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Dairy Development for the Resource Poor Part 2: Kenya and Ethiopia Dairy Development Case Studies

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PREFACE

This is the 44th of a series of Working Papers prepared for the Pro-Poor Livestock Policy Initiative (PPLPI). The purpose of these papers is to explore issues related to livestock development in the context of poverty alleviation.

Livestock is vital to the economies of many developing countries. Animals are a source of food, more specifically protein for human diets, income, employment and possibly foreign exchange. For low income producers, livestock can serve as a store of wealth, provide draught power and organic fertiliser for crop production and a means of transport. Consumption of livestock and livestock products in developing countries, though starting from a low base, is growing rapidly.

The aims of this study are to analyse trends and determinants of dairy development in East Africa and South Asia in order to assess the role of policies and institutions on the evolution of the sector in general, and their impact on the poor in particular. Although traditional and commercial dairy production/marketing systems coexist in both regions, traditional/informal dairy production systems continue to dominate, are generally competitive, and have played a key role in sector development, because of continued strong demand for the products and services they offer. Policies which build on traditional production systems, with a particular focus on employment generation and food safety and quality, are therefore expected to be pro-poor.

We hope this paper will provide useful information to its readers and any feedback is welcomed by the authors, PPLPI and the Livestock Information, Sector Analysis and Policy Branch (AGAL) of the Food and Agriculture Organization (FAO).

Disclaimer

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Keywords

Smallholder dairy production, dairy development policy, informal markets, developing countries, poverty reduction, South Asia, East Africa.

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ACRONYMS

AADDP	Addis Ababa Dairy Development Project
AADPA	Addis Ababa Dairy Producers Association
AI	artificial insemination
ASAL	arid and semi-arid lands
CADU	Chilalo Agricultural Development Unit
CAIS	Central Artificial Insemination Station
CSA	Central Statistical Authority of Ethiopia
DDA	Dairy Development Agency
DDE	Dairy Development Enterprise
ECF	East Coast fever
ERSWEC	Economic Recovery Strategy for Wealth and Employment Creation
ETB	Ethiopian Birr
FAO	Food and Agriculture Organization of the United Nations
FDCS	farmers' dairy co-operative societies
FINNIDA	Finnish International Development Agency
GDP	gross domestic product
GoK	Government of Kenya
ICRAF	International Centre for Research in Agroforestry
ILRI	International Livestock Research Institute
KARI	Kenya Agriculture Research Institute
KCC	Kenya Co-operative Creameries
KDB	Kenya Dairy Board
KEBS	Kenya Bureau of Standards
KES	Kenya Shilling
KETRI	Kenya Trypanosomiasis Research Institute
KFA	Kenya Farmers Associations
KNAIS	Kenya National Artificial Insemination Service
MoA	Ministry of Agriculture
NDDP	National Dairy Development Project
NSSF	National Social Security Fund
PA	Peasant Association
SDDP	Smallholder Dairy Development Pilot Project
SNNRP	Southern Nations Nationalities and Peoples Region
SRA	Strategy for Revitalization of Agriculture
UHT	ultra-high temperature treated
UNICEF	United Nations Children's Fund
USD	United States dollar
VAT	value-added tax

WADU	Wolaita Agricultural Development Unit
WFP	World Food Program

Overview of the Study

The process of dairy development that this study addresses is driven by underlying fundamental changes in economic growth, the value of resources and consumer demand. However, it is also shaped by public policies, interventions and investment decisions and will be accompanied by changes in impact on incomes, opportunities and livelihoods of producers and changes in opportunities and returns for market agents and investors. This study examines dairy development in two key dairy producing regions in the developing world: East Africa and South Asia. The aim of the study is to analyse the trends in dairy development in these two regions and identify their key determinants, to analyse the impact of policy interventions on those trends and to identify impacts of dairy development, particularly on the poor.

The study is reported in three parts: Part 1 presents a conceptual framework for dairy development, followed by a section presenting a regional analysis of dairy development trends across all the countries in the two regions and a synthesis of the outcomes of the case study analyses (see below), highlighting implications for policy interventions and investment, including proposing a model for pro-poor dairy development. Parts 2 and 3 consist of in-depth case studies and analyses of dairy development trends, determinants and outcomes in Kenya and Ethiopia (Part 2 - this report) and India and Pakistan (Part 3).

A Conceptual Framework for Dairy Development

As a simplistic description of the beginning and end points of the dairy development process, two stylized representations of dairy systems are used:

- the ‘traditional model’ (also known as the small-scale subsistence or Southern tropical model) to reflect the small-scale, farm-household milk production and informal market systems that predominate in most developing countries; and
- the ‘commercial model’ (also known as the large-scale industrial or Northern cold-chain model), representing the large-scale industrialized production and integrated marketing that is observed in developed countries.

It is important to note that elements of both models will often occur simultaneously in both rich and poor country settings. The characteristics of these models are described below and reflect both farm and market differences.

Characteristics of ‘traditional’ milk production systems include:

- multi-objective household model of farmer behaviour
- low levels of inputs and outputs
- nutrient deficit in both farm and household

Characteristics of ‘commercial’ milk production systems include:

- single objective enterprise model of farmer behaviour
- high levels of both inputs and outputs
- nutrient surplus in both farm and household

Characteristics of ‘traditional’ milk marketing systems include:

- diffuse market structure, consisting of many small-scale market agents

- artisanal processing, labour-intensive handling and transport methods
- low-cost products, mostly liquid and limited in diversity
- great diversity in market behaviour and roles
- no voice or role in dairy policy making

Characteristics of ‘commercial’ milk marketing systems include:

- concentrated market structure, consisting of relatively few, large-scale, vertically-integrated market agents
- industrial processing, based on capital-intensive technologies at all market levels
- value-added products, mostly non-liquid and diverse
- little diversity in market enterprise types
- loud voice and large role in dairy policy making

At the heart of this process is the shift from a multi-objective farm-household activity to a focused-objective enterprise activity. The conceptual framework poses a number of factors that drive this shift. These include:

Demand levels and consumption patterns, which are closely associated with income growth and urbanization and with local consumption traditions. Milk is not a commodity but rather a complex set of products, the demand for which is determined by:

- increased demand for quality, food safety and standardization
- changes in consumption habits and lifestyles
- *demand for convenience*
- *changes in levels of demand*

Opportunity costs of labour and land are also key driving forces for system change, which tend to bring about a substitution of capital for both of these factors and a general shift towards commercial systems. Aspects of this include:

- opportunity costs of labour in milk production
- opportunity costs of labour in milk markets
- opportunity costs of land

Market access, infrastructure and institutional development condition the structure and performance of production systems for a highly perishable product. Elements of these described in the report include:

- transaction costs and infrastructure
- transactions costs and institutions
- transaction costs and location of production

Finally, *technology and policy interventions* can alter the opportunities and incentives for dairy system change and development. Generally, improved technology will reduce costs and induce shifts towards more commercial systems; adapting to changes in other factors will be dependent on the availability of technological alternatives, either existing or new. Policies - deliberate or inadvertent - for market regulation and infrastructure investment can alter market institutions and transactions costs. Critically, policies can partially determine the winners and losers of structural changes in the sector, determine market participation of smallholders versus larger producers and employment generation and incomes at both farm and market level.

Impacts of Dairy Development on the Poor

While development, meaning commercialization, of the dairy sector is favourably viewed by policymakers, it should be understood in the context of the contribution of livestock production to livelihoods and income generation for smallholder farmers through the production of higher-value products compared to most crops. Of key importance are the differences in policies that can condition those outcomes in terms of benefits to different communities and social groups. Elements of the outcomes for the poor include income and employment generation, which includes both self-employment of farmers and market agents but also hired labour on farm and in the market. Less tangible returns to milk production include the value of livestock assets for finance and insurance functions.

Dairy development is also linked to nutrition, both among farm families and resource-poor consumers of dairy products and also on farm in soil nutrients. Consumption of even small amounts of milk can have dramatic effects on improving the nutritional status of poor people and is especially important for children and nursing and expectant mothers. Further, as long as low soil fertility remains the primary constraint to agriculture in most developing countries, manure from dairy cows can provide a critical source of organic matter and nutrients, boosting smallholder's crop yields on farms where chemical fertilizers are often unavailable and unaffordable.

Policy interventions, as well as market forces, can help to determine whether dairy development follows more or less equitable development paths. An equitable development path occurs when shifts towards farm and market commercialization are associated with increased alternative opportunities off-farm, in urban areas and in alternative agricultural enterprises or industries. An inequitable development path occurs when increased commercialization at farm and market levels are associated with reduced opportunities and alternatives for small-scale farmers and market agents.

Measuring Dairy Development

Our conceptual framework has at its core the shift from labour intensive practices towards more capital intensive practices, both on farm and in market, due to increased opportunity costs of labour. That shift also implies higher productivity of labour. The stages of change between traditional and commercial can thus be measured in terms of labour productivity; if we equate that change with 'dairy development' we can use labour productivity as a general proxy for dairy development, reflecting changes in all parts of dairy systems. Due to data limitations, that productivity measure will take several different forms in the analyses that follow.

Comparative Trends in Dairy Development among Countries in East Africa and South Asia

These two regions represent some of the most important dairy development zones among poorer countries globally. Within them occur countries where dairy production and consumption has a long historical tradition and has been an important part of agricultural systems. In other countries in the same regions, however, dairy production has been a less significant enterprise, often for cultural reasons but also due to limited potential. These regions thus present an excellent framework for understanding both the driving factors and the pro-poor implications of dairy development and of related policies and interventions. Data used from five South Asian countries and ten East African countries, based on FAOSTAT and the World Bank's World Development Indicators database, is used in a regional analysis of comparative trends in milk production. Milk production is used as a proxy for dairy

development. Explanatory variables include proxies for various aspects of demand and market development, inputs and labour markets, technology and human capital, infrastructure and transaction costs and policy.

Summary of Results of Regional Analyses

East Africa. Demand-related factors play a key role in explaining development of the dairy sector in East Africa, as shown by the significant contribution to growth of demand-related factors in the three countries with the fastest growth in milk production (Sudan, Kenya and Uganda). Development of formal milk markets, input markets, technology and policy do not explain the differences between fast-growing countries and the rest. This suggests that adjusting supply to type and quality of products demanded, expanding demand by reducing consumer prices and reducing transaction costs should be a necessary condition to expand the dairy sector in East Africa.

South Asia. The dairy sector in South Asia is following a different path. Consumption of dairy products is higher on average than in East Africa and demand-related factors have been contributing to growth in the dairy sector for the past 30 years in all countries. Differences in growth are more related to the possibility of expanding supply to match the growing demand of dairy products. India and Pakistan were able to link the transformation in agriculture originated in the Green Revolution to successfully expand production and output; this is reflected in the contribution of input markets and technology to growth in milk production. In the case of countries with slow growth in milk production, such as Bangladesh and Nepal, development of cereal production, feed markets and a growing demand did not translate into technical change in the dairy sector, as was the case in India and Pakistan. The policy environment in these countries is also less favourable than in the fast-growing countries. Sri Lanka's constraints to growth in the dairy sector appear to be mainly on the supply side. As in East Africa, development of formal milk markets in South Asia is not associated with increased growth rates.

Country Case Studies from South Asia and East Africa - Kenya, Ethiopia, Pakistan and India

These four countries represent a range of production conditions, histories and policy environments related to dairy development: India and Kenya are also held up as examples of 'successful' dairy development. Where available, detailed provincial and district data were gathered from each country on dairy development and its potential determinants. Data were analysed using similar approaches to those applied in the regional analysis, outlined above. Due to severe data limitations, relatively complete analyses were only possible in Kenya and in India. Data were also gathered from farm and market level on income and employment generation in different scales of dairy enterprises.

The results exhibit more similarities than differences. Of importance to dairy development in all cases are the roles of demand growth, the traditional market and availability of improved dairy animals. Policies related to investment and trade show mixed results. More detail from the four country case studies can be found in Part 2 (Kenya and Ethiopia - this report) and Part 3 (Pakistan and India) of this series. The final synthesis of the regional and case study results, summarized below, highlights the main outcomes from all the analyses.

Synthesis of Regional and Country Results: Defining an Agenda for Pro-Poor Dairy Policy and Development

Synthesis of Key Lessons for Dairy Development and Policy

Demand-side change

The analyses highlight the importance of growth in consumption and demand, brought about either through growth in GDP per capita or exports, or through increased urbanization.

Supply-side interventions can, in some cases, be over-credited with bringing about growth. The Indian milk revolution, for example, may be largely a result of demand-side forces, although the technical and agricultural sector factors discussed below played a key role as well. Unless these facts are understood, there may be overemphasis on supply-side interventions that have not been demonstrated to bring about development in some cases.

Clear understanding of potential market trends and opportunities is needed for policy and planning in the dairy sub-sector. Because demand is highly conditioned by local perceptions and traditions regarding dairy consumption, this understanding should be pragmatic and based on local realities, not on assumed duplication of trends observed elsewhere. Where poor people play a large role in the consumption of dairy products, interventions to support the provision of low-cost products are likely to simulate dairy development.

Interventions to facilitate better, more efficient supply-demand linkages are also likely to have positive impact.

Supply-side change

Improved dairy animals and other farm technology. A consistent and clear outcome of the analysis, both at the regional and country-case levels, is that nearly all strong dairy development growth scenarios are associated with *technical change in terms of yield per animal*. Genetic improvement has obviously had dramatic impact on development and growth.

- Clearly, use of exotic cattle genes is a rapid and potentially sustainable path to higher productivity, even among small-scale and resource-poor farmers and in warm, semi-arid or humid climates. At the same time, the failures caused by importing high-grade animals should be noted and avoided.
- National and local breeding strategies need to address the realities of climate and disease risk. Given appropriate breeding strategies and disease control measures, however, it is possible to develop and sustain cross-bred dairy production systems; such systems have often played a key role in dairy development.
- Although it is difficult to capture the role of fodder technology in the aggregate analyses in this study, for the Kenya case it was possible to demonstrate that planted fodder technology played a key role in growth in dairy productivity.
- Research has shown that the ‘appropriateness’ of intensive fodder production is much more likely to depend on availability of cheap labour, scarcity of land and good access to milk markets, than it is on agro-climatic setting. Where labour is scarce, evidence shows that intensive fodder cultivation practices and feeding of crop residues to cattle, unless mechanized, are unlikely to be taken up. Interventions to promote those should pay very close attention to labour opportunity costs.

- Where relative land and labour values constrain uptake of specialized fodder technologies, a potential avenue for increased productivity is through improved ‘food-fodder’ crop varieties, bred to increase the fodder quality and digestibility of the straws and stovers they produce.

Agricultural sector growth

In some regions and countries, general agricultural sector growth and transformation was shown to play a role in dairy development; for example India and Pakistan were able to link the transformation in agriculture originated in the Green Revolution to expand milk production. The link with the agricultural sector is not as evident in some other South Asian countries or in East Africa. Productivity change in those cases may continue to rely on fodder technology, given the low opportunity costs of labour.

Traditional milk and dairy product markets. One of the key findings of the study is that traditional/informal milk markets have apparently played a key role in dairy development in both regions and in most countries. In countries with the strongest growth, such as Pakistan, India, Sudan and Uganda, traditional, small-scale markets control over 80% of marketed milk; there is no evidence that this basic structure will change significantly in the next few decades. These facts, which are often overlooked because traditional markets are generally not reflected in national dairy industry statistics, pose several important implications for dairy policy and development.

- All the evidence suggests that the traditional market dominance is not a result of lack of investment in formal market channels, or of non-enforcement of national milk standards; rather they are the result of continued strong *demand* for the products and services that they offer. As a consequence, in many cases, investment in formal dairy processing facilities, both in the private and public sectors, have failed leading to underutilized capacity surviving on subsidies or abandoned milk processing plants and cooling facilities.
- In some cases there is strong demand for traditional products by high-income consumers as well as the resource poor; growth in disposable income may not necessarily significantly reduce demand for traditional products.
- The analysis in this study does not support the view that formal market structures are required to stimulate dairy development. One of the countries in this study with the strongest growth, Pakistan, displays a negligible formal market share. In East Africa, the analysis suggests a *negative association* between formal market share and dairy development, as measured. This is likely to be because formal market share in that region was less a result of market forces but rather due to public investment decisions. Also, poorly managed formal market institutions provided a much less effective link between farmers and consumers than the traditional informal market.
- Traditional informal markets have clearly provided an effective, functional link between farmers and consumers which responds to consumer demand: they should not be regarded as market failures. Moreover, such markets are generally those most often serving the needs of small-scale farmers and resource-poor consumers. The analysis has also demonstrated the large and positive employment implications of such markets.
- Public policy-makers should engage constructively with traditional markets rather than oppose them directly, particularly as demand for food safety may grow with increases in disposable income. Policies that allow the continued functioning of such markets, but which support increased quality and food safety, are likely to be pro-poor in nature. Policies that simply oppose and attempt to police such markets are likely to impact negatively on small-scale farmers, consumers and small-scale market agents.

Dairy co-operative development. Mixed messages emerge from the analysis of the two countries where co-operatives have played a significant role in dairy development: Kenya and India. In Kenya, evidence suggests that dairy co-operatives played a significant role in fostering dairy development, primarily by providing a stable market environment and delivering services to farmers. In India, there was no empirical evidence that co-operative development was associated locally with dairy development as measured, although it were found to be associated with genetic improvement in dairy animals.

- Dairy co-operatives may play an important role in providing a base for service delivery to farmers, stable agricultural knowledge systems for uptake of improved technology and increased management skills among farmers.
- There is no empirical evidence that dairy co-operatives are more effective than other market channels in linking poor farmers to output markets. Pakistan illustrates very dramatically that strong market growth can occur in the absence of dairy co-operatives.
- The mixed experience suggests that dairy co-operative development is heavily dependent on good co-operative management, honest and effective investment of resources and accountability to the interests of the farmer members. Political and governmental influence in co-operatives needs to be minimized.
- Further, dairy co-operatives often cannot easily tap into the strong demand for traditional products and raw milk and generally remain tied to demand for formally processed products. While traditional demand remains the driving force, dairy co-operatives face the same growth impediments as the formal private sector.
- Investment in dairy co-operative development can be effective and pro-poor - if it is well-managed, placed outside strong political forces and is linked to strong demand. Because of these constraints, dairy co-operative development should not be the primary focus of dairy development efforts; rather it should be part of a mix of market channels, including formal private sector and small-scale traditional.
- Other less formal forms of farmer groups, such as self-help groups, could play important roles in some local cases.

Smallholder competitiveness. There is ample evidence to suggest that smallholder dairy producers are generally competitive and are likely to endure for some time, particularly where the opportunity costs of family labour and wages remain low. The most compelling evidence towards this is the continued dominance of smallholders in all the countries studied, even where there is steady economic growth. Furthermore, dairy as an enterprise is an option available to landless and socially marginalized groups.

