

Kenyan Dairy Policy Change: Influence Pathways and Economic Impacts¹

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ABSTRACT

Marketing, transporting, processing, and consuming dairy products contribute significantly to the livelihoods of many poor Kenya households. This study analyses the impact of recent research supporting policy changes to liberalize informal milk markets. The study found that behavioural changes in dairy sector participants arising from the research evidence-supported policy and regulatory changes led to an average 9% reduction in milk marketing margins, and a significant increase in the number of licensed small-scale milk vendors. A \$10 million research and outreach effort over 8 years resulted in estimated total benefits that continue to be realized of at least 2.17 billion (\$X) each year, largely captured by consumers, producers, and milk vendors. The net present value of this policy-oriented research investment was estimated to be US\$ 230 million.

Keywords - Policy-oriented research, impact assessment, dairy, equilibrium displacement, Africa, Kenya

1. INTRODUCTION

In Kenya, informal milk markets account for approximately 86% of milk supplies to consumers (Omore et al., 2004) and its supply-chain-related actors include small-scale producers, mobile milk traders, milk bar (tea shop) operators and milk transporters (informal sector small-scale milk vendors, or SSMV's). This dominance of SSMVs in Kenya is also seen in neighbouring countries, such as Tanzania, Uganda and Rwanda, and in many other developing countries, including India, which is now the largest dairy producer in the world.

The demand for milk and milk products is on the rise in Kenya, where annual per capita milk consumption is now estimated at 145 litres, more than five times higher than milk consumption in other East African countries. Dairy products constitute the largest food expenditure item in Kenyan households (Argwings-Kodhek et al., 2005; Salasya et al., 2006).

Although most milk in Kenya passes through informal market channels, previous government policies did not adequately address the concerns of the farmers, traders and consumers who make up these channels. The informal milk markets dominate because milk sold through informal markets reaches and satisfies the traditional tastes of poor consumers who pay a lower price for it and farmers receive higher prices than they do via the formal sector. The former colonial dairy policy, which essentially criminalized the activities of small-scale milk vendors (SSMVs), was largely designed to protect the interests of large-scale settler dairy producers and professed to be based on concerns about food safety and quality. Prior to an important policy change in 2004, small-scale dairy producers and traders were often harassed as large, powerful dairy market players, linked to those in authority, sought to increase their relatively small market share. The activities of SSMVs were not recognized and they could not trade unless licensed, yet the existing regulations made no provisions for licensing or engaging them. The main regulatory body, the Kenya Dairy Board (KDB), perceived its mandate as one to stamp out small-scale marketing channels.

Regulations in effect only recognized a western industrial model of processing and packaging of milk, and small-scale milk producers were required to act only as suppliers.

Efforts to revise the old Kenya dairy policy were spearheaded by the Smallholder Dairy Project (SDP), a collaboratively implemented, integrated livestock research and development project whose broad objectives were twofold. The initial research phase focused on identifying best-bet technologies aimed at improving livestock farming practices and livelihoods. The second phase of SDP initiated and implemented strategies to influence and enhance changes in the Kenyan dairy policy, particularly those that did not officially recognize the existence or operations of SSMVs. The revised policy would allow KDB to engage SSMVs through training and licensing as well as milk promotion. SDP officially commenced in 1997 and ceased its activities by 2005.

This study is an *ex post* assessment of the impact of the revised Kenya dairy policy. It outlines the policy change process, investigates induced behavioural changes at the levels of field regulators and SSMVs, and estimates economic impacts on producers, SSMVs and consumers. It also provides a strategic assessment of the magnitude of returns to the research and coordination roles played by the International Livestock Research Institute (ILRI), recognizing that ILRI was only one partner in a complex project with many people and organizations involved. The SDP was implemented by ILRI, the Kenya Agricultural Research Institute (KARI) and the Ministry of Livestock and Fisheries Development (MoLFD) and funded by the Department for International Development (DFID). The SDP Manager was an employee of MoLFD. Objectives of this *ex post* assessment include:

- To describe and better understand the policy, institutional and behavioural changes that have occurred in Kenya's dairy sector and to identify and learn lessons about how they occurred and what role the research and coordination component of SDP played.

- To measure the overall economic benefits of the policy change to consumers, producers and SSMVs.
- To present a counterfactual situation, depicting what might have happened if SDP had not been implemented and the dairy policy had not changed.

2. METHODS

The study assesses both the influence of the research on the policy change process and estimates the economic impact of the policy change. It describes the pathway from research to economic impacts on ultimate beneficiaries (see Figure 1). Lessons learned regarding influencing policy processes are described in detail in Leksmono et al. (2006) and summarized here.

INSERT FIGURE 1 HERE

The approach analyzes what influenced changes in policy and behaviour, i.e. tracking back from the policy change to explore and document the influences of SDP in Kenya. The economic impact component models the impacts of the changes in policy on farm and retail prices, as well as on the economic welfare of farmers, SSMVs, consumers and input suppliers.

(a) Study area, data sources and sampling framework

Field interviews were conducted in the Nairobi area and Nakuru in August 2007 with a sample of 61 milk traders (30 from Nairobi and 31 from Nakuru) and five field regulators (three from Nairobi and two from Nakuru). In addition, we interviewed several policymakers and SDP researchers, including KDB Technical Services Manager, an assistant to the KDB Technical Services Manager, Chief Executive of SITE Enterprise Promotion, a former SDP Manager and two researchers from ILRI. The field interviews were conducted by an ILRI researcher and consultant experienced in dairy sector regulation and familiar with SDP. The

interviews with milk traders and field regulators were conducted between August 1 and August 10, 2007. The interviews with policymakers and SDP researchers were conducted in June and July 2007 and additional information solicited in January 2008.

The interviews focused on the policy change process as reported by policy officials and associated behavioural changes among field regulators and milk traders. Because this *ex post* impact assessment had limited time and funds available, the study was limited to Nairobi and Nakuru but included Kiambu and Thika towns on the outskirts of Nairobi. The study areas have always had KDB offices and operations. Aside from the police who were tasked under the Dairy Industry Act to act as field-level regulators, most recognized market locations where SSMVs operate have at least one field regulator from the Public Health Department and one from KDB. In addition, KDB is now spearheading training and licensing efforts in these areas, so that the impact of the new policy is more easily identified in these areas than elsewhere.

Nairobi is a high milk density area where the dairy sector is dominated by small-scale milk producers. The area has a large collection of different trader groups with some, particularly transporters and mobile traders, coming from as far as 100 km away. The Thika area supplies parts of Nairobi and Machakos and is dominated by milk bars and small-scale mobile traders. These traders supply a competitive, urban and relatively sophisticated market. Milk is collected in the morning before 0600 hours and transported by public vehicles, arriving at the market by 0900 hours. Some of the traders act as middlemen, selling their milk to other traders who then transport their consignment to the market. Nakuru, on the other hand, is surrounded by large-scale farmers who deliver their milk directly to processors. Small-scale milk traders are left to collect milk from as far as 40 km away from town. The area is dominated by small-scale mobile traders and milk bars. Small-scale mobile traders transport milk using bicycles.

Purposeful sampling of SSMVs was undertaken in order to collect information from as many traders as possible given constraints of time and funds. Similarly, the choice of interviewees was not statistically random. Using a checklist, SSMVs from Nairobi and Nakuru were individually engaged in interviews and informal discussions. No prior appointments were made with the traders; they were interviewed as they were encountered going about routine milk marketing operations.

