

Place of Food Safety in Evolving Pro-Poor Dairy Policy in East and West Africa

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Keywords

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Summary

In East and West Africa, most milk is produced by smallholders who sell it in informal markets. The authors summarize changes in overall development policy that are bringing attention to this previously ignored sector and stimulating a reevaluation of dairy policy. They argue that current dairy policy, derived from developed countries and based on industrial systems, proved unworkable or ineffective as evidenced by the predominance of the informal sector and the high levels of milk-borne diseases. The role of food safety in dairy policy and its potential to constrain the shift of policy to a more pro-poor direction are discussed. The authors review the literature on milk safety in Africa, where high levels of pathogens and other hazards in milk and milk products are reported from both the formal and informal dairy sectors. Case studies that are presented suggest that participatory, risk-based policies may offer an opportunity to increase both dairy safety and benefits to the poor. The authors also show how policy can be positively influenced using examples from East and West Africa.

■ INTRODUCTION

In recent decades, there has been a growing interest in the potential of smallholder dairying to reduce poverty in developing countries. At the same time, policy research revealed major discrepancies between regulations and reality. Specifically, the policy context for transforming and marketing dairy products mainly targets large-scale, resource-intensive systems operating through formal channels, whereas many developing country dairy value chains are dominated by small-scale producers and traditional processors who mostly market informally.

This paper sheds light on this paradox, by reviewing the evolution of dairy policy in sub-Saharan Africa and using examples drawn

from recent research in East and West Africa, and it appraises the impact of such policy on poor farmers, traders and consumers. The authors show how dairy policy reflects broader development policies; while this is showing marked pro-poor shifts, public health concerns, poorly grounded in evidence, have chilled dairy policy development, which largely remains anti-poor, ineffective or unworkable. The authors next present emerging alternatives that may better meet stakeholders' needs both for safe food and wealth creation. A successful strategy for policy engagement and change developed in East Africa is described, and implications for its broader application discussed.

■ DAIRY POLICY EVOLUTION CONTEXTUALIZED

Discussions on dairy policy and development have been dominated by the issue of protectionism and support to domestic producers by rich countries. Subsidized milk from Europe and America is dumped on world markets at less than production cost, and there is widespread concern that this has already seriously damaged the dairy sector in developing countries, especially in West Africa (55). However, a range of economic models and case studies agree that the net

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impact of imported milk on developing country dairy development is probably small (22, 36); the rest of this paper focuses on the more important, but less studied, area of domestic policy.

Dairy policy is located within the broader context of development policy, and changes in development approaches have predictably been reflected in changes in conceptualizing and managing the dairy sector. Understanding development policy helps understand changes in dairy policy; the authors briefly review the broad trends, focusing on similarities rather than differences between East and West Africa.

In the pre-independence era, agricultural development was an objective for most countries with a policy centered on increasing productivity and controlling epizootics. Although many pastoralist groups had a strong dairying tradition (e.g. Maasai, Borani, Fulani and Tuareg), they occupied marginal lands and productivity was low. Modern, intensive dairying was considered viable only in highland areas where rainfall was high and vector-borne diseases less of a problem. In countries such as Kenya with a substantial settler population, dairying was introduced in the early decades of the last century and was stringently protected against potential competition by African producers. This policy was designed not only to maintain prices and prevent diversion of labor, but also to prevent Africans claiming usufructuary title to land (56). Where settler agriculture was less important, dairying was introduced as a development strategy. For example, modern dairying started in Nigeria with the establishment of a number of government Livestock Improvement and Breeding Centers in different parts of the country during the late 1940s and early 1950s, and in Ethiopia in the early 1950s, when a batch of dairy cattle was received from the United Nations Relief and Rehabilitation Administration (UNRRA).

The policy of development through modern dairying dominated during the post-independence era (1960s and 70s). Development (or in the more socialist interpretation, underdevelopment) was regarded essentially as a technical problem to be solved by transfer of technology: intensification, mechanization, industrialization, and import substitution policies were pursued. National dairy policy objectives during this period were to increase milk production in order to meet the deficit of dairy products in the major urban centers and reduce imports of dairy products, while ensuring safety for consumers and markets for farmers. The major policy instrument to achieve this goal was the establishment of large-scale and often parastatal marketing enterprises, which, in turn, were usually given both monopsonistic and monopolistic powers (11).

This system was largely borrowed from Europe and America, where it had been highly successful in improving milk safety, production and productivity. African governments found the modern, industrial model of production more exciting and desirable than traditional systems; it also offered opportunities for developed countries to sell their products and technologies (37). With these demand and supply-side incentives, uptake was rapid but impact elusive. The experiences of Nigeria are typical: milk yields were low; disease levels were high; milk processing plants were dysfunctional and operated persistently under capacity; supply of pasteurized milk was expensive and erratic; and demand for pasteurized milk limited to the small minority of wealthy urban consumers (48). Indeed, throughout East and West Africa, the majority of donor-assisted dairy development programs established in the newly independent countries failed in the first two to three decades of operation.

A parallel policy instrument was the development of dairy cooperatives. Highly successful, in countries as diverse as New Zealand, India and Ireland, they were established in Africa as early as

the 1930s and were widely promoted post-independence with the expectation that as soon as the exploitative colonial structures were gone, the cooperative traditions of the farmers would lead to the development of a "modern cooperative economy" (16). Undoubtedly, cooperatives have potential to improve competition, increase innovation, make use of economies of scale, and empower the poor by increasing their social capital, bargaining power and participation in civil society. However, a major hindrance to cooperatives in Africa has been the difficulty to capitalize given that members are poor and finance institutions weak and reluctant to invest in enterprises without reserves or surety. As a result, governments became heavily engaged in financial and managerial support, in effect creating cooperatives without cooperators. This state involvement isolated cooperatives from competition, locked them into one-way accountability (to government, not members) and allowed management inefficiencies such as inappropriate staffing levels to rise alarmingly (60).

Results of the technical strategy of industrialization and the organizational strategy of cooperatives were both disappointing. Then, with the oil crisis in the 1970s and the dramatic fall in the price of commodities, many African economies entered a period of economic stagnation and indebtedness. This stimulated a radical rethink of agriculture policies. Market-oriented solutions were seen as the new panacea and were widely promoted and adopted from the 1980s on. The Washington Consensus policies were implemented across Africa with support from international financial institutions and reluctance from many African states. These were based on liberalizing markets, increasing competition and getting prices (and latterly, institutions) right. This market-led approach was reflected (with the usual lag) in dairy policy. In recent years, there has been widespread disinvestment of the state from failing milk processing plants and cooperatives, opening of the processing and retail sectors to licensed private companies, decontrol of producer and consumer prices, and withdrawal of the state from input provision (e.g. clinical veterinary services and artificial insemination) (41).

It was hoped that revitalized cooperatives, free from government (mis)management, would be able to mobilize resources from members and become more efficient, thus expanding the dairy sector while maintaining markets for farmers. However, results were largely negative. Corruption and poor management were common, as shown by failure to hold elections, illicit payments, and widespread theft. In Kenya, many dairy cooperatives ceased to function and those that survived have had reduced scale and activities in the last ten years (50). In Uganda, bulking and collecting infrastructure was handed over to farmers' cooperatives without adequate resources and experience in running the network, resulting in mismanagement and collapse in many areas (18).

