An Evaluation of the Impacts of Transaction Cost and Market Outlet Risks on Market Participation of Smallholder Dairy Farmers in Central Kenya

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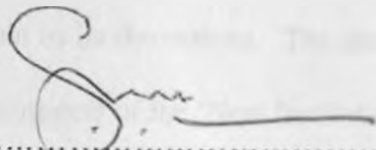A thesis submitted in fulfilment for the degree of Doctor of Philosophy in Agricultural Economics, University of Nairobi.

Nairobi

September 2002

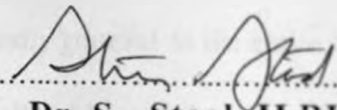# DECLARATION
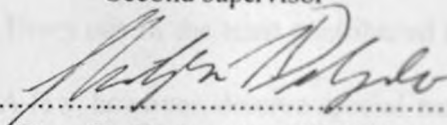
This thesis is my original work and has not been presented for a degree in any other university.

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ACKNOWLEDGEMENT

ABSTRACT

The objective of this study is to characterise the marketing system in which smallholder dairy farmers (SDF) in Kenya operate and to examine how transaction costs (TCs) and market outlet risks (MORs) influence market participation of the farmers. The study begins with a critical review of the evolution of the country's dairy marketing policies, right from the introduction of commercial dairying in the country at the beginning of the 20th century to the period of the study. Economic actors, including organisations, receive special attention as the prime instigators of institutional changes. The importance of history in conditioning future institutional structures makes such a review a fundamental element in placing the prevailing marketing system in proper perspective.

The review shows that Kenya's dairy industry has been a very dynamic industry that has evolved as circumstances are altered. Specifically, the review identifies three major policy turning points, triggered by a great variety of causes all of which generated conditions that both facilitated and constrained SDF production and market activities. The review also illustrates that the behavior of organizations and their relationships with the central administration can set the conditions for an entire industry's development. It also provides a useful starting point for the core objective of the study, which is based on the analysis of primary farm- and market- level longitudinal and cross-sectional data using appropriate statistical and econometric methods.

High perishability and the daily pattern of flow of milk output (at least within a lactation period), which necessitate repetitive tasks of milk sales activities, are the principal sources of TCs and MORs associated with sale of milk. However, while the TCs and MORs inherently arising from these aspects of milk production and marketing potentially face all dairy farmers, the characteristics pose greater challenges to the SDF. This is due primarily to quantity constraints associated with small marketable surpluses and because of market accessibility problems characterising most rural areas. Analysis of the primary data reveals that an average SDF in the study area marketed about 9 litres of milk per day and was located about 4.3 kilometres away from a major road.

Together, quantity constraint and market accessibility are found to have significant influence on SDF's market participation with respect to choice of market outlet. The study reveals that the SDF in the study area operated in a marketing system where: (i) feasible market outlet alternatives varied widely with accessibility to major roads and consumption centers; (ii) size of household's marketable surplus played a significant role in influencing both the choice of market outlet and SDF decisions on whether to sell to cash-sale or to credit markets, and what proportion of milk to allocate to each; and (iii) unit milk prices differed widely with market outlet and contractual arrangements with respect to time pattern of payment.

A price decomposition model based on the ordinary least squares (OLS) method is used to make comparison of values across the observed modes of payment. The results present strong evidence that transactions involving regular

payments by fixed schedules offered lower unit prices relative to spot-cash transactions. In the context of the study, the price differentials are interpreted as revealing compensating differentials across the contractual arrangements with regards to market search, market assurance and savings utility. Spot-cash markets for the highly perishable commodity expose the SDF to greater risks of non-sale. On the other hand, contractual arrangements involving payments at regular fixed schedules implicitly define repeat contracts that 'routinize' milk sales/delivery tasks, offer greater assurance to the farmer for subsequent sales, as well as creating savings utility. Relative to spot-cash prices, the respective price differentials indicate the amount (in cash per litre of milk) the SDF were, on the overall, willing to sacrifice for the benefits of the corresponding flows of payments. The model results suggest that fortnightly payments attracted by far the largest sacrifice of 18%, next highest sacrifice (10%) was for cash-repeat payments followed by monthly (7%) and least was weekly payments (5%).

Further analysis suggests that household-specific socio-economic factors had significant conditioning effects on preferences for the modes of payment. Results from applications of random-effects logit and Tobit models show that, *ceteris paribus*, younger, more educated producers were more likely to accept sales on credit. Conversely, older producers with more experience but less formal education were more likely to sell for cash rather than credit. The results also suggest that the desired liquidity flow was an important criterion for market choice behaviour. Where liquidity flow was required in lumps to match lumpy expenditures, on-credit sales were preferred.