3. UNDERSTANDING POLICY PROCESSES AND RESEARCH INFLUENCE

The Smallholder Dairy Project, funded by DFID, started in August 1997 as an integrated, collaborative research and development initiative whose purpose was to support the sustainable development of the smallholder dairy sub-sector in Kenya.

(a) Research and advocacy activities in SDP

From 1997–2000 SDP carried out a rapid appraisal of dairy production systems and an economic and structural analysis of dairying, while addressing policy and institutional issues. One of the major findings was that the informal milk sector was critical to the livelihoods of milk producers, traders and consumers. Structured household surveys were used in Kiambu District (close to Nairobi) and other districts in Kenya's Central Province. SDP also assessed public health hazards in the informal milk marketing sector, characterized diary systems and technology uptake, and examined policies and laws banning milk sales by SSMVs in urban areas of Kenya

The second phase of SDP (2000–2005) focused on policy-level outputs and more active engagement with policymakers. Following a 'snapshot review' in 2000 which reported favourably on SDP's progress but noted that uptake of technologies at farm level was difficult in the prevailing policy environment, it was recommended that SDP develop a strategy for the reform of dairy policy using evidence-based SDP research findings in order to

increase impact. SDP drew up a strategy for influencing policy, focusing in particular on the findings concerning the informal milk market, its importance for livelihoods and ways in which perceived public health risks could be addressed. The Kenyan dairy policy at that time did not directly prohibit the uptake of any smallholder farm-level technologies. However, it made farm-level production increases and quality improvement less palatable options because the policy prohibited milk sales through the informal sector into urban areas. It was clear that the prevailing policy environment was actively discouraging the predominant section of the market, with major implications for producers, traders and consumers whose livelihoods depended on this informal sector. To tackle some of the identified informal market issues, SDP piloted the training of SSMVs in basic milk testing, hygiene and handling.

Part of SDP's policy-influencing strategy was to foster links with civil society organizations (CSOs) that could bring capacity to engage in policy advocacy in a way that the SDP implementing institutions could not. These CSOs became engaged in active advocacy in support of small-scale traders and farmers and, together with the KDB, were partners in SDP's high-level dairy policy forum held in 2004 to present the project's research results and highlight their policy implications.

DFID funded SDP to the tune of approximately USD 2.5 million from 1997 to 2005. Consultations with former SDP personnel revealed that the project's research and development partners contributed an additional USD 2.5 million in staff time, staff resources and other in-kind contributions over the life of the project. Actual staff time in hours was difficult to quantify but SDP had a project manager appointed by MoLFD, ILRI provided the technical research team and the CSOs were very active in the advocacy phase. A steering committee was established with members from ILRI, KARI, KDB, KEBS, MoLFD and the Ministry of Health and some informal market actors.

(b) *Policy influence pathways in SDP and the evolution of Kenya dairy policy*

Research aimed at influencing policy is challenging and research into what it takes to successfully influence policy is in its infancy. This *ex ante* economic analysis significantly benefited from two years of parallel research into better understanding the underlying processes of dairy policy change and the role played by the smallholder dairy project in influencing policy change that positively impacted many poor people (see Leksmono et al., 2006). Kenyan dairy policy history and processes are captured in detail in Leksmono et al., (2006). Here we focus on the most relevant changes and key lessons learned regarding how research influenced policy processes in this instance. Table 1 presents a summary of important events and activities and their timing in the overall dairy policy change process in Kenya.

INSERT TABLE 1 HERE

By 2003, the policy advocacy phase of the SDP had become very active. The new government made some changes to the KDB, but by then, such vacillations had emboldened large-scale processors who were opposed to the new bill and policy. In addition to safety and quality issues addressed in the research phase, SDP arguments in favour of engaging SSMVs included the huge impact on employment creation and poverty reduction in the era of Kenya's Poverty Reduction Strategy Process (PRSP). Paid advertisements were placed in local newspapers touting the benefits of legalization, but these were met with rebuttals in the same media by large-scale processors, culminating, by late 2003, in what became known as the 'milk wars'. Arguments in favour of legalization which appeared in local media used research evidence from SDP. In May 2004, SDP and partners organized a consultative dairy policy forum of stakeholders including ministers, members of parliament and other government officials, at which it was agreed in principle that the policy of engagement with SSMVs would be supported. Presentations at the forum included research findings that

supported pro-poor policy reforms. In addition, SDP and partners officially launched policy briefs and screened a video entitled '*Unheard voices from Kenya's dairy industry*'.

While the bill and policy change processes continued in parliament, ministerial authority allowed the Minister for Livestock and Fisheries Development, on the advice of the KDB, to issue a set of dairy industry regulations (Legal Notices 101, 102 and 103) in September 2004. While they were all updated versions of sub-sections of the revised 1958 Act, the most pertinent one was Legal Notice 102, also known as the Dairy Industry (Sales by Producers) Regulations, 2004. These regulations streamlined the licence application processes and, more importantly, clearly enumerated the types of licences that were now available in the dairy sector (e.g. primary producer, processor, mini dairy, cottage industry, milk bar and cooling plant), some of which were clearly focused on activities that were compatible with small-scale informal operations. KDB officials used the impetus provided by the issuance of these regulations to engage and institute training, certification and licensing requirements for SSMVs.

Since the policy change, KDB has worked to train and certify SSMVs while licensing their milk outlets and premises which meet requirements on handling, hygiene and quality control. In addition, KDB has trained and employed the services of business development service (BDS) providers to train and certify SSMVs whose businesses would then be licensed by KDB. While progress is being made on these fronts, the number of BDS providers is still small relative to the number of SSMVs waiting to be trained, certified and licensed. Also, KDB is working with NGOs like SITE Enterprise Promotion to encourage milk consumption on the premise that quality is being greatly improved by training and licensing. KDB has started branding milk outlets and premises to improve consumer confidence and promote recognition by regulatory authorities. Evidence, though yet anecdotal, suggests that milk sales are increasing in these branded outlets and premises.

4. IMPACT OF NEW DAIRY POLICY ON ENFORCEMENT AND COMPLIANCE

Primary information to assess the impact of the new dairy policy on enforcement and compliance and changes in general attitudes and behaviour of both regulators and SSMVs was obtained from interviews with field regulators and SSMVs. Survey references to periods before and after the policy changes, respectively referred to the days or weeks prior to September 2004 versus July/August 2007. Additional insights were gleaned from interviews with policymakers and researchers.

(a) Behavioural change among field regulators

Around late 2004, field regulators instituted some changes in enforcement activities, following specific instructions from KDB and Public Health Department officials. Previous activities were limited to policing and inspection, usually checking for licences that were never issued. Currently, their task is to ensure that licensed outlets and premises operated by SSMVs meet conditions on milk hygiene and testing requirements, sanitation of premises and health status of SSMVs. They also provide advice on how to meet these conditions. In addition, some regulators issue milk movement permits to mobile traders and assist the licensing process by enabling relevant paperwork required from SSMVs; these activities are accomplished through field visits, spot checks and training. The skills required to bring about these changes have mostly been obtained through formal training over the last few years.

