Overcoming barriers to informal milk trade in Kenya
A. Omore, S. Staal and T. Randolph.
International Livestock Research Institute (ILRI), PO Box 30709, Nairobi, Kenya

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Abstract
Though informal milk markets dominate the supply of marketed milk in most developing countries, they are largely discouraged by policies based on perceived quality and safety concerns. Kenya provides a prime example of stultifying regulations affecting milk markets. In spite of several derived benefits, regulations governing informal milk markets continue to be unfavourable due to unrealistic safety standards. The rationale for applying regulations modelled along those from industrialised countries where virtually all milk destined for the market is pasteurised and packaged, and the differential political power play between formal and informal sectors, is examined against evidence on consumption patterns, human health risks and benefits associated with informal milk markets.

JEL Codes: E26, O17; Q18.
Key words: Informal markets, milk safety, Kenyan milk standards

1.0 Introduction
Adoption of international food safety standards for domestic markets is increasing throughout the developing world without proper examination of their suitability locally. Adopting such standards and enforcing regulations that they entail often unnecessarily hurt domestic markets, especially those markets that are informal, small scale and without significant export markets.

Marketing of milk in developing countries is largely through informal channels comprising mainly small market agents who sell raw milk and/or traditional processed dairy products. Estimates show that the informal markets account for over 80% of the marketed milk in many countries in sub-Saharan Africa, south Asia and in Latin America (FAO, 2001). Examples include Kenya (86%); Tanzania (98%); India (83%); and, Nicaragua (86%). The predominance is mainly due to the relative lower cost of raw milk and traditional taste preferences. Evidence is presented from Kenya, which has one of the highest annual per-capita milk consumption levels in the developing world (estimated at 100 kg), to show that attempts to discourage informal milk markets in developing countries may be misplaced and development of adaptive local standards and quality certification programmes can better serve local needs.

1.1 Defining ‘informality’
The term ‘informal’ is open to different interpretations. It was coined to refer to people operating outside the law including taxation, but now commonly refers to small-scale traders operating with licenses as well. So, many informal traders are not necessarily informal in terms of legal status. Most
people enter the informal sector as a survival strategy, as it may offer the only immediate opportunity for income generation, particularly for those without access to land resources. In most instances, the majority of people in the informal sector would leave it if they found formal employment. Informality is often a result of low investment into business, be it education, awareness, information or lack of capital. The so-called ‘informality’ is also sometimes linked to traditional or indigenous products or practices, which are labelled informal because they are at variance with accepted international norms.

Informality is also often viewed as a symptom of underdevelopment, but this can be looked at differently. The informal sector provides employment for a huge number of people. Informal businesses also have the distinct advantage of demonstrating more flexibility in responding quickly to new opportunities than does the formal sector. The issue is that because businesses are informal, they may be risky because they are without regulatory support, recognition or are actively discouraged, and so are often vulnerable in terms of incomes, which frequently fluctuate. They are also vulnerable to exploitation because as a sub-sector, they are unorganised, have little voice and lack understanding of business knowledge and technology. But they have the ability to grow and what is needed is to provide them with some of the protective benefits that ‘formality’ can offer.

1.2 The regulatory gap for informal milk traders in Kenya

The description of ‘informality’ above aptly applies to indigenous (or traditional) raw milk traders in Kenya where they include producer-sellers, mobile (itinerant) traders, small-scale farmer groups and retailers in milk bars, shops and kiosks (Figure 1). Approximately 86% of milk sales by these traders reach consumers without prior pasteurisation. Though actively discouraged and without recognition, there are many benefits derived from these traditional milk markets: besides the income and relatively high value employment (estimated at over thrice the minimum wage (Omore et al. 2004)) generated for the traders, they provide cheaper milk for poor consumers; they better satisfy traditional tastes; and, they pay better prices to producers.

Because of their exclusion from policy and lack of attention, there has existed little factual information on safety of traditionally marketed milk. Consequently, national authorities have relied on western models that ignore local realities and practices of ensuring milk safety. This includes insistence on standards that require cold-chain pathways and pasteurization. The negative impacts of such regulations and standards needed urgent addressing to further improve the benefits of dairying to poor traders and their clients. The Kenyan dairy development authorities who realised the potential benefits of providing an enabling environment for small traders urgently required more information as a basis to develop locally derived food safety assurance regulations and standards that also define the required institutional and technical changes and trade-offs. The key question was whether policy change and technology could help bridge the gap between regulated and unregulated markets.
2.0 Partnerships and approaches to address the problem

It was for the reasons cited above that partnerships of international (ILRI and FAO) and several Kenyan public sector organizations in research and development was forged to take appropriate steps to create a bridge to enable the informal traders to be accepted into the licensed milk trade. The Kenyan collaborators were: Ministry of Livestock and Fisheries Development (MoLFD), Kenya Agricultural Research Institute (KARI), Kenya Dairy Board (KDB), University of Nairobi, Kenya Medical Research Institute (KEMRI) and the Ministry of Health (MoH). Risk analysis (risk-assessment –management and –communication) and demonstration of how human health can be safeguarded from milk-borne hazards was considered a critical step.