The formal private sector likewise failed to fill the expectations raised by state withdrawal. Currently, and contrary to predictions from economic theory, most formal milk processing plants pay farmers considerably less than what they receive from informal sector buyers; as a result most plants, even the small-to-medium, operate under capacity. In East Africa, a recent eight-country study found that only 29% of processing capacity was utilized, the rest standing idle (13). In West Africa, modern dairying is even less developed and pioneering enterprises have not had promising results. For example, in Senegal, Nestlé developed a processing plant collecting from pastoralist zones. It experienced great difficulty in establishing a collection network and operated at less than 20% capacity and closed in 2003 after only four years in operation (19). Far from enabling the formal and state-recognized private sector, there is some evidence that liberalization has had the unintended effect of increasing the role of the unregulated raw milk market (52).

The failure of the formal private sector to take off is a general phenomenon in sub-Saharan Africa and is especially marked in the agriculture sector (3). Undoubtedly, there have been some striking successes even in this sector – horticulture in Kenya and cotton production in West Africa are often quoted – but these are exceptions and the consensus is that market-based solutions have not obtained the expected and desired results. Most poor farmers have been unable to access markets or supply the products needed at the price offered, while private sector companies have failed to achieve the efficiencies and economies of scale that would have made them able to supply goods at a more competitive price and/or greater convenience than those offered by the informal sector or importers (42).

Policy makers have concluded that neither transfer of technology nor market liberalization are enough to ensure pro-poor development. As a result, a new policy architecture for Africa is starting to emerge. Examples of this include the Millennium Development Goals, National Poverty Reduction Strategy Papers, New Partnership for Africa's Development (NEPAD), Comprehensive Africa Agriculture Development Programme, Tony Blair Commission for Africa, United Nations Millennium Project, and United Nations Conference on Trade and Development. These approaches predicate that Africa is caught in a poverty trap because of low productivity of agriculture, high disease burdens, slow diffusion of technology, high transport costs, and small markets (57). The way out of the poverty trap is a "big push": a large infusion of cash and human capital, and substantial but appropriate government intervention to jump-start economies and target policies. The preferred strategy hence is no longer getting the state out of markets, but rather helping the state and other stakeholders to develop and implement institutions that allow markets to work better for the poor who constitute the great majority of producers and consumers.

This approach is not without critics (20), but changes in development thinking are already stimulating a new evaluation of agriculture policy with potential for a pro-poor shift that engages with and supports the formerly ignored small-scale sector. One sign of this is the upsurge of interest in smallholder dairy production in the last two decades (32), which in turn has stimulated interest in informal processors, traders and sellers of animal-source foods (23). However, dairy policy in Africa continues to either ignore or actively discourage the informal sector and remains trapped in the views of an earlier era when industrial production, formal marketing, and control regulations dominated the development discourse. A policy analysis in East Africa suggests that this immobility mainly results from concerns over public health (51). But, the next section shows that there is scarce or conflicting evidence on negative health impacts associated with the informal milk sector or on marked quality differences between formal and informal milk sectors.

The rest of this paper addresses the relations between poverty alleviation, dairy policy and food safety in East and West Africa through the following questions:

- To what extent is dairying pro-poor?
- How effective is dairy policy at meeting its objectives?
- Is current dairy policy a constraint to poor producers and traders?
- Can dairy policy be both pro-poor and more effective at assuring food safety?
- How can dairy policy be shifted in a more pro-poor direction?

The authors report case studies from both East and West Africa because there are major differences between the two regions: in East Africa, where milk and dairy products are traditionally consumed, demand for liquid milk is strong, the per capita annual consumption is relatively high [e.g. over 80 kg liquid milk equivalent

(LME) per person in Kenya] and import dependency low. On the other hand, in West Africa consumption of milk by the majority, non-pastoralist population is a more recently acquired habit. As a result, the demand is mainly for processed products (powder, condensed, fermented milk) and the per capita annual consumption is much lower (e.g. only 5 kg LME per person in Ghana) and dependence on imports higher (24).

■ TO WHAT EXTENT IS DAIRYING PRO-POOR?

Dairying had long been considered of little importance to the African poor and was hence neglected by pro-poor development research. But, as industrial dairy development failed to take off, there has been a dramatic and largely spontaneous growth in informally produced and marketed milk. This now constitutes the vast majority of domestically marketed milk in both East and West Africa, which is nearly entirely produced by smallholders, who might not be the poorest in their communities, but who certainly are both poor and disadvantaged. For example, in Kenya the average dairy farm size is 2.6 ha and supports six people; a quarter of these households are female-headed (52). The mean number of cattle is only three, but for about half the farms dairying is a major source of income. Studies in coastal West Africa showed that 60 to 80% of people involved in dairying were resource-poor (61).

As system-wide and value chain approaches have been incorporated into dairy research, it became increasingly apparent that the benefits of smallholder dairying were not limited to farmers and that there were important multiplier effects. Market linkages include: input suppliers (fertilizers, seeds, animal feed, semen), construction (sheds, fences, dairies), equipment maintenance services, contract services (ploughing, vaccination, health, credit), security, buyers of dairy products, transporters, processors, retailers of milk and dairy products, and extension and management services. Each of these ancillary value chains consists in turn of different intermediaries and associated suppliers of goods and services. For example, in Kenya raw milk informally marketed provides income for 350,000 intermediaries along the milk value chain, representing about 12% of the national agricultural workforce (62), while in Ghana every 100 L of milk produced daily can create employment for ten women who use it to prepare and sell milk-based foods (53). In Mali 10 L produced in suburban areas can sustain one household and create employment for one milk collector (8).

The other major impacts of smallholder dairying are the benefits to poor consumers. Milk is high in energy, good quality protein and micro-nutrients (especially vitamin A, B12, riboflavin, calcium and phosphorus), and studies have shown benefits from milk consumption in terms of growth, physical activity and cognitive function (45, 46, 59). Because milk is harvested lower down the food chain, efficiencies of product output per unit feed and of energy output per hectare are usually higher than those for meat production; in addition, in terms of price per unit protein milk typically represents a better value than other domestic animal products (26). There has been concern that lactose intolerance may prevent adults from consuming milk: although it is common among people of African descent, most can consume around 250 ml per day without any ill effects, and tolerance also increases with exposure. Also, the common traditional practice of fermenting milk converts lactose to galactose and glucose increasing digestibility. It is difficult to obtain dietary requirements of calcium from the cereal-based diets common in Africa, and moderate daily consumption of dairy products is recommended even for those of African descent (68).

■ HOW EFFECTIVE IS DAIRY POLICY AT MEETING ITS OBJECTIVES?

In most African countries, the broad objective of dairy policy is to increase milk production through regulated and industrialized production in order to fill the deficit of dairy products in the major urban centers and reduce imports of dairy products (66). An additional objective is to ensure that milk is safe for consumers. Various policy instruments have been tried for these purposes but without the expected results. As discussed earlier, the model of large-scale, state-supported marketing structures failed and was abandoned by most governments. Cooperatives continued to be supported by some governments and many NGOs, but declined in importance after liberalization and withdrawal of government support in the 1980s and 90s: they are now a minority player in the dairy sector. The dominant private enterprise model is also failing to meet policy objectives for the following reasons developed hereafter: i) more than 80% of the milk is marketed informally; ii) most studies show that milk from both the formal and informal sectors contains pathogens or chemicals that make it potentially unsafe; and iii) imports of dairy products are continuing to increase.