(b) Behavioural change among SSMVs

To assess behavioural change among SSMVs, a survey was conducted of 61 milk traders along the purposefully selected Central and Western milk market chain areas. The areas of Nairobi (including Nairobi, Thika and Kiambu) and Nakuru were selected because they represent scheduled trading areas with KDB offices and would therefore be directly influenced by the regulations.

Survey results showed that all the interviewed milk traders owned their operations, although there were milk bar operations established by groups of SSMVs. Most (82%) of the businesses were started in 2004 or earlier, i.e. before the policy change, so most interviewed traders were familiar with the policy enforcement environment before and after the policy change.

Almost 50% of SSMVs interviewed were producer-traders, implying that their milk was sourced from their farms. The remainder were almost evenly divided among traders who were non-producers, transporter-traders and milk bar operators, with almost all their milk coming from other milk traders. Table 2 presents the distribution of SSMVs interviewed.

INSERT TABLE 2 HERE

Almost all respondents were familiar with the new regulations or requirements on milk handling and quality control, and they used these guidelines or regulations in the conduct of their businesses. The specific regulatory requirements mentioned include training and licensing, types of containers used and hygiene. Many SSMVs received information on milk handling and quality control from KDB and, to a lesser extent, from ILRI and other SSMVs, mostly between 2005 and 2007. This was the period when KDB actively encouraged SSMVs to obtain training and to familiarize themselves with issues related to milk handling and quality control.

The surveys were conducted in areas where KDB operates. In the survey, approximately 85% of respondents reported that they had been trained on milk handling and quality control methods. However, only half of them reported applying and receiving operating licences immediately following training, implying a lag between training and licensing. The hiatus is not unusual, given that training and certification of SSMVs by BDS and KDB usually precede licensing of premises and outlets for milk sales. In reality, all but two SSMVs who were interviewed had one form of licence or another for their operations.

The most common licences reported were milk bar licences (49%), milk movement permits (44%) and mini-dairy licences (15%), as presented in Table 3.

INSERT TABLE 3 HERE

Consistent with the policy change timeline, most SSMVs were trained by KDB agents between 2005 and 2007. Nearly 90% of respondents reported that it was presently easier to obtain a license than in the period prior to 2004 when the new policy came into effect, noting that licensing is now being expedited following training and other requirements.

On average, SSMVs reported that before they were trained and licensed, they were harassed by KDB and other regulators about four times a month; the average frequency of harassment was significantly higher in Nakuru (six times a month) than in Nairobi. Forty percent of respondents reported that they were last harassed by KDB or other regulators in 2005 or later. The most common form of harassment was by confiscation of milk, but nearly 10% of SSMVs reported bribing their way out of a potential arrest situation. Nearly all licensed SSMVs who had been in operation before the policy change reported a change in the behaviour of regulators toward them since licensing, noting that they were now allowed to operate as long as they complied significantly with all requirements. However, those whose premises and outlets were still not licensed were usually harassed by regulators, although to a lesser extent than before the policy change.

5. MEASURING THE ECONOMIC IMPACT OF THE NEW KENYAN DAIRY POLICY

The policy changes were expected to improve the welfare of producers, traders and consumers by reducing transaction costs and the retail milk price while increasing producer prices. Previously, small-scale operators venturing into the retail market were likely to incur high transaction costs resulting from milk loss due to adverse police action, quality loss due to milk becoming sour and direct confiscation of milk and containers. However, those SSMVs who paid political rent avoided adverse police action as well as losses due to

confiscation of milk and milk containers. Both options ultimately translated into higher consumer prices.

(a) *Policy impact on transaction costs: a model of equilibrium displacement*

Transaction costs include information, negotiation and enforcement costs (Hobbs 1997). Several studies have shown that market participation by resource-poor smallholders is hindered by high transaction costs (Staal et al. 1997; Holloway et al. 2000). Implementation of the revised Kenya dairy policy reduced transaction costs and hence, marketing margins. Salasya et al. (2006) estimated the reduction in marketing margin at the SSMV level, using the transaction cost approach, at 38%, while this study measured transaction cost as the difference between farm price and retail price. The distribution of gains arising from reduced transaction costs was investigated. The economic model evaluated the collective impact of the new policy through its effect on prices, quantities and overall welfare.

Several studies have used equilibrium displacement models to evaluate the distribution of gains from policy change (e.g. Freebairn et al. 1982; Wohlgenant 1993; Lusk and Anderson 2004). Consistent with these studies, we proposed a model to estimate distributional changes in farm and retail prices, and changes in welfare. To better explain our model of equilibrium displacement following Freebairn et al. (1982), we extended Gardner's (1988) program effects model, to include the impact of a reduction in the cost of marketing goods and services in the Kenya dairy market (see Figure 2).

INSERT FIGURE 2 HERE

The model assumes that the market is competitive, with linear demand and supply functions, and the supply of marketing goods and services is less than perfectly elastic, resulting in a normal supply curve for these goods and services. The model is appropriate because most of the milk produced in the informal sector is sold raw and it is unlikely that aggregate economy-wide pre-policy change milk losses were highly significant given the

following: (1) there was high consumer demand for raw, unpasteurized milk, while processors who served the retail markets sold only processed milk; (2) SSMVs had the legal option of selling their milk to large licensed processors who pay less than consumers; (3) SSMVs could make political rent payments to avoid confiscation of milk and containers; (4) SSMVs could target retail markets in areas where there was little or no regulatory activity and (5) SSMVs could engage in limited production for retail market. Some of these options may also reduce losses in quality.

In Figure 2, we illustrate the impact of change in the Kenya dairy policy on welfare gains by consumers, producers and SSMVs who provide marketing goods and services. We posit a two-market scenario, a ‘retail’ market with demand for milk D_r and supply of marketing goods and services S_n , and a ‘farm-level’ market with derived demand for milk D_f and supply of milk S_f . Note that derived demand D_f is equivalent to $D_r - S_n \forall Quantity$ where $D_r - S_n > 0$.

We define market margin, M , as the difference between D_f and D_r (i.e. $M = D_r - D_f$); we assume that it is not constant but generally comprises a fixed portion and a portion that varies with quantity. In the pre-policy change environment, P_r is the price of milk in the retail market, P_n is the cost of supplying marketing goods and services in the retail market, P_f is the farm price for milk and Q_0 is the initial milk quantity that clears the market.

To demonstrate the impact of the policy change, consider that the new policy of legalizing the activities of SSMVs after training and licensing leads to a reduction in transaction costs or market margin arising from significantly lower political rent payments and milk losses. Consequently, there is a reduction in the cost of supplying milk and milk products to the retail market. This results in a downward shift in the supply curve for marketing goods and services and, consequently, a new derived demand curve. The proportional shift in derived demand reflects a reduction in the market margin, M , by a cost,

w , which is measured as the vertical difference between the D_f and D_f' . The resulting increase in quantity of milk supplied to the market, from Q_0 to Q_1 , is also occasioned by an increase in the number of SSMVs now supplying the retail market. The markets also see decreases in retail milk price and the cost of supplying marketing goods and services, but also an increase in milk prices received by farmers. As a result, Figure 2 shows unequivocal increases in consumer surplus by the area $P_r mnr$ and producer surplus by the area $P_f bcd$ whereas surplus accruing to SSMVs who supply milk and milk products to the market increases by the area $efkl$ while losing the smaller $P_n gfh$. These indicate that there are cost reduction benefits accruing to the market chain actors. In the case of SSMVs, reductions in margins accruing result from political rent that is no longer paid to regulators, and milk and milk containers that are no longer confiscated. The formulae for estimating the welfare changes are provided by Freebairn et al. (1982) and Wohlgenant (1993).