The problems addressed were: a) lack of accurate information on milk-borne health risks, and b) need to define practical steps to optimize milk quality in informal milk markets. Several analyses were conducted towards these objectives including: documentation of milk flows; consumer preference patterns; market participants; profit margins and efficiency; milk quality; and, milk-handling practices. Sampling, laboratory methods and analytical approaches used are outlined below.

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1 A website with various policy briefs and other related reports on the contribution of smallholder dairy production and marketing to improved livelihoods and economic growth in Kenya was recently created and may be accessed at: http://www.smallholderdairy.org.

2 Profit efficiency was estimated through Stochastic Frontier function equation in FRONTER 4.1 (Ccelli, T.J. (1996)
Consumption patterns and results of assessment of exposure of consumers to the hazards were used to formulate recommendations for managing risks arising from the hazards. Various stakeholder meetings were held before to discuss what risks needed to be assessed and at later stages following exposure assessments, to communicate the risk information and recommendations.

3.0 Data and methods to generate the required evidence

3.1 Study areas and Sampling
Sites for both consumer and milk market agent studies (Figure 2) were chosen to provide contrasting types of markets and dairy production systems important in Kenya. For the consumer survey, the study was conducted in Nairobi city and Nakuru town, both urban areas with approximately 3,000,000 and 400,000 persons, respectively, as well as in rural areas adjacent to Nakuru. For the market agent study, two intensive production / high market access sites, Nairobi and Kiambu, and one extensive production / lower market access site, Nakuru, were chosen. Seasonal survey data were collected from these locations from 250 informal milk market agents and 420 households (hh) between January 1999 and February 2000.

Consumers were sampled within the sites as follows. Nairobi city and Nakuru District (urban and rural) each have 120 census clusters (Central Bureau of Statistics (CBS), 2001). For each, 30 clusters were randomly selected. Within each selected cluster, seven households were randomly chosen for a total of 210 hh and milk samples obtained from 230 hh purchasing purchasing raw (unpasteurised) milk in both locations.

The sampling of market agents varied by their location and type. Divisions considered to have dairying as an important activity were selected in each of four targeted districts. In Nairobi, market agents were sampled in six of eight divisions, in Kiambu five of five, and in Nakuru (urban and rural) five of nine. As for market agent types, all cooperative societies, cooperative milk collection centers and self-help groups were sampled. All milk / snack bars, milk shops and mobile traders were sampled in a selected division up to 30. For divisions with more than 30 milk traders, selection was made to cover all major urban/retail sites in the division.

Both consumers and market agents were sampled in the wet and dry seasons. An attempt was made to sample the same consumers and market agents in the second season. When this was not possible, an alternate was chosen.

3.2 Data analysis
Laboratory and analytical approaches included: conducting hazard analyses for milk adulteration, bacteriological quality, zoonoses (Brucellosis, Bovine Tuberculosis and E. coli O157:H7), and antimicrobials (antibiotics and antibacterials); assessing the influence of market and regulatory risk factors
(e.g., market access, handling, licensing) on milk quality using Hazard Analysis Critical Control Points (HACCP); and, estimating the risk to human health of each milk-borne hazard. Specific sampling steps, laboratory procedures and results of hazard analyses have been reported previously (Arimi et al., 2004; Kang’ethe et al., 2004; Omore et al., 2001).

Economic analyses focused on market structure, conduct and performance including profit margins, profit efficiency and spatial factors influencing marketing behaviour and performance. Profit efficiency and other variables identified through regression as significant in explaining variations in milk quality were used in principal component and clustering procedures to identify homogenous groups of market agents. The principal component and clustering procedures were conducted following the method applied by Vidal et al., (2000) and Staal et al., (2001).

3.3. Testing of interventions to improve milk quality
Testing of training and improved handling interventions to improve marketed milk quality through better handling and training followed the initial assessments between April and December 2002 among 80 small-scale milk traders. Three sites in central Kenya, namely Murang’a, Nakuru and Thika Districts (see Figure 1), were selected based on concentration of small-scale milk traders determined through frequency of market outlets used by milk producers (Staal et al., 2001). The milk traders were trained in hygienic milk handling and testing; appropriate milk handling cans developed with their participation; and, milk samples taken before and after training to assess changes in milk quality based on Kenya Bureau of Standards’ quality specifications for unprocessed milk.