Evidence for achieving policy objectives of industrialized production and regulated marketing

The concept of the informal sector was introduced in 1972 by the International Labor Organization (ILO) in its Kenya Mission Report and has been since variously defined. Here, we consider informally marketed milk to be characterized by the absence of a structured sanitary inspection and/or by tax evasion. In East Africa, informal milk is often synonymous with raw milk produced by smallholders and marketed through small-scale channels and is not necessarily illegal. For example, this system was considered appropriate and officially approved for the traditional, rural sector in Kenya. For most sub-Saharan countries for which data exist, the informal sector dominates (South Africa is a notable exception, but the economic and institutional context is atypical). In Kenya, Uganda, and Tanzania, raw milk produced in the informal sector accounts for around 90% of marketed milk (53). In West Africa, more than 90% of domestically produced milk follows informal channels and in some countries informal markets have even emerged for imported powdered milk, which, after reconstitution and fermentation, is sold in eateries (19).

In developing countries in general, informality is typical of markets where consumers are little inclined to pay for quality and safety, authorities lack financial and human capacity for regulation, widespread problems with governance exist which allow inspectors to engage in rent-seeking behavior and decrease compliance with tax payments, and there is not a strong civil society able to represent the needs of consumers. It is hardly surprising that the informal sector accounts for 39% of the GDP in developing countries (21). Previously undervalued or seen solely as a problem, the informal sector is now recognized as an important provider of employment [60-80% of non-farm employment (6)] as well a powerful engine of economic growth. It is especially important for women, the poorest and those with limited opportunities (29). Given the general predominance of the informal sector in developing countries, it was perhaps unrealistic of policy-makers to believe that dairy production would be an exception. Indeed, even when just considering food commodities, evidence suggests that formalization of the dairy sector, similarly to that of other fresh products, lags behind staple foods and dry goods. Kenya, with an estimated 11% of the retail urban food market, has the highest number of supermarkets among sub-Saharan countries apart from South Africa. Yet, 78% of Kenyan supermarket shoppers buy only dry foods and use

dukas (small shops or kiosks) and open markets for dairy and meat purchases (1).

Evidence for achieving the policy objective of ensuring milk safety

Current dairy policy, borrowed from Europe and America, originated in well-founded concerns over safety and adulteration of dairy products in the latter half of the 19th century. However, empirical evidence for similar problems in African informal milk markets is, and has been, scarce. A large number of hazards may be potentially present in milk. Many bacteria and some viruses are shed in milk and milk is a common vector for other zoonotic pathogens found in bovine feces or other secretions and excretions. Milk may also contain hazardous xenobiotics but even less is known of their presence in African dairy products. Table I summarizes some of the hazards of bovine origin that may be present in milk either *ab origo* or from fecal contamination. In addition, milk may be contaminated through poor hygiene practices by milk handlers and from the environment.

Studies on the safety of milk often have been driven by the historical and current importance of diseases in developed countries rather than epidemiological considerations of their likely importance in the very different contexts of African countries. Hence, problems such as brucellosis, tuberculosis and, more recently, enterotoxigenic coliosis, and antibiotic residues are probably over-studied while other problems such as Q fever or tropical plant metabolites are relatively ignored. Table II summarizes the knowledge on milk safety in Africa.

Table I

Hazards to human health that may be present in milk

Xenobiotics	Antimicrobials*, pesticides*, hormones, mycotoxins*, blue-green algae toxins, polychlorinated biphenyls, heavy metals, perchlorate, plant alkaloids and glucosinolates, chlorodibenzofurans
Viral pathogens	Foot and mouth disease, rabies, Rift Valley fever, tick-borne encephalitis
Bacterial pathogens	<i>Staphylococcus aureus</i> , <i>Streptococcus</i> spp., <i>Coxiella burnetii</i> *, <i>Mycobacterium</i> spp.*, <i>Brucella</i> spp.*, <i>Listeria monocytogenes</i> *, <i>Escherichia coli</i> serotypes*, <i>Salmonella</i> spp.*, <i>Campylobacter jejuni</i> *, <i>Campylobacter coli</i> , <i>Aeromonas hydrophila</i> , <i>Yersinia enterocolitica</i> , <i>Vibrio</i> spp., <i>Leptospira</i> spp., <i>Clostridium perfringens</i> , <i>Bacillus cereus</i>
Protozoal pathogens	<i>Cryptosporidium parvum</i> *, <i>Toxoplasma gondii</i>
Other	Lactose (for people with lactose intolerance), newly emerging diseases, unidentified agents, multiple drug resistant bacteria

* Important cause of illness in humans

Table II

Hazards that may be present in dairy products, the role of dairy products in their transmission, and the importance of the associated disease in Africa

Pathogen	Role of dairy products	Importance in Africa
<i>Brucella abortus</i>	Major	High: 40% cows in Africa seropositive (40); 35% of raw milk samples produced and sold in periurban Bamako in Mali contained antibodies from <i>Brucella abortus</i> (9)
<i>Bacillus cereus</i> (enterotoxigenic)	Possibly important (49)	Unknown
<i>Cryptosporidium parvum</i>	Possibly important	Unknown: recent studies (unpubl.) have shown a high prevalence in Kenya
<i>Coxiella burnetii</i>	Possibly important	May be important: urban outbreaks are increasingly reported and these may be associated with milk (63)
<i>Campylobacter jejuni</i>	Minor	High prevalence reported in West Africa (10) and Kenya (64)
<i>C. jejuni</i> spp. <i>doylei</i>	Possibly important	High prevalence reported from South Africa (43)
Enterotoxigenic <i>Escherichia coli</i>	Probably important	Unknown: up to 2% milk sampled in Kampala and Nairobi are positive (unpubl.)
<i>Listeria monocytogenes</i>	Major	Uncertain: reported in meat in East and West Africa but studies on prevalence in milk are lacking (47, 30)
<i>Mycobacterium bovis</i>	Major (15)	Moderate: up to 10% cases of tuberculosis (14); in Tanzania 10% of the extrapulmonary and 4% of pulmonary cases (67)
Rift Valley fever virus	Probably important	High: a serious disease; drinking raw milk has been identified as a risk factor (33)
<i>Salmonella</i> spp.	Major	High: among commonest causes of bacteremia in children under five years and a common cause of meningitis and septicemia (34)
<i>Streptococcus equi</i> spp. <i>zooepidemicus</i>	Unknown	Unknown
<i>Staphylococcus aureus</i>	Major	May be important: present in 6% of raw milk samples in Tanzania (35)
<i>Toxoplasma gondii</i>	Minor	Unknown: raw goat milk has been identified as a source of infection in Ethiopia and Uganda (4, 5)
<i>Yersinia enterocolitica</i>	Unknown	May be important: in Morocco 7% of dairy products were contaminated (25)
Antibiotic residues	Important	High: prevalence of 6% (Mali), 50% (Niger), 36% (Tanzania), 33% (Uganda) and 6-15% (Kenya) (7, 38, 44, 51)
Mycotoxins	Probably important	High prevalence in tropical feeds; has been detected in milk in East Africa (39)

4: Bekele and Kasali, 1989; 5: Bisson, 2000; 7: Bonfoh, 2003; 9: Bonfoh et al., 2003; 10: Bourgeois et al., 1993; 14: Cosivi et al., 1998; 15: Cosivi et al., 1995; 25: Hamama et al., 1992; 30: Hohne et al., 1975; 33: Jouan et al., 1989; 34: Kariuki et al., 2006; 35: Kivaria et al., 2006; 38: Kurwijila et al., 2006; 39: Lanyasuma et al., 2005; 40: Mangen et al., 2002; 43: Miller et al., 2007; 44: Mwiine, 2004; 47: Njagi et al., 2004; 49: Ombui and Nduhiu, 2005; 51: Omore et al., 2005; 63: Steinmann et al., 2005; 64: Turkson et al., 1988; 67: WHO, 2006.

