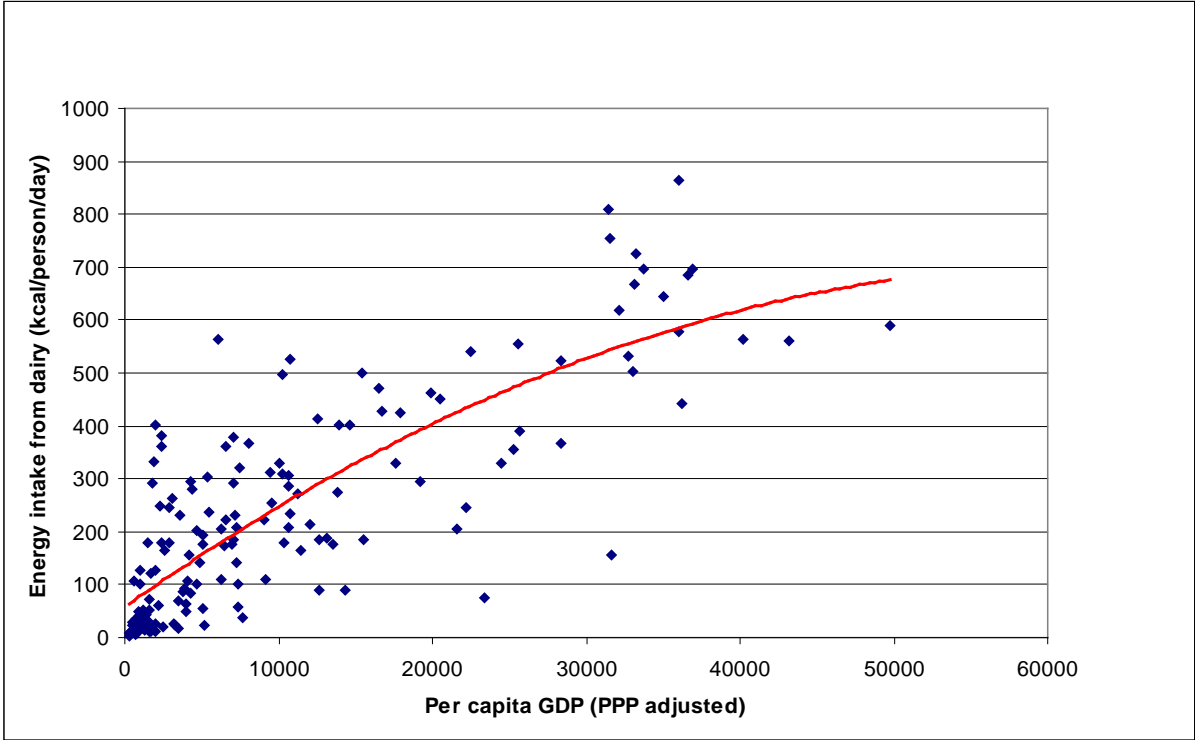
|                            | Low-income countries (N= 28) | Lower middle-income countries (N=36) | Middle-income countries (N= 36) | High-income countries (N=44) |
|----------------------------|------------------------------|--------------------------------------|---------------------------------|------------------------------|
| Food beverages and tobacco | 0.81                         | 0.77                                 | 0.70                            | 0.54                         |
| Beverages and tobacco      | 1.73                         | 1.13                                 | 0.92                            | 0.67                         |
| Cereals                    | 0.59                         | 0.49                                 | 0.34                            | 0.08                         |
| Meat                       | 0.80                         | 0.76                                 | 0.69                            | 0.53                         |
| Dairy                      | 0.83                         | 0.79                                 | 0.72                            | 0.55                         |
| Fish                       | 0.69                         | 0.64                                 | 0.56                            | 0.42                         |
| Fats, oils                 | 0.60                         | 0.50                                 | 0.37                            | 0.15                         |
| Fruits                     | 0.66                         | 0.60                                 | 0.51                            | 0.36                         |
| Other foods                | 1.82                         | 1.23                                 | 0.98                            | 0.70                         |

Note: The income elasticity of expenditure estimates the percentage increase in expenditure on the food category resulting from a one percent increase in income. The numbers reported are simple unweighted averages of estimates for the individual countries included in each income group.

Source: Authors' calculations based on data by the Economic Research Service of United States Department of Agriculture (<http://www.ers.usda.gov/Data/InternationalFoodDemand/>).

The positive relationship between per caput income and dairy consumption levels is also illustrated by figure 10, which plots per capita income against per caput dietary energy intake from dairy products across countries. The graphic clearly reveals the importance of income levels for consumption levels. However, the declining slope of the fitted trend line also shows how the effect of increased incomes on consumption is greater at lower income levels. Also the significant dispersion in the observations around the trend line illustrates the significant importance of other factors in determining consumption levels in different countries.

**Figure 10 - Per caput income and dietary energy intake from dairy – country observations for 2007.**



Note: GDP per capita is measured at Purchasing Power Parity (PPP) in constant 2005 international US\$.

Source: Elaboration on the basis data from FAOSTAT for per caput meat consumption and the World Bank for per caput GDP.

Also demographic factors underlie changing consumption patterns of livestock products. An important factor has been urbanization. With the rural-urban transition taking place in most developing countries, food consumption habits are changing rapidly. Urbanization usually implies higher levels of participation in the workforce and has an impact on patterns of food consumption. In cities, people typically consume more food away from home and higher amounts of pre-cooked, fast and convenience foods (Schmidhuber and Shetty, 2005; Rae, 1998; King, Tietjen and Vickner, 2000). Therefore, urbanization influences the position and the shape of the consumption functions for animal products (that is the relationship between income and consumption of animal products). Estimating consumption functions for total animal-derived products in a sample of East Asian economies, Rae (1998) found urbanisation to have significant effect on the consumption of animal products, independently of income levels. Urbanisation is thus in its own right a contributing factor to increased consumption of animal products.