Figure 2: Map of the study area showing districts in central Kenya where the survey and milk hygiene interventions testing were conducted
4.0 Highlights of the evidence generated

4.1. Dairy product consumption patterns

Consumption patterns have been previously reported (Ouma et al., 2002). Briefly, they report that almost all dairy consumption is in the form of liquid milk (Table 1), and demand for both pasteurised and unpasteurised milk has increased significantly in the last decade. Raw fresh milk was purchased by 23% of households (hh) in Nairobi (average = 5.1 litres/hh/month) in comparison to 80% in Nakuru urban (average = 19.7 litres/hh/month) and 98% in Nakuru rural (average = 28.3 litres/hh/month).

Pasteurised milk was mainly consumed in Nairobi where it comprised 64% of all milk consumed (average = 14 litres/hh/month) and 13% of all milk consumed in Nakuru urban (average = 3.2 litres/hh/month), but was insignificant at less than 1% in Nakuru rural (average = 0.2 litres/hh/month).

Most consumers expressed a preference for raw over pasteurised milk. Raw milk was 20-50% cheaper than pasteurised milk. Rural households, some of which are producers as well, mainly consume raw fresh milk, with an average of approximately one litre per household per day.

<table>
<thead>
<tr>
<th></th>
<th>Nairobi (n = 413)</th>
<th>Nakuru urban (n = 149)</th>
<th>Nakuru rural (n = 259)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>mean S. D.</td>
<td>mean S. D.</td>
<td>mean S. D.</td>
</tr>
<tr>
<td>Raw milk (%)</td>
<td>5.1 (23) 11.6</td>
<td>19.7 (80) 22.1</td>
<td>28.3 (98) 35.7</td>
</tr>
<tr>
<td>Pasteurized milk (%)</td>
<td>14.0 (64) 16.7</td>
<td>3.2 (13) 9.0</td>
<td>0.2(&lt;1) 1.2</td>
</tr>
<tr>
<td>Mala (soured milk)</td>
<td>1.6 5.8</td>
<td>1.1 3.0</td>
<td>0.2 1.2</td>
</tr>
<tr>
<td>Other processed milk</td>
<td>1.27 7.6</td>
<td>0.6 3.3</td>
<td>0.1 1.3</td>
</tr>
<tr>
<td>Total</td>
<td>21.9 24.6</td>
<td></td>
<td>28.8</td>
</tr>
</tbody>
</table>

Source: Ouma et al., (2002).

Interestingly and contrary to expectation, high-income consumers expressed the same preference for raw milk as do those with lower income, and often ended up buying more of it (Figure 3). All households in urban areas and 96% in Nakuru rural reported boiling milk prior to consumption, mainly as an ingredient in other foods, mostly tea. The small minority of 4% who did not boil milk mainly consumed it after natural fermentation.
4.2 Milk quality and hazards present

Adulteration with added water varied widely with site, season, and location but showed no particular trend by type of milk market agent or scale of business (Table 2). Cases of adulteration were generally most numerous during the dry season, when higher milk prices acted as an incentive to add volume to milk.

Bacterial quality of milk was often quite poor in reference to the set standards (Table 2), which most agents are unable to meet mainly due to common use of poor handling containers and the general lack of a cold chain. Variable prevalence levels of brucellosis were found mainly in bulked raw milk samples from dairy co-operatives and milk bars, and in samples from where extensively grazed herds predominate. Of samples tested for faecal coliforms, 22% and 1% contained E. coli and E. coli O157:H7, respectively. This prevalence translates to a potential risk of exposure to the pathogen of about three times each year, for a daily consumer of non-heat treated milk. However, as mentioned above, virtually all consumers boiled purchased milk before consumption, so risks of infection from bacterial health hazards were therefore determined to be low. No M. bovis was found and the sampling strategy applied implies that one can be 95% confident that the maximum prevalence of bovine tuberculosis in the District is not greater than 2%.

An important health risk that heat treatment (including pasteurisation) of milk cannot eliminate is anti-microbial residues in milk. Antibiotic or anti-bacterial residues exceeding acceptable Codex maximum residue limits were detected in approximately 6% of samples, indicating that a consumer who takes milk daily – as most Kenyans do - is at risk of consuming milk with drug residues at least twice every month. The proportion of samples with the residues in rural areas, at 15%, was nearly four times the level in samples collected from urban areas. The proportion testing positive for residues among samples from informal market agents decreased with increasing levels of bulking with milk.
bars and small mobile traders having a significantly (P<0.05) higher proportion of samples with anti-microbials compared to samples from dairy cooperatives.

