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DAIRY DEVELOPMENT IN ETHIOPIA

Mohamed A.M. Ahmed, Simeon Ehui, and Yemesrach Assefa

Environment and Production Technology Division

International Food Policy Research Institute
2033 K Street, NW
Washington, DC 20006 U.S.A.

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ABSTRACT

Ethiopia holds large potential for dairy development due to its large livestock population, the favorable climate for improved, high-yielding animal breeds, and the relatively disease-free environment for livestock. Given the considerable potential for smallholder income and employment generation from high-value dairy products, development of the dairy sector in Ethiopia can contribute significantly to poverty alleviation and nutrition in the country. Like other sectors of the economy, the dairy sector in Ethiopia has passed through three phases or turning points, following the economic and political policy in the country. In the most recent phase, characterized by the transition towards market-oriented economy, the dairy sector appears to be moving towards a takeoff stage. Liberalized markets and private sector investment and promotion of smallholder dairy are the main features of this phase. Milk production during the 1990s expanded at an annual rate of 3.0 percent compared to 1.63-1.66 percent during the preceding three decades.

Review of the development of dairy sector in Ethiopia indicates that there is a need to focus interventions more coherently. Development interventions should be aimed at addressing both technological gaps and marketing problems. Integration of crossbred cattle to the sector is imperative for dairy development in the country. This can be achieved either through promotion of large private investment to introduce new technology in the sector such as improved genotypes, feed and processing, and promotion of integration of crossbred cattle into the smallholder sector through improving their access to improved cattle breeds, AI service, veterinary service, and credit. Similarly, government should also take the lead in building infrastructure and providing technical service to smallholders. Severe shortages,

low quality and seasonal unavailability of feed likewise remain as major constraints to livestock production in Ethiopia. These constraints need to be addressed and technological change be promoted to increase milk production.

Keywords: Ethiopia, dairy, livestock

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Dairy Development in Ethiopia

Mohamed A.M. Ahmed,[1] Simeon Ehui,[2] and Yemesrach Assefa[3]

1. INTRODUCTION

Over the last decade following the political changes in 1993, the dairy sector in Ethiopia has shown considerable progress. Total milk production grew at an estimated rate of 3 percent as compared to 1.8 percent during the period of 1975-1992, thus ending the long-time trend of declining per capita milk production in the country. The progress achieved is mainly due to technological intervention, policy reforms and population growth. The dairy sector in Ethiopia is expected to continue growing over the next one to two decades given the large potential for dairy development in the country, the expected growth in income, increased urbanization, and improved policy environment. The shift towards market economy is creating large opportunity for private investment in urban and peri-urban dairying. However, the main source of growth is expected to be the growth in demand for dairy products.

Ethiopia holds large potential for dairy development. The country currently manages the largest livestock population in Africa, estimated at 29 million cattle, 24 million sheep and goats, 18 million camels, 1 million equines and 53 million poultry. In addition, the country enjoys diverse topographic and climatic conditions. These consist of a high central plateau ranging from 1,800 to 3,000 meters above sea level, a rift valley that divides the country from north to south with altitudes ranging from 1,000 to 1,800 meters and lowland plain

[1] Economist at Livestock Policy Analysis Program of the International Livestock Research Institute, Addis Ababa, Ethiopia
[2] Program Coordinator at Livestock Policy Analysis Program of the International Livestock Research Institute, Addis Ababa, Ethiopia
[3] Research Assistant at Livestock Policy Analysis Program of the International Livestock Research Institute, Addis Ababa, Ethiopia

areas of less than 1,000 meters in altitude. Depending on the altitude, temperatures range from less than 10^0 C in alpine areas to 35^o C and higher in lowland areas. Moreover, rainfall in most of the country is adequate for crop and pasture production (Mengistu 1987). The favorable climate throughout the country supports use of improved, high-yielding animal breeds and offers a relatively disease-free environment for livestock development. Given the high potential for dairy development and the ongoing policy reforms and technological interventions, success similar to that realized in the neighboring Kenya under a very similar production environment is expected in Ethiopia.

Given the considerable potential for smallholder income and employment generation from high-value dairy products (Staal 2001), development of the dairy sector in Ethiopia can contribute significantly to poverty alleviation and nutrition in the country. Ethiopia, with its 65 million inhabitants and an average annual per capita income of less than $100, is among the poorest countries in sub-Saharan African (SSA). Levels of malnutrition are consequently high. The FAO estimates that about 51 percent of the population is undernourished and over two million people are considered to be chronically food insecure (FAO 2001). Compared to other countries in Africa, Ethiopians consume less dairy products. Per capita consumption of milk in Ethiopia is as low as 17 kg per head while the average figure for Africa is 26 kg per head (Gebre wold et al. 1998). Besides providing income-earning opportunities for the poor, dairy development, especially at the smallholder sector level, can improve the nutritional status of Ethiopian children by making available milk for consumption and increasing household income.

The existing excess demand for dairy products in the country is expected to induce rapid growth in the dairy sector. Factors contributing to this excess demand include the rapid

population growth (estimated at 3 percent annually), increased urbanization and expected growth in incomes. With the shift towards market economy and liberalization policies, private entrepreneurs are expected to respond to the increased demand through increased investment in dairying and milk processing. While the response of the private sector to the increased demand for dairy is expected to be significant, the small-scale household farms in the highlands hold most of the potential for dairy development.

This paper assesses the development of the dairy sector in Ethiopia over the last 50 years. In particular, the paper: (1) presents an overview of the dairy sector in Ethiopia; (2) identifies key phases in the development of the dairy sector in Ethiopia and examines the trends in production and consumption, policy changes and development emphasis during each phase; (3) provides evidence on the potential impact of improved dairy cattle and examines the factors that increase smallholder participation in market-oriented dairying; and (4) identifies key policy and technology issues to be considered in design of appropriate policy and development strategies. The paper also draws together evidence from neighboring countries in order to assist in drawing conclusions for dairy development strategies in Ethiopia.

2. OVERVIEW OF THE DAIRY SECTOR IN ETHIOPIA

PRODUCTION SYSTEMS

Livestock is raised in all of the farming systems of Ethiopia by pastoralists, agro-pastoralists, and crop-livestock farmers. Following Redda (2001), milk production systems can be broadly categorized into urban, peri-urban and rural milk production systems, based on location (Table 1).

Table 1—Structure of demand for milk products in Ethiopia 200

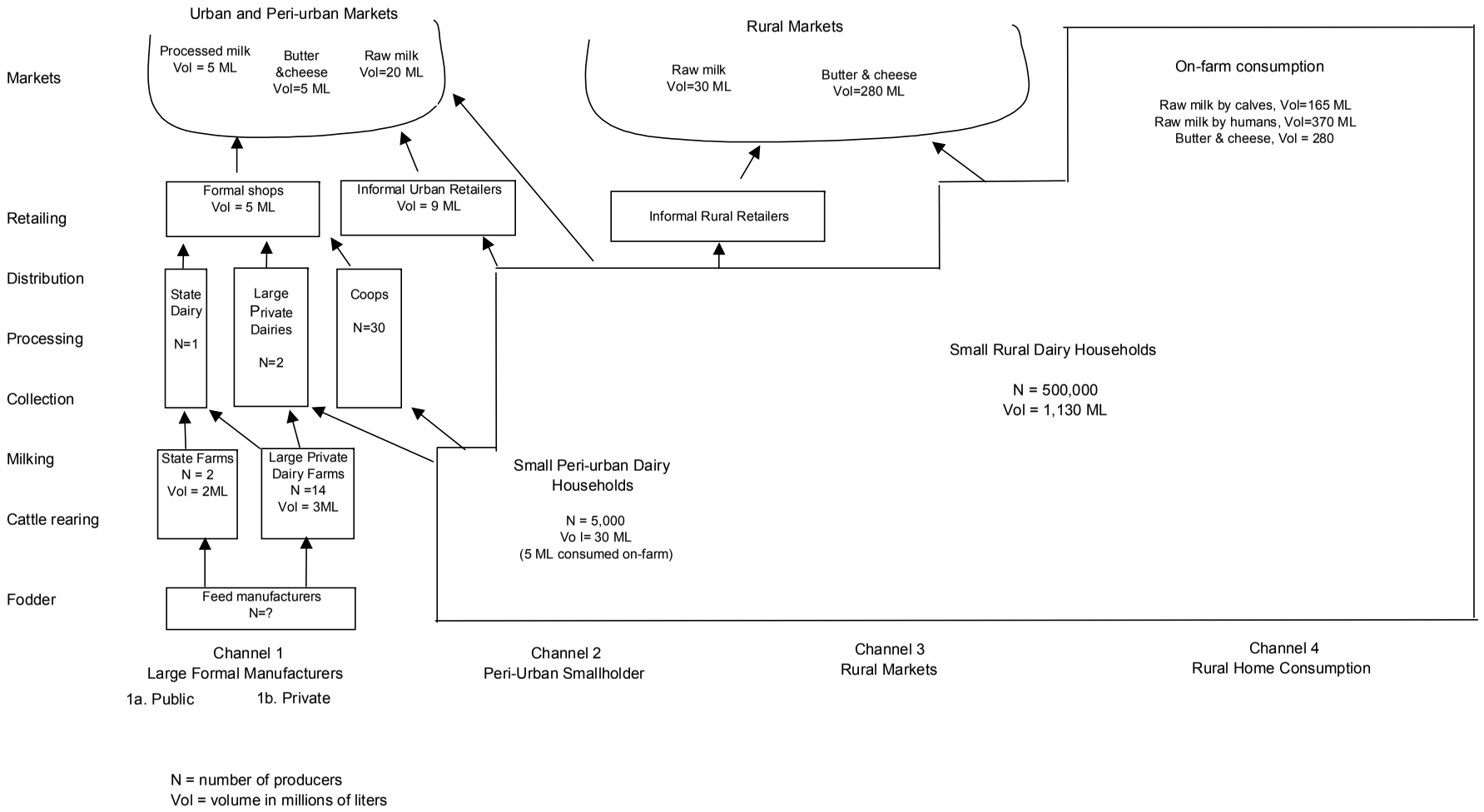
Milk Products	Households (percentage)			
	rural	peri-urban	urban	total
Raw milk consumed by calves	32	13	9	32
Raw milk consumed by humans				
farm households	15	8	10	15
marketed	2	59	61	4
Butter	41	20	8	40
Cheese	9			9
Pasteurized milk	1	0	12	1
Total milk equivalent volume				
percent	100	100	100	100
millions of liters	1115	15	20	1135

Sources: Fellke and Geda (2001), Gebrewold et al. (2000), Hurissa et al. (1994), Redda (2001)

Both the urban and peri-urban systems are located near or in proximity of Addis Ababa and regional towns and take the advantage of the urban markets. The urban milk system consists of 5,167 small, medium and large dairy farms producing about 35 million liters of milk annually. Of the total urban milk production, 73 percent is sold, 10 percent is left for household consumption, 9.4 percent goes to calves and 7.6 percent is processed into butter and ayib (cheese). In terms of marketing, 71 percent of the producers sell milk directly to consumers (Redda 2001). The peri-urban milk system includes smallholder and

commercial dairy farmers in the proximity of Addis Ababa and other regional towns. This sector controls most of the country's improved dairy stock. The rural dairy system is part of the subsistence farming system and includes pastoralists, agropastoralist, and mixed crop-livestock producers mainly in the highland areas. The system is non-market oriented and most of the milk produced in this system is retained for home consumption (Figure 1). The level of milk surplus is determined by the demand for milk by the household and its neighbors, the potential to produce milk in terms of the herd size and production season, and access to a nearby market. The surplus is mainly processed using traditional technologies and the processed milk products such as butter, ghee, ayib and sour milk are usually marketed through the informal market after the households satisfy their needs (Redda 2001).