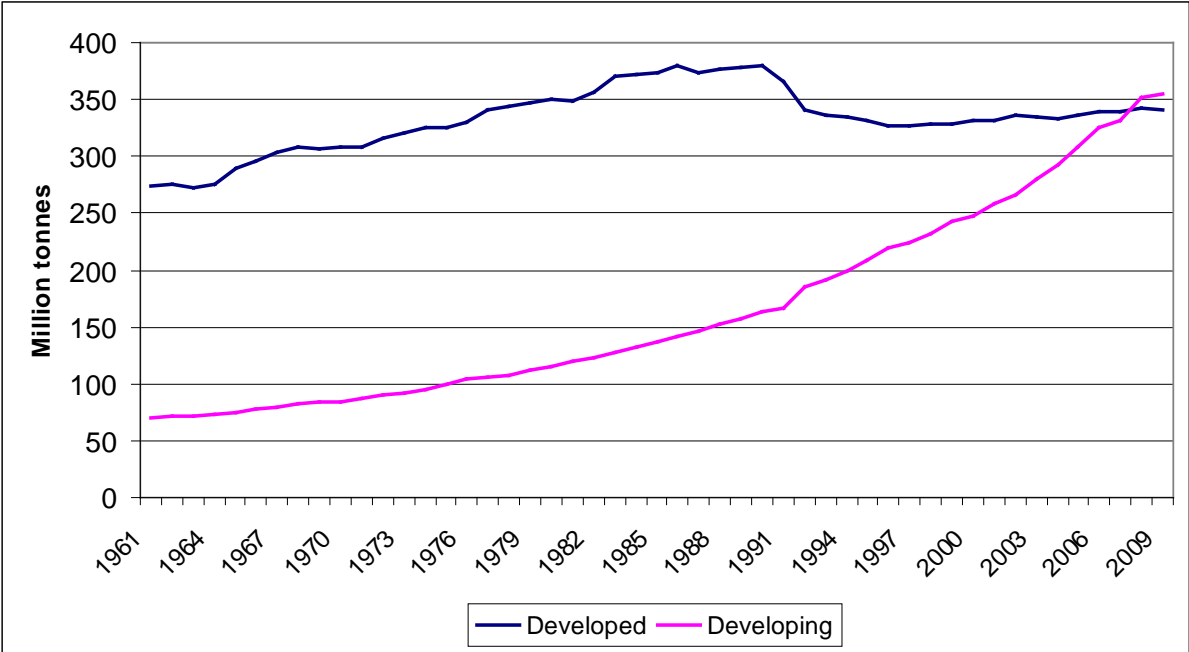
While purchasing power and urbanization explain the greater part of changing per capita consumption patterns, other social and cultural factors can have a large influence locally. For example, Brazil and Thailand have similar income per capita and urbanization rates but animal product consumption in Brazil is roughly twice as high as in Thailand. Japan has significantly lower consumption levels for livestock products than other countries at comparable income levels, inter alia due to a cultural preference for fish products.

Natural resource endowment is one of the additional factors that indirectly affects consumption, as it shapes the relative costs and prices of different food commodities. Access to marine resources, on the one hand, and to natural resources for livestock production, on the other, have drawn consumption trends in opposite directions. Lactose intolerance has limited milk consumption (Dong, 2006). Cultural reasons have further influenced consumption habits. This, for example, is the case in South Asia, where consumption per capita of meat is lower than income alone would explain, but milk consumption is comparatively high, and increasing.

***Trends in milk production patterns***

Developing country growth in demand for and consumption of milk has been matched by increasing production as illustrated by figure 11, which shows milk production in developed and developing countries over the past several decades. Developing country production growth has significantly outpaced that of developed countries. Since the late 1980s virtually all production growth has been concentrated in the developing countries. The former centrally planned economies suffered a sharp decline in production at the beginning of the transition process, while production in the rest of the developed world has grown only slowly.

**Figure 11 – World milk production 1961- 2009 (million tonnes)**

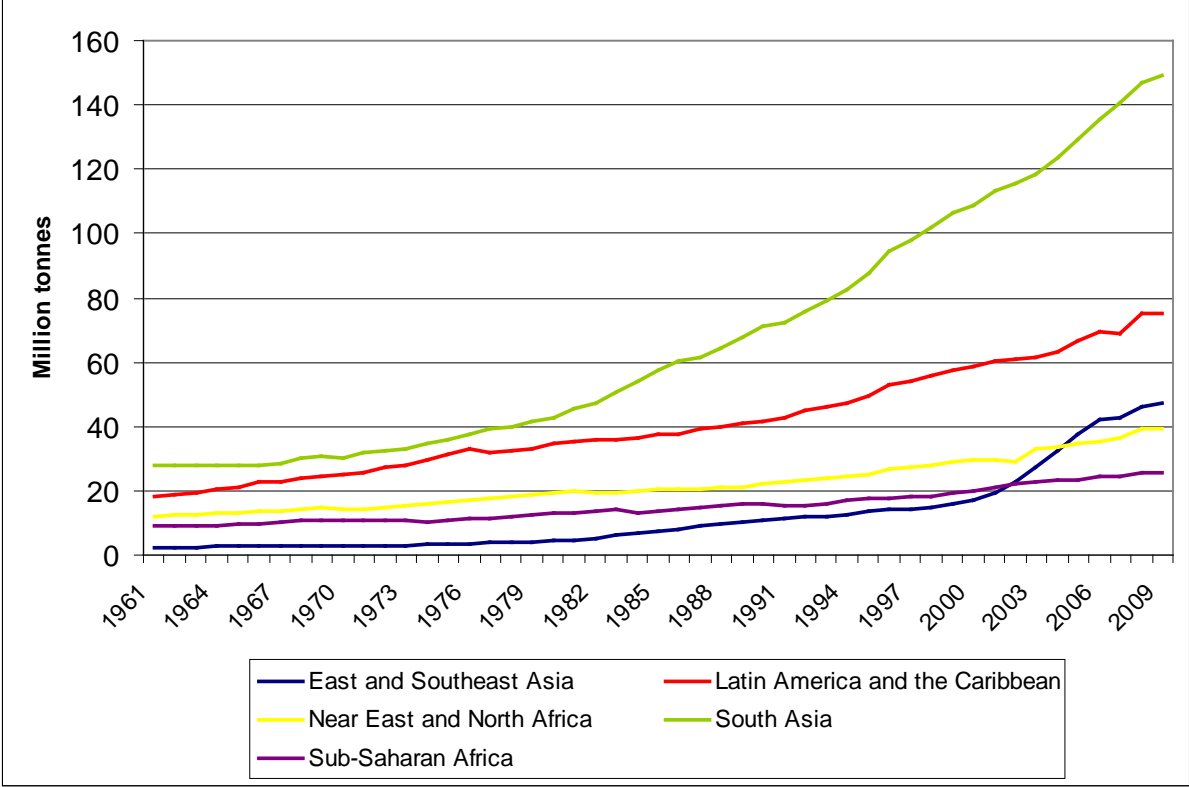


Source: FAOSTAT

However, different regions contribute to very different degrees in overall production as seen in figure 12 and table 3. As was the case for consumption, the real growth pole of milk production in the developing countries has been South Asia, which has seen continuous and sustained growth in production. Today, India alone is responsible for almost a third of developing country production and 16 percent of global production. Latin America and the Caribbean is the second-largest regional producer, but with production having expanded at a slower rate than in South Asia. East and Southeast Asia, and especially China, has seen

production grow at an extremely rapid pace over the past decade, but the region’s production levels are still far short of those of South Asia and Latin America.