But while the literature reviewed in the table reveals worrying levels of substances potentially harmful to humans, there is little information on how unsafe dairy products contribute to the human disease burden. One pioneering study in Bamako showed that regular consumption of boiled milk was a risk factor for diarrhea and vomiting among school children, but did not establish causal links (28). Human brucellosis is endemic in the urban Malian population, and risk factors for infection include direct contacts with animals and consumption of fresh milk (9).

In the United Kingdom, where most milk is pasteurized, it is estimated that less than 2% of all food-borne diseases are attributable

to milk (12), but no comparable statistics exist for Africa. And although food safety is generally considered to be more of a problem in developing countries, the shorter food chains and less intensive systems are risk mitigating (65).

Evidence for achieving the objective of dairy self-sufficiency

Africa, with about one eighth of the world population, produces less than 5% of milk. Over the last two and a half decades milk production and consumption have increased at a parallel rate, while

the milk deficit remained stable at around 5 million tons (27), suggesting little progress toward the policy objective of self sufficiency in dairy products adopted by most developing countries.

■ IS DAIRY POLICY A CONSTRAINT TO POOR PRODUCERS AND TRADERS?

As mentioned previously, dairy policy is failing to meet objectives of establishing regulated systems, assuring safety and achieving self-sufficiency. In particular, the great majority of milk is produced and sold outside the purviews of regulations. A dairy policy that is little enforced cannot be expected to have much impact (good or bad) on dairy development. However, recent studies in Africa have suggested that inappropriate policies increase costs along the milk value chain to the ultimate disadvantage of consumers; they hinder market development, and may paradoxically decrease milk safety.

A recent, relatively small-scale study in Kenya found that transaction costs incurred by informal sector traders included cans and milk losses due to confiscation by police, milk that went sour because it could not be sold, and bribes given amounting to 3600 KSH per month, or around 50 USD. These costs were passed on to consumers and an economic theory predicts that this would in turn reduce consumption thus missing out on the nutritional benefits associated with milk (58).

Studies in urban Kenya (51) and North East India (unpubl.) found that the majority of pasteurized milk sampled in local markets not only failed to meet bacteriological quality standards, but also had a worse rate of compliance with standards than raw milk. For example, the Kenyan study found that 82% of pasteurized milk samples exceeded the national standards for total bacteria (30,000 cfu/ml) and 59% of samples exceeded the national standards for coliforms (10 cfu/ml), while among raw milk samples, the respective proportions were 60% (exceeding 2 million cfu/ml) and 52% (exceeding 50,000 cfu/ml). The formal sector milk production is characterized by longer chains, a greater mixing of milk, longer time delays between production and sale, the need for cold chains and infrastructure: if problems occur during any of these stages, the quality will be affected. In developing countries, these complex systems are prone to breakdown, so the poor quality of pasteurized milk is not surprising. It does, however, indicate a failure of both internal quality control and external enforcement of quality regulations. Substandard pasteurized milk can be detected by organoleptic characteristics and rapid spoilage, and poor quality products reduce consumer confidence and hinder development of a mature segmented market which would meet the needs of different consumers.

A study on urban dairying in Kampala looked at endogenous risk mitigation practices, defined as the practices carried out by farmers, milk sellers and consumers that decreased risk of disease associated with milk consumption, whether these strategies were carried out with this objective or for other reasons. The study found an average of 17 risk mitigation strategies used on the pathway from stable to table (range 7 to 30). Statistical modeling showed that the belief that urban agriculture was legal significantly increased the number of mitigation strategies used, implying that farmer investment in disease mitigation was increased when they believed their activities were recognized as being legal. This is compatible with the theory that legality increases investment by increasing security. Closely related was the finding (significant at 0.1%) that farmers who had been harassed by officials used fewer risk mitigation strategies. A study of the Brazilian beef industry similarly showed that food safety standards could paradoxically lower the safety of food by making informality more attractive (2).

The presence of a huge informal sector, unrecognized by policy, is evidence in itself that the current policy is not supporting milk traders and vendors. But, while the above examples and case studies indicate that the current policy may be anti-poor, negatively affecting smallholder producers, value chain intermediaries and consumers alike, a comprehensive analysis is however lacking as it would allow a definitive conclusion on the overall impact of the current dairy policy on the poor. This is a priority research issue.

■ CAN POLICY BE BOTH PRO-POOR AND MORE EFFECTIVE AT ASSURING SAFETY?

The previous sections presented the evidence that smallholder dairying benefits poor farmers, intermediaries and consumers, that there are human health risks associated with dairy products, and that the current dairy policy is both ineffective and potentially anti-poor. Given that dairy regulation grew out of concerns over public health and that ensuring the safety of dairy products remains a central policy objective in all African states, then consideration of any policy alternative must also address the potential negative health impacts of smallholder dairying.

The first problem to overcome in formulating an appropriate policy for the dairy sector is our inadequate understanding of the harm posed by dairy products. Without this knowledge, decision-makers are in the dark when trying to decide standards, appropriate interventions and levels of resource allocation. Traditionally, surveys have focused on the presence of hazards (that is substances which can cause harm) in dairy products. New approaches to food safety introduce the concept of risk, which is defined as the product of the negative impacts of a hazard and the likelihood of their occurring. By moving from the identification of hazards to the characterization of risk, the above-mentioned studies in Kenya show that the presence of pathogens in milk does not necessarily pose a problem for consumers. In this case, health risks were low because the great majority of consumers took boiled milk with tea, which effectively eliminated most microbial pathogens. Focusing on risk rather than hazard, i.e. human health impacts rather than epidemiological prevalence, answers the questions of most importance to decision-makers. And, because consumers of informal-sector products have often developed behaviors that mitigate risk, this approach may be favorable to smallholder farmers. Conventional food safety assessments typically focus on only part(s) of the value chain in a piecemeal fashion which is often not useful to understanding how to manage risk. Addressing on-farm hygiene, for example, may be of little ultimate benefit if milk is subsequently contaminated during transport or processing. Risk-based methods take a systematic approach to the entire "farm to fork" or "stable to table" chain. This allows the identification of "critical control points" or those steps where action can most effectively be taken to reduce risk.