Figure 1—Ethiopian dairy marketing channels 2002



N = number of producers
Vol = volume in millions of liters

The dairy sector in Ethiopia can also be categorized based on market orientation, scale, and production intensity. Doing so identifies three major production systems: traditional smallholders, privatized state farms, and urban and peri urban systems (Gebre Wold et al. 2000). The traditional smallholder system, roughly corresponding to the rural milk production system described above, produces 97 percent of the total national milk production and 75 percent of the commercial milk production. This sector is largely dependent on indigenous breeds of low-productivity native zebu cattle, which produce about 400-680 kg of milk /cow per lactation period. The state dairy farms, now being privatized or in the process of privatization, use grade animals (those with more than 87.5 percent exotic blood) and are concentrated within 100 km distance around Addis Ababa. The urban and peri-urban milk production system, the third production system, includes small and large private farms in urban and peri-urban areas concentrated in the central highland plateaus (Felleke and Geda 2001). This sector is commercial and mainly based on the use of grade and crossbred animals that have the potential to produce 1120-2500 liters over a 279-day lactation. This production system is now expanding in the highlands among mixed crop-livestock farmers, such as those found in Selale and Holetta, and serves as the major milk supplier to the urban market (Gebre Wold et al. 2000; Holloway et al. 2000).

CONSUMPTION PATTERNS

Milk and milk products form part of the diet for many Ethiopians. They consume dairy products either as fresh milk or in fermented or soured form. Fellke and Geda (2001) estimated that 68 percent of the total milk produced is used for human consumption in the form of fresh milk, butter, cheese and yogurt while the rest is given to

calves and wasted in the process. Butter produced from whole milk is estimated to have 65 percent fat and is the most widely consumed milk product in Ethiopia (Table 1). Of the total milk produced, around 40 percent is allocated for butter while only 9 percent is for cheese. Traditional butter, which ferments slowly at room temperature, can keep for a year or longer, offering rural consumers a readily storable, long-lived dairy product

The consumption of milk and milk products vary geographically between the highlands and the low lands and level of urbanization. In the lowlands, all segments of the population consume dairy products while in the highlands major consumers include primarily children and some vulnerable groups of women. The limited statistical data available on potential milk demand suggest that demand for milk will increase, at least in the urban centers and among the people with high purchasing power.

The demand for milk depends on many factors including consumer preference, consumer's income, population size, price of the product, price of substitutes and other factors. Felleke and Geda (2001) indicated that the demand for milk is inelastic with respect to income and price. In general, increasing population growth, rising real income and decreasing consumer prices are expected to expand the demand for milk and milk products. Population in Ethiopia is estimated to grow at 2.9 percent per year while the urban population increases at a rate of 4.4 percent. Therefore, increase in population growth and consumer income in the future is expected to increase liquid milk consumption.

Based on the 1994 census of the Central Statistics Authority, the urban population accounts for 15 percent of the total population of 63,493,000 in 2000. It is estimated that 40 percent of the urban population (those with average income above 350 Birr, or less

than 50 US$) can afford to buy 20 litters of milk per month. A study by Ministry of Agriculture in Addis Ababa indicated that effective demand for milk was about 36,240 tons in 1995 and projected to reach 55,440 tons in the year 2005. Similarly, the demand for butter was estimated to be 10,624 tons and 16,227 tons in the year 1995 and 2005, respectively. The rural population is estimated to be 85 percent of the total population and its milk consumption largely depends on livestock holding. In the mixed highland regions, it is estimated that 50 percent of households own cattle of which 56 percent are dairy cattle. Consequently, most households have access to milk. Similarly, in the lowlands more than 80 percent of the households own cattle, significant number of small ruminates and camel. In this area, it is likely that all households consume milk (Felleke and Geda 2001).

3. HISTORICAL PROFILE OF THE DAIRY SECTOR

Recent political developments in Ethiopia coincide with three phases of dairy development policy. These include the imperial regime, characterized by almost a free market economic system and the emergence of modern commercial dairying (1960-1974), the socialist *Dergue* regime that emphasized central economic system and state farms (1974-1991), and the current phase under the structural adjustment program and market liberalization (1991to present). The principal rationale for following the political regimes in identifying phases of the dairy development is that during each of these three phases, the country followed a distinct political path and development policies that directly and indirectly influenced the dairy sector. These include land tenure and land policy, macroeconomic policy and orientation of development efforts.

The data used to trace production trends during these three phases are obtained from the FAO agricultural statistical database. Additional data were collected from various sources because no complete data set exists on the dairy sector in Ethiopia. However, reported values vary across differing sources. These disparities, coupled with generally poor data quality mean that conclusions based on the aggregate data should only be taken as indicative. Although it would be interesting to examine growth within each of the production systems over the different phases of dairy development, available data do not permit such analysis.

THE EMERGENCE OF MODERN DAIRYING IN ETHIOPIA (1960 -74)

In the first half of the 20th century, dairying in Ethiopia was mostly traditional. Modern dairying started in the early 1950s when Ethiopia received the first batch of dairy cattle from United Nations Relief and Rehabilitation Administration (UNRRA). With the introduction of these cattle in the country, commercial liquid milk production started on large farms in Addis Ababa and Asmera (Ketema 2000). Government intervened through the introduction of high-yielding dairy cattle on the highlands in and around major urban areas. The Government also established modern milk processing and marketing facilities to complement these input oriented production effort. Most interventions during this phase focused on urban-based production and marketing including the introduction of exotic dairy cattle, feeding with high ratio of dairy concentrated feed, modern dairy infrastructure and high management level (Annex 1).

To facilitate growth of the sector, UNICEF established a public sector pilot processing plant at Shola on the outskirt of Addis Ababa in 1960. The plant started by processing milk produced by the large farms. The plant significantly expanded in a short

period and started collecting milk from smallholder producers in addition to large farms. This led to further expansion of large dairy farms. During the second half of the 1960s, dairy production in the Addis Ababa area began to develop rapidly as a result of the expansion in large private dairy farms and the participation of smallholder producers with indigenous cattle facilitated by establishment of the milk collection centers.

With the advent of modern dairying, the government of Ethiopia established the Addis Ababa Dairy Industry (AADI) in 1966 to control and organize the collection, processing and distribution of locally produced milk. Further, with the help of UNICEF, the Shola plant was expanded in 1969 and several government-owned dairy farms were also established to supply the formal market and to serve as demonstration centers for the large commercial farms. In addition, the government introduced regular programs and projects for dairy development. The first effort, initiated by the governments of Ethiopia and Sweden, was the establishment of the Chilalo Agricultural Unit (CADU), later named Arsi Rural Development Unit (ARDU), between 1970 and1980. The unit produced and distributed crossbred heifers, provided artificial insemination (AI) services and animal health service, in addition to forage production and marketing (Staal 1995).

To create an autonomous body responsible for dairy development, the government of Ethiopia established the Dairy Development Agency (DDA) in 1971. The DDA took over the responsibilities of AADI and assumed more tasks as well, including provision of services for increasing milk production and creating formal milk markets in urban areas outside Addis Ababa. Further, the Addis Ababa Dairy Development Project (AADDP) was launched by the World Bank in 1971 with the objective of developing commercial dairy production and providing support for smallholder producers in the form

of credit, imported cattle, and technical services. By 1972, the DDA was receiving about 21,000 liters/day for processing, of which 57 percent came from 65 large farms (Staal 1995). In addition to collecting milk, the DDA sold milk and dairy products through its kiosks and shops as well as to institutions. It also facilitated the creation of dairy cooperatives to ease the provision of credit and technical and extension service to dairy producers.

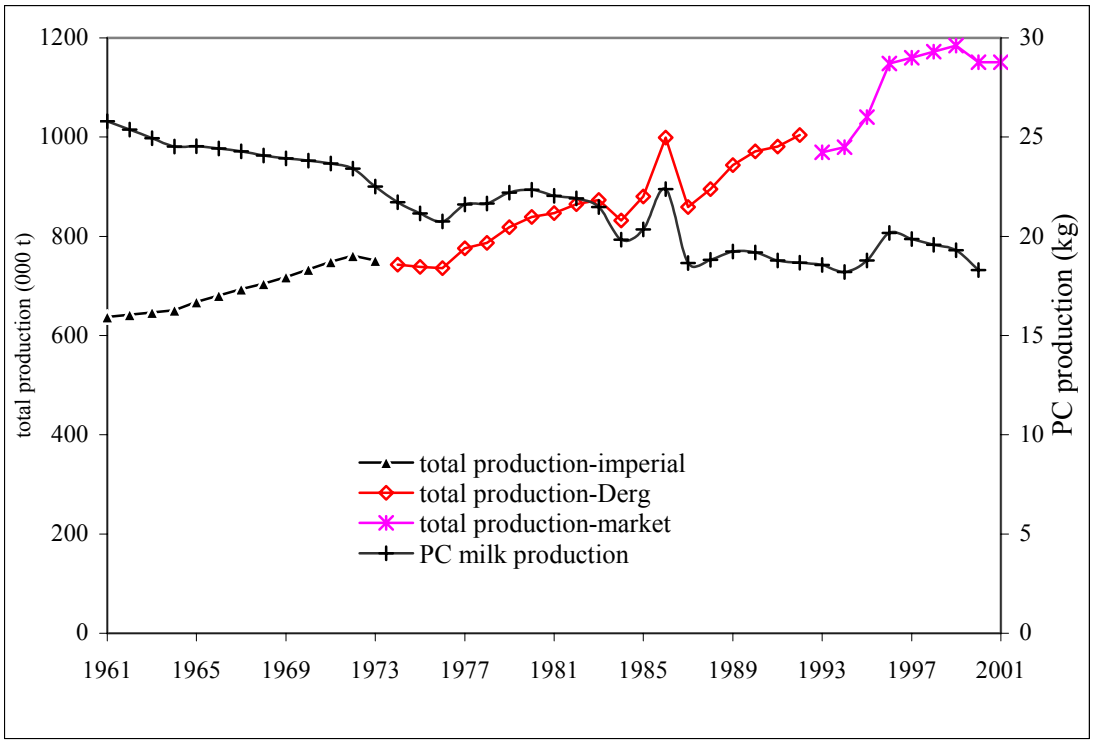
Milk production in Ethiopia increased significantly during 1960s. Between 1961 and 1974, milk production from all species increased by 16.6 percent from 637,375 metric tons to 743,100 metric tons, an average annual growth rate of 1.63 percent (Table 2; Figure 2). This growth was largely due to the economies of scale in production as well as marketing, subsidies in transport to the formal market, secured land tenure and an active free market for feed and other inputs (Staal et al. 1996). On a per capita basis, however, milk production declined during the 1961–1974 period at an average rate of 0.87 percent per annum (Table 3). During this period, butter and cheese processed using the traditional methods grew only slowly by about 0.1 percent (Figure 3). Processed milk production has stagnated in the early 1960s but expanded significantly in the second half of 1960s and early 1970s (Figure 4).

