Development of smallholder dairying in Eastern Africa with particular reference to Kenya.

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Summary

Large increases in demand for milk and dairy products projected for the next 25 years represent exciting market opportunities for smallholders in eastern Africa. With the exception of Kenya, traditional cattle production systems based on indigenous breeds dominate milk production in the region, yet they contribute relatively little to marketed production, mainly because of poor access to major urban markets. Kenya, which has over 85% of the dairy cattle population, dominates dairy production and marketing in the region. Its *per capita* milk availability is four to seven times higher than the other countries in the region. The widespread adoption of dairy cattle in Kenya was stimulated by several interacting factors: the conducive policy and institutional environments provided by successive Governments; the presence of significant dairy populations (owned by settler farmers); a sub-tropical geography suitable for dairy cattle; and, smallholder communities who kept cattle and who had milk as an important part of their diet.

Today most of Kenya's 3 million dairy cattle are kept by smallholders in crop-livestock systems in areas of high and medium cropping potential. Generally 1-2 dairy cows (mostly Holstein Friesian or Ayrshire) comprise 50% of the herd, the other half consisting of female calves and heifers. In the high potential areas feeding is mainly cut-and-carry with planted Napier grass (*Pennisetum purpureum*) and crop residues, especially from maize and bananas, supplemented by forage gathered from common properties around the farm. On average total daily milk output is 10 kg per farm, of which a quarter is for home consumption and the rest sold. In the late 1980s, sales were mainly through local dairy co-operative societies, with some to neighbours. However, following market liberalisation in 1992, marketing channels have diversified. It is estimated that approximately 80% of marketed milk is not processed or packaged, but instead is bought by the consumer in raw form. The factors driving the continued importance of the informal market are traditional preferences for fresh raw milk, which is boiled before consumption, and unwillingness to pay the costs of processing and packaging. Raw milk markets offer both higher prices to producers and lower prices to consumers.

In Kenya, therefore, as elsewhere in the tropics, market-oriented smallholder dairy farms are concentrated close to urban consumption centres because the effects of the market over-ride many production factors. Less proximate production occurs only in those regions where there is an efficient market infrastructure. As infrastructure develops, markets become more efficient and urban consumers develop stronger preferences for pasteurised milk, the advantages of proximity will be reduced and production may well move away from intensive peri-urban systems and shift to more extensive systems (as the New Zealand dairy industry illustrates on a global scale).

Until these infra-structural improvements occur, and because of the ready availability of cheap human capital (labour) and the relative expense of financial capital, smallholder dairy production and informal raw milk marketing are likely to predominate for the foreseeable future. Consequently it is anticipated that the industrialised model of dairy production, processing and marketing will remain a minor contributor in Kenya and elsewhere in the region.

Introduction

If Governments in eastern and southern Africa provide conducive policy environments, there are good opportunities for smallholders and their families to benefit from marketed dairy production. Delgado *et al* (1999) have estimated that between 1993 and 2020, the annual demand for milk and dairy products in developing countries will more than double, from 168 to 391 million tonnes. Driven by population growth, urbanisation and increased purchasing power, the estimated annual growth in the consumption of milk and dairy products is 3.3%. These market opportunities represent exciting challenges for all associated with smallholder agriculture in eastern and southern Africa and its intensification through dairy production and marketing.

If market opportunities for milk are to be exploited by smallholders in the way that they have in Kenya during the last 40 years, milk production higher than that achieved in traditional cattle keeping systems requires the introduction of specialised dairy breeds and increased levels of inputs (nutrition and health care) matched to good market linkages for milk sales and input acquisition. Experience in eastern Africa and especially in Kenya, shows that the intensification of smallholder farming systems through the adoption of dairy production is generally concentrated in areas with good infrastructure close to major markets, although less intensive production may occur in other, more distant areas (Walshe *et al.*, 1991).

Along with agroecology, these market factors play the major role in determining the type of dairy production systems found in the tropics, and they have been, and continue to be, important influences on smallholder dairy development in eastern Africa and particularly in Kenya, which dominates dairy production and marketing in the region (Table 1).