**Figure 12 - Milk production - developing country regions**



Source: FAOSTAT

**Table 3 – Milk production by region 1989-2009**

| Region                             | Milk           |       |                         |
|------------------------------------|----------------|-------|-------------------------|
|                                    | Million tonnes |       | Annual growth (percent) |
|                                    | 1989           | 2009  | 1989-2009               |
| <b>Developed countries</b>         | 378.6          | 341.3 | -0.5                    |
| Former centrally planned economies | 146.8          | 102.1 | -1.8                    |
| Other developed countries          | 232.8          | 257.5 | 0.5                     |
| <b>Developing countries</b>        | 157.8          | 355.3 | 4.1                     |
| East and Southeast Asia            | 10.1           | 47.0  | 8.0                     |
| - China                            | 6.4            | 40.6  | 9.7                     |
| - Rest of East and Southeast Asia  | 3.7            | 6.4   | 2.8                     |
| Latin America and the Caribbean    | 40.7           | 75.2  | 3.1                     |
| - Brazil                           | 14.7           | 27.7  | 3.2                     |
| - Rest of Latin America            | 26.1           | 47.5  | 3.0                     |
| South Asia                         | 68.0           | 149.2 | 4.0                     |
| - India                            | 51.4           | 110.0 | 3.9                     |
| - Rest of South Asia               | 16.6           | 39.2  | 4.4                     |
| Near East and North Africa         | 21.2           | 39.1  | 3.1                     |
| Sub-Saharan Africa                 | 16.1           | 25.7  | 2.4                     |
| <b>World</b>                       | 536.4          | 696.5 | 1.3                     |

Source: FAOSTAT

**Box 2: Low levels of dairy consumption and high levels of malnutrition amidst the success of Indian milk production**

The evolution of dairy production in India is widely regarded as a success story with small-scale dairy farms as fundamental to the dairy agricultural system (FAO, 2009). Coinciding with the fourfold increase in milk production between 1963 and 2003, the average herd size has decreased. Governmental programmes, namely ‘Operation Flood’ has driven dairy agriculture. Unfortunately, the success of production has not necessarily translated into increased access to and consumption of dairy products by all strata of society.

Evaluating the nutritional impact of dairy production on the national population is not a simple task. Economic growth has increased the demand for food of animal origin, with dairy products as the preferred choice in a population that is predominantly vegetarian (FAO, 2009; Gandhi and Zhou, 2010). However, the cost of dairy products has restricted their consumption to the more affluent. The exact demand for animal source foods, including milk, is somewhat ambiguous (Gandhi and Zhou, 2010). Data from the National Sample Survey confirm the predominant position of cereals in the diet in rural areas, even though the consumption of cereal items as a whole has decreased over recent decades (Chatterjee, Rae and Ray, 2007). Among dairy products, liquid milk dominates demand (93.7 percent of demand for dairy products in rural areas and 88 percent in urban regions), followed by ghee (4.1 percent in rural and 7.9 percent in urban areas) (Gandhi and Zhou, 2010). Milk consumption patterns are not uniform across regions. For example, per capita consumption is distinctly higher in Haryana

(up to 146.2 litres per capita) and Punjab, compared to, for example 2.5 litres per capita in Manipur, possibly due to the higher per capita income and different consumer preferences in the former (Gandhi and Zhou, 2010).

To what degree dairy production has affected the nutritional status, particularly among the most vulnerable, has not been explored, as household home consumption figures are difficult to obtain. However, according to Rao, Ladusingh and Pritamjit (2004) the National Nutrition Monitoring Bureau (NNMB) surveys between 1977 and 1996 recorded little improvement in the nutritional status of children in spite of the nation's economic progress. The National Family Health Surveys (NFHS) provide additional insight into the trend of child malnutrition, pointing to severe disparities between states and socio-economic groups. The NFHS-3 (2005-2006) reports that 46 percent of children of less than 5 are moderately to severely underweight, 19 percent are moderately to severely wasted and 38 percent are moderately to severely stunted (International Institute for Population Sciences (IIPS) and Macro International, 2007; Arnold *et al.*, 2009; Kanjilal *et al.*, 2010). There is a higher prevalence (28 percent higher) of stunting in the rural compared to the urban areas, and rural children are almost 40 percent more likely to be underweight. However, income poverty is not the only factor causing nutritional deficiencies, as these also occur in the economically better-off households, indicating that weak nutrition education may be an issue. Calcium intakes have decreased in spite of increases in dairy production and per capita consumption (Venkaiah *et al.*, 2002; Puri *et al.*, 2008; Harinarayan *et al.*, 2007; Wang and Li, 2008). Malhotra and Mithal (2008) have reported that osteoporotic fractures are becoming increasingly prevalent in the Indian population.

Some studies point to both gender and economic inequality as underlying factors of malnutrition. Sanwalka *et al.* (2010) reported that adolescents from lower economic groups had a lower median calcium intake compared to higher income groups who consumed more dairy products; notably girls from both groups had less access to dairy products. Bhatia (2008) and the Indian Council of Medical Research (National Institute of Nutrition, 2009) support this finding regarding osteoporosis. India has demonstrated success in dairy production, but less so in per capita consumption. The challenge remains to distribute this success to the more vulnerable in society, also within households (Renuka *et al.*, 2009).

Cow milk dominates global milk production, but milk from other animals is important in specific regions, countries and local contexts. Table 4 presents data on milk production from the most significant sources at the global level and for major regions and sub-regions. Globally cow milk represents 85 percent of global production and at least 80 percent of total production in all regions except South Asia, where its share is less than half (44 percent). In addition to cow milk, only buffalo milk makes a substantial contribution at the global level accounting for 11 percent of global production and 23 percent of developing country production. The contribution of milk from goats (3.4 percent), sheep (1.4 percent) and camels (0.2 percent) is limited at the global level and only slightly higher among the developing countries as a group.

In South Asia, buffaloes are the most important source of milk, accounting for slightly more than half (51 percent) of total production. They make a substantial contribution to total production also in East and Southeast Asia - especially China, where their share reaches 7.4 percent - and the Near East and North Africa, where it stands at 6.8 percent.

Goat milk contributes only 2.1 percent of global milk production, but is relatively significant in sub-Saharan Africa, with 10 percent of the total, and parts of South Asia and of East and Southeast Asia (excluding China). Sheep milk is important Near East and North Africa, with 8.4 percent of production, somewhat less in sub-Saharan Africa (4.8 percent) and East and Southeast Asia (2.8 percent), but marginal in other regions. Camel milk makes a notable contribution to production only in sub-Saharan Africa (4.8 percent), while its contribution is marginal in the Near East and North Africa and negligible in the other regions.