- Policy-makers and development investors should resist the often-heard assumption that the role of smallholders is ending and that efforts should now be made to support larger-scale, 'more efficient' milk production to meet growing consumer demand. Instead, that growing demand should be used as a mechanism to help continue and sustain smallholder dairy enterprises.
- Smallholders may, in some cases, face increased barriers to participating in changing markets; alternative options, such as contract farming, should be explored and promoted where appropriate.

Public investment. Due to data limitations, the analysis was not able to show a link between agricultural research and development (R&D) and growth in dairy development, mainly because no measures of R&D investment specifically for dairy were available. In spite of the lack of strong empirical evidence in this analysis, it is reasonable to assume that investment in dairy R&D and provision of appropriate credit to smallholder producers will grow in importance, particularly as producers shift towards greater commercial orientation, increasing their demand for improved technologies and investment.

Trade policy. Imports and exports, as well as macro policy and level of openness of the economy, show very mixed results and cannot apparently be demonstrated to play a consistent role in the pace of development.

- Exports, as demonstrated in South Asia, may play a role in dairy development. Export opportunities might increase if, for example, EU export subsidies are curtailed as is expected, although barriers to entry remain significant.
- Countries that do not have a strong tradition of milk production and consumption, such as Sri Lanka and Bangladesh, are particularly susceptible to import competition. Supporting the development of traditional markets takes on the added feature of helping buffer domestic producers from imports.
- Even though trade in dairy products tends to receive a disproportionate amount of attention, perhaps because of issues of national pride and self-sufficiency, there is little evidence that trade issues are of major importance for the welfare of the large majority of producers, market agents or even consumers. The projections of the Livestock Revolution (Delgado et al. 1999, 2001) show very clearly that the demand growth and opportunities in milk is going to happen domestically rather than across borders.
- Policy-makers and planners would be well advised to focus their attention to the much larger and more dynamic domestic markets, rather than the smaller and less welcoming international markets.

An Agenda for Pro-Poor Dairy Policy and Development

The lessons learned from this analysis, as well as those gleaned from the other research cited, suggest some elements of what might be termed an ‘agenda for pro-poor dairy policy and development’.

Objectives of pro-poor dairy development include:

- employment creation in rural and peri-urban areas, both on farm and along market distribution and value chains
- reliable income generation and asset accumulation for resource-poor farmers
- provision of low-cost and safe dairy products to resource-poor consumers
- improved natural resource management and sustained farming systems through dairy cattle-mediated nutrient cycling
- improved child nutrition and cognitive development in resource-poor households

Elements of a model for pro-poor dairy development

Such a model would simply incorporate the lessons and recommendations outlined above, and so would include the following main elements:

- build on traditional dairy product consumption habits and preferences, at the same time as promoting demand for new products
- support development and evolution of traditional domestic markets for milk and dairy products, at the same time as promoting appropriate formal market development
- emphasize and support the role of smallholder dairy production as primary means of rural income generation and of sustaining the intensification of mixed crop-livestock systems:
 - appropriate improved animals and the systems required to deliver these to smallholders
 - fodder technologies and exchange mechanisms for fodder and crop residues

- institutional mechanisms for enhancing smallholder participation in growing local markets - co-operatives but also contract farming and other forms of farmer groups.

INTRODUCTION

This is Part 2 of a three-part series which presents the findings of an analytical study of dairy development in East Africa and South Asia. Part 2 consists of dairy development case studies for two contrasting East African countries, Kenya and Ethiopia. Part 3 consists of dairy development case studies for Pakistan and India.

Part 1 presents a conceptual framework for dairy development that provides the underlying structure and rationale for the analysis; a regional analysis of dairy development trends, looking at a national level over time across all the countries in the two regions; a synthesis of the outcomes of these analyses together with the findings of country case studies, highlighting implications for policy interventions and investment; and goes on to propose a model for pro-poor dairy development.

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History and Status of the Kenya Dairy Sector

Kenya has one of the largest dairy industries in sub-Saharan Africa. It has a well developed production and processing capacity based on over 5 million improved cattle. This is the largest such herd in Africa¹ with more dairy cattle than the rest of the countries in East and Southern Africa combined. In economic terms, the dairy industry is the single largest agricultural sub-sector in Kenya, larger even than tea; it contributes some 14% of agricultural GDP and 3.5% of total GDP (Muriuki et al. 2004).

Except during extreme drought years, Kenya is generally self-sufficient in milk and other dairy products. Annual milk production is estimated at about 2.4 billion litres, although the country has a domestic supply potential of 4 billion litres (Muriuki et al. 2003). About 64% of milk produced is marketed while 36% is consumed at home or fed to calves (Omore et al. 1999). Small quantities of dairy products are also exported to neighbouring countries. Smallholder dairy farmers, estimated to number over 1.5 million households, account for more than 85% of the annual total milk production and 80% of total marketed milk (Staal et al. 2001).

Dairy production is concentrated in the highland and high- and medium-potential areas of the country, occupying about 2.8 million hectares (GoK 1991). Ranking milk production by administrative provinces, Rift Valley produces 47%, Central and Nairobi 31%, Eastern 11%, Nyanza 6%, Western 4% and Coast 1% of total production, respectively. Besides growing crops for subsistence and commercial purposes, most dairy farmers keep up to three cows with their followers, typically on about one hectare of land in the intensively farmed high-potential areas and 2.5 hectares in the less intensively farmed medium-potential areas (Staal et al. 1998).

Dairy production systems largely entail mixed crop-livestock farming which includes other livestock (mostly poultry, sheep and goats), cash crops (coffee, tea and horticulture) and subsistence crops (maize, beans and vegetables). Since Kenya gained independence in 1963, significant changes in the dairy industry have occurred with a major shift towards smallholder production and marketing.

The livestock population is estimated at 10 million beef cattle, over 5 million dairy cattle and their crosses, 9 million goats, 7 million sheep, 800,000 camels, 520,000 donkeys, 300,000 pigs and 29 million chickens (Table 1). In the high potential areas with adequate rainfall and high population densities, exotic breeds of livestock and their crosses are kept for the production of milk, eggs and red and white meat on both smallholder and large-scale commercial farms. Where available land is limited, farmers use zero or semi-zero grazing systems and cultivate fodders for dairy cattle. In these areas, production is market-oriented. In the low potential areas, production is mainly by large commercial ranches, mostly keeping improved livestock meat breeds. In the arid and semi-arid areas (ASALs), indigenous livestock breeds, such as zebu cattle, are kept under pastoral and semi-pastoral systems.

¹ In the absence of a livestock census since 1969, the numbers of cattle and smallholder dairy farmers has been a topic of speculation. A recent rigorous projection exercise estimated much higher levels of both than had previously been reported (SDP 2005).

Table 1: Livestock population estimates (1,000s) in Kenya.

Province	Cattle	Goats	Sheep	Poultry	Camels
Rift Valley	4777	5893	4558	6032	172
Eastern	1826	2475	1048	3934	96
Nyanza	1516	800	737	5409	0
North Eastern	1018	783	421	236	520
Central	1012	271	478	4774	0
Western	936	161	172	2785	0
Coast	887	916	395	2157	59
Nairobi	23	19	9.5	2548	0
Total	11,995	11,317	7818	27,875	847

Source: 2002 Ministry of Livestock and Fisheries Development estimates. Note that these official figures are regarded as significantly underreporting the numbers of dairy cattle, as described in the text.

The supply-side of the dairy industry can be traced to the beginning of European colonization in the 1920s. At that time exotic (*Bos taurus*) dairy cattle breeds were introduced to the highlands, where moderate temperatures and good rainfall provided favourable conditions. Until the early 1950s, indigenous Kenyans were not permitted to engage in commercial agriculture and large-scale white settler farmers dominated dairy production. Following the State of Emergency in the liberation struggle in 1952 and the Swynerton plan of 1954, African farmers were allowed to own land, cultivate cash crops and keep improved dairy cattle. Over time, smallholder farmers have gradually come to dominate dairy production, which is partly attributable to the efforts of government (with the support of its development partners and the private sector) to promote dairy production and marketing using a variety of policy instruments and strategies. These include:

- regulatory framework
- feed prices and quality
- breeding and artificial insemination services
- tick control
- veterinary clinical services
- investment in research
- extension services
- pricing and taxation policies
- market and trade policy and promotion of marketing services, such as through co-operatives
- expansion of rural infrastructure (e.g. roads, electrification, water etc).

These efforts significantly contributed to the rapid growth of the dairy industry until the early 1980s, when inadequate government budget allocations caused the quality of services to decline (Omore et al. 1999). The demand for milk and milk products is influenced by many factors including changes in: (i) consumer prices, (ii) disposable

incomes, (iii) urbanization, and (iv) consumer preferences (taste). The effects of some of such variables as price and income are briefly reviewed later in the report.

This review suggests that policies have historically targeted achievement of national development goals in food security, employment and income generation. These policies have influenced dairy production and marketing and have resulted in phenomenal increase in the contribution of smallholder farmers to total national marketed milk production. The policies have affected land tenure (transfer and subdivision from settler farmers to smallholders), deregulation of input and feed prices, decontrol of producer prices and government divestiture in the provision of public services (Nyangito et al. 2003). This has enabled a considerable increase in private sector investments in feed production and distribution, privatization of delivery of veterinary services and private sector involvement in milk processing and marketing. There are still, however, areas that require both public and private sector participation to revitalize the dairy industry further.

Production Level Policy Issues

Legal and Statutory Framework

A conducive legal regulatory framework is important in facilitating growth and development in the dairy industry and economy. The regulatory framework for the dairy industry consists of various laws enacted in a number of legal documents, not all of which are necessarily harmonized. These acts include the Dairy Industry Act (Cap 336, Laws of Kenya) enacted in 1958, which established the Kenya Dairy Board (KDB) to regulate the dairy industry. The act has been revised in the past (1962, 1972 and 1984) with the aim of improving sectoral performance in the dairy industry. Changes in the legal framework to support changing policy circumstances have generally lagged significantly behind various public policy pronouncements from senior government officials; nonetheless the latter are often taken as 'official policy' and implemented by officials on the ground. The Dairy Industry Act has been under a stop-go revision process from 1997 to 2005, but has yet to be finalized and sent to parliament.

The main functions of the KDB include: (i) licensing of retailers, (ii) controlling of milk movement and quality, and (iii) appointment of dairy inspectors. However, the KDB lacks the necessary resources (personnel, laboratories and operational funds) to effectively implement its mandate (Muriuki et al. 2003). Other bodies charged with regulating the milk market, such as the Kenya Bureau of Standards (KEBS) and the Department of Public Health of the Ministry of Health, seem to experience similar weaknesses.

Another important regulation is the Co-operative Development Act (Cap 390, Laws of Kenya), which governs all dairy marketing co-operatives. Despite good performance in many cases, most dairy co-operatives have not allowed sufficient farmer participation in their management. The act was revised in 1997 to ensure greater farmer control and less government intervention. In early 2004, it was again revised to promote the contribution of co-operatives to economic recovery and development, but this process has not been completed.

The Companies Act (Cap 486, Laws of Kenya) is another important legal and policy framework that provides for registration of companies engaged in various business transactions in the milk supply chain. These include: (i) registration and licensing of milk processors, (ii) licensing of retailers, (iii) regulations of milk transportation, and (iv) inspectors' regulations (by KDB). Violation of these regulations is liable to prosecution.

Another statutory body, KEBS - established under the Standards Act, CAP 496, Laws of Kenya - promotes adherence to standards in industry and commerce and undertakes educational work in connection with these standards. These standards are intended to safeguard both consumers and producers for product quality and for fair commercial dealings. KEBS has specified the methods of analysis to be followed for various products (including dairy products) and has powers to enforce these standards, by prosecution if necessary.

Generally, the policy environment has been evolving since the early 1980s when various reforms were introduced which stressed less government participation in markets for various goods and services. However, most legislative processes have not kept pace with changes in policy directions, such as new thinking introduced through Poverty Reduction Strategies. As a result, there is now a tangle of more than 20 delayed bills in parliament that have some relationship to agriculture and livestock. Changes in policy implementation tend to occur not through changes in legislation but rather through changes in interpretation and implementation, which seems to be allowed considerable flexibility. Some of the regulations that are contradictory to new policy directions are ignored, while others are not enforced due to lack of adequate human, physical and financial resources.

Feed Prices

Until 1987, feed prices were controlled by the government through powers vested in the minister charged with livestock. The Kenya Farmers' Association (KFA) enjoyed a legal monopoly in the marketing of animal feeds. To reduce the cost of animal feeds, the government waived duty on imported feed ingredients and no additional taxes are levied on manufactured feeds. Price deregulation in 1987 resulted in increased participation in processing and distribution of animal feeds by both the private sector and co-operatives throughout Kenya (Mbugua 1999). There is now generally greater feed availability and usage in most parts of the country, although its quality is sometimes suspect. Lack of capacity to enforce regulations has created an environment that fails to deter or penalize manufacturers from supplying sub-standard feeds; variation in feed quality remains a critical constraint to increased farmer confidence in and use of concentrate feeds (Muriuki et al. 2003).

Animal Breeding Programmes

Animal breeding programmes have aimed at improving dairy productivity, shortening calving intervals and enhancing herd fertility by minimizing breeding diseases while eliminating the cost of keeping a bull (Rege et al. 2001). The rapid and widespread adoption of exotic (*Bos taurus*) dairy cattle has been a striking and positive feature in the history of livestock development in Kenya, beginning with their introduction by colonial settler-farmers in the early 1900s. While annual milk production for local zebu breeds (*Bos indicus*) ranges between 100 and 200 litres per cow, cross-bred or grade dairy cattle in Kenya produce some 1400 to 1700 litres per year on smallholder farms, more on larger commercial farms. These figures lag behind the genetic potential of the cattle, but still yield good profits to smallholders. As has been demonstrated in numerous developing country settings, exotic breeds of cattle when crossed with local breeds can significantly improve milk yields in a sustainable manner. Finding an appropriate exotic-local breed mix has been, at least nominally if not actually, the principal objective of various dairy-breeding initiatives by the Kenyan Government and other development agents.

While there is no explicit animal breeding policy in Kenya (unlike Uganda which developed a comprehensive National Animal Breeding Policy in 1997), various livestock and other generic policy statements have provided some direction for the breeding

programmes in Kenya. For example the National Livestock Development Policy (1980) provided some brief guidelines, including:

- expanded breeding and selection through wider use of artificial insemination (AI) and bull camps
- expansion of the dairy herd and increased productivity per cow under intensive production systems through breeding and selection
- expansion of services including:
 - dairy recording
 - registration of cattle
 - bull evaluation (progeny testing)
- rearing of bull calves from best parents under extension service supervision
- exploitation of government institutions and farms for stock breeding and multiplication of high-quality cattle
- production of high-yielding disease-resistant cattle types supported by necessary input and services.

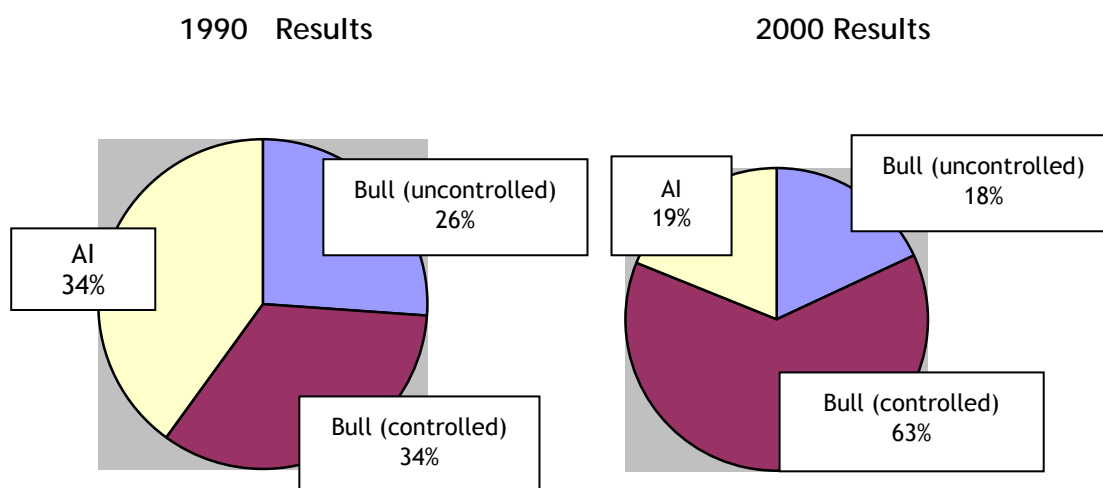
To a large extent these policies were implemented in the early 1980s when the government was still subsidizing agriculture: for example through the establishment of government multiplication farms and recording and progeny testing. However, most of these effort failed and broke down from the late 1980s and 1990s, either through lack of resources and management, or though the withdrawal of support during the liberalization process.

Cattle breed improvement initiatives started almost a century ago when European settlers first introduced dairy cattle breeds in Kenya. The Kenya Stud Book was established to keep animal breeding records in the early 1920s. Since then, major cattle breeding-related activities have been introduced. These include the Livestock Recording Centre, to keep livestock statistics and performance; Dairy Recording Services of Kenya - formerly Kenya Milk Records - to keep milk performance data; Central Artificial Insemination Station (CAIS) to produce semen; and the Kenya National Artificial Insemination Service (KNAIS) to distribute semen (Conelly 1998). To assist further the adoption of the higher-yielding inputs and enhance dairy productivity, duties were waived on imported semen and embryos. However, the breeding efforts were not well coordinated and they suffered perpetual financial problems that rendered the breeding programmes ineffective.

Artificial insemination (AI) services were introduced in the 1940s, with motorized daily runs and frozen semen. Initially the AI programme was quite successful, especially amongst smallholders, and the Swedish Government was a major external financier. However, AI services did not escape the general problems of high operational costs and subsequent subsidies; its decline started in 1979, with government inseminations falling from 548,000 a year to around 60,000 by 1997 (Figure 2). This drop was accelerated by the progressive increase in the subsidized price of an insemination from KES 1 (about USD 0.05-10 depending on the year) that had been set in 1971, to an average of KES 580 for locally produced semen today (some USD 7.25) post-privatization, and double that for imported semen.