Table 2—Changing structure of Ethiopian milk production and distribution

	1985	2000
A. Volume of Milk consumed (tons)		
Imports of dairy products (milk equivalent)	279,651[c]	8,290[c]
Large producers	26,407	34,536
Government enterprises	4,657[d]	1,354[d]
Large private	21,750	33,182
Small producers	853,823[a]	1,116,664[a]
Improved cattle	-	13,585[a]
Indigenous cattle	-	1,103.079
Total	1,159,881[c]	1,159,490[c]
B. Number of dairy cattle		
Grade and pure dairy cattle under private and public		128,745[a]
Of which smallholders own		32,204[a]
Total		35,032,241[a]

[d] Dairy Development Enterprise
[c] Source:FAO Agriculture Database
Source: Authors' calculation from FAOSTATA (2002), DDE, and Felleke and Geda (2001)

Figure 2--Total and per capita milk production in Ethiopia (1961-2001)



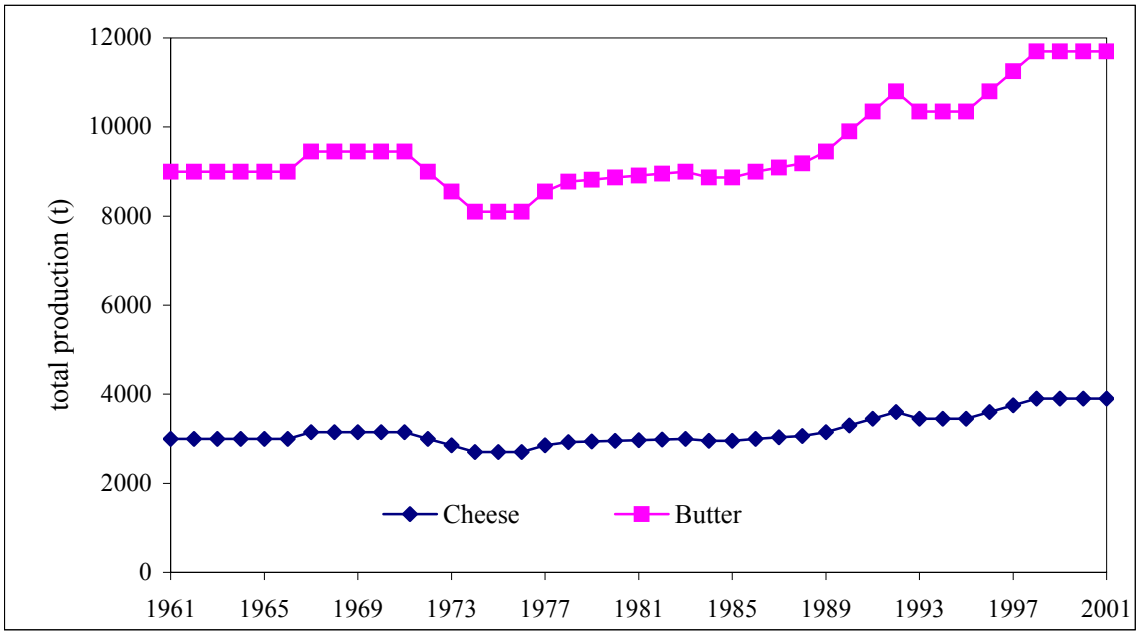
Source: FAO Agricultural Statistical Database

Table 3--Trends in total and per capita milk production (1961-2000)

Period	Milk production		Per capita production	
	Annual average	Growth rate[a]	Average	Growth rate
1961-1974[b]	698,555	1.63	24.07	-0.87
1975-1992[b]	869,181	1.66	20.62	-0.91
1993-2000	1,100,831	3.00	19.09	0.36
1961-2000	862,997	1.55	21.52	-0.84[c]

a Growth rates are estimated statistically with an exponential function
b These periods refer to both Eritrea and Ethiopia before the independence of Eritrea.
c. Statistically insignificant. All other growth rates are significant at 0.01 levels.
Source: Authors' calculation from FAOSTATA (2002)

Figure 3--Butter and cheese production in Ethiopia (1961-2001)



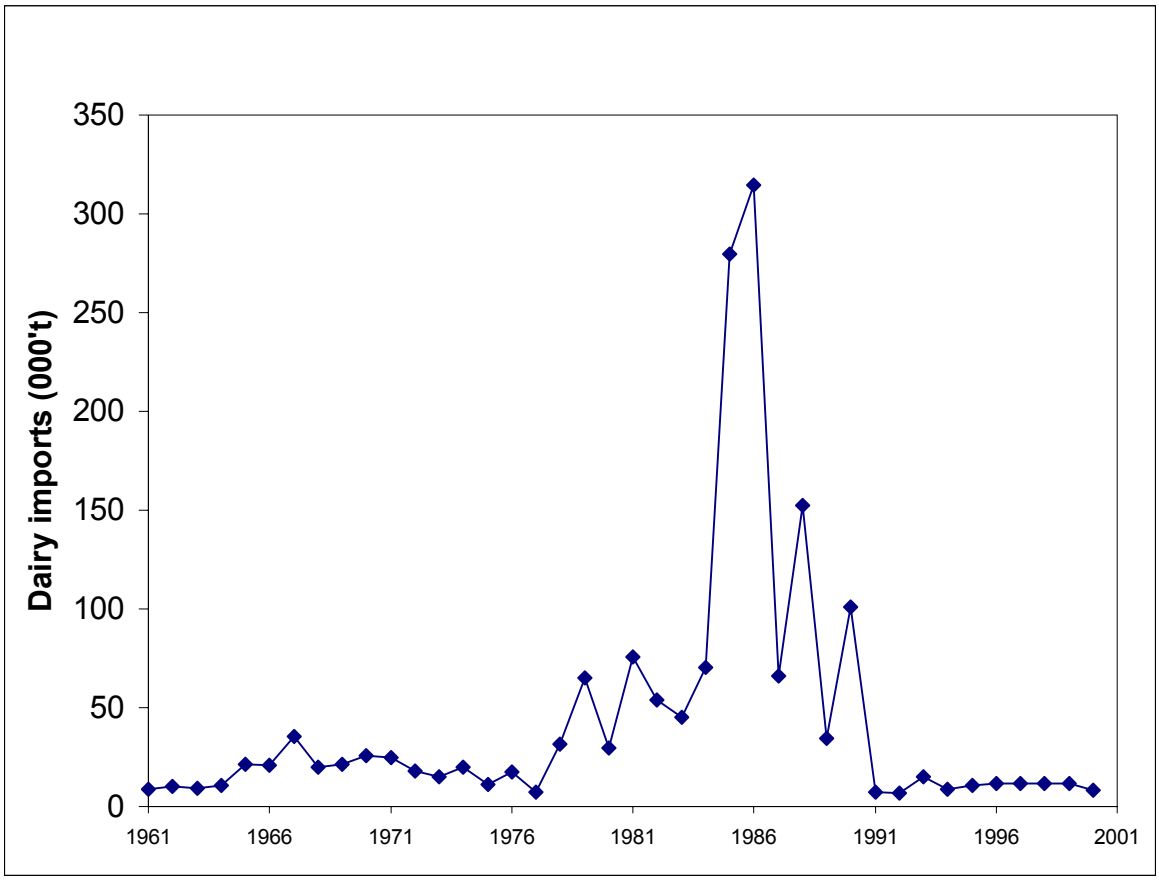
Source: FAO Agricultural Statistical Database

DAIRYING DURING *DERGUE* REGIME (1974-91)

Following the 1974 revolution, economic policy in Ethiopia shifted towards socialism. The DDA continued to operate until 1979 when it was merged with numerous other nationalized dairy farms to establish the Dairy Development Enterprise (DDE).

The DDE was established to operate the nationalized state farms, establish a milk collection network, process and market dairy products, provide advisory and limited technical service to farmers, and sell veterinary medicaments and feed to farmers. The enterprise had a capacity to process 60,000 liters of milk at its inception (Yigezu 1998).

Figure 4--Imports of dairy products (milk equivalent) in Ethiopia (1960-2001)



Source: FAO Agricultural Statistical Database

During this phase, the government shifted attention from urban producers to rural producers. However, substantial resources remained devoted to establishing large-scale state farms to provide liquid milk for urban consumers. This phase was characterized by intensive effort by the government and donors towards developing the dairy sector through producers' cooperatives. The dairy development effort was geared towards rural

producers who in fact were members of producer cooperatives. Projects and programs implemented to improve dairy development focused on producer and service cooperatives and peasant associations as major implementing partners. All the programs intended to bring about improvement in milk production and an increment in income through introduction of improved feeding, breeding and health development programs while less attention was given to marketing and processing. The programs and projects implemented included the Minimum Package Program (MPP), Addis Ababa Dairy Development Project (AADDP), Dairy Rehabilitation and Development Project (DRDP), Artificial Insemination Service (AIS) and Selale Peasant Dairy Development Pilot Project (SPDDP) (see Appendix 1). Although the programs or projects implemented differed in their intensity, most of the efforts were input-oriented.

As a result of these promotional efforts, total milk production increased significantly during this phase with the exception of mid 1980s when the country experienced a debilitating three-year drought (Figure 2). Despite the significant increase in aggregate milk production, per capita milk production was declining. This phase was characterized by low producer prices which discouraged production, emphasis on cooperatives in rural areas, and neglect of most important producers in urban areas. To bridge the gap between supply and demand, dairy imports increased significantly during second phase beginning from 1978. This was partly due to increased food aid, World Food Programme (WFP) milk powder imports, and a level of dairy production development that lagged far behind the demand (Reda 2001). Imports reached a peak of 279,651 and 314,726 metric tons in 1985 and 1986 (Figure 4) during the drought period. Reda (2001) also indicated that import dependency rose steadily during this phase. For

instance, dairy imports as a percent of total consumption increased from 4.1 percent to 12.8 percent between 1977 and 1989. Commercial imports grew rapidly at 24.18 percent per year (Felleke and Geda 2001). Further, it is estimated that imported milk powder accounted for 23 percent of Addis Ababa market.

DAIRYING DURING THE TRANSITION TO A MARKET-ORIENTED ECONOMY (1991-PRESENT)

With the downfall of the *Dergue* regime in 1991, Ethiopia has embarked on policy reforms that aim to bring about a market-oriented economic system. Several macroeconomic policy changes were implemented. The exchange rate policy was altered from a fixed-rate system to a more market determined system. A major devaluation of the local currency took place in 1992 followed by a series of smaller devaluations. A system for foreign currency auctioning was introduced in 1995 and later changed to an inter-bank system. This probably has discouraged milk and dairy imports. Similarly, a new land policy was declared. Although land remained in the hands of the government, the new constitution, drawn up in 1994, allows temporary leases. Now, farmers have the right to use the land indefinitely, lease it out temporarily to other farmers, and transfer it to their children but they cannot sell it permanently or mortgage it. Most importantly, the system of land re-distribution that created land insecurity and uncertainty has been abolished in Amhara and Tigray regions.