Based on these, we present an analytical model following Freebairn et al. (1982), adjusted to reflect that cost reductions only occur for SSMVs activities, but not for producers and input suppliers. The competitive model of the post-policy change environment is presented as:

$$(1) \quad Q = \alpha_0 - \alpha_1 P^r ,$$

$$(2) \quad M = \beta_0 - w + \beta_1 Q ,$$

$$(3) \quad P^r = P^f + M ,$$

$$(4) \quad Q = \phi_0 + \phi_1 (P^f - P^i) \text{ and}$$

$$(5) \quad P^i = \delta_0 + \delta_1 Q ,$$

where Q is the quantity of milk at the farm level (which clears the market at equilibrium), P^r is milk price in the retail market, P^f is milk price at the farm level, M is the retail farm price margin and P^i is the cost of non-farm input per unit farm output. In the model, cost reductions

attributed to the new policy are represented as w to the SSMV. In all cases, the overall effect is an increase in milk quantity. From the model above, equation (1) is the retail demand schedule, equation (2) is the SSMV schedule or market margin equation, equation (3) is the price link equation representing the retail farm price margin, equation (4) is the farm supply schedule and equation (5) is the input supply schedule. As previously mentioned, the market margin is not constant. Rather, it includes a fixed component and a component that varies with quantity. Algebraic solutions to the system of equations above (see Freebairn et al. (1982) for an intuitive insight into the derivations) are provided to estimate changes in surpluses to consumers, marketers, farmers and input suppliers, respectively, as:

$$(6) \quad \Delta CS = \phi_1 W / H$$

$$(7) \quad \Delta SSMVS = \beta_1 \alpha_1 \phi_1 W / H$$

$$(8) \quad \Delta PS = \alpha_1 W / H, \text{ and}$$

$$(9) \quad \Delta ISS = \delta_1 \alpha_1 \phi_1 W / H,$$

where $W = Qh + \alpha_1 \phi_1 h^2 / 2H$ is aggregate welfare change, $h = w$ is aggregate cost reduced by the policy change and the term $H = (1 + \alpha_1 \beta_1) \phi_1 + (1 + \phi_1 \delta_1) \alpha_1$. The aggregate welfare change measures additional benefits that accrue to the economy as a result of the policy change. The parallel supply shift presented in Figure 2 represents a simplification; in reality, shifts in supply could also be convergent or divergent. The circumstances under which supply shifts can be divergent or convergent and methods for estimating the resulting benefits are well explained by Lindner and Jarrett (1978). Figure 2 postulates that reduced transaction costs deriving from legalized trading after training and licensing would lead to an increase in farm price and a decrease in retail price, thus resulting in reduced market margins.

(b) *Policy impact and changes in market margin*

The average SSMV conducts several transactions in the milk sales business. Those transactions that may not have changed with the new policy include transportation, cess, market place tax and the number of containers used. Those that may have changed with the new policy include the type of containers used, payment of illegal contingency fees or political rent, milk and container loss due to confiscation, milk preservation and quality control, and training and licensing. This study measured transactions costs in terms of retail-farm price margins. Results for daily milk prices are summarized by location and trader type in Table 4.

INSERT TABLE 4 HERE

Prices paid and received were highest at milk bars both before and after the policy change. As previously mentioned, the study used September 2004 as the policy change date and asked SSMVs to recall transactions in the immediate pre-policy change days and then compare those to similar transactions in August 2007.

In Nairobi, the highest margins accrued to non-producer mobile traders both before and after the policy change, whereas in Nakuru the highest margins accrued to producer mobile traders. When averaged over SSMVs in Nairobi, there was a KES 0.80 per litre (roughly \$X) decline in margin that may be attributed to the new policy's effect of reducing market margins. On the other hand, in Nakuru, the decline in margin attributed to the impact of the new policy was only KES 0.27 per litre (\$X), indicating that the new policy appeared to have a less discernible effect on the prices of unprocessed milk in Nakuru. In Nairobi, gains in margins resulting from the new policy were highest among non-producer mobile traders, followed by milk bars and mobile transporters.

The study used tests of statistical significance to determine whether margins significantly declined following the implementation of the new policy. A *t*-test confirmed that

for the combined data (i.e. Nairobi and Nakuru) comparing margins before and after policy change, there was no statistically significant difference ($t = 1.16$; $p = 0.1256$). However, when Mann Whitney tests were performed for the Nairobi dataset alone, the average margin of KES 6.13/litre before policy change was found to be statistically higher than the average post-policy change margin of KES 5.33/litre, albeit only at 10% probability level ($Z = 1.36$; $p = 0.087$). Tests for Nakuru revealed that post-policy change margins were not statistically different from pre-policy change margins. Consequently, the study estimated separate welfare measurements for Nairobi area alone, and for the Kenyan economy.

Information obtained from the above analysis of market margins in the Kenyan milk sector showed that policy-change effects on margin were more evident in Nairobi than elsewhere in the country. Policy-change institutions such as KDB and BDS providers are more visible, active and effective in Nairobi and its environs. Averaged over all locations and SSMVs, the study found a KES 0.54 per litre (\$X) reduction in margin, equivalent to approximately 9% of the pre-policy change margin. Although the overall reduction in margin (averaged over locations and SSMVs) appears small, Figure 3 shows more than a fourfold increase in quantities purchased and sold in Nairobi in the period after the policy change and more than a threefold increase over all locations. Evidently, SSMVs make their profits from small margins but high volume, quick turnovers. While the decline in market margin may also have been affected over time by other factors such as fuel costs, the simplified framework applied here assumes that such cost changes are minimal and hence attributes all margin reductions to the policy change.

INSERT FIGURE 3 HERE

The increase in quantities purchased and sold by SSMVs is not unusual, given that SSMV activities in scheduled urban areas like Nairobi were previously proscribed and therefore conducted under unfavourable conditions. Allowing licensed SSMVs to operate

freely in an environment with high demand for raw milk (e.g. annual per capita milk consumption was 145 litres in 2005) leads to increased milk supply to the retail market. In addition, approximately 45% of the SSMVs interviewed were licensed milk bar owners and daily throughput at milk bars serving an urban retail market could be much higher than, say, mobile bicycle traders. Still, the increased figures mentioned do not necessarily reflect evidence of higher market share to SSMVs; rather they reflect the ability to now conduct marketing activities freely, aided by increasing demand. While annual statistics for milk intake into the formal sector are readily available, those for the informal sector are not, hence the use of recall information.

(c) *Welfare changes attributed to policy change*

We used the economic model outlined in Section 5.1 to estimate changes in surpluses that accrue to consumers, farmers, SSMVs and input suppliers, and then compared the aggregate of these changes to project costs in order to also estimate the profitability of a POR project: the SDP. In its optimal form, the model is expressed in terms of parameters of retail demand, farm supply and marketer schedules, together with cost changes resulting from policy change. In the absence of survey data typically used to estimate these schedules, we used values presented in Table 5 (and sources) to estimate the parameters for the economy-wide model. Table 6 presents the parameters used to calculate the Nairobi area welfare changes.