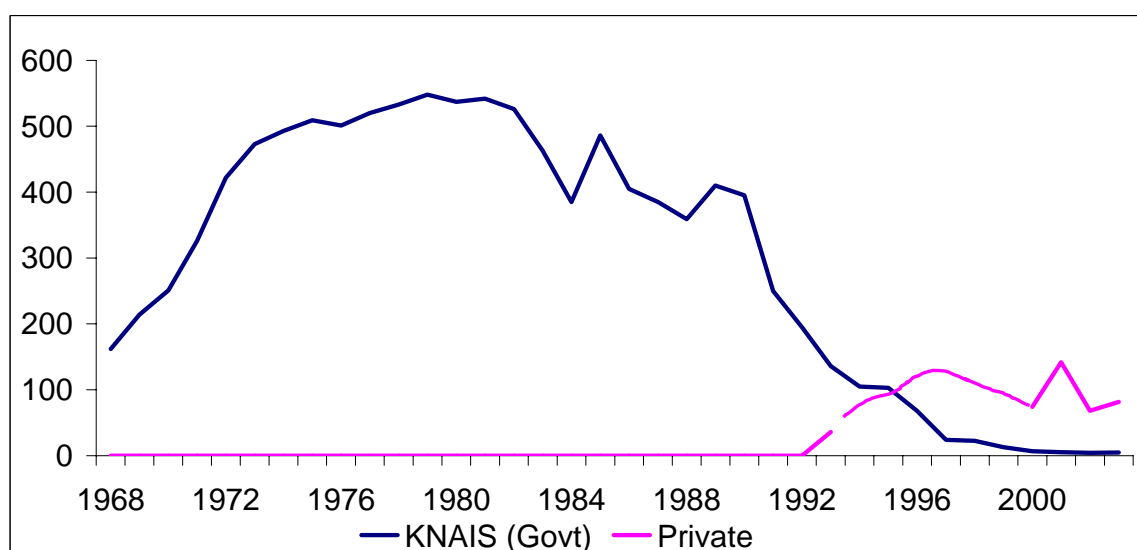
In order to deal with these problems and as part of a wider agricultural liberalization policy, the government decided to privatize AI service provision in 1991. It also licensed private companies to import genetic material. However, the private sector has not grown sufficiently to replace the government service and many farmers are resorting to bull services of unknown quality. Figure 1 shows the dramatic shift from AI to bull service between 1990 and 2000 by highland dairy farmers.

Figure 1: Breeding services used by dairy farmers in Kenyan highlands.



Source: Baltenweck et al. 2005.

Figure 2: Trends in annual artificial insemination services (1,000s) in Kenya.



Source: ILRI/KDDB Breeding Assessment Newsletter- Nov/ Dec 2003

In addition to licensed AI providers, who are mainly vets, a few private large- to middle-scale commercial farms and co-operative societies run their own AI schemes using semen bought from CAIS. Since 1997, however, private provision of AI services has fluctuated, raising concerns regarding the manner of privatization and continued government involvement in AI service delivery.

There is now considerable concern as to how to revitalize AI services within a liberalized environment in order to enhance dairy production in the country. The main issues affecting the breeding services revolve around:

- lack of harmonization of breeding organizations and activities

- government policy of not licensing inseminators trained by the private sector (only those with government training)
- perceived high failure rates in AI services
- high cost of private AI services - where these are available
- lack of availability or systems to produce stabilized crossbreed semen
- need for proper formulation of effective and viable bull schemes in areas where efficient AI is impossible or uneconomical
- need for a national breeding policy.

The strong legacy from the colonial era, including AI, recording systems and breed societies, provided the impetus for a strong genetic improvement system. Encouragement from the government, with external support particularly from Sweden, led to widespread uptake of improved cattle among smallholder African farmers. However, the liberalization and privatization process and lack of finance to government-supported institutions have led to significant decline in the ability of support services to sustain genetic improvement and in use of AI by farmers.

Tick Control

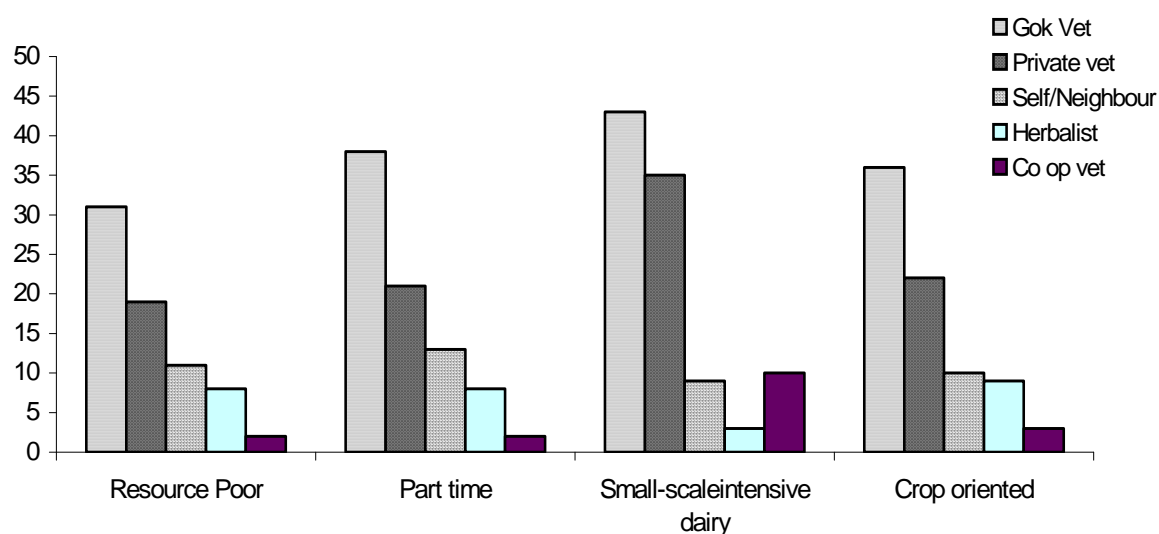
One of the primary disease threats to dairy cattle in Kenya, particularly those with exotic genes, is East Coast fever (ECF) - a tick-borne disease which causes significant mortality. The practice of cattle dipping started in 1912 to control ticks and other disease vectors. Among smallholders, communal dips were the main approach in tick control programmes after independence; by 1987 there were over 6000 dips in the country. Disease and vector control programmes were a major source of success in the dairy industry, although their management was not very efficient. Following the collapse of government-run dip services, dips were handed over to local communities and were run by community management committees on a revolving fund basis (Omiti and Muma 2000). The success of this arrangement has been mixed to poor; some have reverted back to government supervision but with no improvement in service provision and less than half of communal dips were reported to be operational by the end of 1997 (Omore et al. 1999). Many farmers have opted to use hand-sprayers due to the decline in dipping services.

Clinical Veterinary Services

Due to the increasing dominance of smallholders, in 1974 the first veterinary clinical centre was opened to cater for them. By 1978, eighteen clinical centres were in operation, expanding to 284 by 1995. Clinical services operated with strong public sector support, including government-employed veterinarians and nominal charges for drugs. In 1988, the government started to gradually increase the rate of cost recovery as well as encouraging the establishment of private veterinarians. Since the liberalization period of the mid 1990s, public intervention has focused on retaining surveillance and prevention of notifiable diseases, such as anthrax, contagious bovine pleuropneumonia (CBPP), ECF, foot-and-mouth disease, heartwater, lumpy skin disease and rinderpest. Since that time, clinical services have been left almost entirely to the private sector, with little attempt to support or coordinate the privatization process. As a consequence, privatization of veterinary services has been generally slow and patchy, especially in areas with low concentrations of dairy cattle (Oruko et al. 2000). It is generally agreed that public-good disease control interventions, such as vaccination, should be supported by government veterinary

services and public resources. In terms of clinic services, the current policy is to provide public support to clinical services for producers in ASALs who depend heavily on livestock yet may not have resources to pay for services. In marginal localities on the fringes of the highlands, a mix of public and private service provision is intended, with eventual withdrawal of public support. In intensive high-potential areas, the private sector is expected to provide all clinical services. Today, reliable access to clinic veterinary services is nevertheless problematic and variable for different types of dairy producers. Recent analysis (Baltenweck et al. 2005) shows that up to 30% of farmers have no access at all to veterinary services; the most resource poor have the least access, with only some 30% of that category reporting reliable access to veterinary services (Figure 3). Cost and quality of clinical services affect dairy productivity and are an important area of development policy concern.

Figure 3: Sources of veterinary services for different categories of dairy producers in the Kenya highlands.

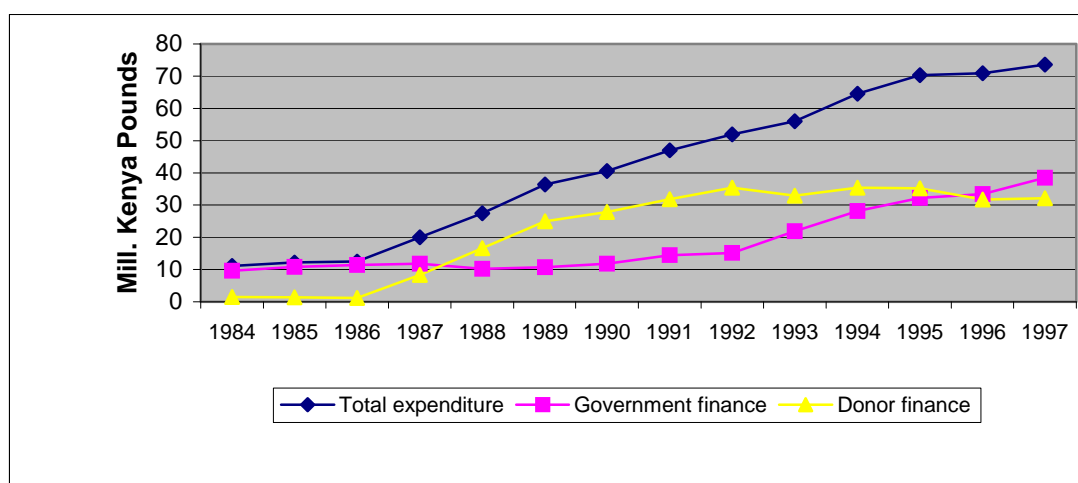


Source: Baltenweck et al. 2005 (based on SDP household surveys, 1997 - 2000).

Investments in Dairy Research

By sub-Saharan African standards, research in agriculture and the livestock sector in Kenya has been relatively well funded (Beynon et al. 1998). Although donor funding in agricultural research has been declining over the years (Figure 4), government investment has increased, leading to steadily increasing expenditure during the 1980s and 1990s. Data for investment specifically in dairy research are not available, but would be expected to be a relatively significant part of general agricultural research investment.

Figure 4: Expenditure trends in agricultural research (million Kenya Pounds).



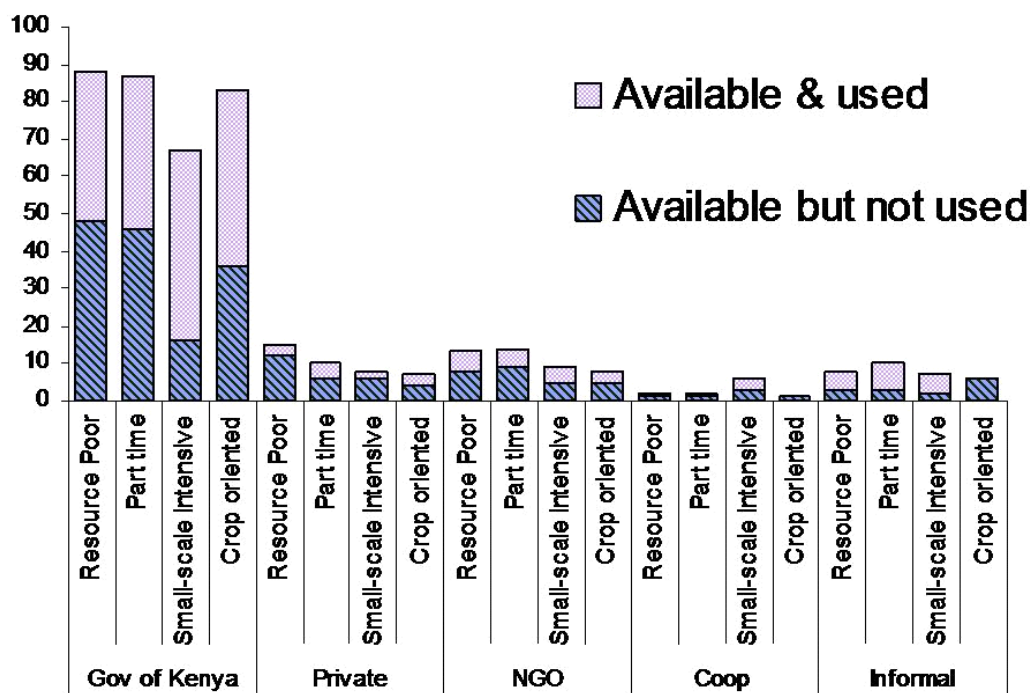
To improve the effectiveness of research in Kenya, in 1989 agricultural research activities were reorganized under one umbrella organization - the Kenya Agricultural Research Institute (KARI). Thematic priorities in dairy research are: i) socio-economics, ii) feed resources and utilisation, iii) animal health, and iv) animal breeding/genetic improvement (KARI 1991). KARI has started to encourage active participation by the private sector in addressing these priority research issues, including financing of research activities that benefit them. Of interest in the context of this study, the new KARI strategy gives particular emphasis to addressing agricultural policy analysis and advocacy.

Besides KARI, useful dairy research continues to be conducted at agricultural faculties at the University of Nairobi and Egerton University, the Trypanosomiasis Research Centre-KARI (formerly KETRI) and the Kenya Forestry Research Institute. The International Livestock Research Institute (ILRI) has been an active collaborator in a number of national dairy research activities including: (i) KARI/ILRI collaborative research activities on smallholder dairy in the coastal lowlands; (ii) KARI/ILRI/MoA collaborative smallholder research and development activities in the highlands; and (iii) field testing of animal health technologies. The World Agroforestry Centre (formerly ICRAF) is also involved in research aimed at improving natural resource management through the introduction of trees, including fodder trees.

Extension Services

Through national extension programmes, there has been much effort to improve dairy husbandry practices. Investments have also been made in training at university, diploma and certificate levels. Donor agencies have contributed greatly in enhancing the efficiency of extension services. Notable among these efforts was the National Dairy Development Project (NDDP) in the 1980s, funded by the Dutch government. However, during the general liberalization programmes of the 1990s, public resources for extension services, including livestock, were generally reduced. Recent research shows that, although most farmers report continued availability of government extension, many do not use those extension services, possibly reflecting lack of access (Figure 5).

Figure 5: Proportion of Kenya highland dairy farmers indicating availability and use of extension services from alternative sources.



Source: SDP surveys, 1997-2000.

Market Level Policy Issues

Overview of Pricing and Taxation Policies

For most of Kenya's post-independence history, producer and consumer milk prices were controlled by the minister in charge of livestock development and more recently through the KDB. Generally, the government would announce pan-territorial prices that applied across seasons for that year. In 1971, a dry-season price bonus was introduced to assist with livestock feeding during this challenging period, which usually occurs between the months of January and April. Price legislation continued until the advent of the economic reforms that led to price decontrols in 1992. After liberalization, real milk prices rose by 20-40 % between 1992 and 1994, but appear to have remained relatively stable since then (Owango et al. 1998).

There are other direct taxes that processors and consumers pay, such as value-added tax (VAT) on farm and processing inputs and dairy products such as fermented milk (*maziwa lala*), cheese, yoghurt and butter. Up to 1997, the dairy industry was zero-rated; this meant that VAT on some inputs was refundable. Now the dairy sector is duty-exempt; this is a cause of concern in the industry as, though it removes the requirement to collect VAT on milk product sales, it also removes the ability to recover VAT on inputs, thus increasing input costs.

The KDB also levies a quantitative monthly tax (cess) on all milk sold by a licensed party. Milk processors, milk bars, traders and co-operatives pay cess of KES 0.20 per litre handled. Failure to pay cess attracts a penalty equal to one-quarter of the amount of cess in default. Cess is intended to be used for dairy development activities, such as in the repair and maintenance of feeder roads; in practice its usage appears to leave a lot to be desired.

Milk Marketing

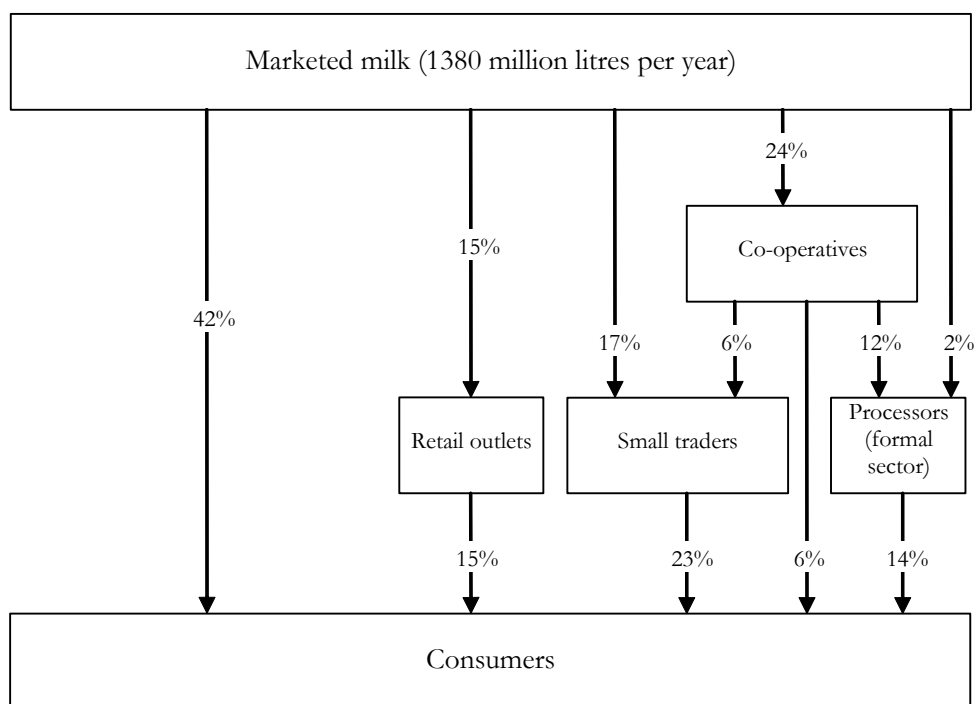
The Kenya Co-operative Creameries (KCC) was registered as a company in 1925 and in 1932 became a registered co-operative under the Dairy Industry Act (Cap 336, Laws of Kenya). After its first creamery was opened at Naivasha in the 1920s, KCC rapidly expanded to become the biggest milk processor: by the early 1980s it had 11 milk processing and another 11 milk cooling centres with a combined installed capacity in excess of one million litres per day. A few farmers' dairy co-operative societies (FDCS) also operate their own cooling centres, some established through donor-supported dairy development projects.