In addition to these major policy reforms, the new federal government launched a new national development strategy namely, Agricultural Development-Led Industrialization. The national strategy seeks to bring about an improvement in the livestock sector by enhancing the quality and quantity of feed, providing improved animal feed and improved extension services, increasing livestock health services and

improving productivity of local cows by artificial insemination while preserving the indigenous breeds (Benin et al. 2002). Although no clearly defined dairy development policy existed, it was envisaged that dairy policy would move increasingly towards private sector-led development. The policy recognizes the potential of smallholder dairy production and accords due attention to small producers although it also leaves room for the development of medium and large scale dairy farms in peri urban areas. Activities undertaken include: utilization of the potential adaptive genetic merit of animals, raising the quantity of the feed available to livestock, improving health service, breeding and husbandry services, encouraging the participation of private investors by improving income tax, improving the delivery of artificial insemination, developing and expanding efficient marketing system in remote areas and organizing farmers into milk producing, processing and marketing cooperatives (Felleke and Geda 2001).

In the third phase of post-*Dergue* market-oriented development, the private sector has begun to enter the dairy market as an important actor. Several private investors have now established milk-processing plants in Addis Ababa to supply fresh milk. Currently, privately-held Sebeta Agroindustry is competing with DDE in supplying milk to urban consumers. DDE remains, however, an important actor in the formal dairy market. In 1993, the producer price paid by DDE increased from Birr 0.65 per litter to Birr 1.00 per litter and later to Birr 1.25. Meanwhile, government privatized inefficient state farms, reducing the number of state farms from fourteen to only two. Moreover, the government accorded attention to the urban dairy producers and began serving them after they officially registered by the Ministry of Agriculture (MOA).

Post 1991 producer groups such as the Addis Ababa Dairy Producers Association (AADPA) emerged encompassing 90 percent of all urban dairy producers and a large proportion of peri-urban producers within a radius of 100 kms of Addis Ababa (Staal 1995). Dairy development efforts in the post reform period have focused on smallholder dairy producers. The two major donor-funded SDDPP and SDDP projects focused exclusively on improving dairy production at smallholder level. Unlike the projects implemented during Dergue regime, these two projects addressed marketing problem of smallholder producers in addition to provision of inputs.

Milk production grew faster in the post reform period, at an annual growth rate of 3.0 percent (Table 3). Although per capita milk production stagnated during this period (Figure 2) and grew at a positive but insignificant rate after the policy reform, this represents a reversal or termination of the negative trend in the growth of per capita production during the previous two phases. However, production of butter and cheese stagnated in the post reform period (Figure 4).

In order to gain insight into possible sources of growth in the third phase, an attempt was made to disaggregate the total consumption of milk into different production systems. Using rough estimates from the FAO data base and available information from DDE and Felleke and Geda (2001), the contribution of imports of milk to total consumption of milk declined from 24 percent in 1985 to less than 1 percent in the year 2000. At the same time, the share of government-owned enterprises in total milk production decreased markedly. In contrast, the share of smallholder production in total consumption increased by 30 percent from 71 to 96.6 percent. Of the total milk production from smallholders, only 1.2 percent comes from improved cattle. This is not

surprising because the sector only contains 32,204 head or 25 percent of the total improved cattle. Similarly, the contribution of large private farms increased from 21,750 tons in 1985 to 33,182 tons in 2000 (Table 2). The increase in private sector production is mainly due to government policies such as privatization of state enterprises, removal of input market controls and increased use of improved livestock that were in the hands of producer cooperatives and state farms.

To sum up, total milk production in Ethiopia increased during the 1961-2000 period at an average annual rate of 1.55 percent, though per capita production declined (Table 3) as a result of the high population growth rate. However, during the last decade production is growing at even higher rate (3.0 percent). The increased coverage of extension services (such as better management skills) and increased use of improved inputs (improved breeds and feed) and policy changes promoting dairy production have contributed to faster growth of output. Dairy product imports during this phase were relatively smaller than in the two earlier phases (Figure 4). Most of the growth during the third phase is concentrated in the peri-urban and rural production systems[4]. The emergence of private processing industries and marketing units is likely to stimulate producers in the peri urban areas and rural production systems as it offered producers a new market for their milk production.

[4] Azage Tegene, personal communication.

4. DAIRY MARKETING SYSTEMS IN ETHIOPIA

As is common in other African countries (e.g., Kenya and Uganda), dairy products in Ethiopia are channeled to consumers through both formal and informal dairy marketing systems. Until 1991, the formal market of cold chain, pasteurized milk was exclusively dominated by the DDE which supplied 12 percent of the total fresh milk in the Addis Ababa area (Holloway et al. 2000). Recently, however, private businesses have begun collecting, processing, packing and distributing milk and other dairy products. Still, the proportion of total production being marketed through the formal markets remains small (Muriuki and Thorpe 2001). Formal milk markets are particularly limited to peri-urban areas and to Addis Ababa. However, unlike the early phases, the formal market appears to be expanding during the last decade with the private sector entering the dairy processing industry in Addis Ababa and Dire Dawa in the eastern part of the country[5].

The DDE remains only the only government enterprise involved in processing and marketing dairy products. The DDE collects milk for processing from different sources, including large commercial farms, collection centers that receive milk from smallholder producers and to a lesser extent WFP powder milk. The enterprise at present operates 25 collection centers located around Addis Ababa, 13 of them near Selale, 5 near Holetta and 7 around Debre Brehane.

As the data in Annex 2 indicate, the total supply to DDE declined from 16.03 million liters in 1983/84 to 4.03 million liters in 1991/92. The state dairy farms were the dependable source of milk for the enterprise supplying more than 45 percent of the total

[5] Azage Tegene, personal communication

milk for processing between 1983 and 1991. But the share of state farms in milk supply to DDE fluctuated substantially after 1991 (Annex 2). This was mainly due to the reduced capacity following the sale of twelve state dairy farms and declining production from the remaining two farms due to feed shortage and management problems. To fill this gap, the share of private farms and smallholders increased significantly after 1991 and now accounts for over half of DDE supply. DDE currently purchases milk from farmers at 1.25 Birr per liter at the collection centers. They offer a price 15 to 25 cents less than that paid by private traders operating in the informal market (Yigezu 2000). The sale price charged by DDE for pasteurized milk changed from time to time. Until the mid 80s, DDE charged a price of 0.70 Birr. The price of milk increased from 1.00 Birr in 1985/86 to 1.70 in 1987/88 and 2.15 Birr in 1990. Currently, DDE charges 2.85 Birr per liter of milk.

DDE processes milk into pasteurized milk, butter, soft cheese, yogurt, cream milk, formago (cheese) and ice cream (see Annex 3). The wide gap between production and sale of milk by DDE during 1980-1990 reflects the failure of DDE to efficiently market its products. During the last decade, the period of transition to a market-oriented system, the marketing situation has improved and almost all the output was marketed. However, since its inception the enterprise has only utilized its full capacity during the four-year period from 1987 to 1990 (Staal 1995). The reasons for low capacity utilization include management problems, financial difficulties, and unstable and low consumption levels of processed milk in the society due to fasting that prohibits the orthodox Christians (about 35-40 percent of the population) from consuming dairy products for almost 200 days every year (Yigezu 2000).

In addition to DDE, several private milk-processing plants have been established in Addis Ababa, two of which -- Sebeta Agro Industry and Dinsho dairy industries -- have already started marketing their products. Although their share of the market is still small compared to DDE's, the entry of private firms in the formal milk market is a significant development indicating the profitability and potential of private investment in dairy in Ethiopia and that the policy environment is facilitating such entry.

In recent years, promotional efforts have focused on dairy marketing. Milk-marketing cooperatives have been established by the SDDP with the support of Finnish International Development Association. These groups buy milk from both members and non-members, process it and sell products to traders and local consumers. The units also process milk into cream, skim milk, sour milk, butter and cottage cheese. The number of these milk cooperatives reached to 32 in total, 2 established by FAO/TCP (Technical Cooperation Programme) and World Food Programme (WFP) while 30 by SDDP (Redda 2001).

The informal market involves direct delivery of fresh milk by producers to consumer in the immediate neighborhood and sale to itinerant traders or individuals in nearby towns. In the informal market, milk may pass from producers to consumers directly or it may pass through two or more market agents. The informal system is characterized by no licensing requirement to operate, low cost of operations, high producer price compared to formal market and no regulation of operations. The relative share and growth of the formal and informal market in the three phases was different. In all three phases, the informal (traditional) market has remained dominant in Ethiopia.

The traditional processing and trade of dairy products, especially traditional soured butter, dominate the Ethiopian dairy sector (Table 1). Of the total milk produced only 5 percent is marketed as liquid milk due to underdevelopment of infrastructures in rural areas.

5. KEY POLICY AND TECHNOLOGY ISSUES

TECHNOLOGY GAP IN ETHIOPIA

Advances in biological technology in livestock have been induced primarily to improve the yield of animal products per unit of feed or per unit of breeding stock (Hayami and Ruttan, 1985). Analogous to the case of crop production, these advances typically involve one or more of the following elements: (a) improved feeding to provide satisfactory environment for animal growth and feed supplements to stimulate higher productivity; (b) disease control; (c) better environments for animal growth, particular shelter; and (d) selection of efficient breeds specifically adapted to respond to those elements in the environment that are subject to man's control. These advances raise two issues relevant to the dairy sector in Ethiopia, namely feed constraint and genetic improvement.

FEED CONSTRAINTS

Inadequate supply of quality feed and the low productivity of the endogenous cattle breeds are the major factors limiting dairy productivity in Ethiopia. Feed, usually based on fodder and grass, are either not available in sufficient quantities due to fluctuating weather conditions or when available are of poor nutritional quality. These constraints result in low milk and meat yields, high mortality of young stock, longer

parturition intervals, and low animal weights (McIntire et. al. 1992, p. 103). Improved nutrition through adoption of sown forage and better crop residue management can substantially raise livestock productivity. National and international research agencies, including the International Livestock Research Institute (ILRI), have developed several feed production and utilization technologies and strategies to address the problems of inadequate and poor quality of feeds. So far, adoption of these technologies in the Ethiopian highlands has been limited.

Unlike residue management, hay and silage making or adoption of forage legumes often involves the introduction of a new crop into the farming system. Therefore, how the new crop fits into the existing system is critical to successful introduction. In the case of forages, this is determined by the degree of crop-livestock interactions, forage and livestock product markets, the extent of market participation of forage growers and resource availability.

Depending on the degree of crop-livestock interaction, several polar cases can be identified. In livestock-specialized systems such as the pastoral systems in southern Ethiopia and Afar regions, the crop enterprise is not part of the household production unit. Households in these systems are typically subsistence-oriented and based on seasonal milk production. The livestock herders are dependent on natural pastures and grazing areas and to some extent on grazing crop residues in crop systems after harvest. As such, adoption of improved forages is irrelevant since livestock owners usually do not own cropland. However, a transition to agro-pastoralists occurs in different parts of pastoralist areas. In these emerging systems, improved forage is becoming increasingly feasible.

The other polar case is the crop-specialized farming system in which households are predominantly crop producers with limited livestock holdings, mainly small ruminants. In these systems, crop-livestock interaction is minimal. Typical examples include the savannah zones of western Africa. In this system, a necessary condition for adoption of forage is the availability of external markets for forage and animal products (McIntire and Debrah, 1987). This system is very limited in Ethiopia as most of the crop production systems also involve livestock as an integral component.