Dairying in Eastern Africa

The three major land-based systems producing milk in sub-Saharan Africa, pastoralists, agro-pastoralists and crop-livestock farmers (Walshe *et al.*, 1991), represent a descending scale of cattle wealth and therefore potential milk off-take. Household demand and market access determines actual off-take, which ranges from near zero to 500 kg per lactation in the traditional (indigenous breed) systems (de Leeuw and Thorpe, 1996). Except in Kenya, these traditional systems and their indigenous cattle breeds dominate milk production in eastern Africa (Table 1). Yet they contribute relatively little to marketed production (apart from cooking butter in Ethiopia), mainly because of poor access to major urban markets.

In contrast to the low extracted milk yields in the traditional systems, lactation yields three to four times higher are common in market-oriented smallholder dairy systems in the region; and, in turn, these systems have the potential to increase their and farm productivities considerably (Omiti and Staal, 1996; Omore and Staal, 1998; Omore *et al.*, 1999).

As Table 1 shows, Kenya dominates dairy production and marketing in eastern Africa to the extent that it has over 85% of the dairy cattle population in the region (and because the dairy cattle populations in southern African countries are small, Kenya has over 70% of the population in eastern and southern Africa). As a result of this large dairy herd, the per capita milk availability in Kenya is four to seven times higher than the other countries in the region (Table 1).

Table 1. Dairying in Eastern Africa: cattle, milk production, milk prices and per capita milk availability.

Parameter		KENYA	TANZANIA	UGANDA	ETHIOPIA
Cattle ('000)	Zebu	9,860	13,500	4,060	31,000
	Dairy	3,045	250	150	<100
Total annual milk prod. ('000 MT)		3,075	814	455	738
Farmgate milk price (US$)		0.20-0.45	0.30-0.60	0.20-0.40	0.25-0.35
Annual per capita milk availability, Litres LME		106	28	22	14

Sources: Omiti and Staal, 1996; Omore and Staal, 1998; Omore *et al.*, 1999; FAO.

Smallholder Dairying in Kenya: historical and policy contexts

The adoption of dairy cattle for marketed milk production has been a striking feature of Kenyan agricultural development. As smallholder crop-livestock systems intensified in the face of increasing human population pressure, the integration of dairy cattle into the systems was a frequent strategy for increasing productivity and generating income, particularly in the densely populated Kenya highlands (Conelly, 1998; Omore *et al.,* 1999; de Leeuw *et al.*, 1999). Favouring this widespread adoption by smallholders were several interacting factors: the conducive policy and institutional environments provided by successive Governments; the presence of significant dairy populations (kept by settler farmers); a sub-tropical geography suitable for dairy cattle; and, smallholder communities who kept cattle and who had milk as an important part of their diet.

As Conolly (1998) and Omore *et al.* (1999) have documented, market-oriented dairy farming with exotic cattle in Kenya started almost a century ago when European settlers introduced dairy cattle breeds from their native countries. Most of these settlers occupied the most agriculturally productive highland areas of Rift Valley and Central Provinces. Cross-bred dairy cattle production by Africans started after 1954 when a colonial policy paper, the Swynnerton Plan of 1954, allowed them to engage in commercial agriculture. By 1963, when Kenya attained independence, the dairy herd had expanded to about 400,000 exotic cattle and their crosses with the local East African zebu.

To support dairy production by the European settlers, input services and output market organisations were established. These included: the Veterinary Research Laboratories (in 1910); the Kenya Co-operative Creameries (KCC) (1925); the Animal Husbandry Research Station, Naivasha (1935); the Central Artificial Insemination Station (1946); and, in 1958 the Kenya Dairy Board to regulate dairy marketing.

After independence in 1963, many foreign settlers who opted to leave the country sold their farms to Africans or to the government. Many of these farms were rapidly sold to African smallholders resulting in a decline of the dairy cattle population in large-scale farms to 250,000 heads by 1965 and a rapidly expanding smallholder herd. To encourage dairy production, the government effected a number of changes in the provision of livestock production and marketing services. By 1966, free or cheap and efficient livestock services were introduced including clinical and daily runs to provide artificial insemination services. In 1971, the government abolished the contract and quota system of dairy marketing to KCC, because it had effectively excluded most smallholder producers from selling milk to KCC.