At this time, KCC had a government-mandated monopoly on all urban milk sales. Of milk supplied to the KCC, 34% came from large-scale producers, 54% from small-scale producers through their co-operatives, and 12% from individual small-scale farmers who supplied KCC directly. The KCC was regarded as the milk buyer of the last resort, although it was not able to accept all the milk offered for sale during 'flush periods' due to plant capacity limitations. Surplus milk was made into skim-milk powder and butter and also ultra-high temperature treated (UHT) milk for distribution to more remote areas and also primary schools under the School Milk Feeding Programme.

In May 1992, reforms took place in the industry and price controls were abolished to create a competitive self-sustaining dairy industry, characterized by increased private sector participation (Owango et al. 1998). The liberalization was interpreted to also imply the lifting of the KCC's urban milk monopoly, although that was never explicitly decreed. With liberalization, KCC milk intake showed a downward trend that led to closure of most of its processing plants. New private processors, co-operative societies and informal milk traders became major participants in milk marketing. There are some 45 licensed processors handling less than 20% of the total marketed milk, while informal traders account for an estimated 38% of marketed milk: the balance is marketed directly to consumers by producers. Currently, the dairy industry has a processing capacity of 2 million litres per day; KCC has a capacity of 1.2 million litres per day with the balance in the private sector.

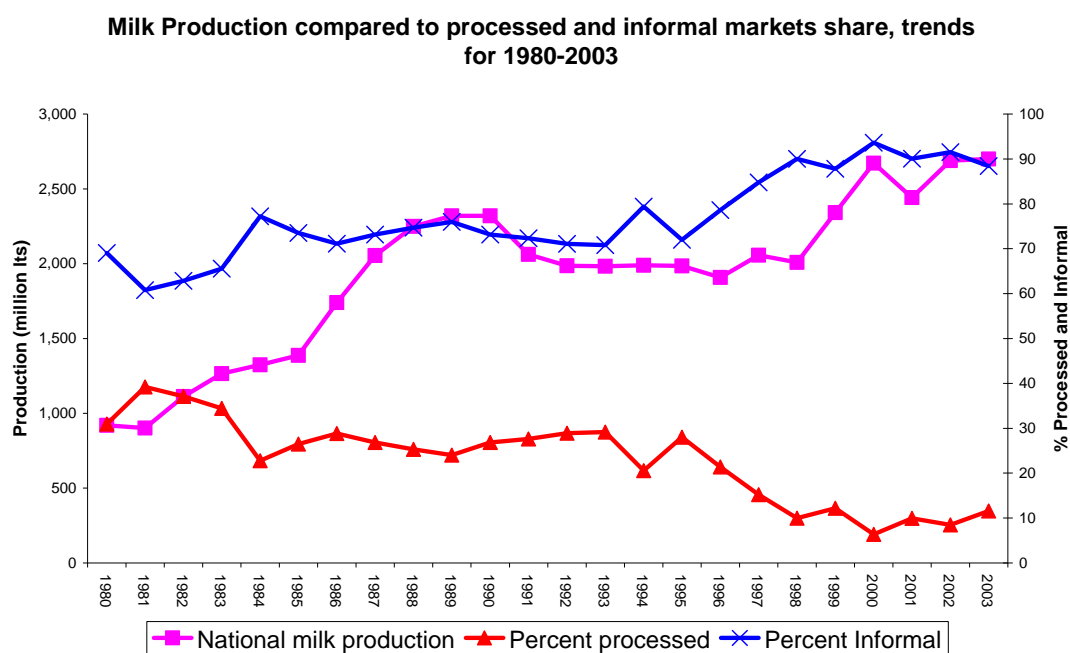
Informal milk marketing, or hawking, is especially important in rural areas although it also operates in 'zoned' (urban) areas, even though hawking has been considered illegal for a variety of reasons. The main participants in informal milk markets are dairy co-operatives, milk bars, middlemen/traders and farmers (Figure 6). The high proportion of raw milk sales directly to consumers and through informal traders is an indication not only of many consumers unwillingness to pay the extra costs of processing but also of strong traditional preferences for raw milk, which is generally boiled before consumption. Although the informal raw milk market grew after liberalization, it had always played an important role, contrary to the perceptions of many observers and industry players (Figure 7). What did change after liberalization was more open activity by raw milk traders and greater penetration into urban areas, particularly Nairobi - formerly the preserve of the KCC.

Figure 6: Milk marketing channels in Kenya.



Sources: SDP Policy Brief # 4 (SDP, 2004b), Public Health Issues in Kenyan Milk Markets 2004 Notes: Percentage marketed flows are calculated on marketed milk, not on total production.

Figure 7: Trends in milk production, processed and informal milk market shares.



Source: Government of Kenya and KDB data.

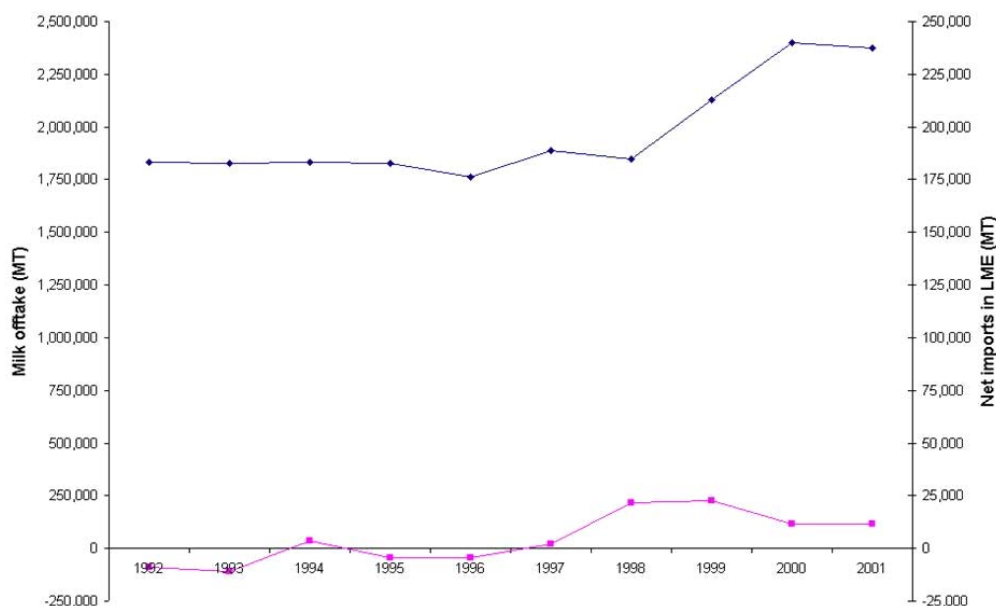
Regulation and licensing of the many players in the raw milk trade is a major policy issue. Although the dairy policy recognizes milk bars as a source of cheap (unpacked) and safe (pasteurized) milk, the dairy industry act does not. Although retail shops are licensed to sell pasteurized milk, many of them use the licence to sell raw milk. In the past, traders/middlemen and farmers have not generally been licensed to sell raw milk, although locally some authorities have granted such licences. Beginning in 2004, however, there was significant public policy debate in the media and among stakeholders about the role of raw milk markets for small-scale farmers and poor consumers. As a consequence and in the climate of a new reformist and pro-poor government, the dairy act is being revised to formalize raw milk marketing under minimum handling and packaging standards. This is regarded as a major pro-poor policy change, which is also now being adopted in other countries in the region, particularly Tanzania and Uganda.

Dairy co-operatives have played a critical role in milk procurement systems in some areas of Kenya. Where there are significant local milk surpluses that small-scale informal milk markets cannot handle, FDCs provide a functional means to access larger formal markets. There are about 200 dairy co-operatives in Kenya, although only about 70% are functional. In recent years, some members have abandoned their co-operative societies due to mismanagement and collapse and opted to either operate independently or form self-help groups. Nearly all FDCs sell raw milk locally at retail prices, supplying only the excess to processors for which they receive a lower price. Some FDCs joined the KCC as co-operative members so that they can supply it with the excess milk during flush production periods. Currently, however, most FDCs sell most of their output to private processors; these now occupy the largest share of the formal milk market but generally reduce prices paid during the flush season and sometime limit quantities purchased when supply peaks. The formal and the informal marketing subsystems have therefore become intrinsically linked.

Dairy Imports and Exports

Kenya has been generally self-sufficient in dairy requirements in the past and has not experienced significant importation of dairy products except during years of extreme droughts (Figure 8).

Figure 8: Total Kenya milk off-take and net imports, 1992-2001.



Sources: SDP Policy Brief # 3, Competitiveness of the Smallholder Dairy Enterprise in Kenya, (SDP 2004a.)

Kenya imports very small quantities of dairy products, usually less than 1% of domestic production (Muriuki et al. 2003). Between 1985 and 1997, annual milk powder imports averaged 1444 tonnes. Since liberalization of the industry, fresh milk and butter exports averaged 158 and 381 tonnes per year, respectively (Staal et al. 2002).

Local dairy processors import small quantities of milk powder regularly, presumably to use in processed products such as yoghurt, although they may also be reconstituting it into liquid milk. In spite of the relatively small scale of milk product imports, they are often targeted as being a primary source of concern to Kenyan farmers. The duty on such imports was raised from 35% to 60% in early 2002 in response to a fall in the milk prices paid to farmers in some parts of Kenya. However, milk imports during that period actually fell by half and the farm-level price fall was almost certainly due to unusually abundant rains during early 2002, which is usually a dry period (Muriuki et al. 2003). In general, the engine of the Kenya dairy industry is the domestic market and there is little evidence that trade policy will influence its fortunes.

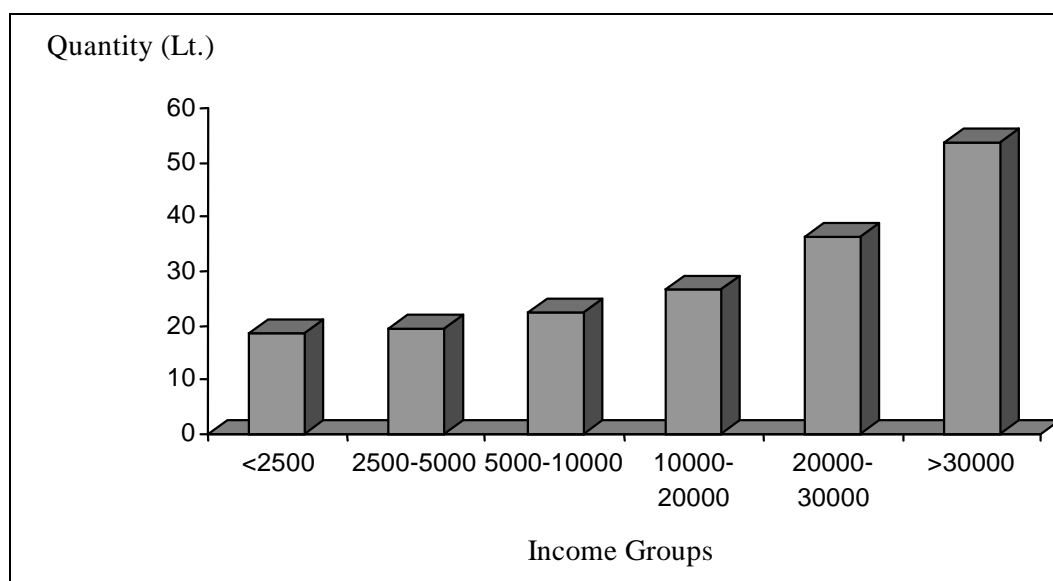
Dairy Consumption Trends

Kenya has amongst the highest levels of milk and dairy product consumption of all developing countries. Traditionally, dairy consumption is mainly in the form of liquid milk (as tea) with a high preference for raw milk even among high-income urban groups. Raw milk is regarded as superior due to its high butterfat content, appealing taste and lower price compared to pasteurized milk. Raw milk is generally 20-50% cheaper than pasteurised milk, making it more available to the poor.

The proportion of households consuming raw fresh milk (which is boiled before consumption), pasteurized milk, yoghurt and soured milk has increased in recent years. However, more households consume home-made fermented milk, butter, tinned condensed milk and skimmed milk than a decade ago (early 1990s). Some

products, such as milk powder and UHT milk, were more readily available in the past (Ouma et al. 2002), when KCC subsidized production of these products from surplus milk. Yoghurt consumption is increasing because it is more available as a result of the increase in the number of processors. When all dairy products are converted into liquid milk equivalents, consumption of liquid milk averages over 97% of total dairy products, with higher consumption in rural areas than urban areas. Rural households tend to consume more raw milk and less processed milk compared to their urban counterparts. Quantities of dairy products consumed increase as income increases (Figure 9) and the composition of the dairy products consumed changes with income changes (Ouma et al. 2000).

Figure 9: Average monthly consumption of dairy products per household by income groupings.



Source: Ouma et al. (2002)

Changes in population, urbanization and the ability to purchase food have changed food expenditure patterns over time. Kenyan households spend a large share of their budget on foods (56%), with an expenditure elasticity of 0.93 (Staal et al. 2002). Expenditure on services averages 23%, much lower than food expenditure. Although as expected cereals take the largest share in the household food budget, this is closely followed by dairy products (17% of food expenditure), underlining the importance of milk in the Kenyan diet. Estimates of per capita annual consumption of milk in Kenya range from 80 to 125 kg, depending on location, ethnicity and other socio-economic characteristics: for sub-Saharan Africa as a whole, per capita consumption is less than 25 kg. In terms of unit milk consumption per capita GDP, a crude proxy for share of income spent on milk, Kenya is surpassed globally only by Mongolia and Mauritania (FAOSTATS).

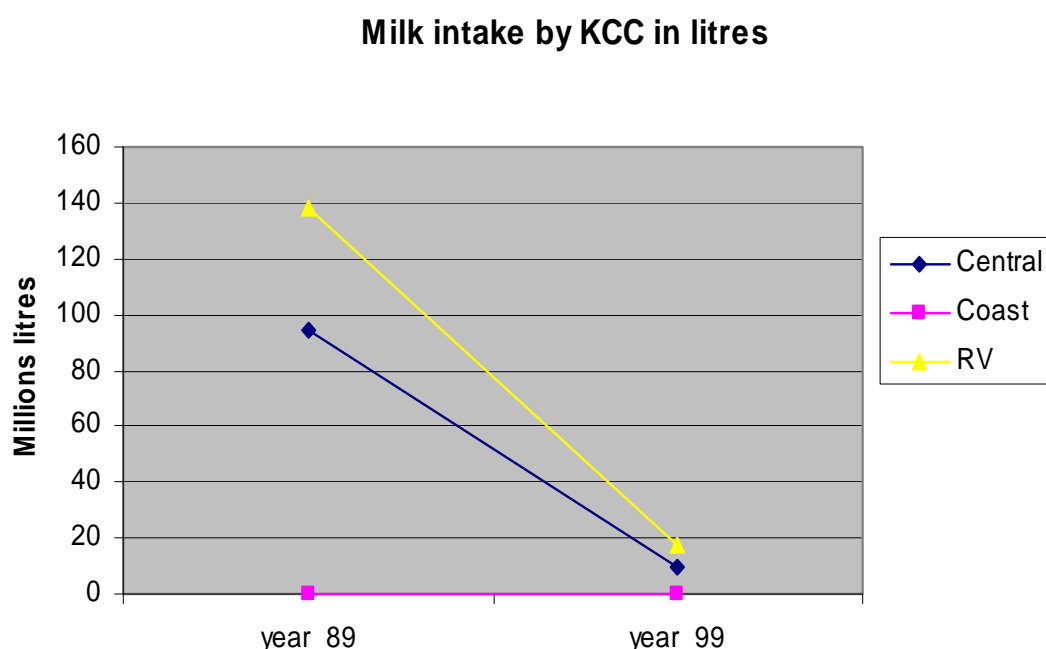
The budget share of raw milk is higher than processed milk derivatives among low-income households. This implies that consumption of more processed milk derivatives increases with income, depicting variations in purchasing powers across income groups. However, raw milk is highly income inelastic implying that demand does not change with changes in income levels. Demand for the highly processed dairy products is income elastic with an expenditure elasticity of 1.10; this implies purchase of more units with an increase in disposable income. This suggests that processed product

consumption will increase with increasing incomes, but that demand for raw milk will also be sustained, pointing to continued growth prospects for the raw milk industry in Kenya

Analysis of Recent Trends in Dairy Development in Kenya

The dairy industry plays an important role in the livelihoods of farmers, traders, processors and other participants engaged in the entire milk supply chain. In recent years, the industry has witnessed major changes in policy leading to substantial reduction in milk supplies to KCC, as described above (Figure 10). These changes have been due to a number of factors, including the removal of the KCC's monopoly and entry of other processors, but also due to increasing urbanization.

Figure 10: Changes in KCC milk intake, 1989 to 1999.



To understand better these changes, a regression model was fitted to capture these developments. Accurate historical data were very difficult to obtain, so the analysis is limited to a few points in time and regions. Data for the regression includes information for five regions: an aggregate of Central Province (not including Nyeri), and information for each of the following districts: Kajiado, Nakuru and Narok in Rift Valley Province and Mombasa in Coast Province. The database covers information for 1989 and 1999 only. As a proxy for dairy development, in a slight variation from the conceptual framework presented earlier in this report, the model uses as its dependent variable milk production per agricultural worker. The independent variables used are based on the conceptual framework. Due to extreme limitations of the types of data available, a more complete model was not possible.

The regression results indicate that the key factors associated with dairy development include: area under fodder production, urban population, enrolment ratio for primary school, percentage of household with electricity and trends in the rest of the economy (Table 2). These contribute significantly and positively to the change in the dependent variable (milk production per worker).

In spite of the apparent historical role of the KCC, milk intake by the KCC is not shown to be significant during the period analysed. This points towards the relatively small role played by the formal sector, particularly during the 1990s, and the large and important role of the informal sector. This suggests that dairy farmers can be motivated to increase production through a variety of market channels. For each additional percentage point of agricultural land put under fodder cultivation, milk production in the three provinces increases by about 0.9%. In the case of highland Kenya, the primary fodder for intensive dairy production is Napier grass (*Pennisetum purpurum*), an elephant grass that yields very high quantities of fodder per unit land. Similarly, for each percentage point increase in maize production, milk production in the three provinces increases by about 1.4%. This accurately reflects the fact that both green and dried maize stalks and stovers are key fodder sources for dairy production: a significant proportion of highland farmers depend on these by-products from maize in order to feed their dairy cattle.