A basic conclusion of the study is that smallholder's market-outlet choice behaviour is not based on the levels of price alone; it is also influenced by some other important contractual elements of exchange. The study recommends that comparisons of producer's market-outlet choice behaviour should be based on sound and objective theoretical and empirical analysis of differentials in benefits derived by the producer from the different contractual arrangements offered by the existing marketing system. In particular to milk marketing, this study shows that a particularly important contractual element relates to the time pattern of payments.

The findings of the study have important implications for the basic structure of the first point of sale of milk under liberalized market conditions. Differentiated producer-preferences for modes of payments, coupled with buyers' need to minimise TCs involved in procuring milk from SDF, imply that the first point of sale of milk will continue to be characterised by a wide range of market-outlets, each tailoring its major marketing strategy towards one of SDFs' preferred modes of payment. This further implies that mode of payment is a potentially powerful competitive tool as opposed to offering generalised sales arrangements for all sellers.

Participation of Dairy Farmers' Co-operative Societies (DFCS) seems to be on the decline. Collective marketing by SDFs nonetheless remains potentially useful in reducing TCs and MORs. This is clearly demonstrated by a spontaneous emergence of new organisational forms of collective milk marketing based on smaller-sized groups of self-selected farmers as opposed to the large-sized

DFCS based on open membership. Such institutional innovation clearly implies that exogenously prescribed organisational structures may not be as effective and responsive as farmer-evolved processes, such as learning and incremental innovations. Therefore, government policy must promote an environment that induces smallholder farmers to make incremental innovations in organisational types and governance structures appropriate for the diverse market outlet types and modes of payment.

Chapter 1

Introduction

1.0 Problem Statement

Since the mid 1980s, most sub-Saharan African countries have embarked on reforms aimed at reducing the role of the state in the co-ordination of food commodity markets, while increasing that of the private sector and of market forces. Former systems of market regulation were characterised by tight controls, including the restriction of sale of major agricultural commodities through single-channel outlets with government prescribed modes of payments (including time patterns of payment and mode of transmission of payment to farmers). Market liberalisation, however, has stimulated the emergence of diverse market outlets with corresponding diversity in contractual arrangements, including wide varieties of modes of payment and of transmission of payments to farmers.

The diversity in market outlets and contractual arrangements presupposes the formation, by farmers, of market outlet preferences. This in turn prompts, or at least allows, choices — implying some kind of decision-making. Differentials in prices are presumably a determinant of, and a consequence of, market outlet choice. However, the existence of transaction costs (TCs) and market outlet risks (MORs) is likely to drive a wedge between the true price (i.e., the "shadow price") to the producer and the observed market price. This suggests that farmer's market-outlet choice behaviour may be different from what is expected under choices based on pure market price differentials. Hence, the opportunities and constraints to farmer participation in food commodity markets may be diffi-

cult to understand unless placed in the broader context of TCs and MORs.

Within this broad context, differentials across farm households in market outlet choices exemplify differentials in market outlet preference entailing a rational decision-making process of assessing the available market outlets against TCs and MORs specific to the household. It is the contention of this research that valuable insights into farmer market participation are obtainable through empirical analysis of the effects of TCs and MORs on observed market outlets choice behavior.

1.1 Hypothesis and Objectives of the Study

With special reference to milk marketing by smallholder dairy farmers (SDF) in Kenya, the research sets out to address the issue of farmer market participation. We hypothesize that transaction costs (TCs) and market outlet risks (MORs) imposed by the marketing system, on the one hand, and by socio-economic factors specific to the farm household, on the other, are the principal determinants of constraints and opportunities that face the farmer in his participation in food-commodity markets. To examine this proposition, the thesis starts by sketching out a detailed picture of the dairy marketing system in which the SDF operates as well as by providing a comprehensive description of household's socio-economic attributable to TCs and MORs. Then it examines how SDF's market outlet choices and, hence, participation is determined by this interplay between market-level and farm-level TCs and MORs. More specifically, the study sets out the following objectives:

(i)   To characterise the marketing systems in which SDF in central Kenya operate;

(ii)   To characterise the contractual arrangements employed in milk exchange mechanisms between SDF and buyer-markets;

(iii) To assess empirically the relative independent influences of various factors presumed to contribute significantly to TCs and MORs in the sale of milk by SDF on the choice of market outlet;

(iv)   To test empirically the relationship between the choice of payment mode (cash versus credit) and the various factors "presumed" to contribute significantly to market TCs and MORs in the sale of milk by SDF.