The relatively efficient provision of livestock services continued to the early 1980's when inadequate Govt budget allocations caused the quality of services to decline, prompting the government to think about restructuring the industry with a view to increasing the role of the private sector (Omore *et al*., 1999). For the dairy sub-sector, the major policy change was the liberalisation of milk marketing in 1992 (Dairy Development Policy, 1993), which effectively ended KCC's monopoly in milk marketing in urban areas and stimulated increased smallscale trading in fresh milk (Owango *et al.*, 1998). Its major impact has been a rapid growth of the formal and informal private sector who provide input and output services, and a redistribution and increase of the overall social and economic benefits of market-oriented dairying to smallholder producers, market agents and consumers in Kenya. Changes in the legal framework to support the stated policy revisions have however lagged behind the policy statements.

Smallholder Dairying in Kenya: current production and marketing

After independence, therefore, marketed milk production shifted from large-scale (mainly settler-owned) herds to smallholder crop-livestock farms closer to the urban centres. These smallholdings also grew coffee and tea, and vegetables and fruit (Tiffen *et al.*, 1994). Hence, the dairy enterprise became an integral part of a farming system having cash crops, and subsistence maize and beans, supported by off-farm income from towns through the extended family network.

Today most of Kenya’s 3 million dairy cattle are kept in smallholder agriculture areas of high and medium cropping potential (80% in Central and Rift Valley Provinces) on farms of <2 ha. Generally the 1-2 dairy cows (mostly Holstein Friesian or Ayrshire) comprise 50% of the herd, the other half consisting of female calves and heifers. Feeding is mainly cut-and-carry with planted Napier grass (*Pennisetum purpureum*) and crop residues, especially from maize and bananas, supplemented by forage gathered from common properties around the farm (Staal *et al.*, 1997a). On average total daily milk output is 10 kg per farm, of which a quarter is for home consumption and the rest sold. In the late 1980s, sales were mainly through local dairy co-operative societies, with some to neighbours, but, as explained in the previous section, since economic reforms and liberalisation of trade, marketing channels have diversified, with a larger proportion of direct sales to private and institutional consumers (Staal *et al*., 1997b; Owango *et al.,* 1998).

Characteristic of tropical regions with good market access, the development of smallholder dairy production systems in the Kenya highlands is therefore marked by three elements: declining farm size, upgrading into dairy breeds and an increasing reliance on purchased feeds, both concentrates and forage (Staal *et al.*, 1997a), resulting in milk yields per lactation increasing by as much as five times, while milk yield per ha of land planted with forage rose by a factor of 40 (de Jong, 1996). Underpinning these production responses are a strong local demand for milk (rural communities and neighbouring urban populations) and effective market mechanisms, which link smallholder producers to local and distant markets (Staal *et al.*, 1999).