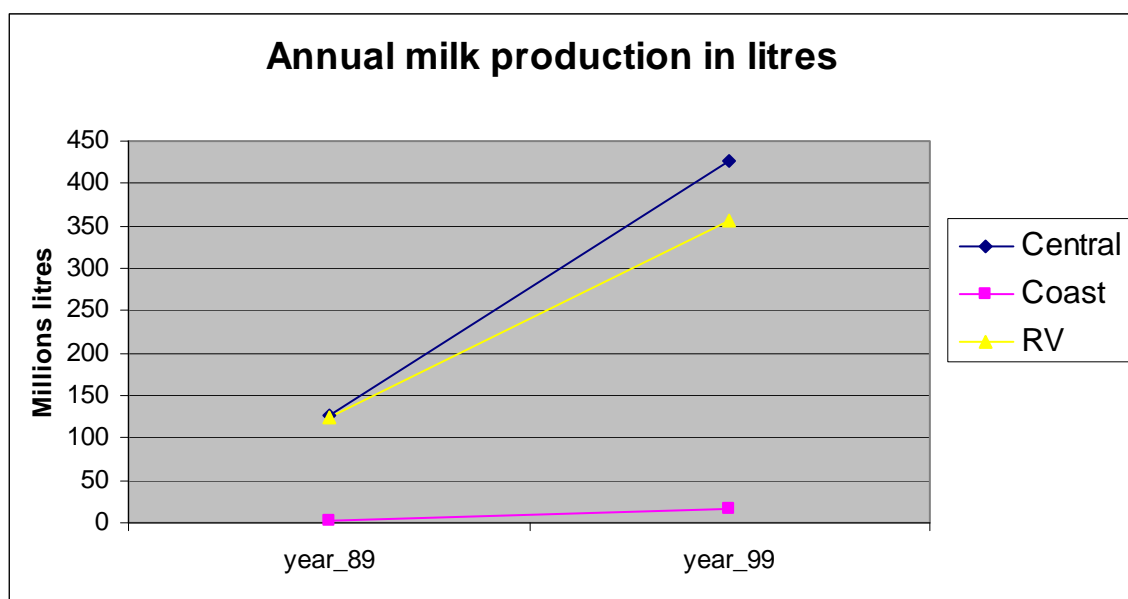
Table 2: Key factors affecting milk production per worker in 5 regions in Kenya, 1989 to 1999.

Variable name	Estimated coefficient	Standard error	Significant at 5 % level
Total milk intake by KCC per year (litres/year)	0.08	0.04	
Area under fodder in hectares	0.91	0.09	*
Area under maize in hectares	1.38	0.24	
Urban population	3.64	0.48	*
Enrolment ratio for primary school education	-10.58	1.28	*
Earnings by registered employee (K£'000] (income earned by those registered by NSSF)	0.29	0.08	
Percentage of households with electricity	-2.40	0.29	*
Rest of some dairy producing areas	-22.90	2.96	*
Constant	14.86	2.82	

Although the adjusted R^2 (0.9872) is high, this regression was run using only 10 observations due to data constraints and should only be considered as roughly indicating the effect of some variables on the development of the dairy sector.

Urbanization is a major driving force in increasing demand for milk. For each percentage point increase in the urban population in the three provinces, milk production increases by about 3.6%. Milk consumption per capita is higher in urban areas and hence the positive sign is consistent with effects of urbanization on demand for food items such as milk. Moreover, increase in disposable incomes drives effective demand of high-value food items, such as milk and other protein sources. For each percentage point increase in income in the three provinces, milk production increases by about 0.3 percentage points, although the coefficient is only significant at the 10% level.

Figure 11: Trends in milk production in major milk producing areas.



There are, however, some factors that are negatively associated with milk production per worker. For example, for each percentage point increase in the number of children enrolled in primary school in the three provinces, milk production per worker decreases by some 11%. School enrolment is a proxy for population: these reflect higher density areas, so production per worker is lower. Furthermore, for each additional percentage point of households supplied with electricity in the three provinces, milk production decreases by about 2.4%. These results reflect lower production per worker and localities shifting from rural to more densely populated, peri-urban settings. Finally, the constant term represents average milk production per worker for all regions included in the analysis, while the negative coefficient for districts in Coast and Rift Valley provinces means that, on average, these districts show values of milk production per worker below the average values of regions included in the regression analysis (below Central Province).

These basic regression results, while only indicative due to the extreme data limitations, supports key findings seen elsewhere: a) the formal market is not a requirement for dairy development, since the informal market has provided apparently effective market mechanisms, b) complementary agricultural development can support dairy production through fodder and potentially through its role in larger infrastructure development, and c) demand is critical to developing production of a relatively high-value good such as milk.

Income and Employment Generation in the Dairy Sector

Employment and Income Effects at the Farm-Level

Poverty-reduction and employment generation are important goals in various development strategies and policies in Kenya, including the recent Economic Recovery Strategy for Wealth and Employment Creation (ERSWEC, 2003-2007) and the Strategy for Revitalization of Agriculture (SRA, 2004-2014). In both these policy documents it is

recognized that dairy activities generate many employment opportunities in the course of milk production, processing and marketing.

For some time, there has been an estimated 650,000 dairy farm households in Kenya (Omore et al. 1999). Based on random surveys of thousands of rural households by the Smallholder Dairy Project (SDP) in late 1990s and early 2000s, it is now clear that the true number is much higher (SDP 2005). SDP estimates from these surveys, followed by further ground-truthing surveys and complete censuses of selected locations, now indicate that there are some 2 million dairy farm households, keeping over 5 million grade or cross-bred dairy cattle, mostly in the highlands. The employment figures below are based on these revised estimates of the size of the dairy sector.

Smallholder dairy farms depend heavily on family labour to perform various tasks. Dairy production is therefore an important source of self-employment, especially for rural households. A significant proportion of dairy operators also hire long-term or casual labour, which creates employment among some of the poorest segments of society, including landless households. Recognizing that most of the dairy activities occur in predominantly mixed crop-livestock production systems, it is not easy to attribute full-time engagement of farm households to dairy activities alone. From existing surveys, it estimated that about 50 long-term waged labour opportunities are generated for every 1000 litres of milk produced by farmers on a daily basis, while some three persons are employed on casual basis per 1000 litres of milk produced at the farm level (Table 3). Even on the smallest farms, in total at farm level some 77 people are employed full-time for every 1000 litres of milk produced on a dairy basis. To put this in perspective, in the Netherlands 2500 litres of milk flow per day are required to generate a single job.

Table 3: Employment and income generation through dairying at the farm level.

	Small-scale farms ≤2 cows	Medium-scale farms 3-6 cows	Large-scale farms >6 cows	Average
Self employment (full-time jobs/1000L of milk produced daily)	39	17	5	23
Permanent hired labour (full-time jobs/1000L of milk produced daily)	60	44	43	50
Casual labour (full-time jobs/1000L of milk produced daily)	6	2	1	3
Total direct farm employment per 1000L milk production	104	63	49	77
Average returns to labour from dairy production (KES/year)	38,000	102,000	482,000	114,000

Source: SDP surveys, 1997-2000. These are based on detailed random structured surveys of over 3000 households in highland Kenya.

Dairy farming generates an average annual return to labour per enterprise of KES 38,000 (USD 475) for small-scale farmers and KES 298,129 (USD 6025) for large-scale farmers, with an average weighted annual return of KES 114,000 (USD 1425). Compared to an average per capita GDP of approximately KES 27,825 (USD 347) for Kenya (World Bank 2003), dairying provides significant additional income to farmers and consistently higher returns than those available through rural wage labour.

Dairying is estimated to engage more than one-third of dairy farmers on a full-time basis, which translates into some 256,000 self-employed persons. Small- and medium-

scale dairy enterprises account for most (87%) of the employment that is attributed to dairying at farm level, largely because of their dominance in the dairy industry in the country.

Significantly, dairy farmers also engage full-time (permanent) hired labour for dairy production activities and also occasionally hire casual labour. Countrywide, hired farm labour for dairy is estimated to represent about 585,000 full-time workers, or about 24 % of the total agricultural labour force of some 2.5 million (Table 4). In total, some 841,000 people, 34% of the total agricultural labour force, are directly employed in dairy production at the farm level.

Table 4: Direct full-time employment created through dairying at the farm level.

	Small & medium-scale	Large-scale	Total	Total employment in dairy as a % of the agri labour force
Self-employment	245,000	10,960	256,000	10
Long-term hired labour	454,000	93,000	547,000	22
Casual labour	35,900	2,300	38,000	2
Total (numbers)	735,000	106,000	841,000	34
% of total	87	13	100	

Source: SDP dairy farm data and JICA 2003 for total agricultural labour figures

Income and Employment Effects at Milk Market Level

Approximately 6 million litres of milk is traded daily in Kenya through both formal and informal, small-scale and large-scale, processors and traders. Beyond farm level, processing and marketing of milk and other dairy products offers numerous employment and income-earning opportunities for the various participants in the milk supply chain. These include transporters, mobile milk traders, milk bars and shops/kiosks operators, small-scale processors and service providers, such as vehicle repairs, security firms and catering outlets. Mobile milk traders do not have fixed business premises. Milk collection from producers is mainly on foot, by bicycle or public transport.

Most small-scale traders handle between 50-120 litres of raw milk daily. Traders with milk bars have fixed premises and mainly sell unpasteurized and fermented liquid milk. Besides family labour, waged employees are actively involved in running milk bars. Small processors in Kenya mostly process and sell pasteurized milk, with a small proportion of throughput devoted to yoghurt and cheese, either as wholesalers and/or retailers: they are much fewer in proportion to other cadres of milk traders.

Labour requirements in small-scale milk marketing activities include milk collection, transportation, processing and sales, creating direct and indirect employment. Direct employees are those who occupy themselves with the milk marketing and processing on a daily basis and include self, family and wage labour. Indirect employees are those involved in providing services to the dairy business, such as artisans repairing farm equipment, bicycles etc. The overall number of both direct and indirect jobs created in the marketing segment of the supply chain varies from 3 to 20 for every 1000 litres traded on a daily basis, depending on type and scale of enterprise (Table 5). This suggests that a significant number of jobs are created considering the volume of milk that is traded via various intermediaries daily.

On average, informal milk marketing generates 18 jobs per 1000 litres of milk handled daily and this includes 15 direct job opportunities and 3 indirect jobs. The formal sector generates less employment per 1000 litres of milk handled on a daily basis (13) with 12 direct jobs and one indirect. Scaling out the employment effects to cover the whole country, formal milk processing and marketing generates about 15,000 jobs compared to informal marketing that creates more than 39,000, giving a total of about 54,000 jobs.

Further, these are relatively well remunerated jobs. From this study, it is estimated that formal employment in milk processing and marketing provides an average monthly wage of KES 11, 936 (USD 150) while informal market agents earn an average of KES 9,992 (USD 125), both much higher than the government's minimum wage guideline of USD 43.

Table 5: Traded volumes, employment and wage effects in milk marketing.

		Small-scale	Large-scale	Total
Aggregate milk quantities Handled (000'L/day) [†]	Formal Processing & marketing	122 (2%)	1524 (25%)	1646 (27%)
	Informal Marketing	2682 (44%)	1768 (29%)	4450 (73%)
	Total	1734 (46%)	2041 (54%)	6,096 (100%)
Rate of employment generation (Jobs /1000L handled daily) [§]	Formal processing & marketing	Small-scale	Large-scale	Weighted mean
	Processing factory	11.6	4.5	4.9 (37%)
	Collection of raw milk	0	5.2	3.1 (24%)
	Distribution of processed dairy products	0	1.4	0.8 (7%)
	Retail of processed dairy products	3.1	3.1	3.1 (24%)
	Indirectly through supply of material & services to processors	1.2	1.2	1.2 (9%)
	Total number of jobs	11.6	12.1	13.1(100%)
	Informal Marketing	Small-scale	Large-scale	Weighted mean
	Direct Employment	17	11	15 (83%)
	Indirect employment	3	3	3 (17%)
Total number of jobs	20	14	18	
Scaling out the number of jobs generated country-wide		Small-scale	Large-scale	Total
	Formal processing & marketing	905	14,177	15,082
	Informal marketing agents	15,620	23,950	39,570
	Total	16,525	38,127	54,652
Mean Wage (KES / month)		Small-scale	Large-scale	Weighted mean
	Formal processing & marketing	7,810	12,199	11,936
	Informal marketing	9,550	8,137	8992

[†] Numbers in bracket shows the percentage market share for each category of milk marketing agent

[§] Numbers in bracket indicate the percentage contribution to the total number of jobs per 1000L of milk handled on a daily basis by each activity in the formal and also informal milk marketing sectors

Main Lessons from Kenyan Dairy Development

There are a number of important lessons that can be drawn from Kenya's generally successful dairy development history and the policies associated with it.

Effects of Key Factors and Policies on Dairy Development Trends

Improved dairy cattle. Grade and cross-bred dairy cattle, using European dairy genes, have had a clear and large positive role in the development of the dairy sector in Kenya. The strong legacy from the colonial era - when AI, recording systems and breed societies were established - provided the impetus for large improvements in productivity. This required large-scale public investment, including from foreign donors such as Sweden and the Netherlands, and subsidized provision of genetic material. Clearly, use of exotic genes, particularly in a temperate climate such as found in highland Kenya, is a rapid and potentially sustainable path to higher productivity, even among small-scale and resource-poor farmers.

Fodder technologies. As demonstrated in the regression analysis (Table 2), planted fodder technology has played a key role in growth in dairy productivity. This is nearly all due to widespread adoption of high biomass-yielding Napier grass, apparently introduced originally as mulch for coffee plants. Reflecting its importance, it currently occupies as much land in some parts of highland Kenya as maize, the national staple food (Staal et al. 1998).

Co-operative development. Although the data available were not able to demonstrate this empirically, there is adequate evidence to suggest that, particularly towards the end of the 1980s, dairy co-operatives played a significant role in fostering dairy development, primarily by providing a stable market environment. It has been demonstrated that proximity to a co-operative milk collection centre was significantly associated with an increased probability of a household successfully entering into dairy production (Baltenweck 2000).

Demographics. Growth in urban populations and incomes appears to be linked to growing demand and scale of the dairy industry and to diversification of products.

Policy reform and liberalization. There is considerable evidence to show that the period of policy reforms and liberalization during the 1990s produced mixed outcomes for the sector. While price liberalization and lifting of the KCC's monopoly led to more competitive milk markets and higher real farm prices for milk, access to livestock services appears to have suffered significantly. This is evidenced by the dramatic decline in use of AI and also of worsened farmer-reported access to veterinary services.

Informal market development. There is no evidence that investment in formal milk market processing, such as the KCC, has had a measurable impact on dairy development. On the contrary, the growth in the dairy industry has continued even when the informal raw milk market has grown in share. This has been accompanied by a shift towards liquid and traditional products, apparently as a result of demand-driven market responses, compared to the supply-driven product mix offered under the subsidized KCC monopoly system.

Effects of Trends, Key Factors and Policies on the Poor

The dairy industry is important in Kenya's economic development. As has been demonstrated, it supports many farmers, traders and service providers as a source of income and employment. It also provides many poor households with a daily source of protein, energy and micronutrients. Development of the dairy sector has generally had clear benefits for the poor.

Public investment and support for smallholders. A policy of Africanization of production during the late colonial era and after independence deliberately brought smallholder indigenous farmers to the forefront of the dairy sector. This was supported in the early years by a relatively strong government extension system and support to disease control, although those had weakened by the late 1980s. As a consequence, smallholders now dominate the dairy industry and the opportunities that arise from it.

Income and equity in the dairy sector. As shown in the employment section above, approximately 900,000 people, more than a third of the total agricultural labour force, are employed in the dairy sector: some of the most resource poor are hired as labourers on dairy farms; over 85% of this total are engaged in small-scale production and marketing. Further, these employment opportunities, on average, yield greater incomes than available alternatives, both at farm level and in the market place. Although large-scale producers show higher levels of returns overall, research has shown that unit profitability ranges between USD 0.13 and USD 0.16 per litre and is not significantly different between large- and small-scale producers (Omiti et al, 2006). Research has also shown that access to land is not a significant constraint to engaging in dairy production in Kenya and that women-headed households are just as likely as male-headed households to be dairy farmers. Both these indicators point to the dairy enterprise being a viable option, even for resource-poor and socially marginalized households.

The informal market and the poor. The informal raw milk market has been demonstrated to play a key role in providing important market outlets for small-scale farmers and for providing low-cost milk and dairy products for poor consumers. Its strength is that it is driven by demand for traditional products. An unintended consequence of the liberalization of the 1990s was the growth of the informal market.

Liberalization of livestock services. One area where policy is likely to have had a detrimental affect on the poor is liberalization of services. Access to and use of AI has declined dramatically and evidence suggests that access to veterinary and extension services has also declined. As shown in Figure 5, resource-poor dairy farmers, who are the majority, report the lowest access to private veterinary services which were intended to fill the gap left by reduced public services. An apparent consequence of the reduction in public services was that the rate of adoption of dairy production by smallholder producers in highland Kenya fell significantly in the 1990s (Baltenweck 2000).

Policy Opportunities and Entry Points, Strategies and Resources

Legislation. Dairy-related policy issues need to be coherently addressed and legislation, under revision since the mid-1990s, needs to be updated and passed. Particularly important is to ensure that legislation and policy documents incorporate: a) adequate inclusive stakeholder representation and institutional reform to implement that, and b) steps to formalize the large raw milk markets. Policy and legislative efforts should pay due attention to the dairy sector within the broader national goals of poverty reduction, employment creation and food security: these need to look beyond the typical objectives of increased milk production and strict public health enforcement. Harmonization of the different acts that affect the dairy sector is required to reduce existing conflicts and to facilitate faster sectoral growth.

Mainstreaming the informal sector. The informal milk market has enormous potential for off-farm employment generation. However, the efficient operation of this market sector and its potential evolution towards higher quality standards has been impeded by the failure to recognize raw milk traders due to public health concerns. The mobile traders have often operated without trade licences and actively sought innovative ways and means to circumvent such official impediments to their business operations.

Research has shown, however, that the quality of milk sold by mobile milk traders is not significantly different from those with fixed premises and licences and that training can help improve quality (Omore et al. 2002). Recently, in 2004 and 2005, the Kenyan Government has taken steps to 'formalize' and legalize raw milk marketing, for example through training and certification of small-scale traders. Where appropriate, institutions should explore alternative systems, such as self-regulation and partnership with the private sector. The required legislation to safeguard these policy changes is currently making its way through the legislative channels for enactment. Similar changes have occurred or are occurring in other countries in East Africa, particularly Tanzania and Uganda. Even as income and urbanization trends favour a larger share for the formal market, this type of policy shift can mainstream the informal sector and raise the quality of milk it handles, bridging the informal-formal gap as the industry develops.