1.2   Justification of the study

Understanding the producer's market choice behaviour has assumed great importance with reforms of agricultural food markets. The aggregate effects of market-outlet choices made by the individual farm producers have important implications for the direction of development and the efficiency of agricultural food marketing. Therefore, understanding the factors underlying market outlet choice is important for market participants at higher channel levels interested in influencing their competitiveness in food procurement markets. The knowledge is also important in guiding policy-makers' design and implementation of food marketing policies.

The decision to focus on smallholder farmers in this study is justified on the account of the contribution that smallholder agriculture makes in Kenya's economy. As is the case for most sub-Saharan African countries, whose economies are predominantly based on smallholder agriculture, the performance of smallholder agriculture is a major concern for the Kenya government since it is crucial for the overall rural development and alleviation of poverty. In the light of a rapidly increasing population, Kenya faces challenges of limited scope for horizontal expansion of agriculture. Per capita land holding continues to grow smaller with land subdivisions. Accordingly, agricultural production is increasingly based on smallholder farming.

Of an estimated 3 million smallholders, 80 percent have a land size of less than 2 hectares and smallholder agriculture is estimated to contribute 75 percent of the nation's marketed agricultural products (Kenya, 1995). In the dairy sub-sector, smallholders contribute about 70 percent of total production and about 80 percent of total marketed milk (Mbogoh, 1984; MoALD&M, 1992; Waithaka, 1993; Muthee, 1995). Consequently, any strategy aimed at improving food security or developing efficient marketing systems at the national level must start with a detailed understanding of the constraints and opportunities facing the smallholders. Such information is important, especially within the context of the ongoing market reforms, in identifying scope for guided corrective policy measures to avoid situations where distributive functions of the market would weigh against smallholders. The findings of the study are, thus, likely to be of interest to all those interested in improving the marketing performance of Kenya's dairy

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industry, namely, the policy makers, advisors to policy makers, private processors, dairy marketing collective groups, farmers and consumers.

1.3 Approach and organisation of the thesis

The theoretical foundation of the study is the New Institutional Economics (NIE) framework. The approach taken assumes that a comprehensive understanding of the way in which institutions and organisations have developed and changed over time is integral to understanding and explaining how an economic system presently operates. Accordingly, the rest of this chapter focuses on the critical review of the evolution of Kenya's dairy marketing policies since the introduction of commercial dairying in the country in the early 20th century. This is deemed an important step towards placing in proper perspective and providing a useful starting point for a detailed discussion of the institutional and organisational issues of current importance to smallholder dairy marketing in Kenya. The approach is also useful in recalling some of the reasons that dictated the need for the recent reforms of the marketing systems. Chapter 2 focuses broadly on the theoretical foundation of transaction costs analysis and the development of a conceptual analytical model for analysing the market choice behaviour of the SDF in the study area. Chapter 3 discusses the data while chapter 4 presents empirical results and discussion. Chapter 5 gives a summary, conclusions, and policy recommendations.

1.4   *A Review of Kenya's Dairy Marketing Policy*

On attainment of political independence, Kenya adopted a strategy based on extensive involvement of the state in the control of the country's development process. The strategy, a combination of direct intervention and statutory control of production activities and of markets, greatly benefited smallholder dairy production through subsidies on production inputs, including breeding, veterinary, and extension services. Smallholder milk marketing also benefited from a market guaranteed by statutory control measures. However, the strategy, while justifiable especially during the transition period when commercial dairying was shifting from large-scale to smallholder farmers, was clearly not sustainable.

By 1970s, government control of development process was being called to question. The need to revise the country's development strategy was especially made imminent in the advent of severe socio-economic crisis in the late 1970s and early 1980s (GoK, 1986). This, moreover, coincided with global changes in the perspective regarding the appropriate extent of government control of and intervention in production and marketing processes. At the same time, major lending institutions (the World Bank and the International Monetary Fund) were increasingly using lending conditionalities as a leverage of compelling loan-recipient governments of the developing countries to implement specific policy reforms aimed at reducing the current account deficits of the respective countries to manageable proportions. Within the context of these broad structural adjustment programs (SAPs), the Kenya government embarked, from the early 1980s, on reforms aimed at reducing the role of the state while increasing that of the pri-

vate sector in the provision of services (GoK, 1986). The reforms also aimed at increasing the role of free market forces in the co-ordination of markets.

With regard to marketing of milk and dairy products, reforms arose in response to unsatisfactory marketing performance of a single-channel system centred on a *de facto* parastatal, the Kenya Co-operative Creameries Limited (KCC). The system was under tight statutory controls, including the setting of producer and consumer prices. Over time, the KCC had fallen into inefficiencies culminating in failure to pay farmers promptly and remuneratively, and in frequent shortages of fresh milk at retail outlets (DANIDA/MALD, 1990; FAO, 1991; Jaffee, 1995; Ngigi, 1995). The failing performance was blamed on the non-competitive structure of the marketing system and on government's interference with pricing, thus hindering the mechanisms of free market forces.