In the typical mixed crop-livestock farming system, the household has two integrated enterprises, crop and livestock production. Since in mixed systems households can grow and feed forages for their own animals without recourse to forage markets, this system holds the highest potential for adoption of improved forages. Also, forages prove useful in this system to support livestock during periods of low availability of crop residues and natural pastures, such as during the cropping season. In addition to contributing to livestock production, forage legumes contribute significantly to soil nitrogen and provide a break in cereal-dominated rotations (McIntire and Debrah, 1987).

Empirical analysis of the adoption of forage in dairy farms in mixed farming systems has taken place in Holetta area where forage technology has been introduced in association with improved dairy production. The empirical results suggest that the potential for adoption of improved forage is high where both livestock productivity and response to improved feed technology are high, as with crossbreed cows, and where production is more market-oriented, as with dairy. Here, the potential for adoption is high because of the possible complementarities between regular cash income generation from dairy sales and the opportunity for intensification of crop production. Factors

affecting adoption also appear to be interrelated such that the effect of one factor may influence adoption through its impact on another factor. For instance, crop intensification through increased use of purchased inputs eases land constraints and may lead to intensification of livestock production via improved feeding strategies.

GENETIC IMPROVEMENT

Unlike Kenya, the large cattle population of Ethiopia has relatively limited numbers of exotic dairy cattle and their crosses. Less than 1 percent of the 34.5 million cattle population of Ethiopia are exotic or crossbred dairy cows (Muriuki and Thorpe 2001). Although it was difficult to trace the ownership of improved dairy animals, it is estimated that state and private farms own a total of 128,745 grade and pure female dairy animals of which the small holders sector owns 32,204 crosses and improved female dairy cattle. However, due to dissolution of producer's cooperatives and privatization of state farms, most of the crossbreed cows are currently owned by private individuals residing in peri-urban and urban areas of the country (Felleke and Geda 2001). Consequently, milk productivity in Ethiopia is low. The indigenous zebu breed produces about 400-680 kg of milk/cow per lactation period compared to grade animals that have the potential to produce 1,120-2,500 liters over a 279-day lactation.

Genetic improvement has been recognized in the design and implementation of the development projects in the country during the last four decades (Annex 1). With the exception of SDDP, production and distribution of crossbreed heifers, provision and distribution of dairy stocks, provision and strengthening of AI services, and/or bull service were major components of the development projects implemented between 1967 and 1998. Through the effort of these projects, Ethiopia has built up a herd of 120,000

exotic cattle. So far, AI service is provided only by a government institution, the National Artificial Insemination Center (NAIC). The service is available in urban, peri urban and rural areas.

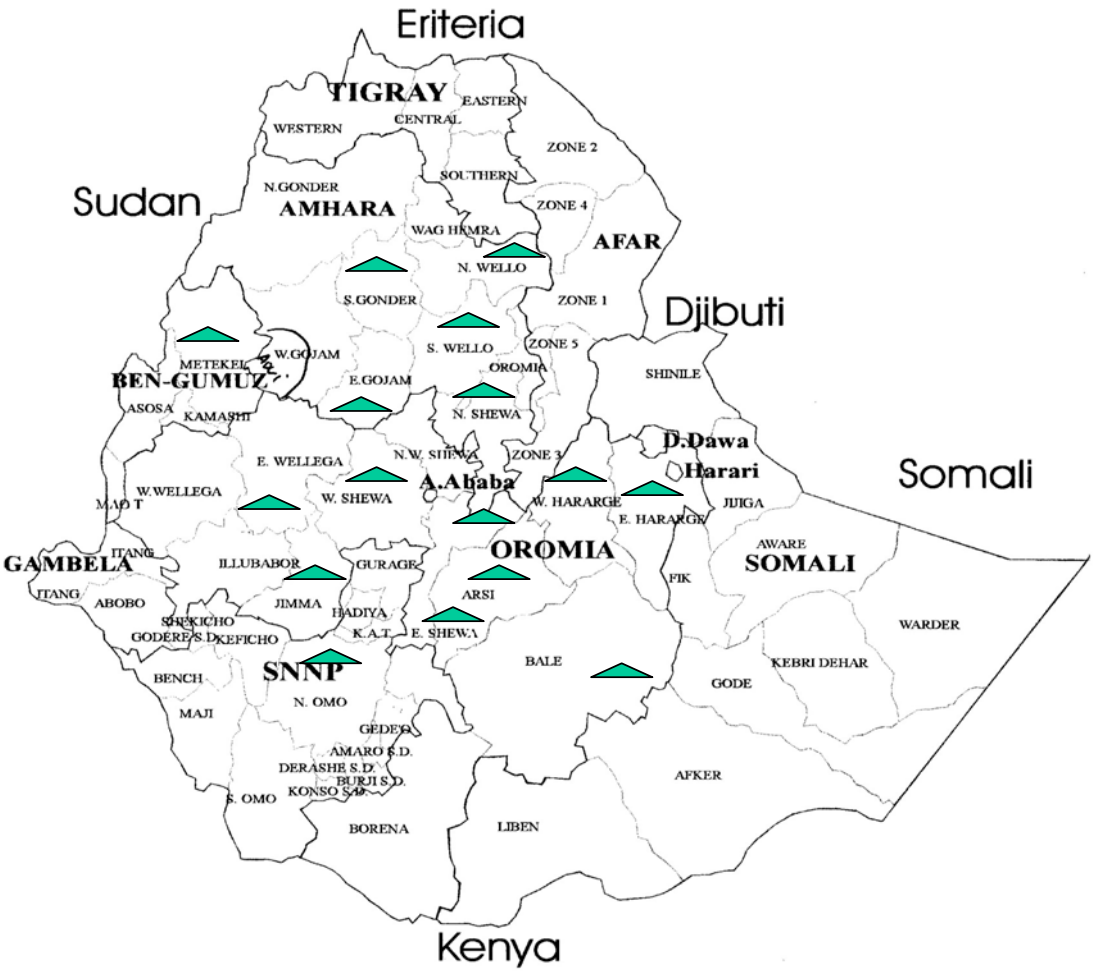
All regions except Tigray, Somali and Gambela appear to have benefited from the distribution of crossbred heifers (Figure 5). However, most of these projects -- all except two -- failed to address the genetic improvement and the feed shortage problem simultaneously. The energy deficit resulting from poor quality or low quantity feed, especially during the dry season, could result in losses in body weight and body condition, thus affecting the production and reproduction efficiency of the cows (Zerbini, et al. 1995). Besides, crossbreeds may need specialized management and veterinary health care. These were also not addressed in these projects. The only development project that addressed these issues simultaneously beside marketing and processing, agroforestry and water development is the Smallholder Dairy Development Projects implemented between 1995 and 1998. The project, supported by Finnish International Development Association, was implemented in 16 *weredas* in three regions.

SMALLHOLDER PARTICIPATION IN THE DAIRY MARKET

Enhancing the ability of poor smallholder farmers to reach markets and actively engage in them, poses a pressing development challenge. Difficult market access restricts opportunities for income generation. Remoteness results in reduced farm-gate prices, increased input costs and lower returns to labor and capital. This, in turn, reduces incentives to participate in economic transactions and results in subsistent rather than market-oriented production systems. Sparsely populated rural areas, remoteness from towns and high transport costs all pose physical barriers impeding market access.

Transaction costs such as lack of information about markets, lack of negotiating skills, and lack of collective organization are other impediments to market access. The question of how to expand the market participation of smallholder livestock producers is a major challenge facing many governments and NGOs in developing countries.

Figure 5 – Distribution of cross-bred heifers in Ethiopia



Triangles represent distribution points.

A study carried out by ILRI using SDDP project data in Selale indicates some important points to be considered in introducing new dairy technologies. The policy-relevant variables having the greatest impact in fluid milk markets are cow numbers, time to the milk group, and visits by an extension agent. The number of cows kept affects marketable surplus through total production and marginal costs of production (Holloway, et al. 2000). The action of pooling, especially pooling of milk collection and transportation activities, has the potential to mitigate costs. Reducing the milk delivery time from farm to collection point can increase sales to the milk group. This clearly relates to the transaction costs of reallocating family labor to milk delivery. Currently many potential fluid milk-marketing households are hours distant from any milk collection points. Any policy support to raise smallholder participation in milk marketing would necessarily need to weigh public costs against the expected gains by smallholder households.

Market access poses a key bottleneck to the expansion of smallholder milk production and processing. Milk groups and co-operatives increase the participation of smallholders in fluid milk markets in the Ethiopian highlands. Milk groups are a simple example of an agro-industrial innovation, but they are only a necessary first step in the process of developing more sophisticated co-operative organizations. The survival of the milk groups will depend on their continued ability to capture value-added dairy processing and retain that value-added for their members. The cost of milk production in Ethiopia is low but transaction costs are high, preventing dairy export for the moment. Milk groups, when developed further, could serve as basis for development of producer-oriented processing that better integrates smallholder producers with the Ethiopian dairy

markets and with the global agro-industry. Boxes 4 and 5 present two illustrative cases of milk groups.

Box 1—Dairy Marketing Association

The Adaa Liben Woreda Dairy and Dairy Products Marketing Association was founded in September 1999 in Debre Zeit town, 50 km southeast of Addis Ababa. It has 34 founding members with a single share of 100 Birr. The initial capital of the association was thus only 3,400 Birr. The amount of milk collected from founding members was 308 liters per day or about 24,319 liters per month. The association, although informally established in 1997, got its legal certificate of registration from the Oromiya State in September 2000.

Over the last few years, the association has grown significantly, and by June 2002, full membership had increased to a total of 426 members, composed of 245 male and 183 female dairy farmers. The total number of dairy cattle owned by members is 1,716. In addition, 181 non-member dairy farmers also supply milk to the association. The current capital of the association has increased to 500,000 Birr. Milk collections have reached 174,360 litters per month in 2002, up by a factor of seven from the 24,000 litters supplied monthly in 1999. There are seven milk collection sites in and around Debre Zeit town. Recently, the association has purchased two coolers with 25,000 liter capacity have been purchased.

LESSONS FROM THE NEIGHBORS

The superior performance of Kenya's dairy sector offers several lessons for Ethiopian, whose dairy sector remains in its infancy. First, grade cattle provided the major source of increased in productivity in Kenya. Hence, smallholders in Ethiopia should be assisted to acquire grade cattle to increase productivity. Second, the development of effective infrastructure for collection of milk in Kenya has also played a

very important role in the development of dairy in the country. This was made possible because the Kenya Cooperative Creameries (KCC) provided a guaranteed market for smallholder's milk. However, Ethiopia's DDE, the major public enterprise engaged in collection and processing of milk from smallholders and private farms in Ethiopia, is operating below full capacity and it has not played a comparably significant role as market outlet or buyer of last resort. Hence, the enterprise needs to increase its efficiency and increase its collection network. The milk coops should also be given enough technical and financial support as they are serving as an important market outlet for smallholder producers. Currently, only a few milk processing industries operate, and only in the capital and regional towns. The emergence of these private agro industries has given the smallholders and peri-urban producers an alternative market to the DDE. Hence, the private sector should be promoted to engage in dairy processing and marketing as it gives opportunity for smallholders to market their milk. The input market should also be liberalized and the private sector should be promoted to actively participate in the market. More importantly, the dairy sector success in Kenya was driven by increases in demand. Yet this has not happened in the case of Ethiopia. Therefore, stimulating consumption of milk and milk products in the major cities and townships through increasing awareness is important for sustainable development of the sector.