Renewed public investment in livestock services. It is apparent that the withdrawal of government support to livestock services in the 1990s was not matched with increased provision by the private sector. Smallholders in particular now have less access to some of these services. In order to support continued opportunities for resource-poor farmers to increase productivity and opportunities in dairy, it is likely that renewed public investment in services will be required until viable, appropriate private services are widely available.

Encouraging private service provision. The policy of simply vacating public services with the expectation that private providers will step in to fill the gap has failed. This is partly because of continued barriers to private service entry, in particular licensing requirements that have restricted private sector participation. Changes that allow licensing of privately-trained AI technicians and animal health technicians are needed to reduce barriers to private participations. Where that is not possible, sustainable alternatives should be sought, such as the introduction of cost sharing, or the training and equipping of community-based service providers.

Improving road infrastructure. Although improved roads benefit a variety of agricultural and rural sub-sectors, infrastructure is particularly important to dairy development due to the perishable nature of milk and the need for daily collections. For every kilometre of poor feeder road that separate them from the nearest main road, farmers receive 3% less for their milk (SDP Policy Brief # 3, 2004a). Improved feeder roads are likely to have a significant positive impact on dairy development.

DAIRY DEVELOPMENT IN ETHIOPIA

Alejandro Nin Pratt, Mohammad Jabbar, Zelekawork Paulos and Elias Mulugeta

Introduction

In the late 1980s, agriculture in Ethiopia contributed about 45% of national GDP while the livestock sector contributed about 40% of agricultural GDP (18% national GDP) and 30% of agricultural employment. Dairy output accounted for about half of livestock output (Feleke and Geda 2001). More recent figures indicate that the livestock sector contributes about 12-16% of national GDP, 30-35% of agricultural GDP, 15% of export earnings and 30% of agricultural employment. Livestock contribute to the livelihoods of 60-70% of the population (Aklilu 2002; Ayele et al. 2003; Ejigu 2003).

Over the last 30 years, national and per capita production and consumption of livestock products declined (Ayele et al. 2003). During 1993-2001, per capita income remained at about USD 100. Livestock production increased by much less than the production increase for the agriculture sector as a whole, so relative share of livestock to agricultural GDP declined. During this period, per capita livestock output fell by 5% while crop, food and agriculture grew at 14, 7 and 6%, respectively (Halderman 2004).

From 1966-2000, milk production in Ethiopia increased by 1.6% and per capita production decreased by 0.8% annually. Per capita production grew slightly only after the introduction of structural adjustment and market liberalization policies in 1992 (Table 6). Due to declining per capita production over the long term and decreases in net imports in recent years, per capita consumption decreased from about 26 litres in the mid 1980s to about 16 litres in 2001 (Muriuki and Thorpe 2003).

Table 6: Trends in total and per capita milk production in Ethiopia, 1961-2000.

Period	Total production		Per capita production	
	Annual average, tonnes	Growth rate, %	Average, kg	Growth rate, %
1961-1974 ^a	698, 555	1.63	24.07	-0.87
1975-1992 ^a	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

a. Includes figures for Eritrea, as separate figures were not available.
Source: Ahmed et al. (2003) based on FAOSTAT database

Estimates of specific contributions of the dairy sector to output, income and employment are not readily available. Four main dairy production systems can be identified in the country: a small commercial sector consisting of large private and state farms; small urban/peri-urban systems raising cross-bred or both cross-bred and local cattle and having access to milk collection centres or co-operatives; smallholder mixed farming systems in the highlands using indigenous breeds; and pastoral/agro-pastoral system in the lowlands. Reliable figures on the relative importance of these systems in terms of number of farms/herds, dairy population or share of milk produced are not available. However, a rough estimate indicates that currently, out

of about 1.43 billion litres of milk produced annually, 900 million litres (63.3%) is produced by rural small-scale mixed farms in the highlands, 205 million litres (14.3%) by small urban/peri-urban farms in the highlands, 320 million litres (22.4%) by pastoral/agro-pastoral producers in the lowlands and 5 million litres (less than 0.03%) by large private and state farms (Ahmed et al. 2003; Feleke and Geda 2001).

Household consumption and expenditure surveys indicate that livestock products comprise only 8% of total food expenditure, with half of this expenditure allocated to dairy products. About 56% of milk in the country is processed into butter, cheese and yoghurt and 44% is consumed fresh (Table 7). Although levels of consumption vary according to income levels, relative shares of liquid milk and other products, mainly butter, remain about the same across income groups (Figure 12).

Table 7: Use of milk in Ethiopia, mid 1990s.

Use of milk	Million litres (milk equivalent)	Percent of total
Fresh/raw milk	630	44
Pasteurized milk	5	<1
Butter	595	42
Cheese	185	13
Yoghurt	15	1
Total	1430	100

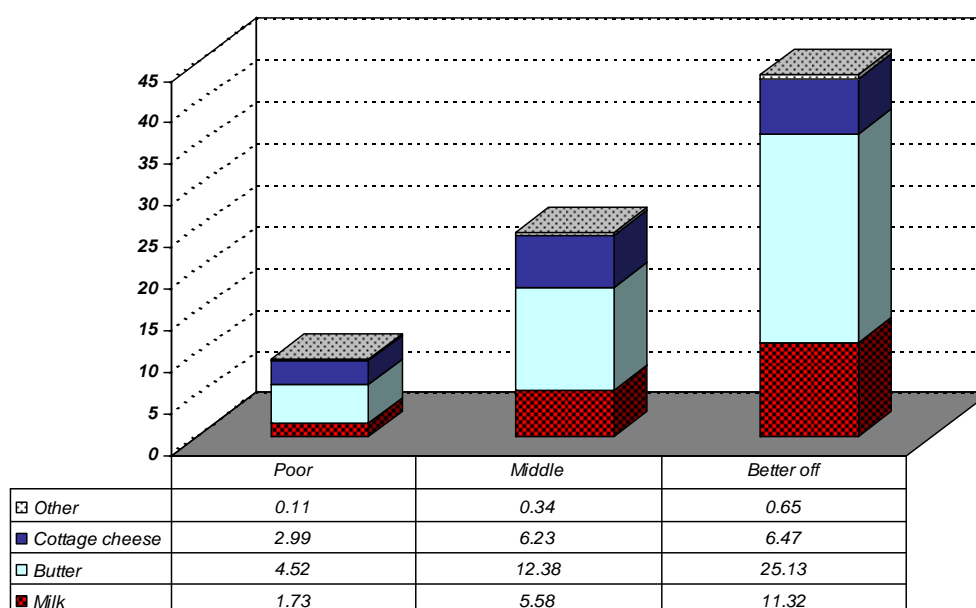
Source: CSA 1997, 2001

Only a small amount of milk is processed into pasteurized milk, butter and cheese by large-scale commercial processors. Most of the milk produced in the country is processed on-farm into butter and soft cheese (*ayib*) for home consumption and sale. Rural producers, located far from urban markets, usually process surplus milk into butter because of difficulties in selling fresh milk locally; the main butter markets are in the towns and cities.

Apart from income, consumer preferences and dietary customs also help to explain the relatively low demand for dairy products. Orthodox Christians, comprising about 40% of the Ethiopian population, abstain from consuming dairy and other animal products for about 200 days a year. Low demand for dairy products in Ethiopia compared to demand in other low-income countries in sub-Saharan Africa appears to be a major reason for the slow growth of the dairy sector.

Many factors other than demand, however, have contributed to the stagnant nature of the overall economy and the poor performance of the dairy sector. The purpose of this section is to highlight some of the policy issues that contributed directly and/or indirectly to the performance of the dairy sector, explain the regional differences in dairy sector growth and marketing and assess the potential for income and employment opportunities in dairy production, processing and marketing. Finally, conclusions are presented along with lessons learned.

Figure 12: Milk consumption by expenditure group in litres per capita (1995-1996).



Dairy Development Policies and Their Impacts

Since the 1960s, three distinct periods can be identified in Ethiopia: the later years of the Imperial Regime (pre-1974), the socialist Derg Regime (1974-1991) and the structural adjustment and market liberalization policies since 1991. Though Ethiopia's rural economy is dominated by smallholder mixed crop-livestock farms, the objectives of various policies of the successive regimes over the past five decades have been similar; to improve commercial dairy production in selected areas of the country, especially around Addis Ababa, through introduction of exotic and cross-bred cattle and related feed and management technologies, and development of a milk processing industry to supply the Addis Ababa market. The policy instruments and operational procedures employed to achieve these goals varied over time, reflecting the politico-economic philosophy of the respective governments.

The Imperial Regime

The first attempt to introduce modern dairy production in the country was made by the Imperial Government in 1947, when 300 Friesian and Brown Swiss dairy cattle were received as a donation from the United Nations Relief and Rehabilitation Administration. A small milk processing plant was established in Shola, just outside Addis Ababa, to support commercial dairy production (Yigezu 2000). Later missionaries and some foreign individuals and organizations also introduced small numbers of imported exotic dairy cattle. Between 1959 and 1969, with additional support from the UNICEF, several successive steps were taken to meet increased urban demand for milk. These included: expansion of the capacity of the Shola plant, first to 10,000 litres per day and later to 30,000 litres; to supply the processing plant, opening of milk purchasing and collection centres throughout Addis Ababa, and later up to a radius of 70 km around Addis Ababa along main roads; and limited extension service and incentives to well-off farmers to take up commercial dairy production to supply the milk collection points (Staal 1995).

In 1971, the Dairy Development Agency (DDA) was created as an autonomous body to provide guidance and assistance; for example provision of extension and credit to farmers to establish commercial dairy farms in areas serving the cities and townships and improve the quality and increase the quantity of milk and milk products (Ketema 2000; Yigezu, 2000). Under this scheme, 30 medium-sized farms (40 milking cows each) were established with imported exotic cattle, 885 grade and cross-bred in-calf heifers were distributed to medium- and small-scale farms and 13 new milk collection centres were constructed and renovated.

With the encouragement of the DDA, co-operatives came into existence to undertake commercial agricultural production, including dairy, although co-operatives did not engage in milk collection at that time. Co-op members were those with larger land holdings for dairy production purposes (Alemayehu 1992). At that time the DDA used to pay lower prices to farmers compared to prices paid by milk hawkers who would buy milk from urban/peri-urban farmers and sell directly to consumers in the city. Consequently a large informal market developed that was unregulated by the authorities but estimated by FAO to account for one-third of the liquid milk market in Addis Ababa.

While promotion of commercial dairy production around Addis Ababa was going on, attempts were also made to improve dairy production of smallholder farmers in selected parts of the country through a number of agricultural development projects. Prominent among these were the Swedish International Development Agency-supported Chilalo Agricultural Development Unit (CADU), initiated in 1967 in the Arsi region, and the Wolaita Agricultural Development Unit (WADU) funded by the International Development Association (IDA). Achievements of CADU in the dairy sector include the pioneering of the 'one-cow-unit' dairy development package, in-country production of frozen cattle semen and cross-bred dairy heifers, introduction of small-scale milk processing units and AI services to smallholder farmers, and the popularization of forage cultivation. Achievements of WADU included the establishment of the project's farm of 290 dairy cattle, the attempted introduction of AI and bull station services, which led to positive attitudinal change to improved dairying, and a reduced calf mortality rate from 17% to 5% due to animal health services. Also, livestock was included in the Minimum Package Programme of the extension service of the Ministry of Agriculture: this was initiated in 1972 with IDA funding to expand CADU's dairy development operation to other parts of the country.

Because of all these efforts, by 1972 the dairy industry in the Addis Ababa area was well established and growing. As large farms were emerging, surplus intake was occurring at the Shola plant. AI services were established and the general quality of animals belonging to small-scale dairy producers gradually improved. By 1972 the DDA was receiving about 21,000 litres of raw milk each day, 57% coming from 65 large farms (defined as having 10-250 cross-bred cows), the remainder from smallholders through some 30 collection centres (Staal 1995). Between 1961 and 1974, milk production increased by over 16% from 637,375 tonnes to 743,100 tonnes, an average annual growth rate of 1.6%; at the same time, however, per capita milk production declined at an average rate of 0.9% per annum (Table 6). This growth in production was largely due to economies of scale, as well as marketing facilities in the Addis Ababa milkshed, subsidies in transport to the formal market, secured land tenure and an active free market for feed and other inputs (Staal and Shapiro 1996).

However, the development projects and extension programmes implemented in other parts of the country made an insignificant contribution to dairy output growth. CADU could not be replicated countrywide because of the high cost per beneficiary and it led to the acceleration of evictions of landless tenants as landlords became more aware of the benefits from improved dairying and began to farm themselves. WADU experienced a high staff attrition rate; it made more investment in infrastructure than extension services and the project was very capital intensive. The dairy component of

the Ministry of Agriculture's Minimum Package Programme was constrained by shortage of animal stock.

The Socialist Regime (1974-1991)

In 1974, the Imperial Government was overthrown by the socialist Derg Regime, which pursued a range of policies under a centralized economic system. Some of the important policies that directly or indirectly affected the dairy sector were:

- a) All land was nationalized and distributed to peasants through newly formed Peasant Associations (PA) with only usufruct rights, without the right to rent, mortgage or sell. Allocated land could be taken back by the PA in order to reallocate to new families. All large farms, including dairy farms established under the Addis Ababa Dairy Development Project (AADDP) and other projects such as CADU and WADU, were nationalized or annexed by the PAs. Some large farms were converted into state farms and also some new state farms were established. Between 1985 and 1989, 63% of all public expenditures were directed towards state farms.
- b) Apart from PAs, formation of producers' and service co-operatives was promoted, which changed the nature of agricultural extension work including the services to dairy producers; rather than individuals, producer co-operatives which collectively owned heifers and other supporting inputs were approached as a group (Staal 1995). Producer co-operatives had priority in the allocation of good-quality grazing land, leaving individual non-member peasants with any remaining poor-quality land for communal grazing. It was assumed that state farms and producer co-operatives would have greater capacity to utilize modern technologies and would demonstrate greater efficiency deriving from positive economies of scale. The operational procedures of CADU and WADU were changed and inputs and services were distributed to producer co-operatives rather than individual peasant households. New donor-funded dairy projects restarted in the mid 1980s and had the primary objective of supporting the dairy farms of producers' co-operatives (Ketema, 2000).
- c) The DDA and the nationalized dairy farms previously established under the AADDP were merged under the newly established Dairy Development Enterprise (DDE). Operational budgets were no longer provided by the government but had to be attained through sales revenues and loans from banks. From 1976-89, 79% of formal sector loans to agriculture went to the state farms though these farms contributed less than 10% of output. Of the total loans disbursed, only 3% went to the livestock sector, with the bulk of these being allocated for draft cattle and beef fattening (Assefa 1990).
- d) With additional assistance of the Government of Finland and the United Nations Capital Development Fund, the processing capacity of the Shola plant was increased to 60,000 litres per day, butter-oil recombination capacity was introduced, 30 collection kiosks and 16 chilling centres were established and milk collection routes were extended to 150 km around Addis Ababa. DDE retained the right to fix prices paid to raw milk suppliers. Prices paid to producers by DDE increased by 43% in nominal terms from 1972 to 1992 (ETB 0.50 per litre); this favoured the expansion of the informal sector where the rate of price increase was apparently much higher, although exact figures are not available.
- e) The Derg Regime pursued a fixed, overvalued foreign exchange rate policy throughout almost its entire reign; as a consequence exports became more expensive and imports cheaper.

The consequences of these policy changes adversely affected the growth of the dairy industry in Ethiopia for the following 17 years (Ketema 2000). The rural mixed farming systems, which produced the largest share of milk in the country, remained largely neglected. According to Staal (1995), dairy policy in the 1980s can be characterized as a “severe misdirection of effort”. The focus of substantial resources on parastatal institutions yielded little benefit to consumers or producers. Attempts to develop market-oriented dairying in rural PAs were hampered by low producer prices and a narrow focus on co-operatives. These same attempts also led to a complete neglect of the informal urban producers; though they were the most important for urban milk supply they were forced to seek the inputs and services they needed without institutional support.

In spite of huge public expenditure and credit facilities provided to state farms, production from these farms declined from a high of some 6 million litres in 1983/84 to less than 5 million litres in 1989/90. At that time calf mortality rates were as high as 38%. All dairy services (technical, plant operations, veterinary etc) declined rapidly. By 1978, milk intake at the Shola plant had fallen to 3.5 million litres per year from 5.8 million litres in 1974: processing in this plant never exceeded 60% of capacity; a little above one-third of capacity was utilized only because of World Food Program (WFP) donations of milk powder which were reconstituted at the plant. The policy of a fixed and overvalued exchange rate led to stifled domestic production and cheaper commercial imports in addition to dairy food-aid (Von Massow 1989).

During this period, co-operatives suffered from a loss of credibility by members and the public; they were turned into government and political tools rather than instruments for socio-economic development. Members, who were forced to form or join co-operatives, started to show their dissatisfaction and they lacked tangible benefits or a clear role. Their sense of ownership gradually faded with the result that the co-operatives gradually became non-functional (Ketema 2000).

Government policies during this period led to a dramatic increase in the role of the informal market in urban milk supply and demand. A study of consumer purchases of liquid milk in Addis Ababa between 1984 and 1986 showed that 71% of milk was purchased directly from producers, 14.8% from DDE shops or outlets, 13% from private grocery shops and 2% from itinerant traders (Mbogoh 1992). Another study, carried out in 1986 on producer sales of milk in Addis Ababa and surrounding areas, showed that most large urban and peri-urban producers sold milk directly to various institutions, such as hospitals, schools, the armed forces, coffee houses, hotels and restaurants, in order to reduce marketing and transaction costs. On the other hand, small rural producers who had access to DDE milk collection centres chose to sell most of their milk to this outlet due to lower marketing and transaction cost and year-round access, even though prices were on average lower than in the local market (Debrah 1992). Hurissa (1998) found that 53% of intra-urban producers sold milk at their farm gates, while 33% and 14%, respectively, delivered to customers’ homes or used both methods of distribution.

Although informal urban producers were supplying 70% of the urban liquid milk they received little, if any, assistance (AI, veterinary services, feed quotas etc.) as urban areas contained no PAs or co-operatives to channel assistance and informal urban producers were not officially recognized to exist (Prank and Tuinenberg 1998). The growing importance of the informal market resulted in a major supply shift, from peri-urban landholders to urban backyard producers who purchased feed from peri-urban areas. Driving this process was insecure land tenure. During the period in which land was claimed by the state and farms were annexed by the PAs, the number of cross-bred cattle held by urban backyard producers increased. Milk production thus shifted away from the rural feed-base to near urban consumers, bypassing the formal milk collection and marketing system which remained geared towards the rural areas around Addis Ababa (Staal 1995). The rest of the countryside remained largely ignored.