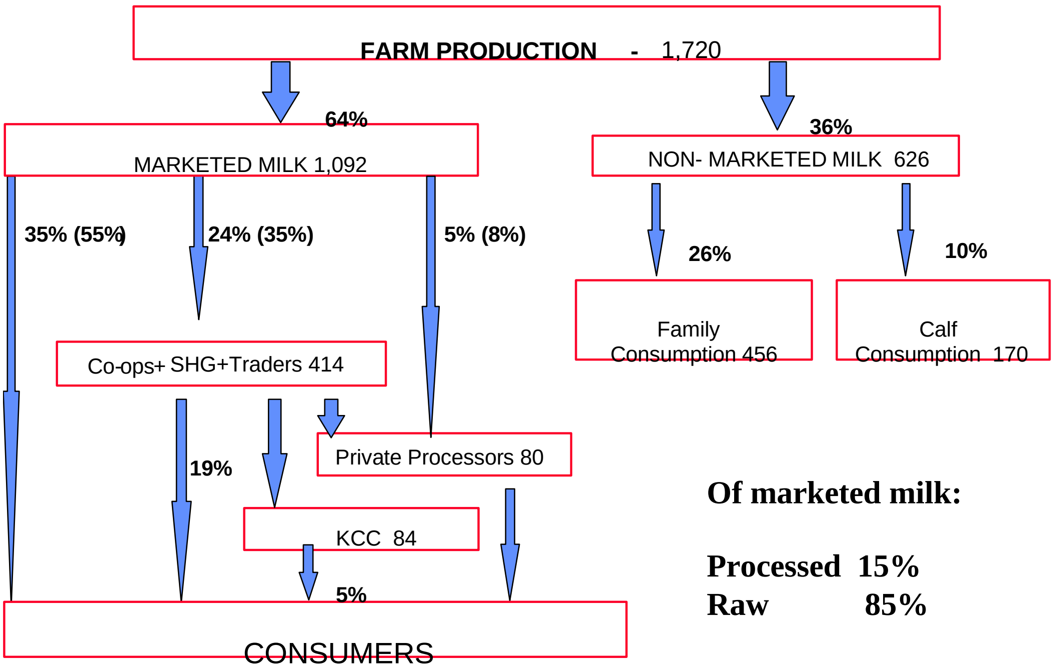


Figure 1 Milk marketing channels ('000 MT) in Kenya, 1997
(modified from Omore *et al.*, 1999)

The predominance of smallholder crop-dairy farms in the highland areas as the major suppliers of marketed milk in Kenya reflects the strong historical linkages between cash crop co-operative marketing systems (especially tea and coffee, but also pyrethrum) and dairy production and marketing. Kenya therefore has given less emphasis than, for example, Uganda, and is doing less currently than Tanzania, to increase marketed milk production from pastoralist and agro-pastoralist systems. The competitiveness of these systems in comparison with marketed milk from the intensive smallholder crop-dairy farms will depend on the costs of milk collection and transport, particularly where distance-sensitive informal (raw milk) markets predominate as they do in Kenya (Figure 1).

Unit costs of the support services (input supply; animal health services; milk marketing) for dairying decrease as production density increases (Walshe *et al*, 1991). Consequently, production systems nationally become highly differentiated in structure of production and achievement of biological potential, effects which have recently been quantified in central Kenya by applying combined household and GIS analytical methods to current production systems (Staal *et al.*, 1999).

The Importance of Market Access

The importance of these spatial and temporal effects of markets is clearly illustrated in Tanzania where a quarter of a million dairy cattle (compared to 13.5 million zebu, Table 1) contribute some 90% of marketed milk (Omore and Staal, 1998). In 1997, nearly all milk in Tanzania was marketed informally, either by direct sales to customers (60%) or through vendors (30%); the remainder was marketed by co-operatives and retailers. The very small contribution of the extensive and semi-intensive (mainly zebu-based) production to milk markets (10% of market flow from 98% of the animals) is indicative of the separation of these systems from the major urban consumption centres, and the inadequate market infrastructure to link them. This is further indicated by large price differentials between rural and urban, indicating relative deficit and surplus areas.