**Table 4 : Production of milk from different animals - average 2006-2009**

|  | Sheep milk       |            | Goat milk        |            | Cow milk         |             | Camel milk       |            | Buffalo milk     |             | Milk, total      |            |
|--|------------------|------------|------------------|------------|------------------|-------------|------------------|------------|------------------|-------------|------------------|------------|
|  | Volume<br>1000 t | Share<br>% | Volume<br>1000 t | Share<br>% | Volume<br>1000 t | Share<br>%  | Volume<br>1000 t | Share<br>% | Volume<br>1000 t | Share<br>%  | Volume<br>1000 t | Share<br>% |
| <b>Developed</b>                                       | <b>327</b>       | <b>0.9</b> | <b>2516</b>      | <b>0.8</b> | <b>320886</b>    | <b>98.1</b> | <b>0</b>         | <b>0.0</b> | <b>228</b>       | <b>0.1</b>  | <b>327000</b>    | <b>100</b> |
| Formerly centrally planned economies<br>Industrialized | 101              | 1.1        | 858              | 0.8        | 99367            | 98.4        | 0                | 0.0        | 13               | 0.0         | 101000           | 100        |
|  | 243              | 0.9        | 1782             | 0.7        | 238381           | 98.1        | 0                | 0.0        | 221              | 0.1         | 243000           | 100        |
| <b>Developing</b>                                      | <b>309</b>       | <b>1.8</b> | <b>10623</b>     | <b>3.4</b> | <b>221174</b>    | <b>71.6</b> | <b>1292</b>      | <b>0.4</b> | <b>69983</b>     | <b>22.6</b> | <b>309000</b>    | <b>100</b> |
| East and Southeast Asia                                | 45               | 2.8        | 587              | 1.3        | 39479            | 88.7        | 19               | 0.0        | 3124             | 7.0         | 44500            | 100        |
| China  | 39               | 2.8        | 265              | 0.7        | 34950            | 88.9        | 15               | 0.0        | 2925             | 7.4         | 39300            | 100        |
| Rest of East and Southeast Asia                        | 5                | 2.9        | 322              | 6.2        | 4529             | 87.0        | 4                | 0.1        | 199              | 3.8         | 5207             | 100        |
| Latin America and the Caribbean                        | 62               | 0.0        | 449              | 0.7        | 61811            | 99.2        | 0                | 0.0        | 0                | 0.0         | 62300            | 100        |
| Brazil   | 20               | 0.0        | 136              | 0.7        | 19976            | 99.4        | 0                | 0.0        | 0                | 0.0         | 20100            | 100        |
| Rest of Latin America and the<br>Caribbean             | 42               | 0.1        | 312              | 0.7        | 41836            | 99.1        | 0                | 0.0        | 0                | 0.0         | 42200            | 100        |
| South Asia   | 126              | 0.1        | 5751             | 4.6        | 55972            | 44.4        | 0                | 0.0        | 64520            | 51.2        | 126000           | 100        |
| India  | 89               | 0.0        | 2927             | 3.3        | 43466            | 48.7        | 0                | 0.0        | 42799            | 48.0        | 89200            | 100        |
| Rest of South Asia                                     | 37               | 0.2        | 2824             | 7.6        | 12506            | 33.7        | 0                | 0.0        | 21721            | 58.5        | 37100            | 100        |
| Near East and North Africa                             | 35               | 8.4        | 1231             | 3.6        | 27924            | 80.9        | 142              | 0.4        | 2333             | 6.8         | 34500            | 100        |
| Sub-Saharan Africa                                     | 23               | 4.8        | 2391             | 10.3       | 18691            | 80.2        | 1127             | 4.8        | 0                | 0.0         | 23300            | 100        |
| <b>World</b>   | <b>8641</b>      | <b>1.4</b> | <b>13144</b>     | <b>2.1</b> | <b>542069</b>    | <b>85.4</b> | <b>1292</b>      | <b>0.2</b> | <b>70211</b>     | <b>11.1</b> | <b>635000</b>    | <b>100</b> |

Source: FAOSTAT (2011)



## *Drivers of production growth<sup>2</sup>*

Underlying the growth in production of dairy – along with that of other livestock products - has been major technological change across the food chain to meet the growing demand for livestock products. Technological change is a constant factor in human activities. It is a necessity in agriculture and livestock, where we are dealing with biological processes which are themselves subject to constant evolution. The most obvious example is probably that of animal diseases, which are under constant change requiring new responses. However, over the past decades there has been a clear acceleration in the process of technological change in the livestock sector.

For the last 50 years, the dairy sector in most developed countries has shifted towards bigger herd size and significantly higher annual milk production per cow. The driving force in this development has been the farmers' ability to increase incomes through higher productivity, adopting the many technological innovations which often require high capital and therefore bigger herds to be profitable. At the same time, feeding has seen a big shift from roughages to feed concentrates to reach the higher yields. However, when it comes to industrialization, milk production is lagging production systems for poultry and pigs, partly because dairy cows are normally are fed more bulky and fresh fodder and because of the relative labour intensity of dairy production, which makes economies of scale more difficult to achieve. There are major differences between developed and developing countries, where most milk in developing countries still are produced in a very traditional small scale system with little or no mechanisation or new technological innovations, although large-scale units can be found also in developing countries.

Most developed countries have seen increasing herd size and higher annual milk production per cow. According to the International Committee for Animal Recording (ICAR) database on “the yearly cow milk enquiry”, the herd size in developed countries in the period between 2001 and 2007 went from 74 to 99 cows per herd in 17 countries covering Europe, Asia, Australia and North America. However, there is a large variation among countries, ranging from 19 cows per herd in Norway to 337 on average in New Zealand. Annual milk production in the same period increased from 7,726 to 8,550 kg per recorded cow in these countries. The highest average production was obtained in Israel, amounting to 12,546 kg per cow, and the lowest in New Zealand with 3,974 kg per cow. This reflects different production systems, especially in regard to the nutrition of the cows, and only to a minor extent different genetic potential of the animals. The feeding strategy has a major impact on the production obtained. The system in New Zealand is based on all year grazing in contrast to Israel, where the system is based on in barn feeding with energy-rich total mixed rations.

Most developing countries have adverse conditions for milk production in the form of higher ambient temperature and/or humidity compared to countries with a developed dairy sector. This implies a harsher environment for the dairy cattle and in many cases a reduction in the expression of the full genetic potential of the cows. Also difficult access to high-quality fodder is a limiting factor in the tropics. It is possible for dairy cows to produce similar yields under tropical conditions, but this requires efficient management and housing systems to protect against the adverse climatic environment, a condition that is normally seen in particular in large-scale production systems.

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<sup>2</sup> Based on Henriksen et al., 2009

In the developing countries, large-scale commercial dairy farms have access to many of the same technology options as for developed dairy industry. Moreover, they have cheaper manpower to supply more manual support while they might suffer from lower qualifications of staff to manage and maintain the more sophisticated technological equipment. However, the vast majority of milk in developing countries is and will for many years still be produced in the smallholder sector – in a dairy country like Kenya the smallholder sector accounts for about 85 percent of total milk production. Many of the technological solutions for feeding and management of a dairy herd is neither affordable nor feasible for the smallholders. On the other hand, new and future knowledge of optimal nutrition and feeding of the dairy cows will be of good use also to the smallholders, provided they have access to an efficient and qualified advisory service which – unfortunately - is lacking in most developing countries. The main constraint to increased milk production in the smallholder sector is poor animal management, leading to sub-optimal feeding, with poor forage and low levels of concentrate supplementation. Therefore, the potential is large for increasing milk yield in the smallholder sector by better nutrition based on improved feed evaluation and increased concentrate supplementation (Madsen et al., 1997; Mlay et al., 2001). The specific constraints of the smallholder production system requires local research interventions to identify appropriate solutions as many of the mechanical and technological solutions developed for the large scale systems cannot easily be adopted by the small-scale production system.