Table 2. Proportions of unacceptable milk samples (according to Kenya Bureau of Standards) from raw milk traders in Kenya

<table>
<thead>
<tr>
<th>Milk quality indicator and proportion below national standard</th>
<th>Average (%)</th>
<th>Range (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adulteration (specific gravity&lt;1.026kg/litre)</td>
<td>10</td>
<td>0 - 22</td>
</tr>
<tr>
<td>Total plate counts (&gt;2 million cfu/ml)</td>
<td>62</td>
<td>38 - 91</td>
</tr>
<tr>
<td>Hygiene: coliforms counts (&gt;50,000 cfu/ml)</td>
<td>52</td>
<td>29 - 70</td>
</tr>
<tr>
<td>Prevalence of brucellosis antibodies</td>
<td>5</td>
<td>0 - 34</td>
</tr>
<tr>
<td>Prevalence of E. coli O157:H7</td>
<td>&lt;1</td>
<td>-</td>
</tr>
<tr>
<td>Antimicrobial agents present</td>
<td>6</td>
<td>0 - 12</td>
</tr>
</tbody>
</table>

4.3 Milk handling practices by market agents

Methods of milk handling were markedly different between types and scales of business. The use of plastic containers was recorded because most are not food-grade quality and are not easy to clean properly. Smaller market agents used more plastic containers (up to 89% for mobile agents) than larger scale market agents such as dairy cooperatives which used plastic containers in only 10% of cases, the rest being mainly aluminium metal cans. Smaller agents reported that they used the cheaper plastic containers, which were significantly associated with higher coliform counts, because health inspectors often confiscated their equipment.

Overall, only 12% of milk handlers had received any form of training in milk handling and quality control with a wide variation amongst different cadres from only 4% of mobile traders to 43% of dairy cooperative staff. Small traders had been in business for a short period of only 2.5 yrs (SD=2.9), many times less than farmer groups (mean=24yrs). This may indicate a high turnover in the milk market business, or an expanding market with several recent entrants. These factors need to be considered in any milk hygiene improvement efforts.

4.4 Clustering of market agents

Clustering of variables of bacterial quality (based on bacterial counts) and efficiency are presented on Table 3. Small traders were grouped together irrespective of licensing, and milk quality is not a major problem of small traders compared to other groups. A critical control point was identified within a small group that sells very small quantities of milk and is also associated with low milk quality, low profit margins and long duration between milk collection and re-sale. None in this group had received any training in milk quality control. However, the majority of small traders were largely neutral with regard to milk quality. Currently, milk traders must have fixed premises before they can qualify for trade licenses. However, the fact that the majority of smaller, mobile, unlicensed traders show no significant difference in milk quality from licensed fixed vendors suggests that there is no justification for this requirement.
Table 3. Associations among principal components and clusters of traders on bacterial quality and profit efficiency: Summary of means of new variables and major clusters with significant frequencies

<table>
<thead>
<tr>
<th>Cluster Frequency</th>
<th>% Traders</th>
<th>Means of new variables</th>
<th>Relative scale of business (Litres sold/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>High milk quality</td>
<td>High profit efficiency</td>
</tr>
<tr>
<td>244</td>
<td>84</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>8</td>
<td>3</td>
<td>- -</td>
<td>- -</td>
</tr>
<tr>
<td>19</td>
<td>7</td>
<td>++</td>
<td>NS</td>
</tr>
<tr>
<td>19</td>
<td>7</td>
<td>NS</td>
<td>++</td>
</tr>
</tbody>
</table>

Key: NS = No significant difference; + = means are significantly higher than the overall sample means; -- = means are significantly lower than the overall sample means.

The lack of significant difference in milk quality as indicated by coliform counts between licensed and unlicensed traders are further elaborated in Figure 4. This invalidates the current unwillingness to license small traders who have no fixed premises, which is the major consideration when issuing licenses. On the other hand, licensing would facilitate systematic testing of traded raw milk, and present an opportunity to engage with traders to offer training towards increasing raw milk quality.

Figure 4. Comparison of quality of milk samples between licensed and unlicensed traders based on national standards for coliform counts (50,000 cfu/ml)

4.5 Testing of training and improved milk handling

The testing showed that significant gains in milk quality could be achieved through training and better handling using more hygienic containers (Figure 5). There was a marked decline in the proportion of unacceptable milk samples following training. In addition, there was clear consumer demand for milk purchased from the trained traders using more appealing containers.