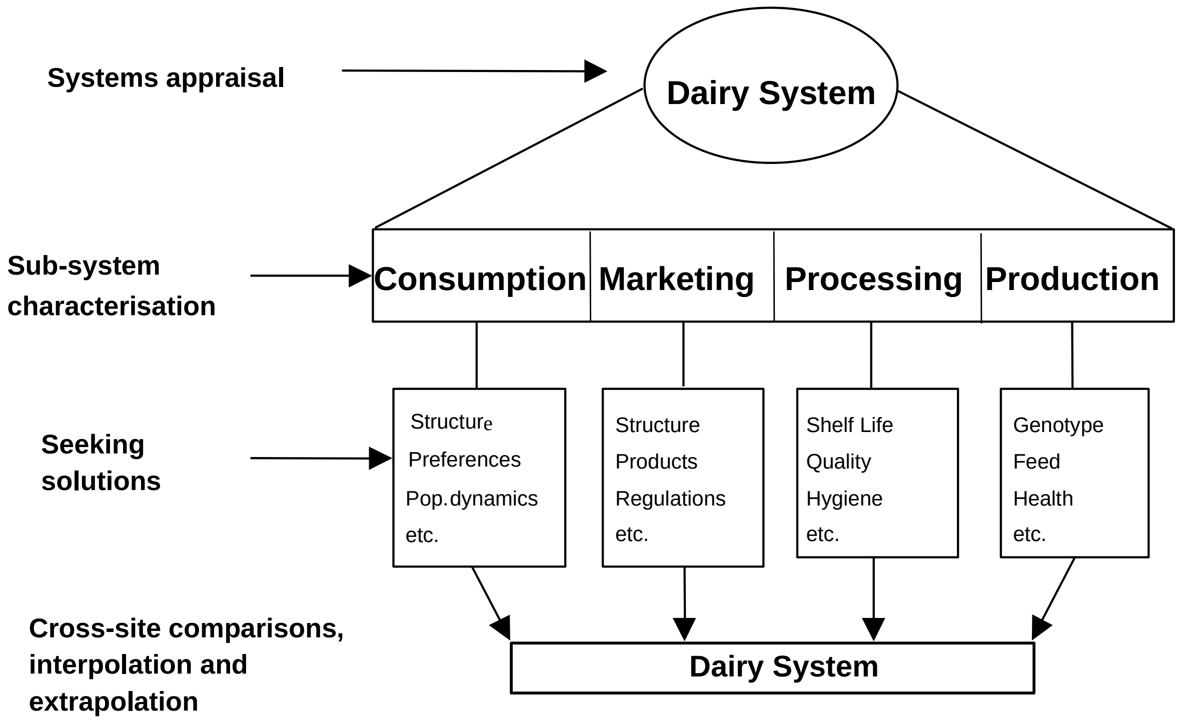
Even given the extensive formal marketing network in Kenya (KCC; private processors; dairy co-operatives), estimates (e.g. Omore *et al*., 1999) show that currently about 80% of marketed milk is not processed or packaged, but instead is bought by the consumer in raw form. The factors driving the continued importance of the informal market are traditional preferences for fresh raw milk, which is boiled before consumption, and unwillingness to pay the costs of processing and packaging. By avoiding pasteurizing and packaging costs, raw milk markets offer both higher prices to producers and lower prices to consumers. Recent surveys in the Kenyan highlands consistently show some 15% higher farm-gate prices and 25-50% lower retail prices through the raw milk market compared to the formal packed milk market (Staal *et al.,* 1998).

As a consequence, the largest single market outlet for farmers, comprising some 36% of marketed milk, consists of direct sales of raw milk from producer to consumer, typically through farmer delivery to nearby households. Other important players in the informal market are small milk traders, who handle another 28% of marketed milk, and who deliver milk to consumers or other retail outlets. In the more formal market, dairy farmer cooperatives are the largest players, with another 28% of the market, while private dairy processors are thought to capture only some 19%. Dairy cooperatives play an intermediary role, by supplying both informal traders and dairy processors. Thus the market share of the dairy processors includes that share collected through cooperatives which is then sold to the formal market (Staal *et al*., 1998).

These relative market shares have been changing through the 1990s, with an increasing role for the informal market. As explained earlier, in 1992 the Kenyan government liberalized the dairy industry, revoking a parastatal (KCC) monopoly on urban milk sales. The period since then has seen the rapid development of a variety of milk market innovations, mainly in raw milk markets. Dairy co-operatives themselves, once an integral part of the formal milk collection system, are marketing a greater proportion of their milk raw through intermediaries to urban markets. Owango *et al*. (1998) found that between 1990 and 1995, the share of cooperative milk sales going to dairy processors fell by more than half in some cases. The market policy change caused dairy cooperatives to pursue the higher prices in the informal market. As a consequence, the same study showed that real milk prices paid to producers by the co-operatives rose significantly during 1990-1995 (Owango *et al.*, 1998). In the more competitive and uncertain market post-liberalization, both individual producers and dairy farmer cooperatives have better opportunities for higher milk prices, but also face greater risks due to the uncertainties of relying on informal traders. As a consequence, more recent research has indicated that milk suppliers are returning to traditional outlets (the cooperatives and dairy processors) as the costs and risks of dealing with informal intermediaries are found to be too high (Morton *et al.*, 1999).