### **Box 3: The pathway from milk production to consumption and nutritional status in Kenya**

Milk production has evolved significantly in Kenya, with a fourfold increase in production since the 1970's. However, regional variations are pronounced, and the highlands provide better conditions, including more favourable climate, for dairy agriculture. Small-scale dairy farms account for 85 percent of total milk production, and it is estimated that 2 million households are involved in dairy farming (Staal, Pratt and Jabbar, 2008; FAO, 2009). Dairy farming is often integrated with crop farming in mixed production systems. Informal marketing via small-scale agents is the main channel of milk distribution. A smaller, but well-organized formal sector provides processed and packaged milk to urban consumers. Raw milk is less expensive than the pasteurised form, which tends to be purchased by the more affluent consumer. Nicholson *et al.*, (2003) highlighted that fresh ('raw') milk was generally preferred to the UHT and pasteurised milk in coastal Kenya. The preference for raw milk is generally more marked in the rural regions but is also common in urban areas (Smallholder Dairy Project, 2004).

Economic growth and rising consumer demand have contributed to the development of the dairy sector. However, consumption patterns are far from uniform. Njarui *et al.*, (2010) reported that the annual per capita milk consumption in rural areas in 1999 was 19 litres for 'milk-purchasing' households and 45 litres for 'milk-producing' households. This contrasted with urban per capita consumption levels of 125 litres. However, accurately quantifying home dairy consumption is inherently difficult. Studies of milk consumption tend to focus major urban areas such as Nairobi and Mombasa. A survey of urban households conducted by the Tegemeo Institute of Agricultural Policy and Development highlighted that milk is not commonly consumed by the poor and middle classes outside of the home where there is steep competition from other beverages such as soda. Within the home, milk is consumed by all socio-economic strata; what differs is the type of milk, with higher intake of pasteurised milk in the higher income groups (Tegemeo Institute of Agricultural Policy and Development,

2005). While dairy products such as cheese and ghee are consumed less frequently, consumption levels are even lower in the poorer households (Njarui *et al.*, 2010).

The past 50 years have also seen major developments in the processing of milk, ensuring the continued expansion of the dairy industry and increased consumption of dairy products in most parts of the world. Milk is a perishable raw material that rapidly deteriorates if left at ambient temperature. Hence the major challenges have been to ensure healthy and safe dairy products of a consistent quality to an ever increasing number of consumers, as well as to provide farmers and industry with increased revenue from the milk delivered. Technological development has played an important role in this, mainly by providing the dairy industry with the necessary tools to reduce wastage, optimize production and maximize utilization of milk constituents.

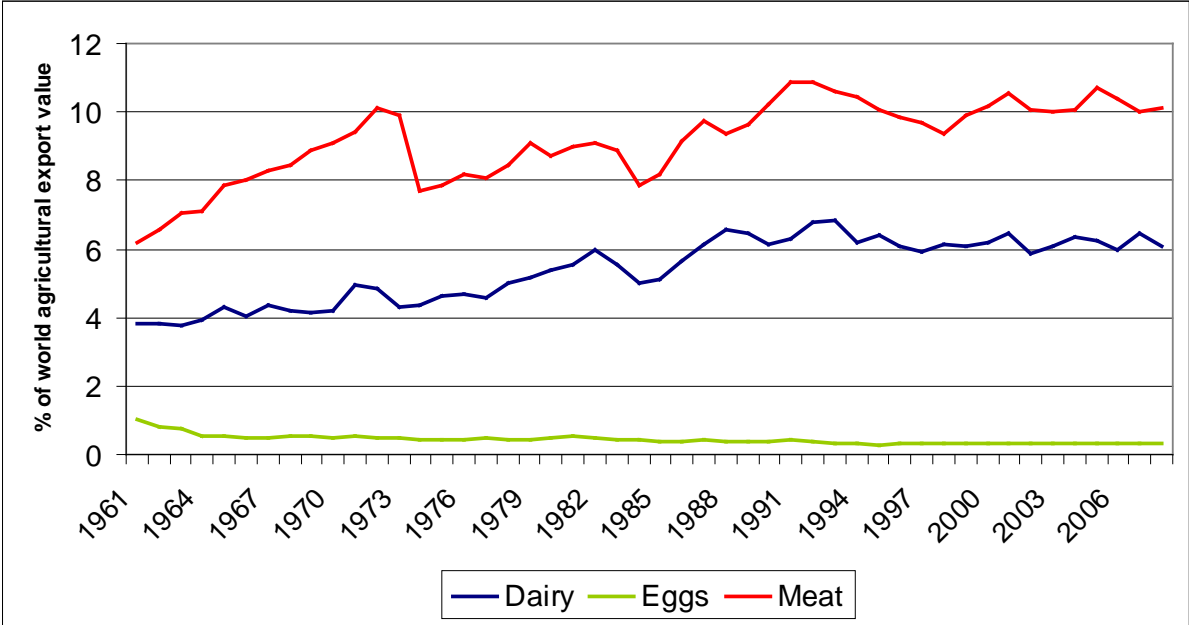
The technological development and innovation has not, of course, been the same globally. However, the increased globalization of the dairy industry as well as the concentration of companies supplying ingredients or dairy processing equipment in the last decades has evened out many regional differences. Dairy plants are developing along very similar lines and emerging technologies or novel processing aids are being applied irrespective of region. Thus products with very similar characteristics are available in many different countries. Differences are apparent, though, in dairy plants. The use of manual labour in the packaging departments, for example, is naturally much more widespread in countries with cheap labour costs than where wages are high and industrial robots much more evident. The dairy processing industry is generating much more employment in developing countries.

### ***Trends in international trade in livestock products***

Global trade in livestock products has increased significantly in value and volume terms over the last decades. Growth in livestock trade has been facilitated by increasing consumption of livestock products as well as technologies in processing and shipping that have facilitated product movement. In particular, developments in transportation, such as long-distance cold-chain shipments and large-scale and faster shipments, have made it possible trade and transport products and feedstuffs over larger distances.

Between 1961 and 2008, the relative share of the world's agricultural export value coming from livestock products (meat, dairy and eggs) went from 11 percent to 17 percent (figure 13). However, most of this was represented by meat products with dairy representing a smaller share. In spite of the growing importance of livestock products in international agricultural trade, trade in crops still dwarfs that of livestock products.