Conventional milk safety policy is based on the single objective of safeguarding human health. Public health has been traditionally viewed as a separate, stand-alone discipline, dominated by sectoral experts who make decisions based on public health grounds which are isolated from economic or social considerations. Given the realities of developing countries, where resources are scarce and trade-offs must be made, alternative policies that are multi-objective and take into account the benefits associated with informally produced milk are likely to be more useful. While a systematic comparison is possible by using cost/benefit or regulatory impact analyses, in practice these have been little used in developing countries. However, simply documenting, on one hand, the benefits and, on the other hand, the harms of informal milk can help food safety

authorities make decisions that are better informed and more pro-poor. In Kampala, this approach was applied to the equally controversial issue of urban agriculture and helped policy-makers realize that, given the benefits of urban livestock-keeping to livelihoods, and the ability to manage risks, supporting urban livestock-keeping was a better option than banning it (31).

Policies directed at improving food safety have traditionally used an enforcement-through-punishment model. If standards are not met, then suppliers are fined or delicensed and products removed. Pro-poor policies, aimed at keeping smallholders in markets, would instead support evidence-based actions to improve milk safety. This is an under-researched area as most studies have focused on identification of hazards rather than mitigation of risks, but there are some interesting findings that show considerable improvements can be obtained by simple interventions in informal value chains. For example, in Kenya, training in hygiene resulted in significant and substantial improvements in the proportion of milk samples meeting standards (53). In another example from Mali, a project identified constraints in local milk production: farmers lacked a market for milk, they were reluctant to discard milk containing antibiotic residues and unwilling to participate in testing for brucellosis or other diseases such as bovine tuberculosis. A hygiene package was developed, costing 158 USD (excluding the opportunity cost of the labor) and the cost of quality improvement was 4.6% of the benefit. Through training and awareness-raising, and by providing credit for supplementary feeding, farmers improved both the efficiency and safety of milk production (8).

However, most of these interventions have taken place with support from NGOs or development projects and there is little information on their sustainability and affordability. Moreover, there is almost no information on the policy changes needed to support their scaling up and out in developing countries. But evidence from developed countries suggests that technological innovations and training most likely result in behavior change when linked to incentives. For example, bulk milk is regularly tested for antibiotic residues, bacteria and other quality indicators. Milk which fails is rejected without compensation, while premiums are given for high fat levels. These measures have been highly effective at improving and assuring milk quality. Evidence of successful innovations in developing countries also suggests the importance of appropriate incentives. In Kenya, microbiological studies showed that the quality of milk stored in plastic jerry cans was lower than when metal cans were used. However, traders were reluctant to use metal cans, firstly, because the standard sizes available were too large given that the common form of transport was by bicycle and, secondly, because metal cans were more expensive to replace if confiscated by authorities. The combination of a simple technological innovation of small cans and a policy innovation of greater legitimacy led to wider use of more hygienic containers. In an example from West Africa (Burkina Faso), an anthropological approach to understanding food safety suggested that social environment and the desire for social approval in motivating hygiene behavior have an important influence on quality. The study concluded efforts to promote safer hygiene might be more effective if they were built on the desire for cleanliness, rather than relying on the traditional, rational, but not very attractive, appeal to fear of disease (17).

These strategies – risk-based approaches, multi-objective policy making, enforcement through incentives – have a high potential to increase the effectiveness and appropriateness of the food safety system. Although ensuring food safety is essential, it does not generate sufficient pro-poor dairy development. Dairy value chain agents are constrained by both lack of inputs (including services)

and lack of market access. Part of the problem is structural; informality makes it more difficult to access services, inputs and markets and “stroke of the pen” reforms which recognize the informal sector would easily remove this problem. However, in resource-constrained developing countries access to services is poor even for actors operating in the formal sector.

But new models that have been tested with success in other areas could also improve dairy production: these innovations relate to input supplies, training, and institutions to better access markets. Community based animal health (CAH) is an appropriate and effective way of delivering animal health services. It has been mainly used in pastoral areas and has had positive impact on both animal health and producers’ livelihoods. However, with a few exceptions national policy is hostile to CAH. The “farmer field school” concept, in which groups of farmers learn together better ways of farming through practical examples on their own farms, was developed in Asia. In Kenya it has been applied with success to livestock farmers and is a promising model for smallholder dairies. However, this intensive and practical training is relatively expensive to implement, and requires policy support from extension services or civil society. Studies among farmers and traders have identified financial constraints as important barriers to increasing production and productivity. Microcredit in which mutual guarantees substitute for collateral is one of the most outstanding development successes of the last few decades. However, this intervention requires high levels of management. Merry-go-round and heifer schemes have been very successful at increasing access to dairy cattle: again requirements for external support are high. Fodder and forage innovations also have potential to support smallholder intensification of dairying. For example, conventional breeding experiments have not looked at the nutritional value of stover although this is an important source of food for cattle (in some areas such as India, the single most important source). If nutritional qualities of stover can be increased without adversely affecting yield or other production characteristics, major benefits could be achieved at minimal cost. As discussed earlier, there has been much interest (and considerable disappointment) in the potential of collective action for improving dairy productivity and market access. New models for collective action with larger ownership by members and better governance are being developed, some with good initial success.

■ SHIFTING DAIRY POLICY IN A PRO-POOR DIRECTION: EXAMPLES FROM EAST AND WEST AFRICA

As described earlier, most dairy policies in Africa either do not recognize or actively discourage the informal markets on which smallholder farmers and poor consumers depend. However, some recent examples may offer templates for pro-poor policy change.

During the 1990s, the Kenyan dairy industry was progressively liberalized. This process, together with problems of poor internal management and corruption, led to the collapse of the state-owned cooperative. The gap was quickly filled by a proliferation of small-scale, illegal, informal milk traders and a more politically powerful large-scale, licensed and regulated, private sector. The small-scale traders sold raw milk while the private dairy companies sold packaged, pasteurized or ultra-high-temperature milk and other dairy products. The informal sector was able to provide cheaper milk more conveniently to customers and as a result grew more rapidly than the formal sector and captured more of the market share. It became almost impossible for the Kenya Dairy Board (KDB) – the government-appointed body

responsible for regulating the dairy industry – to control the proliferation of traders and vendors, and the private dairy companies regarded the untaxed, unregulated and unlicensed informal sector as unfair competition. They launched a campaign claiming that the consumption of raw milk was dangerous, because of milk adulteration by informal milk traders, who were portrayed as criminals who added potentially dangerous substances to preserve or increase milk volumes in order to boost their profits. A group of civil society organizations, supported by research institutions, responded with a press statement using evidence generated by the Smallholder Dairy Project (implemented by the International Livestock Research Institute in collaboration with Kenya Agricultural Research Institute and Kenya Ministry of Livestock) to show that the claim that informal milk traders routinely adulterated milk was not true. They also showed that unsubstantiated health concerns were likely to cause panic which would reduce overall milk consumption, reduce health benefits to low income customers, and destroy hundreds of thousands of farmer and traders' livelihood. This was followed up by constructive engagement with KDB, which in turn led to a dairy policy forum.

The ability of empowered farmers and traders to speak on behalf of their colleagues in person proved to be a most compelling factor in successfully changing the decision-makers' opinion about the need to recognize and develop the informal sector. Subsequent analysis of the process of policy change suggested that much of the success could be attributed to the following factors: the generation and communication of credible evidence on the benefits and harms of dairying; broad engagement of stakeholders and focus on stakeholder incentives; creation of ownership of the policy reform drive among civil society organizations who then acted as advocates; and support by donor organizations.