Milk production and marketing systems are similar in Kenya and Ethiopia (Muriuki and Thorpe 2001) and smallholders dominate dairy production in both countries. Both countries have parallel formal and informal marketing systems where the proportion of milk production marketed in the formal market constitute a very small portion of the total milk produced (Muriuki and Thorpe 2001). In Kenya, the proportion

of marketed milk sold in the formal market is 15 percent compared to only 5 percent in Uganda and a negligible share in Ethiopia (Muriuki and Thorpe 2001). With agro-industrial development of the dairy sector in Ethiopia through private investment, the proportion of marketed milk sold in fthe formal market is expected to increase.

Despite the agroecological similarities between Kenya and Ethiopia, the Kenyan highlands have higher and more evenly distributed rainfall and hence higher potential for feed and forage production. In Ethiopia, on-farm feed and forage production as well as industrial concentrate need to be emphasized.

Since the major part of the demand for dairy in Ethiopia is mainly for processed milk (butter and cheese), smallholder, labor-intensive processing technologies should be encouraged. Such technologies, hand-driven churners, are available and are used by women in rural areas for butter production. In the future and as income grows, demand for processed dairy products such as ice-cream and yogurt are expected to grow.

Box 2--Addis Ababa dairy cooperative

The Addis Ababa Dairy cooperative is the pioneer cooperative in Addis Ababa and it's surrounding area. The cooperative was first established in December 1992 with the aim of facilitating the supply of feed for urban dairy producers. By 2002, the number of members in the cooperative reached 171, almost half of them (85) women. The current capital of the cooperative amounts to 61,497.35 Birr and each member on average own 10 dairy cattle. Currently, the average milk collection per member is 20-30 litters per day or about 102,600 to 153,900 litters per month.

6. HOUSEHOLD IMPACT OF SMALLHOLDER MARKET-ORIENTED DAIRY

In the typical the mixed, crop-livestock system of the highlands of Ethiopia, farming households produce milk using local zebu cows that are kept on communal pasture and crop residues. Milk productivity is low and most of the product is retained for home consumption. The small surplus may be processed into butter and cheese and either consumed or sold. In contrast, improved dairy technology based on high-yielding crossbred cows and production of improved forages has the potential of increasing milk production of smallholder households for both home consumption and the market. The household impacts of smallholder, market-oriented dairying has been analyzed to test whether gains in real income from technical change or commercialization may translate into food consumption of the poor and nutrient intake in a pilot research project implemented in Holetta[6] area between 1993 and 1998 (Ahmed, et al. 2000; Ahmed, et al. 2002). The research project aimed at evaluating the feasibility of using crossbred cows (CBC) for both dairy and draft under farmers' conditions.

The pilot project site is located in the Ethiopian highlands, about 40 km west of Addis Ababa in the vicinity of Holetta town. The altitude of the research area is about 2600 meters above sea level. The farming system in the study area is classified as a mixed crop-livestock system with livestock playing an important role in the provision of food (milk and meat), draft power and dung which is used mainly as a source of fuel as well as for soil fertility enhancement.

[6] In recent years, smallholder dairy technology consisting of crossbred cows, improved feed and improved management practices has been introduced throughout the highland of Ethiopia (see Figure 5). The case in Holeetta differs only with respect to the marketing potential of fresh milk due to its proximity from the Addis Ababa market. However, the introduction elsewhere is expected to have produced comparable impact.

The dairy technology consists of crossbred cows, improved feed technology such as on-farm production of forages, and improved management. Pairs of crossbred dairy cows were initially introduced to 14 farmers in Holetta in 1993, half for only milk production and the other half for dairy and draft. In 1995 and early 1996, 120 more crossbred cows were sold on credit to an additional 60 households. Some households other than those participating in the project also own crossbred cows. Willingness and ability to pay the initial down payment and costs for maintaining the CBCs were the major criteria used for selection of the participating households. Although the initial 14 farmers were relatively rich, the latter sixty farmers were selected from a list of farmers in three wealth groups, namely poor, medium wealth, and rich farmers. Sixty control households using traditional practices of local Zebu cows for milk production and oxen for traction were included in the household surveys beginning in mid-1995. The number of control farmers in each wealth group is roughly equal to the number of CBC owners in the same wealth group. Within each wealth group, participating and control households were comparable, selected on the basis of the same criteria.

Based on the profile of adopters and non-adopters (Table 4), household heads of both groups tend to be of similar average age and education. Households in both groups have comparable size in terms of adult equivalence, dependents and labor resources. However, adopters have more farm area, allocate more area to food crops and smaller livestock herd size in addition to 1.69 crossbred cows on average[7]. As a result of the higher income from improved dairying, adopting households earn significantly higher per capita income and they spend more on household consumer items as well as on farm

[7] Hereafter, adopters refer to households owning crossbred cows.

inputs. In addition, per capita intake of calorie, protein and iron is higher in adopting households.

Table 4--Profile of adopters and non-adopters of improved, market-oriented dairy in Holetta, Ethiopia

Variable	All cases	Participants (adopters)	Non-participant (non-adopters)
Number of observations	147	78	69
Per capita annual income (Birr)	1435	1663 [a]	1178
Per capita annual cash expenditure on food	160	168	151
Per capita annual cash expenditure on non-food	169	178	159
Household expenditure on farm inputs	1199	1382 [a]	988
Proportion of cash income	0.37	0.41 [a]	0.32
Per capita nutrition intake			
Calorie (Calorie)	2354	2511 [a]	2177
Protein (gm)	72	76 [a]	67
Iron (mg)	118	131 [a]	103
Farm area (ha)	2.97	3.32 [a]	2.58
Area allocated to food crops (ha)	2.30	2.44 [c]	2.15
Input use per hectare (Birr)	375	379	369
Local breed herd size (TLU)	6.23	5.55 [b]	7.00
Number of crossbred cows	0.91	1.69 [a]	0.00
Labour units in adult equivalents	3.09	3.06	3.13
Adult equivalent size of the household	5.79	5.72	5.89
Age of household head	45	46	45
Age of mother or spouse	37	37	37
Dependency ratio	0.39	0.40	0.38
Women ratio	0.48	0.45 [b]	0.51
% Illiterate head of households	0.29	0.26	0.32
% of heads with high school education	0.14	0.15	0.14

[a], [b] & [c] means of the two groups are significantly different at 1%, 5% and 10 % level respectively.
Source: Ahmed, et al. 2002.

Within the study area, crossbred cow yield a gross margin of 937 EB/cow/year, or more than seven times the gross margin of a local cow in 1997 (Table 5). This results mirrors that of a similar study by SDDP on the central highlands of Ethiopia in 1998, which shows gross margin of 865 EB/cow/year for crossbred cow with milk production of 700 litters annually (Ojala 1998). Crossbred cow yield 37.2 litter of milk/cow/labor day, which is twice the yield per cow per labor day of the local breed. Although

crossbred cows require a higher variable cost than local cows, the gross margin per unit variable cost was still higher than local cow indicating the profitability of crossbred cow (Table 4). This result compares favorably with the results of recursive econometric analysis, which indicates significant productivity gains from crossbred cows as compared to local breed.

Table 5--Gross margin for crossbred and local cows

Item	Unit	Local Cows	Cross Bread Cow
Milk in liter	Liters	134.07	783.68
Milk Revenue (cash sales only)	EB	140.77	822.87
Meat Production[1]	EB	67	107
Heifer Surplus[2]	EB	47	326
Value of Manure[3]	EB	148	236
Gross Revenue	**EB/Cow/Year**	**402.77**	**1491.87**
Variable Costs			
Feeding of cow	EB	135	217
Feeding of Heifer	EB	134	173
Purchased feed	EB	11.53	153.66
Health care, AI service	EB	1.42	11.0
Total Variable cost	EB	**281.95**	**554.66**
Gross Margin		**120.82**	**937.21**
Labor	person days	8.33	21.87
Value of labor	EB	41.67	109.34
Gross revenue per labor day	EB	16.89	37.62
Gross margin per labor day	EB	14.50	42.87
Gross margin per unit of variable cost	EB	0.43	1.69
Capital Costs	EB	890	4,070

Source: Calculation by the authors and personal communication Abebe Misinga.
Note: Currently 1 USD is equivalent to 8.57.

A recursive econometric model was estimated based on the conceptual framework of the impact of MODP at a household level presented in Annex 4. In this framework, high productivity of crossbred cows and complementary technology may result in a higher milk and dairy production. Adopting households may use the incremental

increases of cash income for buying food, to meet other household needs, or to purchase farm inputs. The impact of dairy technology on nutrition and health may result from direct increases of household consumption of milk and dairy products. The impact can also be indirect through higher household expenditure on food, health and sanitation or both. It has been well established by nutritionists that consumption of more dairy products results in a better human nutrition and health (Neumann et al. 1993). Thus, we expect children of the adopting households who consume more dairy products to be healthier.

IMPACT ON PER CAPITA INCOME

In the recursive system, per capita income is defined as the market value of crop and livestock production and income from all other sources and estimated as a function of productive resources of the household and socioeconomic characteristics of the household (for more details, see Ahmed, et al. 2002). The household earns income from production of crops and livestock including dairy, and renting of its resources such as land and labor. Crop production is a major source of income. Accounting for 61 percent of the income on average, this share is slightly higher (at 67 percent) for the control group and slightly lower (55 percent) for the adopters. Animal production constitutes 34 percent of the income of the MODP participants, and only 15 percent for the non-participants. Per adult equivalent, income in the study area is generally low with a significant difference between the two groups of households. This difference is mainly attributed to the difference in dairy production.

As expected, adoption of dairy and associated technology is a significant determinant of household income. The estimated coefficient of 0.51 on per capita

crossbred cows owned translates into an income elasticity of 0.465 at the mean value of per capita holdings of crossbred cows (0.91 cows). The mean per capita income of an adopting household is 41 percent higher (Birr 1,663) than that of a non-adopting household (Birr 1178) (Table 4). This is a substantial contribution attributable to ownership of crossbred cows and adoption of associated feed and management technology. This increase comes mainly from the additional milk sales.

Local breed livestock herd also contributes significantly to per capita income in this mixed crop-livestock system, as indicated by the positive and significant coefficient of 0.12. Local livestock may contribute to household income indirectly through provision of draft power to crop production and directly through animal sale and milk production for sale. Households with only local breeds generate on average only 15 percent of their income from livestock, mainly from live animal sales. However, the contribution of local breed livestock is much smaller than that of crossbreed cows.

Crop markets appear to be an important institution for rural households for facilitating profitable transactions and income-generating opportunities. The longer the travel time to crop market, the lower the per capita income of the household. Longer travel time may discourage cash transactions, constrain the flow of market information especially on prices and availability of inputs, add to transaction costs of purchases and sales and shift labor from production activities. In this analysis, the estimated elasticity of income with respect to distance to crop market is –0.137.

Tangka et al. (2002) showed positive and significant effects of dairy technologies on food security and food production in the same area. These effects are reflected mainly through their impact on incomes and wealth. Besides, women in CBC households earned

nearly seven times more dairy income than women in households with only local cows. The average monthly non-dairy farm and off-farm incomes between the two groups of households were not statistically different, suggesting that the higher household income in CBC households came mainly from dairy (Tangka et al. 2002).