**Figure 13: Share of livestock products in global agricultural export value.**



Source: FAOSTAT

Technological progress in processing and packaging has contributed to expansion of trade in dairy products. Between 1980 and 2008, the volume of total dairy exports (expressed in milk equivalents) more than doubled. Also the share in volume terms of production that enters international trade increased, from 8.5 percent to 12.6 percent for dairy products, reflecting the increasing degree of openness to trade of the sector and influenced by heavy use of export subsidies, which supported shipments of developed countries’ dairy exports. However, due to the perishable nature of dairy products, the share of output that is traded internationally still remains relatively low; at the global level. The bulk of dairy products are consumed within the country of production and do not enter international trade.

Generally, as for several other agricultural products, geographic patterns of production and trade of dairy products have been significantly affected by agricultural and other economic policies in both developed and developing countries which have influenced the relative economic incentives to dairy producers in different countries and regions. Typically, developed countries have tended to protect and subsidize agricultural producers through various trade and agricultural policy instruments. Milk has been no exception and has indeed been one of the agricultural subsectors which – on average - have seen the highest level of subsidies and protection (second only to rice) as measured by the nominal rate of assistance (NRA). The NRA is an indicator that measures the percentage by which government policies have raised gross returns to farmers above what they would have been without government intervention. However, between the beginning of the 1980s (1980-84) and the beginning of the 2000s (2000-2004) the level of subsidization of milk in the developing countries – measured by the average NRA has declined significantly as a result of widespread agricultural policy reforms among the developed countries. However, the NRA for milk remains positive and among the highest among the products for which it is estimated - third after rice and sugar. (Anderson, 2009).

Typically in the developing countries, agriculture has faced the opposite policy stance, that is taxation – rather than subsidization - of the sector, reflected in a negative NRA. Nevertheless among the developing countries, milk has been an exception (along with poultry) with a positive average NRA for the country group. Thus, on average, also developing countries have tended to subsidize milk producers, although the to a much lesser extent, reflected in a lower average NRA for the developing country group. Also – as for the developed countries – the level of subsidization declined between 1980-84 and 2000-04 (Anderson, 2009).

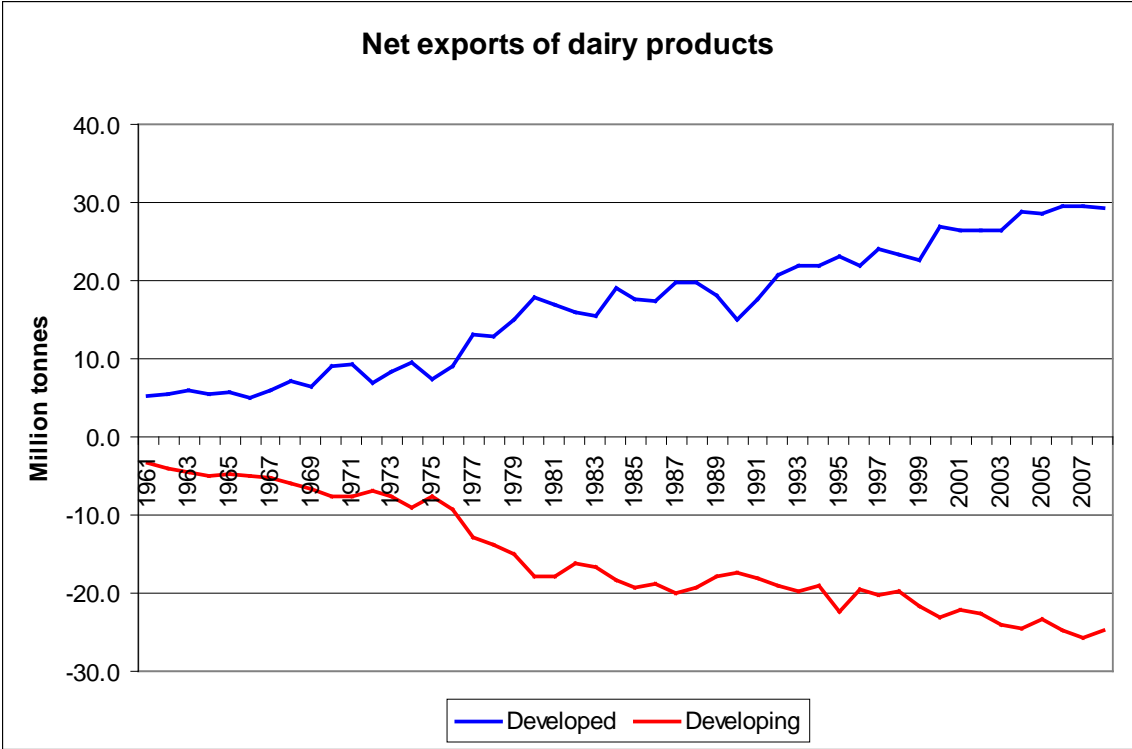
**Table 5 - Global trade in dairy products, 1980-2008 (in milk equivalent).**

| Product | World exports<br>(Million tonnes) |      | Share of total<br>production<br>(Percent) |      | Annual growth<br>in exports<br>(Percent) |
|---------|-----------------------------------|------|---|------|--|
|         | 1980                              | 2008 | 1980                                      | 2008 | 1980-2008                                |
| Dairy*  | 41.7                              | 92.2 | 8.5                                       | 12.6 | 2.9                                      |

\* Milk equivalent  
Source: FAOSTAT

In spite of the subsidization of the sector, the developing countries as a group are net importers of dairy products, and their external dependency for dairy products has been increasing (Figure 14), reflecting the higher degree of subsidization prevailing in the developing countries. All major developing country regions are net importers of dairy products in volume terms, with India recording a very marginal export surplus.

**Figure 14 - Net exports of dairy products of developed and developing countries.**



Source: FAOSTAT

### *Future trends in production and consumption of dairy products*

The rapid growth of the livestock sector, including dairy, in large parts of the developing world over the past decades has been essentially demand-driven. The factors that have encouraged growth in demand in developing countries – rising incomes and urbanization, combined with population growth – will continue to be important over the coming decades, although the effects of some may weaken. Population growth, although slowing, will continue. Trends towards increasing urbanization are considered unstoppable. Income growth is generally considered the strongest driver of increased demand for dairy products. In the longer run growing incomes will continue fuelling demand growth. The effect of economic growth on demand for dairy and other livestock products depends on the rate of growth and where it occurs. Demand is more responsive to income growth in low-income countries than in higher-income countries. Overall the potential for expanding per capita consumption remains vast in large parts of the developing world as rising incomes translate into growing purchasing power. FAO (2006) projected possible future long-term trends in global consumption and production of different food products, including dairy. The projections for dairy are presented in table 6.