INSERT TABLE 5 HERE

The data sources included a combination of SDP statistics, survey data and grey literature. We used SDP data for raw milk production in Kenya, updated in 2005 (SDP 2005). Farm and retail prices were obtained from the surveys. Following Salasya et al. (2006), we used housing as a non-farm input and expressed the cost of housing obtained from that study (KES 1313 per month) per unit of raw milk produced per year. We also obtained own price

elasticities of demand and supply from the same study. We found no comparable previous studies measuring elasticities of marketing services and marketing inputs, but Freebairn et al. (1982) mention evidence of highly elastic long-run supply curves, thus using a value of 2 or ∞ for illustrative purposes. To use these elasticity measures, the usual caveat of assuming homogeneous preferences among consumers, farmers, SSMVs and input suppliers applies.

INSERT TABLE 6 HERE

Estimates of cost reductions in the market margin due to the policy change include KES 0.54 per (\$X) litre, or X% of the retail price to the milk vendor. The Nairobi area model used the same information on elasticities of milk demand, farm-level milk supply and supply of marketing services as did the country-wide analysis. In the models under consideration, aggregate gains are known to be proportional to cost reductions but elasticities have minimal effects, except in terms of distributions. Simulation results are presented in Table 7 for the economy-wide scenario and for the Nairobi scenario.

INSERT TABLE 7 HERE

Table 7 presents estimates of how much the dairy sector is contributing to the Kenyan economy, when the effect of the policy change is to reduce transaction costs at the SSMV level alone. Total benefits accruing to the sector are estimated at KES 2.17 billion per annum. More than 70% of the benefits accrue to producers and consumers, and less than 30% to SSMVs and input suppliers. As earlier observed, SSMVs and input suppliers operate in a small margin environment, and this could account for their smaller share of total benefits. Gains realized by SSMVs and input suppliers come from higher sales alone.

Nairobi area welfare gains account for approximately 18% of the economy-wide gains. With a potential consumer base of nearly 3.4 million (or 10% of Kenya's total population), Nairobi area welfare gains are sufficiently high to justify the efforts to date on training and licensing and suggest the level of potential benefits to further investment in these

activities. However, when the total costs of training and licensing (country-wide costs) are accounted for, policy change in Nairobi area alone is not cost-effective.

The NPV of the stream of net benefits was calculated for the economy-wide model (Table 8) using the following assumptions: First, research costs (USD 5 million) were equally spread over the first eight years, corresponding to the life of the project and ending in the year 2004 when the policy change was effected. Second, total DFID funding for SDP was USD 2.5 million over an eight-year period, plus an estimated USD 2.5 million from in-kind contribution by SDP partners. Third, benefits were assumed to start accruing in year 2005 and, for the purpose of this analysis, to the year 2039. Fourth, in the year when benefits start accruing, we impute additional costs of training and licensing of SSMVs (as estimated above) amounting to KES 864 million per year as follows (see ILRI, undated, for cost estimates): because the system was designed to be sustainable, costs of training and certification would be borne by SSMVs. Fifth, based on discussions with KDB officials, we estimated that 50 BDS providers (the target figure for KDB) would train approximately 160 SSMVs per week. SSMVs pay KES 1000 for training (KES 8.3 million per year). Trained SSMVs pay a one-time licence fee of KES 3500 (KES 29.12 million per year). Sixth, SSMVs pay cess fees to KDB at KES 0.20 per litre (KES 803.17 million per year). The cess fee is a tax collected by the KDB, which should technically be collected at the farm level. However, because small-scale producers are not easily tracked (unlike large producers), KDB officials have routinely opted to collect cess fees at bulking and collection points, where SSMVs operate. This adds a tax burden to SSMVs. Seventh, SSMVs pay statutory costs that include municipal/council fees, commerce fees and health inspection fees, amounting to KES 2811 (KES 23.39 million per year). And finally, we assumed interest rates of 1.99% (real interest rate in Kenya; base year 2007), while 5% and 15%, were used to account for inherent risks in some projects.

INSERT TABLE 8 HERE

The results of the analysis (Table 8) show that under the economy-wide scenario, the SDP research investment costs are easily recouped, as the NPV is greater than zero, even when the interest rate is 15%. When the cost of capital exceeds the internal rate of return (IRR), the investment becomes unprofitable. For the economy-wide scenario, the cost of capital would have to exceed 55% before the costs outweighed the benefits of the investment. For the Nairobi area scenario, overall costs exceed benefits, implying that the investment in the policy research has a negative return if the benefits are assumed to only occur in Nairobi.

We also re-estimated welfare benefits of the dairy policy research using an estimate of a 38% margin reduction, derived from Salasya et al. (2006). Based on our data, this amounts to KES 2.38 per litre. As previously explained, the model is highly sensitive to changes in cost reductions. With a decrease in the marketing margin for SSMVs of KES 2.38 per litre, annual total benefits increased to KES 9.64 billion, compared to benefits of KES 2.17 billion when margins were assumed to decline by KES 0.54 per litre.

(d) Creating a counterfactual and attributing policy impact

The benefits from the change in policy in this case study began to be realized in the ninth year following the launch of SDP (Table 8). Policymakers and researchers were interviewed to ascertain their perceptions as to how long it would have taken for the policy change to occur, and how long it would have taken for SSMVs to be engaged by regulatory bodies, without the research and interventions of the Smallholder Dairy Project. These interviews revealed that the key drivers within the KDB policy change process were: (1) release of credible research information by the MoLFD/KARI/ILRI Smallholder Dairy Project; (2) restructuring of KDB operations funded by FAO that involved staff rationalization, recruitment of qualified staff and capacity building; (3) engagement in collaborative projects aimed at improving small-scale milk marketing, mainly focussing on testing a quality assurance approach involving training (based on standardized training requirements) and

certification of small-scale milk traders; (4) development of the first strategic plan with clear goals and activities; (5) the creation of dairy regulatory forums with representatives of key stakeholders at all levels; (6) review of regulations within the current dairy policy framework; and (7) engagement in the process of harmonization of regional dairy policies, regulations, training and quality assurance standards.

SDP played a pivotal role in effecting policy change, accelerating a process and outcome that without the project may have come many years later. Of course, SDP research and policy advocacy were collaboratively carried out by several institutions, including ILRI, KARI and MoLFD. Attributing the benefits of policy change in a multi-institution effort is not a marginal exercise. First, the policy change is technically still in process, both with regards to final parliamentary passage of the main regulation and implementation of current training and licensing activities as envisioned in the policy. Consequently, the problem of attribution is compounded by an outcome that is yet unclear and not easily measurable quantitatively. The CGIAR Science Council commissioned a scoping study which articulated this problem (CGIAR Science Council 2006). Second, the policymaker MoLFD was one of the major institutions involved in the process, playing a key role in advocating for policy change, again making attribution difficult.

However, in order to quantify the probable economic impacts without SDP, information from key informants led to a study assumption that the Kenya policy review and legalization of SSMVs would have been delayed by 20 years, without SDP; impacts were re-estimated, assuming a 10-year delay. A simplified additional assumption is that there are no additional investments or benefits until the year in which legalization would occur (i.e. 2015 or 2025). The differences in NPV, with and without SDP, are presented in Table 9.