More recently, a workshop with stakeholders from three countries in East Africa agreed there had been a shift toward more pro-poor policy in the dairy sector and identified the following as the most important drivers of change:

- increasing general realization that the informal sector is important and should be addressed rather than ignored or excluded;
- increasing body of research evidence showing that public health concerns can be satisfactorily addressed through positive engagement with informal sector actors;
- observation of experiences in neighboring countries (e.g. Kenya) which both stimulated pressure for change and provided examples of how such change could occur;
- over-arching government policies on pro-poor development that strengthened the role of stakeholders in policy processes, and, together with lobbying by relevant groups, have stimulated progress to better informal-sector engagement;
- engaging the regulatory authorities as leaders in development of new policies.

In West Africa, examples of pro-poor policy progress are harder to find. The public health impacts of milk and milk products are now considered in the harmonization of regulation reforms in the West Africa Economic and Monetary Union (WAEMU). But current regulations do not recognize the informal sector and do not provide incentives for safer production of milk and milk products by smallholders and traditional producers.

A major obstacle in both East and West Africa has been the translation of policy into action. In East Africa, the lack of support given to the transition from state-controlled to liberalized market has been blamed for the collapse of cooperatives and milk quality control. In West Africa, despite the considerable recent interest in developing national policies, in practice all policies remain intentions without a clear supportive program.

■ CONCLUSION

This paper reviewed the evolution of dairy policy and argued that current policy does not meet objectives of a regulated milk market, consumer safety or self-sufficient production. The authors show that smallholder dairying in East and West Africa generates significant benefits for poor farmers, traders, retailers and consumers. While evidence on the negative health impacts associated with smallholder milk and milk products is scarce, almost all studies found there were pathogens or chemicals in milk; there are therefore potential risks. Although current policy is not effective in assuring safety or supporting smallholder production, other policy approaches exist with better potential for minimizing the risks while maintaining or enhancing the benefits of smallholder production to poor consumers. Policy change, while possible, is not easy and requires considerable investments of time, money and especially human capital. Experience shows that well-intentioned policies can have unforeseen negative consequences; hence, the essential role for research in understanding and analyzing policy impacts. Development of pro-poor, pragmatic and evidence-based policy has been a continuing challenge, but the major difficulty continues to be, not the development, but the implementation of policy. New stakeholder approaches incorporating risk-based methodologies offer a promising solution for policies that are both pro-poor and workable.

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REFERENCES

1. AYIEKO M.W., TSCHIRLEY D.L., MATHENGE M.W., 2005. Fresh fruit and vegetable consumption patterns and supply chain systems in urban Kenya: implications for policy and investment priorities. Egerton, Kenya, Tegemeo Institute of Agricultural Policy and Development, 52 p.
2. AZAVEDO P., BANKUTI F.I., 2002. When food safety concern decreases safety: evidences from the meat informal market. In: 6th annual meeting International Society for New Institutional Economics, Cambridge, UK, 27-29 Sept. 2002.
3. BAYLISS K., MCKINLEY T., 2007. Privatising basic utilities in sub-Saharan Africa: the MDG impact. Brasilia, Brazil, UNO/UNDP, 4 p. (Policy research brief No 3)
4. BEKELE T., KASALI O.B., 1989. Toxoplasmosis in sheep, goats and cattle in central Ethiopia. *Vet. Res. Comm.*, **13**: 371-375.
5. BISSON A., MALEY S., RUBAIRE-AKIKI C.M., WASTLING J.M., 2000. The seroprevalence of antibodies to *Toxoplasma gondii* in domestic goats in Uganda. *Acta trop.*, **76**: 33-38.
6. BLUNCH N., CANAGARAJAH S., RAJU D., 2001. The informal sector revisited: a synthesis across space and time. Washington, USA, World Bank, 31 p. (Social Protection Discussion Paper Series)
7. BONFOH B., DEM S., KEITA O., DELORENZI S., TRAORE H., SIMBE C.F., ALFAROUKH I.O., FARAH Z., NICOLET J., ZINSSTAG J., 2003. Assessment of antibiotics residues by microbial inhibitor tests in cow's fresh milk sold in Bamako, Mali. *Milk Sci. int.*, **58**: 304-307.
8. BONFOH B., FANE A., NETOYO L., MBAYE Y., SIMBE C.F., ALFAROUKH I.O., NICOLET J., FARAH Z., ZINSSTAG J., 2003. Collecte et distribution du lait produit localement en zone périurbaine de Bamako (Mali). *Rev. Stud. Res. Sahel.* (8-9) : 13-18.