The cash and non-cash costs of conducting a market exchange, termed transactions costs, are particularly important in smallholder dairy because of the high value, yet highly perishable nature of milk. The challenge to policy-makers seeking to increase smallholder market access is to identify means of reducing the overall level of transactions costs, and of reducing the differential with respect to smallholders (Staal *et al.*, 1997b). Recent analyses in central Kenya quantified some of these effects and highlighted the important contribution that policy changes would make to improving the adoption rate and the productivity of smallholder dairying, and thereby improving family welfare (Staal *et al.*, 1999). The priorities identified were: freeing the informal market; improving tertiary road infrastructure; and, enabling the development of private livestock services.

Figure 2 A Framework for Dairy Systems Research and Development
(**Modified from Rey **et al.,** 1993)



A Framework for R&D Support to Smallholder Dairying

Despite the relative success of Kenya's smallholder dairy development and the parallel lessons regarding market linkages from, e.g., Operation Flood in India, publicly-funded efforts to support dairy development in many tropical countries have continued to be supply (production)- rather than demand (market)-driven. Experience now clearly shows that viable dairy systems are market-oriented, and that R&D efforts should focus on considering current and potential market demand. A consumption-to-production approach is required, with interdisciplinary teams evaluating dairy systems shaped by the interactions of economics, policy and technology.

The approach is presented schematically in Figure 2, which shows the conceptual framework for development-oriented dairy systems research used by ILRI and its partners (Rey *et al.*, 1993). Supporting the framework are methodologies for carrying out each phase of the research: the Systems Appraisal (Omore *et al., in press*); and, the characterisation of the consumption, marketing/processing and production sub-systems (Mullins *et al.*, 1994; Jabbar *et al.*, 1997; Rey *et al.*, 1999). By using common methodologies for the national, regional or milkshed level studies, the approach allows comparative analyses of the study results from the various sites (Figure 2).

Recent studies applying the Framework and its methodologies have included appraisals of the national dairy systems of Uganda (Omiti and Staal, 1996), Tanzania (Omore and Staal, 1998), Kenya (Omore *et al.*, 1999) and Sri Lanka (Ibrahim *et al.*, 1999), as well as appraisals of milk sheds in several west African countries (Agyemang et al., 2000). As the collaborative research gathers more information, then the more reliable will be the results of the comparative (cross-site) analyses and greater the confidence to extrapolate and interpolate the conclusions beyond and within the regions and countries directly contributing to the studies.

Conclusions

In eastern Africa, as elsewhere in the tropics, market-oriented smallholder dairy farms are concentrated near or within urban consumption centres because the effects of the market over-ride many production factors. Less proximate production occurs only in those regions where there is an efficient market infrastructure. Therefore, the potential to increase dairy production depends largely on the unit costs of milk collection and transport. Those in urban peripheries are doubly advantaged, because with better access to markets, the unit costs of the support services (input supply; animal health services; milk marketing) decrease as production increases (Walshe *et al.*, 1991)

The advantages of integrating dairy production into crop systems, however, also offer potential, as has been shown by the widespread development of market-oriented smallholder dairying in Kenya. Compared to pastoralists and agro-pastoralists, crop-livestock farmers have more control over feed inputs, and they are able to capture complementarities in feed resource use and nutrient cycling, which increase overall farm efficiency and reduce vulnerability to market shifts. Such farmers may also have advantages over large-scale specialized dairy producers by capturing the value of animal waste nutrients through farm use of animal manure, estimated at 30% of the value of milk in some cases (Lekasi *et al*, 1998).

In Kenya and in many other countries, informal raw milk marketing is the general rule (except when rigorously suppressed by regulatory bodies) because of its benefits to the majority of producers and consumers. Such markets are particularly susceptible to distance (Staal *et al.*, 1999). As infrastructure develops, markets become more efficient and urban consumers develop stronger preferences for pasteurised milk, the advantages of proximity will be reduced and production may well move away from intensive peri-urban systems and shift to more extensive systems (as the New Zealand dairy industry illustrates on a global scale).

Until these infra-structural improvements occur and because of the ready availability of cheap human capital (labour) and the relative expense of financial capital, smallholder dairy production and informal raw milk marketing are likely to predominate and the industrialised model of dairy production, processing and marketing will remain a minor contributor in Kenya and elsewhere in eastern and southern Africa (de Leeuw *et al.*, 1999).

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