IMPACTS ON HOUSEHOLD EXPENDITURE PATTERNS

Household expenditure can broadly be disaggregated into expenditure on food, non-food, and farm inputs. Theoretically, expenditure on food includes value of food produced and consumed by the household. However, for lack of data, expenditure on food is defined here as cash expenditure on food and includes goods that are not produced by the household in addition to purchases of food to close any food deficit. Non-food expenditure includes household expenses such as clothing, health care, education, and social contributions. Expenditure on inputs covers farm inputs such as fertilizer, chemicals and seed and livestock expenditure such as feed and veterinary expensive. Expenditures on food and non-food are computed on a per capita basis and expenditure on inputs is computed for the household. The three relationships are estimated as functions of per capita income, proportion of cash income in total income, per capita area allocated to food crops, round-trip time to the nearest crop and livestock markets, and household socioeconomic characteristics. Average annual per capita cash expenditure on food is estimated at Birr 40 and Birr 34 for the MODP participants and the non-participant households respectively with a statistically significant difference between the two groups (Table 5). These estimates are low mainly because these farm households consume most of their own food. Adopters have higher cash expenditures for

farm inputs, transportation, tax and debt repayment, milling and clothing, which add up to higher but not significantly different total cash expenditures.

The coefficients of the income variable in the three equations are positive and statistically significant. Expenditure elasticity of income is highest in the case of farm inputs (0.99) and lowest for non-food expenditure (0.21). This result indicates that income increments from technology adoption and commercialization do not necessarily translate fully into additional food purchases but are distributed among the alternative needs of the households. It worth noting that doubling income almost doubled expenditure on inputs indicating the high priority for increasing future income earnings from use of purchased of farm inputs. This also reflects the willingness of households to adopt improved crop technology such as improved seed and fertilizer. The high proportional increase in farm input expenditure from increments of income from adoption of the dairy technology suggests that livestock intensification through introduction of improved production technology may lead to intensification in crop production.

The proportion of cash income in total household income measures the degree of market participation of the households. This proportion is significantly higher among the improved dairy households (Table 5). Sales of dairy, livestock and surplus crop are the major source of cash of households. As the proportion of cash income increases, both expenditure on food and non-food increase significantly. However, the proportion of cash income does not affect the expenditure on inputs as credit is an alternative source for input purchases. Credit may be substituted for cash income allowing a household to spend more on other expenditures. At the mean, the elasticities of food and non-food expenditure with respect to the proportion of cash income are, respectively, 0.30 and

0.61. These results suggest that technologies that increase productivity of a cash commodity such as dairy and other livestock technology also promote market participation through increased expenditures on food and non-food goods consumed by the household. This may generate significant growth linkages in the rural economy.

IMPACT ON NUTRITIONAL INTAKE

It is hypothesized that the income impact of adoption of dairy technology transmits, recursively, through expenditure effects to influence nutrient intakes. Average per capita daily nutrient intake functions – for calories, protein, and iron -- are estimated as functions of per capita expenditure on food, per unit price of the nutrient, area allocated to food (cereals and pulses) as a proxy for food produced at home, and socio-economics factors of the household.

On average both the MODP participant and non-participant households meet this minimum. MODP participants consume about 15 percent more calories, 13 percent more protein and 27 percent more iron compared to the non-participants (Table 5). Statistically, however, these differences are not significant. As discussed earlier, the contribution of the MODP to household nutrition may not only come through a direct consumption of milk but through substitution effects due to the impact of improved dairy production on market integration. Also, the diets may not change significantly as most households will stick to their usual diets. However, the main gains may be for the households that face deficiencies.

Expenditure on food is a significant determinant of the intake of all three nutrients with estimated elasticities of 0.317, 0.326 and 0.193 for calorie, protein and iron. This supports the study hypothesis that increasing household incomes through adoption of

improved technology leads to improving household nutrient intakes and therefore contributes to better nutrition and health.

There is a significant and negative relationship between the unit prices and nutrient intakes. The demand for these nutrients is relatively inelastic with own price elasticities of -0.39, -0.77 and –0.70, respectively. This reflects the degree of response of the household to the cost of high-nutritive meals such as meat, dairy and vegetables. This may explain the fact that households with dairy crossbred cows consume 22 percent more milk than households without crossbred cows due to the perceived lower cost of own production. This also suggests an inverse relationship between the cost of food and the quantity prepared by the household. Unfortunately, these elasticities cannot be compared to estimates from other studies as in these studies commodity prices were used directly as regressors. The estimates obtained here are with respect to a weighted price index that depends on the cost of individual ingredients used in meal preparation.

Nutrient intakes significantly increase as household food production (as measured by area allocated to these staples) increases. This is clearly because food produced on farm constitutes the major source of household food consumption and hence, nutrient intakes. There is an inverse and statistically significant relationship between age of mothers and the per capita protein and calorie intake. This may be due to likelihood that young mothers may have received more formal education due to the recent increase in schooling availability and more exposure to nutritional information. Male-headed households tend to consume significantly less energy and protein while households with more children consume significantly more calories.

To sum up, the assessment of the household impacts of adopting market-oriented dairy production consisting principally of crossbred cows and improved feed and management practices by smallholder households in rural Ethiopia demonstrates that adoption of market-oriented dairy technology significantly raises per capita income and income effects extend positively to expenditure and consumption. The higher the income level, the higher the expenditure on food, non-food items and farm inputs. On the other hand, expenditure is directly related to nutrient intakes. The resource base, including cultivated area and capital inputs, are also important determinants of per capita income.

From a policy perspective, these results imply that introduction of market-oriented activities is an effective way of reducing poverty and malnutrition of smallholder households in rural areas. Moreover, such introduction has the potential to stimulate the rural economy through demand stimulus for non-food. The enabling environment for success of such activities includes marketing infrastructure and availability of farm inputs and necessary veterinary services for dairy farmers. Policies that encourage farmers' participation in markets and generation of cash income appear to be critical.

FARMER PERCEPTIONS OF THE BENEFITS OF CROSSBRED COWS

According to smallholder farmers who participated in the dairy project in Holetta, keeping crossbred cows has brought significant changes to their lives. According to recent interviews in Holetta area, crossbred cows have improved households' access to food, especially dairy products. This has helped them to raise healthy children through increased consumption of dairy products. Moreover, the benefits of crossbred cows go far beyond household consumption. Farmers were also obtaining cash income from the sale of surplus milk, milk products and heifers. This increased their ability to buy fertilize

and improve their living standards by building decent houses and sending their children to school. Unlike crop production, which is seasonal, market-oriented dairying was more sustainable throughout the year in terms of generating cash income and hence, allows savings (Box 3, Box 4 and Box 5). .According to farmers, benefits include access to dairy products and stales for consumption and sustainable income for repayment of debt and for household expenditure on items such as schooling, clothes and asset building

Box 3--Fekeru Getachew on the benefits from dairying

Fekeru Getachew is a young farmer. In 1995, he was among the poor farmers with only one ox. Then he received two crossbred cows on credit. After eight years, he said, "I have entirely different way of life and I brought visible changes to the household." Currently, in addition to the two crossbred cows he has five draught oxen that he bought by selling the CBC heifers.

Mr. Fekeru believes that crossbred cows have brought many benefits to his family. "To mention some", he said, "I am now the father of three healthy well-fed children because we had always milk at our home". Remembering his old days where there was no cooking oil, he said, "Now, thanks to these cows, we have enough cooking butter than ever. The benefits of these cows were not only for household use; the crossbred cows are source of cash income to the family. The cash income from sale of dairy products is used to send his children to school and buy clothing. He said that the cash from sale of dairy products and crossbred heifers is helping him also to repay fertilizer credit. "In situations like dry seasons where the price of crop produce goes down, I am no more obliged to sell at low price. I rather use dairy products as alternative source of cash".

Moreover, the fresh manure obtained from the cows has saved his wife from collecting fuel wood. However, he is facing problems such as inadequate feed supply, feed shortage and inadequate AI services. He has no doubt that the crossbred cows bring significant benefits. To sustain the benefits, he needs regular supply of AI service and concentrates.

Box 4--Gizaw Wendmu on the benefits from dairying

Mr. Gizaw Wendmu is a young secondary school graduate farmer. He said, "I believe that I am a model to my neighbors because I have a better life since I received the two crossbred cows in 1995." He elatorates, saying, " I remember the day I learnt about crossbred cows with lots of joy. Since I brought the two crossbred cows in the house, we never had problem of food and I have now two crossbred cows and two heifers". Expressing his strong attachment to crossbred cows, he said, " I couldn't imagine a life with no milk and milk products in the future". The crossbred cows, apart from helping him to have healthy children, are earning him income. He supplies the excess milk to the hotel near by and to individuals.

Mr. Gizaw built a decent house with the cash he obtained from sale of milk and other dairy products. As the dry period for crossbred cows is shorter than for local breeds, the income he earns proves more sustainable over time. Hence, he was able to save and repay his fertilizer credit. "I could see a better future with my crossbred cows", he said, " Therefore, I am planning to build new barn for the cows." He attributes the benefits he obtained to the new technology as well as the continued effort he is making on the management of crossbred cows. He thinks that dairying can be a way forward for many farmers like him if it is supported with extension services.

Box 3--Mr. Tekelu on the benefits of dairying

Mr. Tekelu is an experienced farmer who appreciated the benefits of adopting crossbred cows if they are managed properly. At the beginning he said, "I have only 4 cows, and then I received two crossbred cows on credit in 1995. Currently, I have 5 heifers and 3 crossbred cows." He added, "I have benefited for the last eight years from the crossbred cows and for me the cow is just like a dedicated mother who never got tired of taking care of her children". Mr. Tekelu has planted oats and vetch for his crossbred cows on the plot he used to plant teff on because he discovered that the dairy income in only two months is twice as high as the income from planting teff in that plot.

Besides the consumption needs of his family, Mr. Teklu earned cash income from the sale of crossbred heifers and dairy products, which enable him to build a new house in town. "I also pay regularly my debt for fertilizer credit", he said, "as the cows lactate for almost 9 months per year. I keep my crossbred cattle at home and I do not mix them with the local breeds during grazing". This is basically to reduce the risk of diseases that can easily attack crossbred cows. Managing the crossbred cows for him is like child nurturing which should be done continuously with no reluctance.

7. CONCLUSIONS AND IMPLICATIONS

Like other sectors of the economy, the dairy sector in Ethiopia has passed through three phases or turning points, following the economic and political policy in the country. In the most recent phase, characterized by the transition towards market-oriented economy, the dairy sector appears to be moving towards a takeoff stage. Liberalized markets and private sector investment and promotion of smallholder dairy are the main features of this phase. Milk production during the 1990s expanded at an annual rate of 3.0 percent compared to 1.63-1.66 percent during the preceding three decades.