INSERT TABLE 9 HERE

NPV continues to be positive even as legalization is postponed beyond 2004 when SDP influenced policy change (Table 9). In addition, the directly attributable impacts of SDP are also positive, as measured by the differences in outcomes with and without the project, suggesting that legalization resulting from SDP advocacy was beneficial.

6. CONCLUSIONS

The research and coordination efforts of SDP continue to contribute to the policy implementation phase, producing policy briefs, training manuals and sessions on milk handling and quality control. These research efforts have also contributed empirical evidence supporting the harmonization of dairy policy regulations across East Africa. Lessons learned in terms of ILRI's success in getting empirical evidence to inform dairy policy changes are highlighted in a study by Leksmono et al. (2006) on the role of research in pro-poor dairy policy shift in Kenya. They include: (1) good collaboration between the SDP institutions was a key contributor to the success of SDP in achieving policy change; (2) SDP research was rigorous and by the time the advocacy phase came along, SDP had obtained a set of highly technical and pertinent research results; (3) SDP was particularly effective in achieving policy change because it started as a research and development project and (4) farmers and SSMVs were empowered by SDP to speak out on issues affecting the sector, and this was a most compelling factor in changing opinions of decision makers at the May 2004 policy forum.

Currently, the Kenyan dairy sector is liberalized and moving ahead with plans to train and license SSMVs to become fully engaged in the formal sector. The revision of the Kenyan dairy policy to reflect engagement with SSMVs in the formal sector is still in parliamentary process. However, significant progress has been made and Kenya now leads a noteworthy regional effort to harmonize dairy policies and liberalize trade in dairy products among countries in East Africa. In neighbouring countries like Tanzania and Uganda where there

have been no SDP-like activity, policy change has been carried out at a slower rate than in Kenya, hence the process of policy harmonization in the region is helping to speed it up.

We found that the smallholder dairy project efforts produced a significant volume of evidence used to influence the policy change process at various stages by different decision-makers and organizations. Although the Kenyan dairy policy document and bill have been in parliamentary process for more than a decade, written ministerial subsidiary regulation and KDB reorganization provide ample regulatory authority for engaging SSMVs, and this significant shift in dairy regulation was traced back to September 2004. The study found significant evidence of behavioural change among regulators and SSMVs that has led to positive economic benefits across Kenya.

The impact of the new policy on market margins shows a significant lowering of margins in Nairobi, by KES 0.80 per litre. In the post policy change environment, increased market quantities were observed in both locations, with approximately fourfold increases in Nairobi. Small-scale dairy operators have profited from quick, relatively high volume turnovers, and as a result, welfare benefits accruing to SSMVs increased; these benefits were also captured by consumers and producers. A cost-benefit analysis revealed that the policy change was highly profitable. In addition, the very high IRR value suggests that positive net benefits will continue to be gained by many actors in the dairy sector for years to come. However, the Kenyan government will need to devise a fairer way of distributing the cost of access among consumers, producers, and SSMVs, rather than leveling a significant portion of this tax on the small-scale market vendors.

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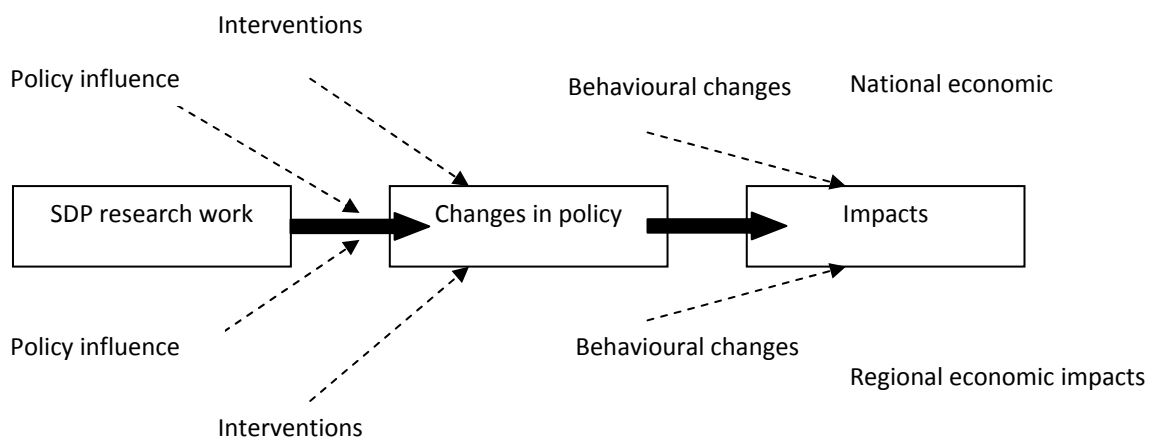