9. BONFOH B., FANE A., STEINMANN P., HETZEL M., TRAORE A.N., TRAORE M., SIMBE C.F., ALFAROUKH I.O., NICOLET J., AKAKPO J.A., FARAH Z., ZINSSTAG J., 2003. Qualité microbiologique du lait et des produits laitiers vendus au Mali et leurs implications en santé publique. *Rev. Stud. Res. Sahel.* (8-9) : 19-27.
10. BOURGEOIS A.L., GARDINER C.H., THORNTON S.A., 1993. Etiology of acute diarrhea among United States military personnel deployed to South America and West Africa. *Am. J. trop. Med. Hyg.*, **48**: 243-248.
11. BRUMBY P.J., GRYSSELS G., 1984. Stimulating milk production in milk-deficit countries of Africa and Asia. *ILCA Bull.*, **19**: 2-7.
12. CASEMORE D., 2004. Public health issues related to retail bottled raw (Green top) milk. Wales, UK, Food Standards Agency, 32 p.
13. COMESA/EAC, 2004. Regional dairy trade policy paper. Lusaka, Zambia, Common Market for Eastern and Southern Africa and East African Community / Arusha, Tanzania, East African Community, 122 p.
14. COSIVI O., GRANGE J.M., DABORN C.J., RAVIGLIONE M.C., FUJIKURA T., COUSINS D., ROBINSON R.A., HUCHZERMEYER H.F.A.K., DE KANTOR I., MESLIN F.-X., 1998. Zoonotic tuberculosis due to *Mycobacterium bovis* in developing countries. *Emerg. infect. Dis.*, **4**: 59-70.
15. COSIVI O., MESLIN F.X., DABORN C.J., GRANGE J.M., 1995. Epidemiology of *Mycobacterium bovis* infection in animals and humans, with particular reference to Africa. *Revue sci. tech. Off. int. Epizoot.*, **14**: 733-746.
16. CRAIG J., 1993. The nature of cooperation. Montreal, Canada, Blackrose Press, 250 p.
17. CURTIS V., KANKI B., COUSENS S., DIALLO I., KPOZEHOUE A., SANGARE M., NIKIEMA M., 2001. Evidence of behaviour change following a hygiene promotion programme in Burkina Faso. *Bull. World Health Org.*, **79**: 518-527.
18. DENIVA, 2006. Uganda: the impacts of trade liberalisation in the dairy and maize sectors on household welfare. Kampala, Uganda, DENIVA, 53 p.
19. DIEYE P.N., LY C., SANE F.C.N., 2005. Study of veterinary services in the milk sector in Senegal. Rome, Italy, FAO-PPLI.
20. EASTERLY W., 2006. Reliving the 50s: the big push, poverty traps and trade-offs in economic development. *J. Econ. Growth*, **11**: 289-318.
21. ENSTE D., SCHNEIDER F., 1998. Increasing shadow economies all over the world – fiction or reality? a survey of the global evidence of their size and of their impact from 1970 to 1995. Bonn, Germany, Institute for the Study of Labour, 65 p. (IZA discussion paper No 26)
22. FAO, 2005. Dairy: measuring the impact of reform. Rome, Italy, FAO, 17 p. (Trade policy technical notes No 11)
23. FAO/WHO, 2005. Informal food distribution sector in Africa (street foods): importance and challenges. Rome, Italy, FAO, 152 p.
24. FAOSTAT, 2007. Rome, Italy, FAO. <http://faostat.fao.org> (consulted 12.05.07).
25. HAMAMA A., EL MARRACKHI A., EL OTHMANI F., 1992. Occurrence of *Yersinia enterocolitica* in milk and dairy products in Morocco. *Int. J. Food Microbiol.*, **16**: 69-77.
26. HEINBUCH U., 1994. Animal sources for rural and urban populations in Ghana. Rome, Italy, FAO, 25 p.
27. HEMME T., WEERS A., CHRISTOFFERS K., 2005. A global review – the supply of milk and dairy products. Braunschweig, Germany, International Farm Comparison Dairy Network, 41 p.
28. HETZEL M., BONFOH B., FARAH Z., TRAORE M., SIMBE C.F., ALFAROUKH I.O., SCHELLING E., TANNER M., ZINSSTAG J., 2004. Diarrhoea, vomiting and the role of milk consumption: perceived and identified risk in Bamako (Mali). *Trop. Med. int. Health*, **9**: 1132-1138.
29. HOFFMANN D., RIETHMULLER P., STEANE D., 2003. Some issues associated with the livestock industries of the developing countries of Asia: opening Pandora's Box. *J. Food Agric. Env.*, **1**: 148-154.
30. HOHNE K., LOOSE B., SEELIGER H.P., 1975. Isolation of *Listeria monocytogenes* in slaughter animals and bats of Togo (West Africa). *Ann. Microbiol.*, **126A**: 501-507.
31. IDRC, 2006. Growing better cities: urban agriculture for sustainable development. IDRC. http://www.idrc.ca/uploads/user-S/11456426301UA_2_Kampala.pdf (consulted 12.05.07).
32. ILRI, 2003. Dairy and human development in the tropics: laying the foundation for equitable, broad-based growth. Nairobi, Kenya, ILRI, 3 p.
33. JOUAN A., COULIBALY I., ADAM F., PHILIPPE B., RIOU O., LEGUENNO B., CHRISTIE R., OULD MERXOUG N., KSIAZEK T., DIGOUTTE J.P., 1989. Analytical study of a Rift Valley fever epidemic. *Res. Virol.*, **140**: 175-186.
34. KARIUKI S., REVATHI G., KARIUKI N., KIRU J., 2006. Invasive multi-drug resistant non-typhoidal salmonella infections in Africa: zoonotic or anthroponotic transmission. *J. Med. Microbiol.*, **55**: 585-591.
35. KIVARIA F.M., NOORDHUIZEN J.P., KAMAQA A.M., 2006. Evaluation of the hygienic quality and associated public health hazards of raw milk marketed by smallholder dairy producers in the Dar es Salaam region, Tanzania. *Trop. Anim. Health Prod.*, **38**: 185-194.
36. KNIPS V., 2006. Developing countries and the global dairy sector part 2: case studies. Rome, Italy, FAO, 82 p. (PPLI Working paper No 31)
37. KRISTENSEN E., LARSEN C.E.S., KYVSGAARD N.C., MADSEN J., HENRIKSEN J., 2004. Livestock production – the twenty first century's food revolution. *Livest. Res. rural Dev.*, **16**: 1-5.
38. KURWIJILA L.R., OMORE A., STAAL S., DOE S.Y., 2006. Investigation of the risk of exposure to antimicrobial residues present in marketed milk in Tanzania. *J. Food Prot.*, **69**: 2487-2492.
39. LANYASUMA T.P., WAMAE L.W., MUSA H.H., OLOWOFESO O., LOKWALEPUT K., 2005. The risk of mycotoxins contamination of dairy feed and milk on smallholder dairy farms in Kenya. *Pak. J. Nutr.*, **4**: 162-169.
40. MANGEN M.J., OTTE J., PFEIFFER D., CHILONDA P., 2002. Bovine brucellosis in sub-Saharan Africa: Estimation of sero-prevalence and impact on meat and milk offtake potential. Rome, Italy, FAO, 53 p. (Livestock policy discussion paper 8)
41. MBOGOH S.G., 1995. Impact of marketing liberalization on dairy marketing and the dairy marketing system in Kenya. In: Kurwijila L.R., Henriksen J., Aboud A.O.O., Kifaro G.C., Eds., Strategies for market orientation of small scale milk producers and their organizations. Rome, Italy, FAO, 165 p.
42. MCCORD G., SACHS J.D., WOO W.T., 2005. Understanding African poverty: beyond the Washington Consensus to the Millennium Development Goals (MDG) approach. In: Conf. on Africa in the global economy: external constraints, regional integration, and the role of the State in development and finance, Pretoria, 13-14 June 2005. Amsterdam, the Netherlands, FONDAD, 32 p.
43. MILLER W.G., PARKER C., HEATH S., LASTOVICA A.J., 2007. Identification of genomic differences between *Campylobacter jejuni* subsp. *jejuni* and *C. jejuni* subsp. *doylei* at the nap locus leads to the development of a *C. jejuni* subspeciation multiplex PCR method. *BMC Microbiol.*, **7**: 11.
44. MWIINE N.F., 2004. Benefits and health risks associated with milk and cattle raised in urban and peri-urban areas of Kampala City. Thesis Veterinary Preventive Medicine, Makerere University, Uganda.
45. NEUMANN C.G., BWIBO N.O., MURPHY S.P., SIGGMAN M., WHALEY S., ALLEN L.H., GUTHRIE D., WEISS R.E., DEMMENT M.W., 2003. Animal source foods improve dietary quality, micronutrient status, growth and cognitive function in Kenyan school children: background, study design and baseline findings. *J. Nutr.*, **133** (Suppl 2): 3941S-3949S.
46. NEUMANN C., HARRIS D.M., ROGERS L.M., 2002. Contribution of animal source foods in improving diet quality and function in children in the developing world. *Nutr. Res.*, **23**: 193-220.
47. NJAGI L.W., MBUTHIA P.G., BEBORA L.C., NYAGA P.N., MINGA U., OLSEN J.E. 2004. Carrier status for *Listeria monocytogenes* and other *Listeria* species in free range farm and market healthy indigenous chickens and ducks. *E. Afr. Med. J.*, **81**: 529-533.
48. OGBIMI F.E., OYEWALE A.A., 2000. Analysis of the experience of developing the dairy industry in Southwestern Nigeria. *Food Rev. Int.*, **16**: 485-502.
49. OMBUI J.N., NDUHIU J.G., 2005. Prevalence of enterotoxigenic *Bacillus cereus* and its enterotoxins in milk and milk products in and around Nairobi. *E. Afr. Med. J.*, **82**: 280-284.
50. OMITI J., 2003. Enact policies to guide milk trade. Daily Nation, <http://www.ipar.or.ke/milk%20trade.pdf> (consulted 13.05.07).
51. OMORE A., LORE T., STAAL S., KUTWA J., OUMA R., ARIMI S., KANG'ETHE E., 2005. Addressing the public health and quality concerns towards marketed milk in Kenya. Nairobi, Kenya, ILRI, 51 p. (SDP Research and development report 3)