In 1990, in view of the world's economic prospects, the Derg Regime revised its policies and adopted a mixed economy. Due to the failure of socialized agriculture, producer co-operatives were reorganized by giving them the opportunity to act in a democratic manner and decide their own destinies: 95% of producer co-operatives disintegrated within three months of this announcement (Alemayehu 1992). Collective property was either divided between members or sold; in this way a large number of cross-bred dairy cattle came into the hands of small-scale private producers in urban areas (Gizaw and Amare 1992). The Dairy Rehabilitation and Development Programme and the extension programme then had to revise their programmes to serve individually owned dairy farms which kept one or two cows rather than the co-operatives (Ketema 2000; MoA 1994).

Democratic Government and Market Reform Policies (1991-Present)

In 1991, the Ethiopian People's Revolutionary Democratic Front came to power and implemented several macroeconomic policy changes: the fixed exchange rate system was changed to a more market-determined system and the local currency was devalued significantly in 1992, followed by a series of smaller devaluations. This discouraged imports, including of dairy products. A new land policy was declared in which land remained a national property but usufruct was made tenable for indefinite period with rights to transfer to children; although selling and mortgaging remained prohibited temporary leasing was allowed.

During the initial transition period, service co-operatives were looted, peasants forcibly repossessed communal property and cattle breeding ranches had large parts of their land repossessed by PAs (Alemayehu 1992). From 1990-92, the milk supply systems rapidly collapsed due to the increased insecurity, culminating in the collapse of the Derg Regime and subsequent paralysis and uncertainty among official institutions (Staal 1995). Subsequent dairy development strategy formulated during this period focused on creating an environment for greater market access by smallholder dairy farmers. The objective was that producers would be stimulated to produce more to satisfy market demand.

The only official body dealing with dairy policies during this period was the Dairy Development Advisory Board, whose sole task was the allocation of funds, generated from reconstitution and sales of WFP milk powder, towards dairy development. Financial support used to go primarily towards forage development, expansion of veterinary and AI services and the supply of feeds and veterinary inputs (Staal 1995). In 1993, the DDE was taken back under government control but was given more management autonomy to make it more efficient, profitable and financially self-supporting (Yigezu 2000). Of the 14 large dairy farms run by DDE, 12 were returned to their previous owners or sold. These farms have now expanded their activities to include self-processing of milk. As a result of policy change to allow private sector investment in dairy production, processing and marketing, several small- and medium-scale dairy processing companies have been established around Addis Ababa and other urban areas. These firms process milk from their own production and also collect from other producers.

The DDE retained its role as the primary actor in the dairy market. In 1993, intake at the Shola plant was one-sixth of installed capacity. Since then, official prices paid to producers were progressively raised, reaching ETB 1.50 per litre in 2003. The entrance in late 1991 of Sebeta Agro-Industry, a private dairy processing firm which offered producers up to ETB 2.00 per litre of raw milk, stimulated competition and helped expand the formal market: as a result many peri-urban producers have stopped supplying the DDE. Though the administratively set prices paid to producers have been raised, the informal sector continues to dominate the market and accounts for about 80% of the milk market in the Addis Ababa milkshed (Staal and Shapiro 1996). The move towards deregulation had a similar effect at about the same time in Ethiopia

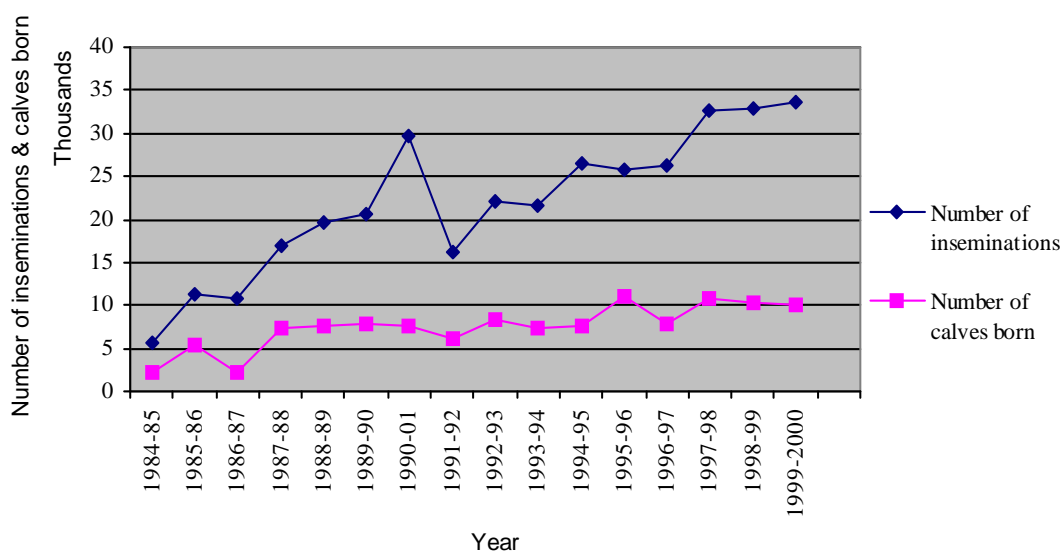
and Kenya, although the two countries were not fully and directly comparable because of historical differences in the evolution and structure of the dairy industry and related policies.

To take advantage of the newly created market opportunities as a result of the economic reform measures, prominent dairy producers within a 100 km radius of Addis Ababa formed the Addis Ababa Dairy Producers Association (AADPA). By the end of 1992, 90% of all urban dairy producers were members. The main objective was procurement of cattle feed rather than milk collection. The rural co-operatives were rebuilt giving more attention to human capital; their role would be to serve and not to govern, taking account of lessons learned about the undesirable role of the government in co-op affairs. A new government proclamation in 1998 further helped to promote a new kind of co-operative: the role of government was reduced from direct control to that of an advisor. However, these multipurpose co-operatives were still primarily engaged in crop activities and input supplies for members; dairy was not yet a major activity and therefore they had only a minor role in the milk market - formal or informal.

Among the development projects, FINNIDA implemented the Smallholder Dairy Development Pilot Project (SDDP), with additional funding from FAO and WFP. This covered two *woredas* from 1991-1994 and 16 more from 1995-2000. Identifying marketing as the major constraint for dairy development, the SDDP organized small-scale milk processing and marketing units to raise income and nutritional standards of smallholder farmers through improved dairying. About 30 co-operatives were formed in the peri-urban areas of Addis Ababa. Due to input limitations, however, the project had to reduce the number of contract farmers from 1000 to 500.

In addition to these focused projects, general improvements in veterinary services, breeding services including artificial insemination and promotion of forage and feed production through the general extension service has also been observed. For example, between 1984/85 and 1999/2000, more than 351,000 inseminations were performed throughout the country, most in the Addis Ababa milkshed (Figure 13). About 75% of the semen was Friesian and 20% Jersey. An average of three inseminations were required per conception due to problems on both the supply (untimely delivery, poor quality of semen) and demand side (inability to detect heat in time, delayed insemination due to long distance) so the actual number of calves born due to AI was about one-third the number of inseminations (Feleke and Geda 2001).

Figure 13: Number of artificial inseminations carried out and calves born in Ethiopia, 1984-2000.



Source: Feleke and Geda 2001

Overall, policy changes during this period were successful in reinvigorating a dairy sector that had been gravely affected by the socialist regime. Macroeconomic policies, changes in co-operative legislation and the openness of the manufacturing sector to private investment all resulted in positive changes. This gave growth in the dairy sector a new impulse in both the peri-urban areas, where most development projects are located, and in rural areas, where mixed farming is practiced. Although the results obtained by the sector so far are positive when compared to the past (Table 6), the historical performance of the dairy sector in Ethiopia has been disappointing given its potential.

Explaining Regional Differences in Dairy Sector Performance

It was mentioned earlier that dairy development efforts in the country were concentrated in the highlands, especially around Addis Ababa, so differential growth across geographical areas would be expected due to differences in production environment, infrastructure and other factors that facilitate or hinder growth. In the absence of suitable time-series data at lower administrative levels, e.g. woreda, the analysis of regional differences was conducted using cross-sectional data from a livestock survey carried out in 2001/2002 by the Central Statistical Authority of Ethiopia (CSA 2003). Data were available at zone level for 43 zones in all the regions, except for Mekele in Tigray region and two zones (Godere and Zone 3) in Gambella region. Information was collected on demography, agricultural resources, production systems and practices, input use and outputs and sales for different enterprises. For the present study two aspects are considered: differences in dairy production and marketing are explained by descriptive statistics of production and marketed patterns and differences in the degree of commercialization of dairy are explained by using a regression with appropriate variables.

Regional Differences in Dairy Production and Marketing

There are virtually no reliable estimates of milk production under different production systems over time for different regions: FAOSTAT database only gives national figures. According to a survey by the CSA (2003), 9.3 million milking cows produced an estimated 2.59 billion litres of milk in 2001/2002; an average yield of 278 litres per cow per year. However, the FAOSTAT database shows that 7.3 million milking cows produced 1.45 billion tonnes of milk in 2001. The FAO estimate is close to the CSA's estimate of milk consumption from their household income and expenditure surveys (CSA 1997; 2001), which shows that total consumption of dairy products (in milk equivalents) amounted to 1.38 billion litres in 1995/1996 and 1.19 billion litres in 1999/2000. Since FAO data is not available at regional level, for the purposes of this study the regional figures of the CSA survey have been adjusted proportionally using the FAO estimate of total output (Table 8). For regional comparisons, Amhara and Oromia regions are divided into sub-regions in order to capture variability within an extensive area. Milk production in Somali and Afar regions are not included in the comparison because information in the CSA survey of 2003 for these regions is not complete.

The regional distribution shows that 20% of total output is produced in SNNPR followed by the zones in Oromia and Amhara surrounding Addis Ababa and other zones in Oromia and Amhara, all of them with shares between 10 and 15% of total output. This distribution of output roughly follows dairy shares of the cow population in the different regions, indicating that production and consumption are local - as expected given economic development and income, infrastructure, urbanization and geographic distribution of population. The only exception to this is the region comprising the capital Addis Ababa, which is supplied by producers in neighbouring zones. In any case, the impact of the Addis Ababa market on these zones is not evident at this level of aggregation.

Yields are significantly higher in Addis Ababa due to the high incidence of cross-bred and exotic cattle but variation between other regions is not high. Cross-bred and exotic cows represent only 1.8% of total milking cows in Ethiopia but 47% in Addis Ababa (Table 8). This is a result of the past and present policy of promotion of exotic blood in and around Addis Ababa and the recognition by producers that these breeds are most economically suited to highland intensive urban production. This explains higher yields per milking cow in Addis Ababa. Areas in central Amhara and Eastern Oromia regions around Addis Ababa and between Addis and Dire Dawa show cross-bred and exotic cows above the average for the country but below 2% in all cases, so have no significant impact on yields and total output of these sub-regions. Gambella and Benishangul, showing a small proportion of total milk production, have slightly higher yields than other regions.

Table 8: Milk production, milking cows and yields in Ethiopia, 2003.

Regions/Sub-regions	Milking cow (1,000s)	% total cows cross-bred & exotic	% milking cows cross-bred & exotic	Milk production(mi ll.litres)	Yield (kg/cow/year)
Tigray	483	0.36	1.0	82	170
N.W.Amhara	921	0.23	0.7	145	157
C.Amhara	846	0.57	1.3	128	151
W.Oromia	418	0.01	0.0	63	151
C.Oromia	729	0.10	0.1	111	152
Addis surroundings	1270	1.86	4.5	205	161
E.Oromia	1104	1.48	3.5	199	180

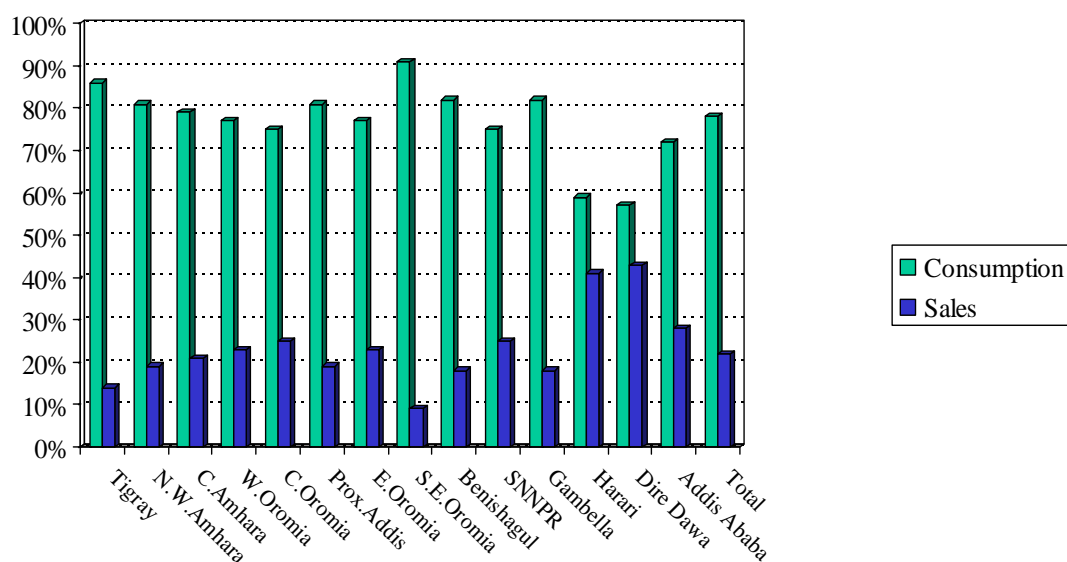
S.E.Oromia	876	0.15	0.4	135	154
Benishagul	63	0.00	0.0	12	192
SNNPR	1614	0.61	1.1	277	172
Gambella	34	0.00	0.0	8	232
Harari	9	0.46	1.0	2	200
Dire Dawa	19	0.73	2.1	3	146
Addis Ababa	20	18.99	46.6	7	362
Total/Avg	8406	0.79	1.8	1376	164

Note: Production figures are based on household and expenditure survey 1995-1996 (CSA, 1997) adjusted proportionally using FAOSTAT data for total production.

Source: CSA 2003

On average, 78% of all milk produced in the country is consumed by producing households; only 22% goes to market (Figure 14). In Dire Dawa and Harar about 40% of output is marketed; in Addis and its surroundings about 30% of a much larger volume of output is marketed. In most regions, about half of total milk consumed by the producer household is consumed as liquid milk and 30% as butter, the remainder in other forms such as fresh cheese and yoghurt. Households producing milk in urban areas and also in zones in East and Southeast Oromia consume significantly lower amounts of butter. On average for Ethiopia, 53% of total milk sold by producers is sold as liquid milk and 42% is sold as butter, though with considerable regional variation in these proportions. In urban areas and in East and Southeast Oromia, most of the milk is sold as liquid milk. Butter is the main commercial product in Central Amhara, West and Central Oromia and also in the zones around Addis Ababa, Tigray and SNNRP.

Figure 14: Milk consumption and sales in different regions (2001).



Source: CSA 2003

Determinants of Regional Differences in Dairy Commercialization

A regression analysis was done using level of milk sales per agricultural population as the main indicator of commercialization of the dairy sector². This approach was also used in the regional analysis presented in Part 1 of the study. Three different dependent variables were considered: total milk sales, sales of liquid milk and sales of cheese and butter per capita of agricultural population. The explanatory variables are grouped into the following categories;

- Crop production: cereal production per rural population, production of other crops per rural population
- Agricultural systems: % households in livestock systems, % households in mixed systems, % households in crop systems (base system)
- Crop and livestock technology: % of crop area irrigated, number of exotic and cross-bred cows, number of vaccinated animals, % of cereal seed improved, improved fodder as % of green fodder
- Market access and urbanisation: % urban population, population density, road density, distance to Addis Ababa, % households access to credit
- Human capital: literacy rate
- Regional dummy: which takes a value of 1 when the zone belongs to a particular region and 0 otherwise. Each region is compared with the average of all regions instead of a specific base region.

While interpreting the results, it should be noted that some of the variables have a direct relationship with milk sales while others are proxies which explain milk sales indirectly. Estimates use a heteroskedasticity-consistent covariance matrix. Because of the small sample size, significance levels for estimated coefficients have been shown only up to the 5% level.

The regression results show that total milk sales per capita was significantly higher in regions with a higher percentage of the population in livestock and mixed farming systems, but significantly lower in regions with a higher percentage of urban population and a higher rate of literacy. This could be explained by the fact that specialization in livestock leads to higher output, leading to higher sales. The negative effect of urbanization and literacy appear to be counterintuitive; urbanization and literacy usually lead to higher income and higher demand for milk, requiring higher milk sales. The negative result may partly be explained by the form of milk sales rather than milk sales *per se* (see below). Among the regions, total milk sales were significantly higher in West and Central Oromiya and Gambella regions but significantly lower in Northwest Amhara region compared to the average for all regions. Differences from the average were not significant for the other regions.

Regression results show significant differences between determinants of sales of liquid milk and those of butter and cheese (Table 9). Larger sales of liquid milk per capita of agricultural population are associated with high cereal production per capita and high population density³. On the other hand, sales of butter and cheese per capita are not significantly related with crop production per capita and population density. Instead,

² The variable 'milk sales per agricultural population' also accounts for butter and cheese sales converted to milk equivalents.

³ These relationships between cereal productivity and dairy growth are consistent with our findings from South Asia, especially India and Pakistan (see Part 3), where significant take-off in dairy growth was preceded by a period of Green Revolution technology-based cereal productivity growth that generated sufficient income to enhance demand for livestock products and also released land and feed resources for reallocation to dairy animals. Rudimentary evidence of this pattern is also observed in Ethiopia. A survey of 98 villages in the Amhara region in 1999-2000 showed that, overall, irrigated crop production is uncommon but in villages where a higher proportion of land is irrigated, adoption of improved livestock technologies (improved breeds, artificial insemination, feeds and veterinary inputs) is also higher (Benin et al. 2003)

there is a positive relationship between the dependent variable and the share of farms engaged in mixed crop-livestock and only livestock production. Distance to Addis Ababa is not significant in any of the regressions.

Table 9: Estimated coefficients of regression on milk sales using three different dependent variables.