Figure 1. *Pathway of research outputs to impacts*

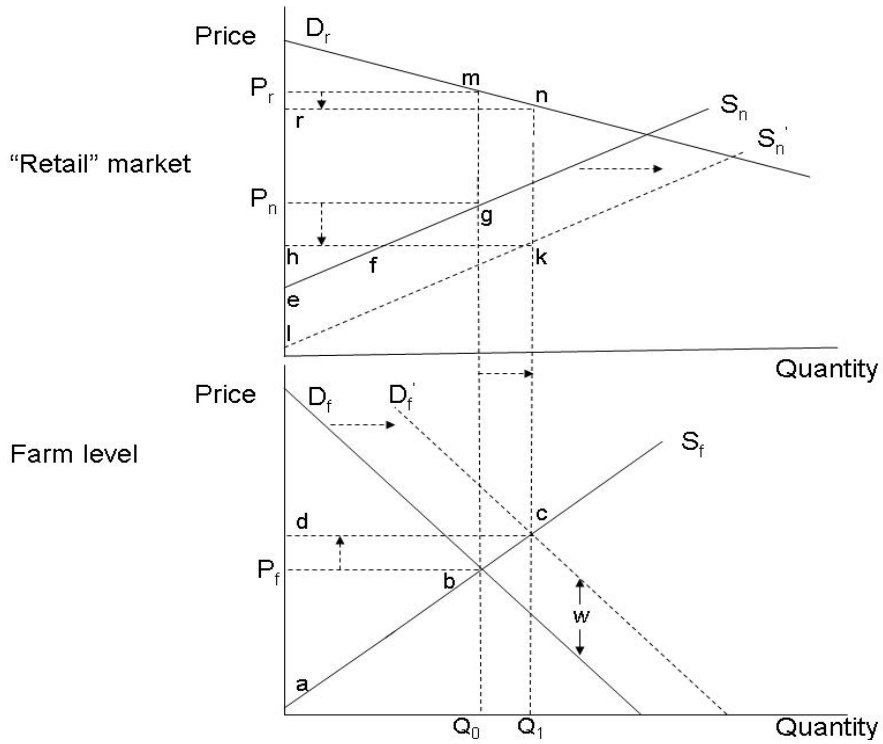
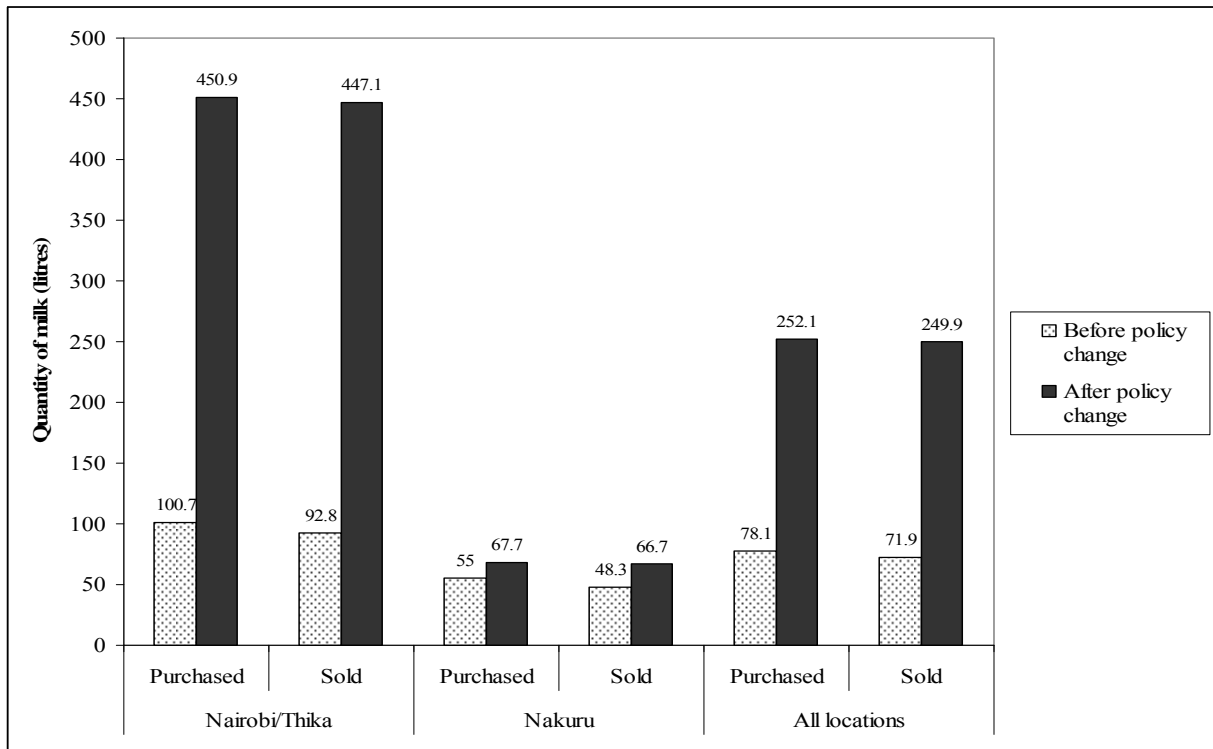


Figure 2. *Distribution of returns from implementing the new Kenyan dairy policy*



Source: Authors' survey data (2007)

Figure 3 *Average daily quantities of milk purchased and sold by SSMVs before and after the policy change*

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Table 1. *Events and dates in Kenya's dairy policy change process*

Year	Dairy policy event
1992	The government committed to restructuring and strengthening of KCC and KDB.
1993	A KDB workshop ' <i>Promoting Kenya dairy industry to the year 2000 and beyond</i> ' was held in Naivasha in June. The Ministry of Agriculture, Livestock Development and Marketing (MALDM) published the Dairy Development Policy document.
1994	The government agreed that the Board of Directors for KDB be put in place and the Dairy Industry Act (CAP 336) be amended to reflect the liberalization of the dairy industry.
1995	MALDM put in motion the process to revise the Dairy Industry Act. Agricultural sector review carried out, emphasizing the need to revise the Act and address KCC as part of the interventions required for privatization. Stakeholder workshop held in Naivasha in May, charged to revise the Act and draft a bill; a draft Dairy Industry bill was produced in the process. MALDM, donors, processors (from KCC), Kenya National Farmers Union, cooperatives etc. attended the workshop. A mission to restructure and reform KDB, sponsored by the Danish International Development Agency (DANIDA), proposed that KDB be reconstituted along the lines of the traditional, democratic annual general meeting. The government accepted a report emphasizing autonomy of KDB. DANIDA also agreed to fund the completion of the revision of the Act.
1996	National stakeholders workshop convened in Embu in February to revise CAP 336, focusing on organization and structure of the new KDB; functions, powers and duties of the new KDB; management and administration of the new KDB; financial aspects of the new KDB; next steps (way forward) and the transition until KDB is fully autonomous and wholly funded by stakeholders through cess etc. KDB Board of Directors gazetted for the first time since 1972. Task force formed in April to consolidate the views arising from the stakeholders and other review processes. Assisted by consultant Prof. Mutungi, the task force held another national stakeholder workshop on the draft Dairy Industry Bill (1996) – or revised CAP 336 – in Naivasha in June to provide stakeholders with an opportunity to comment on and make suggestions to improve the draft Bill. A sub-committee of the task force was formed to review and revise the national dairy policy. MALDM referred the draft Bill to the Attorney General after making the amendments arising from the June stakeholder workshop. Due to critical changes in the ministry, the dairy reform process was delayed.
1997	With financial assistance from DANIDA and consulting help from Prof. Mbogoh, the sub-committee of the Dairy Industry Act review task force was reconstituted to include the Ministry of Livestock, KDB, KCC, Planning Division and commercial farmers and charged with continuous review of policy. The sub-committee also reviewed the Act. Drafts of policy document were circulated to stakeholders for comment and after incorporating stakeholders' comments, a new draft policy document was presented to a stakeholder workshop held at Karen KCB Institute in November and attended by SDP Project Manager, KDB, MALDM, ILRI, KARI, university academics and non-governmental organizations (NGOs).
1998	The task force sub-committee revised the draft policy document to incorporate inputs from the November 1997 workshop and circulated the revised draft for comments in February. The consultant finalised the document after receiving and incorporating comments. The committee presented the final draft of the policy to the Permanent Secretary in March and thereafter it was presented to the Ministry Policy Committee.
1999	The ministry accepted the draft policy document in March; copies widely circulated to stakeholders.
2000	With reconstitution of the committee, the ministry began work on the policy in March; new instructions were for the committee to harmonize the Bill and the policy document but changes in the ministry delayed the process. Harmonization of the two documents was completed in May and the harmonized document presented to the ministry, the Parliamentary Committee on Agriculture, Lands and Natural Resources and the KDB Board of Directors in August/September. The Parliamentary Committee requested that stakeholders be given another chance to contribute to the documents, citing delay in harmonization and editing of documents.
2001	A workshop on ' <i>Assessing and managing milk-borne health risks for the benefit of consumers in Kenya</i> ' was held in February to present findings on levels of risk associated with different market channels and how to control the risks. Dairy Public Health Committee was formed as a result of the workshop and SDP invited to join. A stakeholders' consultative workshop on the harmonized dairy Bill and Policy was held at Karen KCB Institute in

March and attended by the Parliamentary Committee. The Minister for Agriculture and Rural Development chaired the workshop and the Permanent Secretary moderated it. DFID funded the workshop through SDP. After the workshop, revised Bill and Policy document were resubmitted to the Parliamentary Committee.

SDP and partners started participatory work with SSMVs to develop training approaches and appropriate containers for milk handling. SSMVs would later be asked to form groups and seek licensing.