Figure 5. Comparison of quality of milk samples from untrained and trained traders according to national hygiene standards for coliform counts (50,000 cfu/ml)

![Bar chart showing comparison of milk quality](source: MoLFD/KARI/ILRI SDP Policy Briefs (2004))

5.0 Discussion

The key evidence indicated: 1) consumers generally prefer whole raw milk, even those who can afford pasteurized milk; 2) more than half of samples exceed bacterial quality standards and zoonotic pathogens were present in the milk, but nearly all consumers boil milk before consumption, eliminating any microbial threat to health (except for naturally fermented milk that is normally not heat-treated before souring and drinking); 3) anti-microbial residues were found in many samples, and since they are not destroyed by pasteurisation, they may pose the major long-term public health threat in milk; 4) small mobile vendors use poor quality containers, mainly due to policies that exclude them from applying for licensing; 5) the quality of milk delivered by the small mobile traders does not differ significantly from those with fixed premises and licenses; and, 6) training and experience can significantly improve the quality of marketed raw milk. In addition, economic analyses conducted alongside this assessment, but not reported here, point to strong continued viability of small market agents who dominate the milk markets.

The excuse of poor milk quality as a basis for not encouraging and licensing small traders was not validated, as the quality of the milk sold by them is not significantly worse than that sold by licensed counterparts. The intervention results show that significant improvements in milk quality can be achieved through training. Arising from the new information generated, an important
recommendation to stakeholders is that linking training to certification would be an excellent incentive to promote better milk quality in the market and would be an important step in providing the required ladder or bridge to ‘formality’.

The training and certification envisioned could function as follows: the national regulatory authorities would accredit private training service providers with a minimum qualification of a certificate in hygienic milk handling and quality control using the business development services (BDS) approach. The accredited private training service provider would offer training to traders based on a certified curriculum on basic hygienic milk handling and quality control. The traders would then be issued with a certificate of participation at the end of the training. The certificate of participation would be the basis for issuance of a trading license when it is presented to regulatory authority upon payment of some cess fee. These interactions between the national regulatory authority, accredited service provider and milk trader are presented in Figure 6 below.

Figure 6. Proposed interactions between milk quality regulator, accredited service provider and milk trader through the business development service approach

5.1 Have the efforts to bridge the regulatory gap succeeded?
Yes and no. Yes, because the efforts have significantly contributed to providing practical steps to addressing a constraint faced by a large number of voice-less informal traders. The information generated and other complementary efforts have also already contributed to the changing policy environment regarding raw milk marketing. Both the revised (but yet unimplemented) Kenyan Dairy Development Policy and revised Dairy Bill explicitly recognize the predominance of the raw milk trade and provide
institutional guidelines supportive of the small-scale production and marketing of milk.

No, because new legislation is still required to realize the changes already recognized as desirable under the new Dairy Development Policy. This will take some time due to the bureaucratic process involved in passing a bill through Parliament. Vested interests in milk processing and packaging are also fiercely resisting, using the existing legislation and well-funded media campaigns to counter attempts to legalize raw milk marketing.

5.2 Lessons learnt
Any study aiming to formulate strategies to improve commodity marketing where vested interests are strong must anticipate strong resistance to change. In the milk marketing example here, the battle is between a few large, specialized, highly organized, and well-connected producer-processors with significant installed capacity, on one side, and myriad, often part-time, usually haphazardly organized, voice-less small-scale producer-traders of raw unprocessed milk, on the other. The result has been a plethora of press reports highlighting the potential, but undocumented, health hazards associated with raw milk that openly ignores scientific evidence, even when it is made available. These same reports downplay or fail to mention altogether the narrow reach of processed milk supply chains and the higher prices within them.

The competition for market share between the two groups with considerably different levels of investment is being fought on the basis not of price (as it should be) but of perceived quality and safety (even when this is proven false). Thus far, differential political power across the two groups has played a significant part in the contest. Changing the mindsets of some public officials who tend to favour industrial systems that they have been schooled about and who often do not want to appear to support what the outside world may consider as sub-standard, is also a major challenge. Such conflicts are likely to become more common due to increasing pressure on developing countries to implement sanitary and phyto-sanitary (SPS) measures. It can be expected that there will be resistance to the implementation of these measures, which serve the formal sector's interests to the detriment of the informal sector. Clearly, there is need to build on such experiences in promoting policy interventions with enormous potential to reduce poverty such as this, and to devise more effective strategies taking into account the role of vested interests.

6.0 Acknowledgements
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7.0 References