However, most of the growth in milk production (60 percent) was due to the increase in herd size. Only one-quarter was due to productivity per animal resulting from technological change. This is not surprising since dairy production in the country is principally dependent on indigenous zebu breeds. Therefore, integration of crossbred cattle to the sector is imperative for dairy development in the country. This can be achieved in two ways: (1) through promotion of large private investment, which at the end will introduce new technology in the sector such as improved genotypes, feed and processing, and (2) as smallholders will likely continue dominating the sector, government should also promote integration of crossbred cattle into the smallholder sector through improving their access to improved cattle breeds, AI service, veterinary service, and credit. Similarly, government should also take the lead in building infrastructure and providing technical service to smallholders. Severe shortages, low quality and seasonal unavailability of feed likewise remain as major constraints to livestock production in Ethiopia. These constraints need to be addressed and technological change be promoted to increase milk production.

Due to poor infrastructure, concentration of milk producers in rural areas, seasonal fluctuation of demand for fresh milk, and perishability of milk, development and promotion of small-scale processing technologies is critical to increasing smallholder producers' participation in the dairy market. This is particularly important for Ethiopia where the demand for dairy products is dominated by butter rather than liquid milk. In addition, enhancing the ability of poor smallholder farmers to reach markets, and actively engage in them, is one of the most pressing development challenges. Milk groups and co-operatives increase the participation of smallholder in fluid milk markets in the Ethiopian highlands. Milk groups are a simple example of an agro-industrial innovation, but they are only a necessary first step in the process of developing more sophisticated co-operative organizations and well-functioning dairy markets. The survival of the milk groups that supply inputs and process and market dairy products will depend on their continued ability to capture value-added dairy processing and return that value-added to their members. Evidence from Kenya emphasizes the importance of collection organizations in improving access to market and expanding productive bases (Staal 1995). Also there is a need to stimulate consumption of dairy products in the country as low demand for dairy produce can potentially discourage production in the long run.

Review of the development of dairy sector in Ethiopia indicates that there is a need to focus interventions more coherently. Development interventions should be aimed at addressing both technological gaps and marketing problems. If the appropriate producer price incentives are in place and input markets are allowed to operate freely, dairy production may respond positively. This has been demonstrated in the Kenyan dairy development that has to some extent similar agro-ecology and production systems.

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Annex Table A.1 -- Dairy development projects implemented in Ethiopia: 1967-1998

Project name	Duration	Objective	Major components	Area coverage
The first Phase				
CADU/ARDU	1967-1984	- To improve and promote meet and milk production in the region	• Production and distribution of cross breed heifers • AI service • Animal health • Forage Production • Marketing	Chilalo/Arsi
MPPs	1972-1980	-Rising the income and agricultural out-put of smallholder farmers with minimum reliance on scarce resources.	• Distribution of crossbred heifers • Bull service • AI service	Almost all over the country except lowlands.
AADDP	1972-1981	- Increase milk supply for the Addis Ababa market	• -Provision of dairy stock • -Marketing • -AI service • -Expansion of Shola plant	Addis Ababa and 110km around Addis Ababa
The second Phase				
DRDP	1986-1992	-Improve rural incomes and nutrition status of Ethiopian peasants -Improve operational efficiency and financial performance of the state dairy sector. -Increase the supply of butter and milk to the capital and other major cities. -Place dairying on sound footing.	• Cooperative dairy farm development through the introduction of crossbreds • State farm development • Health services	10 provinces
SPDDP	1987-1991	- Increase sustainable smallholder dairy production in the highlands of Ethiopia.	• Dairy stock distribution • Cooperative development	Former Selale awraja
SNAIS	1987-1990	- To provide an efficient and reliable AI service.	• Strengthening of AI service and at field level	Kality AI center and to 8 provinces
The Third Phase				
SDDPP	1991-1994	-To organize small milk processing and marketing units that can raise the income and nutritional standard of smallholder farmers. - To generate information and provide experience for future dairy development efforts.	• Milk and marketing and processing	Two woredas in Oromiya and SNNP regions
SDDP	1995-1998	-Improve the standard of living of the smallholder farming families under friendly development approach.	• Dairy stock distribution • Breeding bulls for distribution • Milk marketing and processing • Fodder production • Agroforestry • Water development • Appropriate technology	16 woredas in three regions

Annex Table A.2 -- Milk delivered to DDE for Processing (1983-1999) in liters

Year	State farms	Collection centers	Private farms[a]	WFP	Total
1980/81	5,137,730	3,018,319	1,326,742	-	9,482,791
1981/82	5,353,216	5,062,646	1,152,142	207,200	11,775,204
1982/83	5,768,714	1,500,078	1,088,001	335,000	8,691,794
1983/84	6,718,555	4,209,545	1,460,000.	3,650,000	16,038,100
1984/85	5,579,342	1,876,473	834,096	2,963,500	11,253,411
1985/86	4,656,775	3,756,950	873,445	1,510,000	10,797,170
1986/87	4,714,199	4,571,622	997,383	1,422,500	11,705,704
1987/88	4,925,076	4,079,502	952,099	2,784,220	12,740,897
1988/89	4,388,960	3,351,079	878,488	3,554,500	12,173,027
1989/90	4,884,533	3,115,419	817,047	2,786,250	11,603,249
1990/91	3,366,963	2,013,372	485,172	1,640,500	7,506,007
1991/92	1,373,972	1,053,698	280,877	1,322,580	4,031,127
1992/93	1,002,960	1,065,548	105,855	450,760	2,625,123
1993/94	1,396,564	-	2,407,380	139,000	1,535,564
1994/95	2,159,000	-	2,471,836	150,000	2,309,000
1995/96	2,556,654	-	2,399,968	48,200	2,604,854
1996/97	2,351,634	-	2,116,793	129,050	2,480,684
1997/98	2,502,550	-	2,076,779	-	4,579,329
1998/99	521,763	-	479,452	-	1,001,215
1999/00	1,782,755	-	3,288,671	-	5,071,426
2000/01	1,353,591.00	-	2,501,790.00	-	3,855,381

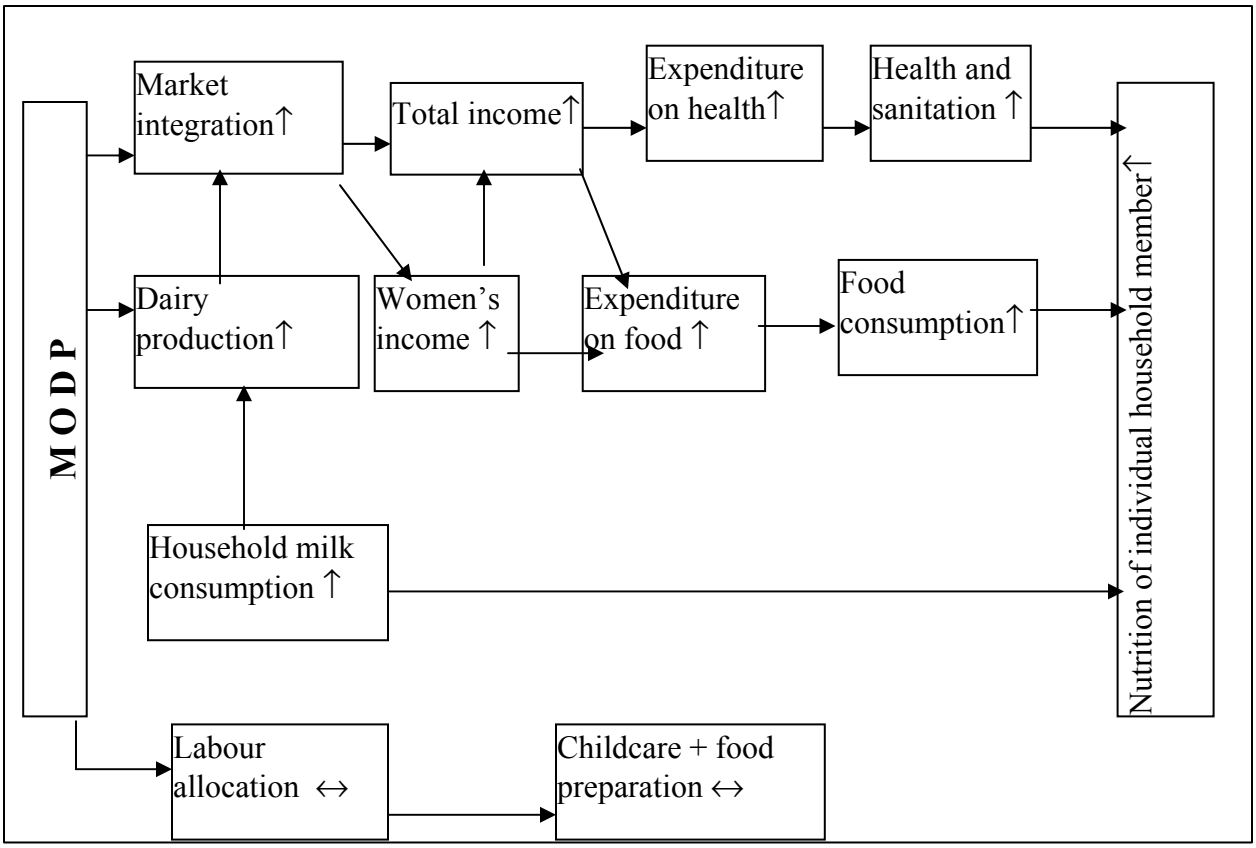
a. For the year from 1991, data in this column indicate milk collection from smallholders and private farms together.
Source: Dairy Development Enterprise (DDE)

Annex Table A.3 -- Total dairy products sold by DDE

Year	Milk (liters)	Butter (kg)	Soft cheese (kg)	Formago	Yogurt (liters)	Cream	Ice-cream
1980/81	8,440,164	126,777	74,580	-	-	2,983	-
1981/82	8,253,124	135,052	87,137	9,406	989	1,021	-
1982/83	9,539,207	147,157	85,848	15,168	2,542	635	-
1983/84	1,070,994	110,635	62,050	24,515	-	736	-
1984/85	11,010,690	137,434	40,866	6,755	-	629	-
1985/86	6,863,313	1,555,955	211,708	202,600	-	4,516	-
1986/87	10,380,663	167,360	95,875	29,886	-	-	
1987/88	12,662,318	197,720	54,269	27,898	514	1,658	
1988/89	8,552,482	1,467,630	86,798	277,433	6,299	33,816	32,244
1989/90	7,706,565	1,814,280	214,819	186,038	8,169	50,248	18,740
1990/91	8,055,752	1,367,370	149,553	130,646	8,291	50,403	13,470
1991/92	4,075,352	33,456	18,603	-	9,380	2,493	244
1992/93	2,403,155	27,872	51,363	1,065	-	490	-
1993/94	2,988,026	71,613	103,540	3,736	41,069	800	87
1994/95	4,217,685	81,935	45,610	7,733	55,299	3,646	77
1995/96	4,522,935	95,659	30,754	5,239	-	3,336	-
1996/97	4,223,352	72,280	33,616	12,675	200	366	-
1997/98	4,244,662	77,777	27,342	14,835	-	-	-
1998/99	1,015,709	14,204	5,054	2,214	-	180	-
1999/00	3,906,193	64,277	50,651	11,240	11,679	175	-
2000/01	3,878,148	62,280	88,027	9,469	31,256	903	-

Source: Dairy Development Enterprise (DDE)

Annex Figure A.1 -- The linkages between the introduction of market-oriented dairy production (MODP) and household impacts



Note: hypothesis: ↑ increase ; ↔ remain unchanged
Source: Ahmed, et al. 2002.

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