2002 Election year in which there was little activity other than follow-up with the Parliamentary Committee for comments (which were not forthcoming due to elections).

2003 After the new government came into office, the Bill and Policy documents were resubmitted to the Parliamentary Committee in an attempt to revive the finalization process.

SDP organized a workshop to develop a policy-influencing strategy and started to engage with CSOs as advocacy partners in preparation for a dairy policy forum.

'Milk wars' in print and electronic media, pitting large-scale processors opposed to legalizing activities of SSMVs against NGOs and SDP allies in favour of legalization of SSMVs. Independent articles written by journalists in support of SSMVs used research evidence from SDP. SDP partners also met with Ministers for Labour and Livestock providing research evidence in support of legalization of SSMVs.

2004 SDP and partners organized a dairy policy forum in May with government ministers, members of parliament and key industry stakeholders in attendance. SDP research findings were presented to support pro-poor dairy policy reform. Policy briefs were officially launched and a video '*Unheard voices from Kenya's dairy industry*' was shown.

In September, subsidiary legislation/legal notices 101, 102 and 103 were gazetted, allowing KDB to develop procedures that would allow SSMVs to operate legally.

Source: Adapted from discussion with HG Muriuki; Leksmono et al. (2006)

Table 2. *Distribution of SSMVs interviewed in Nairobi and Nakuru*

Type of business	Nairobi		Nakuru	
	% interviewed	% licensed	% interviewed	% licensed
Mobile trader (producer)	48	100	47	100
Mobile trader (non-producer)	16	100	20	67
Transporter-trader	16	100	13	100
Milk bar	20	100	20	100
Total	100		100	

Source: Authors' survey data (2007)

Table 3. *Proportion of SSMVs reporting different types of licences*

Type of licence	% of Nairobi SSMVs	% of Nakuru SSMVs	% of all SSMVs
Milk bar licence	45	53	49
Mini-dairy licence	3	27	15
Milk movement permit	67	20	44
Medical/public health certificate	19	3	11

Business permit	6	3	5
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Source: Authors' survey data (2007)

Table 4. *Average daily prices of milk and market margins before and after the policy change*

Type of business	Nairobi price (KES/litre)			Nakuru price (KES/litre)		
	Purchase	Sale	Margin	Purchase	Sale	Margin
Before policy change						
Mobile trader (producer)	14.27	19.53	5.26	13.00	20.77	7.77
Mobile trader (non-producer)	15.40	23.80	8.40	14.17	19.00	4.83
Transporter trader	14.43	20.57	6.14	16.50	20.00	3.50
Milk bar	18.43	24.43	6.00	17.60	23.60	6.00
Average for all SSMVs	15.35	21.48	6.13	14.42	20.85	6.42
After policy change						
Mobile trader (producer)	15.20	20.53	5.33	14.86	22.14	7.28
Mobile trader (non-producer)	16.60	23.60	7.00	14.50	19.50	5.00
Transporter trader	16.14	21.00	4.86	17.50	21.50	4.00
Milk bar	20.67	25.33	4.66	19.40	24.60	5.20
Average for all SSMVs	16.60	21.93	5.33	15.81	21.96	6.15
Reduction in margin attributed to policy change, for Nairobi and Nakuru			0.80			0.27
Mann–Whitney test statistics (before vs. after)			Z=1.36; p=0.087			Z=0.85; p=0.1977
Average margin over all locations and trader types, before policy change						6.26
Average margin over all locations and trader types, after policy change						5.72
Overall average reduction in margin attributed to policy change						0.54

Source: Authors' survey data (2007)

Table 5. *Variables for estimating economy-wide welfare changes attributed to the new dairy policy*

Variable description	Symbol	Value	Source of information
Raw milk production	Q	4.02 billion litres	SDP Policy Brief 10 (2005)
Retail price	P_r	KES 21.57/litre	Study survey (averaged over all locations and SSMV sales)

Farm price	P_f	KES 15.58/litre	Study survey (averaged over all locations and SSMV purchases)
Non-market input cost per unit of output	P_n	KES 7.06/litre	Estimated using data from Salasya et al. (2006) and updated SDP milk production data
Elasticity of milk demand at retail	ε_r	-0.97	Salasya et al. (2006)
Elasticity of milk supply at farm	e_f	0.35	Salasya et al. (2006)
Elasticity of marketing services supply	e_m	2	Freebairn et al. (1982)
Cost reduction due to changes in transaction costs	W	KES 0.54/litre	Study survey, decrease in retail farm price margin (comparing before and after policy change)

Table 6. *Variables used in estimating welfare changes attributed to the new dairy policy in the Nairobi area*

Variable description	Symbol	Value	Source of information
Raw milk production	Q	493 million litres	Assuming supply clears the market, estimated from SDP data showing annual per capita milk consumption at 145 litres and Nairobi population at 3.4 million in 2005
Retail price	P_r	KES 21.70/litre	Study survey (averaged over all locations and SSMV sales)
Farm price	P_f	KES 15.97/litre	Study survey (averaged over all locations and SSMV purchases)
Non-market input cost per unit of output	P_n	KES 6.90/litre	Estimated using data from Salasya et al. (2006) and updated SDP milk production data
Elasticity of milk demand at retail	ε_r	-0.97	Salasya et al. (2006)
Elasticity of milk supply at farm	e_f	0.35	Salasya et al. (2006)
Elasticity of marketing services supply	e_m	2	Freebairn et al. (1982)
Cost reduction due to changes in transaction costs	W	KES 0.80/litre	Study survey, decrease in retail farm price margin (comparing before and after policy change)

Table 7. *Distribution of gains from the policy change*

Change in benefits (million KES)	Scenarios	
	Cost reductions only occur at the level of the SSMV	
	Economy-wide	Nairobi area
Benefits to consumers	520.84	95.01
Benefits to producers	1042.62	193.78
Benefits to SSMVs	280.60	48.67
Benefits to input suppliers	330.82	58.63
Total benefits	2174.87	396.09
Annual expenditure on SDP (1997–2004)	40.63	40.63
Annual costs of training and licensing (2005–2039)	864.00	864.00*

*Note that these are countrywide costs and are only being applied to the Nairobi scenario in totality for the sake of expediency.

Table 8. *Cost-benefit analysis of the new policy for different cost and interest rate scenarios*

	Years	Scenarios	
		Economy-wide	Nairobi area
Annual cost	1997-2004	40.63	40.63
	2005-2039	864.00	864.00
Annual benefit	1997-2004	0	0
	2005-2039	2174.87	396.09
NPV (at 1.99%)		28,288.92	-10,509.71
NPV (at 5%)		14,978.64	-5,720.72
NPV (at 15%)		3,051.03	-1,373.56
IRR		55%	n/a

Costs and benefits in million KES

Table 9. *Differences in NPV with and without SDP, for economy-wide scenarios*

Time delay	Interest rate (%)	NPV (without SDP)	Difference in NPV (with SDP – without SDP) million KES
Economy-wide scenario			
10 years late	1.99	18,329.35	9959.57
	5.00	8060.72	6917.92
	15.00	787.42	2263.61
IRR	108%		
20 years late	1.99	9901.65	18,387.27
	5.00	3644.45	11,334.19
	15.00	176.07	2874.96
IRR	62%		

10 years late: legalization occurs in 2014

20 years late: legalization occurs in 2025