**Table 6 - Production and consumption of milk and dairy products – projections to 2030 and 2050 (average annual rate of growth)**

|  | Production              |              |            | Consumption |              |            |
|--|-------------------------|--------------|------------|-------------|--------------|------------|
|  | 1981-2001               | 1999/01-2030 | 2030-2050  | 1981-2001   | 1999/01-2030 | 2030-2050  |
|  | Annual growth – percent |              |            |             |              |            |
| Developing countries                                   | 3.7                     | 2.5          | 1.4        | 3.4         | 2.5          | 1.3        |
| - East Asia  | 6.4                     | 3.0          | 0.6        | 5.5         | 2.7          | 0.7        |
| - Latin America and Caribbean                          | 2.9                     | 1.9          | 1.0        | 2.7         | 1.8          | 0.9        |
| - Near East and North Africa                           | 2.4                     | 2.3          | 1.5        | 1.6         | 2.3          | 1.5        |
| - South Asia   | 4.6                     | 2.8          | 1.5        | 4.5         | 2.8          | 1.5        |
| - Sub-Saharan Africa                                   | 2.2                     | 2.6          | 2.1        | 1.5         | 2.6          | 2.0        |
| Former centrally planned economies                     | -2.1                    | 0.1          | -0.2       | -2.3        | 0.1          | -0.2       |
| Other developed countries                              | 0.3                     | 0.5          | 0.2        | 0.3         | 0.4          | 0.2        |
| <b>World</b>   | <b>0.8</b>              | <b>1.4</b>   | <b>0.9</b> | <b>0.8</b>  | <b>1.4</b>   | <b>0.9</b> |
| <i>World, excl. former centrally planned economies</i> | <i>1.7</i>              | <i>1.7</i>   | <i>0.9</i> | <i>1.7</i>  | <i>1.7</i>   | <i>1.0</i> |

Source: FAO, 2006, *World agriculture: towards 2020/2050 Interim Report*, Rome, June 2006

Growth in consumption and production of dairy products is expected to remain strong although slowing down somewhat. As in the past, the geographic distribution of production increases will largely mirror that of consumption, with rates of growth of the two very close in all regions with most of future growth coming from the developing country group, especially East Asia and South Asia.

Although these long-term projections are no longer very recent, medium-term projections from OECD and FAO for the period 2011-20(OECD-FAO, 2010) appear in line with the longer-term trends highlighted by Table 6. Although the price hikes during the food-price crisis of 2007-08 and the ensuing economic crisis reduced demand and illustrated the high price and income elasticity of demand for dairy products, the OECD and FAO project a return to steady consumption growth driven by growing populations, rising incomes and a growing popularity of dairy products in developing countries. The strongest demand growth is expected in China and India.

According to OECD and FAO, in terms of production the milk and dairy sector will remain one of the fastest-growing agricultural subsectors over the coming decade, only exceeded by poultry meat and vegetable oils. They project global milk production to expand over the 2011-2020 period at an annual rate of 2 percent, similar to that of the last decade (Table 7). Most of the expansion in output is projected to occur in the developing countries. All developing country regions are projected to see sustained growth in production, with particularly high rates of growth in India and China, although growth in China is projected to slow from the fast growth of the previous decade as the industry has matured. India is projected to consolidate its position as the world's largest producer, increasing its share of global production from 15.6 percent to 17.4 percent.

**Table 7 – Production of milk, projections for 2011-2020**

|                                 | Production (kt)      |        | Rate of growth (percent) |         |
|---------------------------------|----------------------|--------|--------------------------|---------|
|                                 | Average 2008-10 est. | 2020   | 2001-10                  | 2011-20 |
| <b>Developed countries</b>      | 318980               | 349769 | 0.4                      | 0.8     |
| <b>Developing countries</b>     | 373667               | 503128 | 3.6                      | 2.8     |
| North Africa                    | 11110                | 14533  | 3.9                      | 2.6     |
| Sub-Saharan Africa              | 25928                | 35878  | 2.5                      | 2.9     |
| Latin America and the Caribbean | 75361                | 93848  | 2.2                      | 2.0     |
| - Brazil                        | 28674                | 35188  | 2.4                      | 1.7     |
| Asia and the Pacific            | 231824               | 314186 | 3.9                      | 2.9     |
| - China                         | 40332                | 59064  | 12.8                     | 3.4     |
| - India                         | 111147               | 153019 | 3.6                      | 3.0     |
| <b>World</b>                    | 692647               | 852898 | 2.0                      | 2.0     |

Source: OECD-FAO Agricultural Outlook 2011-2020.

### *Emerging issues and challenges<sup>3</sup>*

The rapid rise in aggregate consumption of meat and milk is propelled by millions of people with rising incomes diversifying from primarily starch-based diets into diets containing, initially small and then growing amounts of dairy and meat. The underlying forces driving these trends are set to continue, and the potential for increased demand remains vast in large

<sup>3</sup> For a further discussion of the issues highlighted in this section, the reader is referred to FAO, 2009.

parts of the developing world. Growing consumption of dairy and other livestock products is bringing important nutritional benefits to large segments of the population of developing countries who are gaining access to these products. However the rapid growth in production and consumption of livestock products also implies risks to human and animal health, the environment and the economic viability of many poor smallholders.

Undernutrition, including inadequate levels of consumption of food of animal origin, remains a huge and persistent problem in the developing world. Dairy and other livestock products can make an important contribution to household food security and are especially important in meeting the micronutrient requirements of women and young children. Adding a small amount of animal-based foods to a plant-based diet can yield large improvements in maternal health and child development. Inadequate diets also hamper the mental and physical development of children and result in increased morbidity and mortality from infectious diseases. There are also significant economic costs in terms of reduced work performance and productivity in adults. Income growth can help improve nutrition. As incomes of the poor increase, they generally purchase more food with an improved dietary composition, including more food of animal origin. However, measures and programmes to ensure immediate access to better diets, including dairy and other animal products can make an indispensable contribution to assist poor people escape the undernourishment/undernutrition-poverty trap.

On the other hand, a growing number of countries, including developing countries, are experiencing an increasing incidence of obesity and diet-related non-communicable diseases, which impose heavy economic and health burdens on societies. Excessive consumption of high-fat products contributes to this problem, although other dietary and lifestyle choices also play a role.

Continued growth in demand for and production of dairy (and other livestock) products and the associated structural changes in the sector have potential negative long-term implications in at least three other areas that require attention by policymakers. It implies increasing pressures on the world's natural resources as feed demand grows and livestock production is increasingly decoupled from the local natural-resource base. It has implications for both animal and human health as the increasing number and concentration of animals enhances the risk of spreading of diseases and the passage of disease agents between species. Finally, the social implications for smallholders, whose opportunities to supply new markets are constrained, pose serious challenges.