	Total milk sales (Adj. R ² = 0.60)	Liquid milk sales (Adj. R ² = 0.30)	Butter & cheese sales (Adj. R ² = 0.56)
	Estimated Coefficient ^a	Estimated Coefficient	Estimated Coefficient
Crop production			
Cereal production/rural pop.	0.224	2.225**	-0.154
Production of other crops/rural pop.	-0.030	-0.043	-0.028
Production systems (base= crop system)			
% households in livestock systems	0.989**	-0.807	1.401**
% households in mixed systems	4.058**	-1.944	5.222**
Crop and livestock technology			
Irrigated area/crop area	0.411	-0.067	0.137
Length of growing period	0.616	2.091	0.631
No. of cross-bred & exotic cows	0.026	0.110	-0.021
No. of vaccinated animals	0.142	0.622	0.339
Improved feed/green fodder	-0.049	0.135	0.008
Improved seed	-0.087	0.079	-0.083
Market access and urbanisation			
% household access to credit	-0.111	-0.245	-0.013
% Urban population	-0.155**	0.017	-0.157**
Distance to Addis Ababa	-0.087	1.455	-0.510
Population density	0.480	2.889**	-0.204
Road density	-0.150	0.402	0.217
Human capital			
Literacy rate	-1.223*	-3.744**	-1.129
Region dummy			
Tigray	-0.154	0.942	0.817
North West Amhara ^{b/}	-1.139**	-2.997**	-0.424
Central Amhara ^{c/}	-0.589	-2.399**	0.233
West Oromia ^{d/}	1.338**	1.179	1.871**
Central Oromia ^{e/}	0.676**	-0.289	1.011**
Zones around Addis ^{f/}	-0.301	-0.448	-0.143
East Oromia ^{g/}	-0.209	0.840	-0.583
South East Oromia ^{h/}	-0.480	3.142**	-1.438**
Benishagul	-0.404	-1.161	0.194
Southern Nationalities	0.373	0.515	0.742
Gambella	0.832*	2.828**	0.600
Constant ^{i/}	10.625**	-4.585	12.800**

a/ Standard errors or p values are not shown to save space. Significance levels are indicated. ** and * respectively indicate significant at 1 and 5 per cent level respectively.

b/ North Gonder, South Gonder, Wag Hemera, Agew Awi, West Gojam and Bahir Dar

c/ North Wollo, South Wollo, East Gojam and Amhara's Oromia

d/ West Wollega, Illubabur e/ East Wollega, Jimma

f/ North Shewa (Amhara), West, North and East Shewa (Oromia)

g/ Arsi, West and East Harerge

h/ Bale and Borena

i/ Constant term represents the mean of all regions and the coefficient for each region represents differences with the mean

One possible interpretation of these results is that sales of liquid milk are related to development of cereal production and high population density in regional markets; Addis Ababa's liquid milk market has no effect on these regional milksheds because of the long distance. Liquid milk sales would be higher where higher population densities reduce transport and transaction costs and facilitate development of local markets. Sales of butter and cheese are directly related to production systems capable of generating surplus milk, which are processed and then sold in local markets, though Addis Ababa's market is one of the main final destinations. Since all zones target the Addis market for butter to some degree, distance to Addis appears to have a neutral effect on the sales of butter in a zone. In this case, the larger the proportion of the population engaged in specialized crop production systems in a particular zone and the larger the urban population in this zone, the smaller the volume of butter and cheese sales per person in that region. According to this, urbanization's negative effect on butter sales could be related to a positive impact of this variable on sales of liquid milk (positive but not significant in the second regression) and hence indirectly reducing sales of processed products.

Regional effects, captured by dummy variables, are relatively unimportant. Only two regions - Southeast Oromiya and Gambella - show significantly higher liquid milk sales per capita compared to the average and two others regions - Northwest and Central Amhara - show significantly lower liquid milk sales compared to the average. In case of butter and cheese, Oromia - to the west of Addis Ababa - appears to have higher sales per capita and Southeast Oromiya has significantly lower sales, everything else being equal.

Literacy of the population shows a negative relationship with liquid milk and butter and cheese sales. As an indicator of human capital, literacy is normally related to innovation capacity when it refers directly to the dairy producer or the household members. In this case, literacy refers to all population in a particular zone and the negative response of milk sales to literacy could be related to the fact that zones with higher literacy rates develop other activities (probably non-agriculture activities), negatively affecting milk production and sales in that particular zone.

The effect of urbanization appears to be positive but not significant when explaining sales of liquid milk but negative and significant in the case of sales of butter and cheese. Differences in the degree of urbanization across regions are also not very pronounced.

Income and Employment Opportunities in Milk Production, Processing and Marketing

Employment and income from the dairy sector will vary between and within production systems because of differences in feed sources, management, herd sizes, form of milk and disposal patterns, amongst others. A comparison of employment and income from all dairy-related activities for two groups of farms from the highlands - one having cross-bred cows and another with local cows - are shown in Table 10. Both groups have an average of two cows, two oxen, a horse or donkey and some sheep and chickens. These two groups may be taken as representative of the small peri-urban and rural mixed systems, respectively. Share of dairy has been calculated based on detailed daily data records.

Traditional smallholder mixed farming systems generate several times more employment, but less income per unit of milk produced, than urban/peri-urban dairy systems because of low productivity of animals in the former. In both systems over two-thirds of labour is provided by children, who usually do the herding. Women tend not to be involved in production activities but are primarily responsible for traditional processing and marketing (see below).

Extrapolating the labour requirement figures per 1000 litres of milk produced to the systems level, the urban/peri-urban system, which produces 205 million litres of milk a year, creates annually 4.4 million person days of work or 14,760 full-time jobs (assuming a 300 day working year). The figure increases to 16,400 full-time jobs if it is assumed that 270 days are worked per year. The small-scale mixed farming systems, which produce 900 million litres of milk annually, can create 166 million person days of work, equivalent to 553,500 full-time jobs at 300 days per year (615,000 jobs at 270 days per year). Employment figures for the pastoral livestock system, which produces 320 million litres of milk, could not be calculated due to lack of information.

Table 10: Employment and income on dairy farms in Ethiopia.

		Farms with cross-bred cows (small-scale peri-urban system)	Farms with local cows (traditional smallholder mixed farming systems)
Aggregate quantity of milk produced on a daily basis (litres)		561,644	2,465,753
Rate of employment generation (full-time jobs /1000L produced on a daily basis)	Total employment	26.3	224.5
	Family labour	17.3	159.6
	Hired	9.0	64.9
Total employment generated (Full-time jobs)	Total employment	14,760	553,500
	Family labour	9,697	393,539
	Hired	5,063	159,962
Income	(ETB/household/year)	1,908	168
	(USD/household/year)	281	25

a. Child labour has not been converted to adult equivalents as children do grazing and related activities as efficiently as adults. Source: Shapiro et al. 2000; Tangka et al. 2002 and authors' own calculation.

Only a small amount of milk is processed into pasteurized milk, butter and cheese by large-scale commercial processors. Most milk is processed by the producers on-farm into butter and soft cheese (*ayib*) for home consumption and sale. Rural producers who are located far from urban markets usually process surplus milk into butter because of difficulties in selling fresh milk locally and strong demand for butter in markets in towns and cities.

To estimate labour use for on-farm rural processing, previous farm surveys conducted in the highlands (O'Mahony and Bekele 1985) have been used.

For the large-scale industrial processing sector, data were obtained from two industrial processors both located in or close to Addis Ababa: Sebeta Agro-Industry (Mama Milk) and Dairy Development Enterprise (DDE). These two plants process about 9 million litres of milk per year and supply products to small shops and supermarkets in Addis Ababa. For other commercial processors in urban and semi-urban areas, a survey of small-, medium- and large-scale processors was conducted in Central and Western Ethiopia in early 2004.

Extrapolating the results of these surveys and secondary data to the national level, potential employment and income from dairy processing and marketing are summarized in Table 11. In general, there is an inverse relationship between scale of operation of business and jobs per 1000 litres of milk processed daily, although income per worker increases as the scale of operation or business increases. Overall,

labour use in various dairy processing and marketing activities in the different production systems and scales of operation total an equivalent of 174,000 full-time jobs. Of this, on-farm processing and marketing generate 94% of the daily employment because commercial processing is still at rudimentary stage in the country. Nearly all on-farm processing and sales are conducted by women; as processing moves off-farm and scale increases, the share of female labour in processing declines.

Table 11: Employment and income generation through milk processing and marketing in Ethiopia.

Milk processing		Farm household	Small-scale processor	Medium-scale commercial	Large-scale industrial	Total
Market share	Milk quantity handled (L/day)	2,155,616	5,740	7,800	25,200	2,194,356
	%	98.2	0.3	0.4	1.1	100
Rate of employment generation (Full-time jobs/ 1000L)		26	167	23	17	26
Total employment generated	Number of fulltime jobs	55,987	1,009	179	435	57,610
	% employed by category processor	97.2	1.8	0.3	0.7	100
	% of female workers	98	26	50	19	na
Income	ETB/worker/yr	na	1640	2700	6324	na
	USD/worker/yr	na	190	314	735	na
Milk trade		Farm household	Small-scale trader	Medium-scale trader	Large-scale trader	Total
Market share	Milk quantity handled (L/day)	197,260	49,381	12,345		258,986
	Percentage	76	19	5	n.a	100
Rate of employment generation (Full-time jobs/ 1000L)		188	107	88	n.a.	167
Total employment created	Number of fulltime jobs	36,986	5,291	1,058	n.a	43,335
	% employed by type of trader	85	12	3		100
	% female labour	na	72	59	19	na
Income	ETB/worker/yr	na	2,530	2,550	na	n.a.
	USD/worker/yr	na	294	297	na	n.a.
Butter trade		Farm household	Small-scale trader	Medium-scale trader	Large-scale trader	Total
Market share	Volume of butter (milk equiv/day)	816,435	413,700	330,960	82,740	1,643,835
	%	50	25	20	5	100
Rate of employment (full-time jobs/ 1000L)		88	2.27	1.38	0.36	44
Total employment created	Number of full-time jobs	71438	940	456	30	72,865
	% employed by type of trader	98.0	1.3	0.6	0.1	100
	% female labour	100	100	0	0	na
Income	ETB/worker/yr	na	1020	4110	4430	na
	USD/worker/yr	na	119	478	515	na
Full-time jobs		164,311	7,240	1,693	465	173,810
% employed by type of trader		94.5	4.2	0.97	0.33	100

Source: O'Mahony and Bekele (1985) and field survey 2004.

Main Lessons from Ethiopian Dairy Development

Identification of Effects of Key Factors and Policies on Dairy Development Trends

Ethiopia's rural economy is dominated by smallholder crop-livestock mixed farms. However, over the last half century the main thrust of dairy development policies of successive regimes has been on improving commercial dairy production in selected areas of the country, especially around Addis Ababa. This was done by promoting cross-bred and exotic cows and related feed and management technologies and the development of a milk processing industry to supply the Addis Ababa market. However, these development efforts had little impact on the growth of the sector as a whole, even in the areas where they were implemented. Out of a total of 9 million dairy cows in the country (including about 7 million milking cows), there are only about 300,000 (3.3% of total cows) cross-bred or grade cattle, most of them located around Addis Ababa (Ejigu 2003). The exact exotic blood levels of these animals are not known. Only 4 % of total milk consumed in the country is pasteurized.

This poor performance is partly because of low income but also due to demand- and supply-side constraints. The past poor performance of Ethiopia's dairy sector has been attributed to socio-economic, infrastructure and technical constraints, inadequate research and extension in livestock compared to crop and lack of direction and scope of policies related to dairy (Gebrewold et al. 2000). The most common constraints noted are land tenure policies, feed availability, breeds of cattle used and lack of animal services, marketing outlets, roads and transportation. Felleke and Geda (2001) argue that there is no livestock breeding and dairy development strategy in the country except for the draft policy incorporated in the general agricultural policy and the draft breeding policy of 1986, neither of which are yet finalized. Past dairy development efforts were based on projects related to purpose- and area-specific dairy strategies, without any national policy aimed at setting out a comprehensive dairy development strategy or programme.

However, there is general consensus that the most important reason for poor performance has been the policies and policy instruments pursued by various regimes, most notably during the centralized economic systems of the Derg (1974-1991), which stalled and stifled progress. The policy of introduction of an inappropriate technology package for improving productivity under the poor economic and infrastructural environment of the country to serve the urban market also failed. In a low-income country with low consumption of dairy products and where more than 80% of the market is for butter and raw milk, the impact of these policies ought to be very limited. Politicization of the co-operatives also distorted and stifled the limited role they could play in promoting production and marketing. The main outcome of these policies is an established dairy processing industry, with one private firm increasing its share in the Addis Ababa market. This firm is capitalizing on previous developments and policies implemented by the government to supply the government-owned plant, which has been affected by competition, reducing its share in the market and operating at only a fraction of its capacity.

These policies did not benefit consumers; just a small group of producers benefited who supply the manufacturing plants. The impact of these policies cannot even be detected at an aggregate level in the Oromia and Amhara regions, close to Addis Ababa. Liquid milk sales are a regional phenomenon not related to the Addis Ababa market but mainly determined by feed availability (cereal production per capita) and population density. There is some evidence to suggest that where improved cereal production technology has been adopted, better livestock technologies are also being adopted resulting in better productivity and higher marketed surplus of milk. Addis

Ababa appears to have some influence as a regional market for milk surpluses processed as butter and cheese by producers in mixed and livestock production systems, at least in those zones closer to the capital (informal market). However, introduction of economic and market reform measures since 1992 and promotion of other supporting services, such as veterinary services and artificial insemination, have started creating positive impacts on the sector, especially in the peri-urban areas.

Looking at the historical data and considering the key role that domestic demand had played in the development of the dairy sector in other poor countries, we conclude that demand played an important role constraining growth of the dairy sector in Ethiopia. Consumption per capita is low due to consumer preferences and low income. Total growth of GDP per capita between 1961 and 1999 was 17% in total (or 0.4 % per year) compared to 56 and 37% in Kenya and Sudan, respectively.

With such demand constraints, it is not surprising that changes on the supply side were very limited and confined largely in and around Addis Ababa. Improved technology in production and processing did not spread much beyond the Addis Ababa milkshed due to the small size of the market. As shown by de Janvry and Sadoulet (2001), technical change in a sector selling marketable surpluses in the domestic market would result in sharp decreases of output prices with no gains in income for producers, except for those resulting from increased home consumption. If this is the case, the explanations of lack of development of the sector based on supply constraints cannot be sustained.

Growth of the dairy sector could be constrained by low demand and low prices and/or by high transaction costs, which reduces both the price received by producers and their incentive to generate surpluses: milk is mainly produced for household consumption. Any surplus is taken to the market provided the price received compensates the effort involved (the opportunity cost): production costs and technology play no role in this decision. The higher the price received and the lower the cost of selling that milk, the higher the incentive to take more milk to the market. This interpretation may be further supported by the fact that milk consumption per capita decreased between 1995/96 and 1999/2000 according to the CSA's household expenditure surveys (CSA 1997; 2001) although GDP per capita increased at an average annual rate of 3.3% between 1993 and 1999 according to World Bank data. Assuming that income elasticity for dairy products is greater than zero (probably greater than 1), demand should have grown during this period, but in fact consumption decreased. The reason for this apparent anomaly may be that there is a market failure in the dairy sector and that the main constraints to its expansion at present are related to market development and marketing. The market failure would imply that prices for dairy products are too high for some consumers and too low for producers, which could explain why aggregate consumption decreases with income growth and why a growing demand is not reflected in prices and does not result in increased supply. This is normally the case when high transaction costs exist.

Identification of Effects of Trends, Key Factors and Policies on the Poor

Politico-economic philosophies and related policies pursued by three successive regimes are the overriding factors responsible for relative stagnation and endemic poverty in the country. For that reason, the problems and opportunities in dairy production and marketing in the country are no different from the problems of agriculture in general because most of the producers are small-scale mixed farmers. The policy of improving commercial dairy production in selected areas of the country, especially around Addis Ababa, by promoting cross-bred and exotic cows and related feed and management technologies and development of a milk processing industry to supply the Addis Ababa market benefited a small number of producers in the urban/peri-urban areas, but created little impact on rural dairy producers. Co-operatives were unable to play their role effectively in promoting smallholder

production and marketing because there was little incentive on the part of the small-scale producers to do so. Dairy production for the majority of the poor, small-scale farmers remains a minor activity to complement crop production. Large amounts of labour are used in raising animals by traditional smallholders, much provided by children who do not attend school due to poverty. But because of the low productivity of the animals raised, little income and marketable surplus is generated. On-farm processing of milk into butter and cheese is the responsibility of women but inadequate roads and market infrastructure constrain remunerative market access for products, so their return from value-added activities remains meagre.

Identification of Policy Opportunities and Entry Points

Population and urbanization are growing rapidly in Ethiopia. Income growth in the past few years has been modest and will likely continue at this pace, failing to create any major changes in the demand for dairy products. Dairy production will remain primarily in the hands of small-scale mixed farms in the rural areas, though the market share of urban/peri-urban systems will increase slowly. Main government efforts to commercialize agriculture will remain focused on the crop sector, which is understandable and in fact desirable; without a major take-off in the crop sector, dairy development efforts focused on the poor, especially in distant rural areas, will face many problems. Given these scenarios, the following actions should be considered.

First, promotion of dairy as a tool for poverty alleviation will be fostered by supporting both infrastructural and technological options that would enable smallholder farmers and small-scale local processors to add value through marketing and processing products demanded by both rural, town and city-based consumers. Scaling up of processing technology and sizes of firms could gradually evolve with the general economic development of the country.

Second, policies should target the development of raw milk and butter markets because these are the products demanded by most of the population in Ethiopia; pasteurized milk and butter are poor substitutes for these products at the present levels of income. This is why the informal market for these products, representing about 90% of the milk market, kept growing during 40 years of policies focusing on developing industrial processing. Policies to develop the present informal markets should focus on supporting small- and medium-scale private enterprises in rural areas and on reducing transaction costs, increasing prices and margins for producers and reducing prices and increasing quality for consumers.

Third, given poor infrastructure and the costs of moving perishable commodities within the country, policies directed to different milksheds, beyond Addis Ababa, will be necessary in order to expand the benefits of development of the dairy sector to other areas. Regions in the highlands with high potential for crop production and milk surpluses and high population density could contribute significantly to the development of the dairy sector. The expansion of Green Revolution-type technology is still limited and constrained by structural problems in the grain marketing systems. Solving grain marketing problems will also provide greater opportunities to introduce improved technology-based livestock production to complement improved crop production but the complementarities of the issues, constraints and opportunities need to be pursued through appropriate research, policy analysis and design of functional projects. Because of the land tenure policy, many younger families are landless; they are constrained to raise livestock, especially dairy cows, due to feed shortage. However, landless and smallholders can still raise one or two cows by accessing common-grazing resources or collecting feeds from various local sources. Because of their need to buy cereals for family consumption, they have a high propensity to sell their milk output. As farm size increases and dependence on markets for cereal reduce, families tend to consume an increasing share of their milk

output. Larger farms with adequate cereals and a feed-base to raise more dairy cattle have larger marketable surpluses. This production and marketing phenomenon has important implications for development practitioners for targeting technology, credit, input and service delivery; poorer households may not be suitable for raising cross-bred cows but access to credit and appropriate technology may help them get out of poverty by raising local dairy animals.

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