52. OMORE A.O., MURIUKI H., KENYANJUI M., OWANG M., STAAL S., 1999. The Kenyan dairy sub-sector: a rapid appraisal. Research report. Nairobi, Kenya, ILRI, 51 p.
53. OMORE A., STAAL S.J., KURWIJILA L., OSAFO E., ANING K.G., MDOE N., NURAH G., 2001. Indigenous markets for dairy products in Africa: trade-offs between food safety and economics. In: Proc. symp. Dairy development in the Tropics, 2 Nov. 2001. Utrecht, the Netherlands, Utrecht University.
54. OMORE A., STAAL S.J., OSAFO E.L.K., KURWIJILA L., BARTON D., 2004. Market mechanisms, efficiency, processing and public health risks in peri-urban dairy product markets: synthesis of findings from Ghana and Tanzania. Report for LPP Project R7321. Nairobi, Kenya, ILRI, 132 p.
55. OXFAM, 2002. Milking the CAP: how Europe's dairy regime is devastating livelihoods in the developing world. London, UK, Oxfam, 33 p.
56. RAIKES P.L., 1984. Livestock development and policy in East Africa. Uppsala, Sweden, Nordic Africa Institute, 254 p.
57. SACHS J.D., MCARTHUR J.W., SCHIMDT-TRAUB G., KRUK M., BHADUR C., FAYE M., MCCORD G., 2004. Ending Africa's poverty trap. *Brookings Papers Econ. Act.*, **1**: 117-240.
58. SALASYA B., RICH K., BALTENWECK I., KAITIBIE S., OMORE A., FREEMAN A., STAAL S., 2006. Quantifying the economic impacts of a policy shift towards legalizing informal milk trade in Kenya. Nairobi, Kenya, ILRI. (Markets theme discussion No 1)
59. SEIREG M., ZEITLIN M.F., LAMONTAGNE G., MORALES C.M., 1992. Field validation of the tallstick in marginal communities in Nicaragua. *J. trop. Pediatr.*, **38**: 214-223.
60. SHAW L., 2007. Overview of corporate governance issues for co-operatives. In: Meeting on Corporate governance and co-operatives, London, UK, 8 Feb. 2007, 38 p.
61. SOMDA J., KAMUANGA M., MUNSTERMANN S., KEITA K., MENDES A., 2004. Characteristics of the smallholder dairying farmers in West African countries: economic viability and paths for improvement. Socio-economic Bamako (Mali). *Rev. Stud. Res. Sahel.* (8-9): 13-18.
62. STAAL S., 2004. Employment generation in the Kenya dairy industry. Nairobi, Kenya, ILRI, 4 p. (Smallholder dairy project brief 2)
63. STEINMANN P., BONFOH B., PETER O., SCHELLING E., TRAORE M., ZINSSTAG J., 2005. Seroprevalence of Q-fever in febrile individuals in Mali. *Trop. Med. int. Health*, **10**: 612-617.
64. TURKSON P.K., LINQVIST K.J., KAPPERUD G., 1988. Isolation of *Campylobacter* spp. and *Yersinia enterocolitica* from domestic animals and human patients in Kenya. *APMIS*, **96**: 141-146.
65. VAN DE VENTER T., 2000. Emerging food-borne diseases: a global responsibility. *Food Agri. Nutri.*, **26**: 4-13.
66. VON MASSOW V.H., 1989. Dairy imports into sub-Saharan Africa: problems, policies and prospects. Addis Ababa, Ethiopia, ILCA. (Research report 17)
67. WHO, 2006. The control of neglected zoonotic diseases. Geneva, Switzerland, WHO, 55 p.
68. WOOTEN W.J., PRICE W., 2004. The role of dairy and dairy nutrients in the diet of African Americans. *J. nat. Med. Assoc.*, **96** (suppl.): 5S-31S.

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Résumé

Grace D., Randolph T., Omore A., Schelling E., Bonfoh B. Place de la sécurité sanitaire des aliments dans l'évolution de la politique laitière en faveur des pauvres en Afrique de l'Est et de l'Ouest

En Afrique de l'Est et de l'Ouest, la plus grande partie du lait provient de petits producteurs qui le vendent sur les marchés informels. Les auteurs font le point sur l'évolution des politiques de développement qui commencent à prendre en compte ce secteur ignoré jusqu'alors et qui prônent une réévaluation des politiques laitières. Ils montrent que la politique laitière actuelle, élaborée à partir de celle des pays développés et des systèmes industrialisés, est inopérante ou inefficace, comme en témoignent la prédominance du secteur informel et le taux élevé de maladies transmises par le lait. Le rôle de la sécurité sanitaire du lait dans la politique laitière et son potentiel à faire évoluer cette politique plus en faveur des pauvres sont discutés. Les auteurs passent en revue les données de la littérature sur la sécurité sanitaire du lait en Afrique ; des taux élevés d'agents pathogènes et d'autres risques sanitaires dans le lait et les produits laitiers ont été rapportés dans les secteurs laitiers formel et aussi informel. Les études de cas présentées suggèrent que la politique d'évaluation participative basée sur les risques existants pourrait permettre d'améliorer la sécurité sanitaire du lait et les bénéfices pour les pauvres. Les auteurs montrent également comment la politique laitière peut être influencée positivement à partir d'exemples d'Afrique de l'Est et de l'Ouest.

Mots-clés : Production laitière – Politique alimentaire – Innocuité des produits alimentaires – Pauvreté – Petite exploitation agricole – Afrique orientale – Afrique occidentale.

Resumen

Grace D., Randolph T., Omore A., Schelling E., Bonfoh B. Lugar de la seguridad alimentaria en la evolución de la política pro productos lácteos pobres en Africa del Este y del Oeste

En Africa del Este y del Oeste, la mayoría de la leche es producida por pequeños terratenientes, quienes la venden en mercados informales. Los autores resumen los cambios en la política de desarrollo general, que atraen la atención hacia este sector anteriormente ignorado y estimulan la re evaluación de la política lechera. Ellos argumentan que la política lechera actual, derivada de los países desarrollados y basada en los sistemas industriales, se mostró impracticable e ineficiente, como lo pone en evidencia la predominancia del sector informal y los altos niveles de enfermedades originadas en la leche. Se discute el papel de la seguridad alimentaria en la política lechera y su potencial para limitar la deriva de la política hacia una dirección más orientada pro pobreza. Los autores revisan la literatura sobre la seguridad láctea en Africa, donde se reportan altos niveles de patógenos y otros peligros en la leche y los productos lácteos, tanto en los sectores formales como informales. Los estudios de casos que se presentan sugieren que políticas participativas, basadas en los riesgos podrían ofrecer una oportunidad para aumentar tanto la seguridad láctea como los beneficios para los pobres. Los autores también muestran como la política puede ser influenciada positivamente, usando ejemplos de Africa del Este y del Oeste.

Palabras clave: Producción lechera – Política alimentaria – Inocuidad alimentaria – Pobreza – Explotación en pequeña escala – Africa Oriental – Africa Occidental.