Dairy production systems are important and complex sources of greenhouse gas (GHG) emissions, notably of methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O) and carbon dioxide (CO<sub>2</sub>). According to a global Life Cycle Assessment (LCA) of the cattle dairy sector in 2007 the sector emitted 1 969 million tonnes CO<sub>2</sub>-eq, of which 1 328 million tonnes were attributed to milk. The contribution of the global milk production, processing and transportation to total anthropogenic emissions is estimated at 2.7 percent (FAO, 2010) of the total anthropogenic GHG emissions reported by IPCC (2007). Methane emissions are by far the largest contributor, accounting for about 52 percent of the total from the sector, followed by nitrous oxide and then carbon dioxide.

Globally, emissions per unit of milk product are estimated at 2.4 kg CO<sub>2</sub>-equivalent per kg of fat and protein-corrected milk (FPCM) at the farm gate (FAO, 2010). However, values vary greatly among different regions. The highest emissions per unit are estimated for sub-Saharan Africa, with an average of 7.5 CO<sub>2</sub>-eq per kg FPCM at the farm gate, but, given the low level



of production, in absolute terms emissions remain low. In the remaining part of the developing countries emissions per unit are in the range of 3 and 5 CO<sub>2</sub>-eq per kg FPCM at the farm gate, while in Europe and North America the corresponding values are 1-2 kg CO<sub>2</sub>-equivalent

Improvements in livestock productivity have been locally shown to have resulted into reduced (direct) emission intensity - described as CO<sub>2</sub> eq per physical unit of output - (Capper et al., 2009, European Commission, 2005). Such productivity gains were achieved through the introduction of a combination of production and management practices that increase yields; notably through increased and improved use of inputs such as feed and related fertilizer use, genetic material, animal health inputs and energy).

At the same time, the livestock sector is itself affected by the degradation of ecosystems and climate change. Climate change will have far-reaching consequences for animal production through its effects on forage and range productivity, as well as on feed intake and feed conversion rates. The probability of extreme weather events is also likely to increase. Some of the greatest impacts of climate change are likely to be felt in grazing systems in arid and semi-arid areas, particularly at low latitudes. In the non-grazing systems, which are characterized by the confinement of animals (often in climate-controlled buildings), the direct impacts of climate change can be expected to be limited and mostly indirect, e.g. feed, energy and water costs. Climate change will play a significant role in the spread of vector-borne diseases and animal parasites, which will have disproportionately large impacts on the most vulnerable men and women in the livestock sector (FAO, 2009).

Dairy chains also contribute to other environmental issues, notably water resource management, through withdrawals, modification of runoff and release of pollutants. Cattle can use crop residues and agro-industrial by-products, such as molasses cake and brewers grains, some of which would otherwise be burned. However, extensive production systems often have limited productivity, as a large share of feed is spent on the animal's maintenance rather than on producing products or services useful to people. The result is inefficient use of resources and often high levels of environmental damage per unit of output. Dairy cattle require large amounts of bulky fibrous feed in their diets. Dairy herds therefore need to be close to the source of their feed, more than other forms of market-oriented livestock production. This provides good opportunities for nutrient cycling, which is beneficial to the environment. However, excessive use of nitrogen fertilizer on dairy farms is one of the main causes of high nitrate levels in surface water in OECD countries. Manure runoff and leaching from large-scale dairy operations may also contaminate soil and water (FAO, 2009).

The increasing concentration of production and growth in trade are leading to new challenges in the management of animal diseases. Animal diseases reduce production and productivity, disrupt local and national economies, threaten human health and exacerbate poverty. The most serious health threat is that of a human pandemic. The economic threats from livestock diseases may be less dramatic, but may also exact high cost in terms of human welfare and pose significant livelihood risks for smallholders. Humans, animals and their pathogens have coexisted for millennia, but recent economic, institutional and environmental trends are creating new disease risks and intensifying old ones, as a result of a combination of rapid structural change in the sector, geographic clustering of intensive livestock production facilities near urban population centres and the movement of animals, people and pathogens between intensive and traditional production systems. At the same time, also climate change

is altering patterns of livestock disease incidence, as pathogens, as well as the insects and other vectors that carry them, enter new ecological zones. (FAO, 2009).

Animal-health and food-safety systems are also confronted with new and additional challenges as a result of the lengthening and increasing complexity of supply chains in the livestock sector, facilitated by globalization and trade liberalization. Meanwhile, increasingly stringent food-safety and animal-health regulations and private standards aimed at promoting consumer welfare are creating challenges for producers, especially smallholders, who have less technical and financial capacity to comply with them. (FAO, 2009)

Many national institutions for disease control are obliged to respond to an increasing number of crises instead of focusing on principles of prevention, progressive disease containment, or elimination of a new emerging disease before it spreads. Consequently, the economic impact of diseases and the cost of control measures are high and increasing. In addition, sometimes necessary control measures such as culling may severely affect the entire production sector, and may be devastating for the poorest households for whom livestock forms a major asset and safety net. (FAO, 2009).

Livestock are important to the livelihoods of many poor people in rural areas. Growing demand for livestock products and technological changes along the food chain have spurred major changes in production systems. As a result, small-scale mixed production systems are facing increased competition from large-scale specialized production units based on purchased inputs. These trends present major competitive challenges for smallholders and have implications for the ability of the sector to contribute to poverty reduction.

Despite rapid structural change in parts of the sector, smallholders still dominate production in many developing countries. Dairy production can contribute to household livelihood, food security and nutrition. Strong demand for dairy products and increasingly complex processing and marketing systems offer significant opportunities for growth and poverty reduction at every stage in the value chain. However, these new market opportunities and livelihood options are accompanied by rapidly changing patterns of competition, consumer preferences and market standards, which may undermine the ability of smallholders to remain competitive. They must therefore be carefully managed to ensure that smallholders, both women and men, are in a position to exploit opportunities in this rapidly changing sector. Policy reforms, institutional support and public and private investments are urgently needed: to assist those smallholders who can compete in the new markets; to ease the transition of those who will exit the sector; and to protect the crucial safety-net function performed by livestock for the most vulnerable households.

Productivity growth in agriculture is central to economic growth, poverty reduction and food security. Decades of economic research have confirmed that agricultural productivity growth has positive effects for the poor in three areas: lower food prices for consumers; higher incomes for producers; and growth multiplier effects through the rest of the economy as demand for other goods and services increases (Alston et al., 2000). However, serious questions and policy challenges must be addressed if the potential of the livestock sector to promote growth and reduce poverty is to be met in a sustainable way.

In conclusion, the rapid growth of the dairy sector, and the livestock sector at large, in a setting of weak institutions and governance have given rise to risks with potentially large negative implications for livelihoods, human and animal health and the environment. To meet

the challenges and constraints it faces, the sector requires renewed attention and investments from the agricultural research and development community and robust institutional and governance mechanisms. The future contribution of dairy and livestock products to human welfare will depend also on how these issues are addressed.<sup>4</sup>

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<sup>4</sup> For a further discussion, see FAO, 2009

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