The panacea was envisioned to lie in deregulation of producer and consumer prices and the removal of legal monopoly for processing, packaging and urban milk sales which had for years been accorded the KCC (DANIDA/MALD, 1990, FAO, 1991, MoALDM, 1993). It was expected that the resultant changes in incentive structure would promote the development of a competitive network of private intermediaries and producer organisations in milk procurement, processing, distribution, and sale. This, it was perceived, would exert competitive pressure on marketing costs and result in improved efficiency of milk procurement from farmers while paying them regularly at remunerative prices. All this was aimed at increased supply response and reduced consumer prices (MoALDM, 1993).

Relaxing of the KCC monopoly powers coupled with the removal of restrictive licensing arrangements has gradually eliminated barriers to entry by private entrepreneurs in procurement, processing, and distribution of dairy products (Ngigi, 1995). This has widened the range of market outlets and the nature of milk sales arrangements at the first point of sale. Apart from selling through dairy farmer's co-operatives societies (DFCS), farmers can now sell milk to rural-to-urban resellers (including itinerant traders and *milk bars*[1]). As well, they can individually sell directly to household and catering institutions, both in local and urban markets. On their part, DFCS now have a wide choice of customers, including processors and rural-to-urban resellers. The capacity of the emerging processor markets has also increased to the point where strong competition for supplies and consumer market shares is building, both within the processor markets and between processors and raw milk traders.

The rest of this chapter traces the evolution of the country's dairy industry marketing institutions. The aim is to describe policy reactions to critical issues of dairy marketing and the political and economic contents of the reactions and to analyse how the policies affected smallholder dairy farmers' participation in dairy products markets. It begins with a review of colonial era institutional and organisational framework. This is followed by a review of reforms designed and implemented after independent and ends with a brief discussion of the most visible changes brought by liberalisation.

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[1] Dairies dealing in raw milk have come to be popularly referred to as milk bars

1.4.1 Frame of Reference

A useful starting point in the search for a relevant frame of reference is to first consider the meaning of the words 'organisations' and 'institutions'. That the definitions need to be precise may not be apparent right away since the two words have acquired synonymous meaning in the way they are commonly used. However, a review of the 'New Institutional Economics' (NIE) literature, from which this study heavily draws, shows that economists have sought to establish distinctions between the two words as well as to define each within very clear limits. North (1989; 1990; 1996) defines an organisation as comprising groups of individuals bound together by some common objectives. This clearly distinguishes organisations from institutions, which are defined as "rules, enforcement characteristics of rules, and norms of behaviour that structure repeated human interactions" (North, 1989). The interactions, as Bromley (1993) explains, encompass two related dimensions. One is a behavioural manifestation of "shared preferences and shared expectations of the action of others" while the other is the outcome of "socially sanctioned and enforced set of expectations of actions of others".

The next important point is to recognise that institutional analysts are generally agreed that change seldom occurs because of a single event. Rather, several factors will have interacted on each other in a complex way to make change imminent. Indeed, Alston (1996) acknowledges that institutions are never formulated in a vacuum but are conditioned by inherited rules and norms. Further, Conelley (1998) has cautioned that failure to assess current problems against the background of past problems and solutions may lead to repeated er-

background of past problems and solutions may lead to repeated errors in policy formulation and implementation. Pesaran (1987) has also suggested that history is often a necessary source of explanation as to why certain customs and habits dominate over others. Bromley (1989) too has pointed out that existing institutions are the results of prior "institutional transactions" or even historical accidents. North (1995) has also argued that since existing organisations owe their existence to existing institutional matrix, they tend to develop into on-going interest groups, thus perpetuating the institutional structures and, hence, fostering path dependence.

Briefly, the above points of view propose that the past bears significant controlling influences on the present and future. These viewpoints, therefore, suggest that, to fully appreciate the institutional and organisational frameworks presently in force in an industry, it is important to take a critical look at the events that make up the history of the industry. Accordingly, this review seeks to identify major turning points in Kenya's dairy marketing policy and to present a description and an evaluation of policy reactions to critical issues in the history of the industry's marketing policy. A distinction is made between political and economic contents of the reactions and their roles in precipitating and determining the timing of any institutional changes identified. The overall analysis is aimed at revealing how the evolution, over the years, of Kenya's dairy marketing policies has shaped milk marketing opportunities and constraints of smallholder dairy farmers (SDF) in the country.

The review follows the framework provided by Alston (1996), which identifies two levels of analysis as being foundational to any understanding of institutional evolution. One, and the more pertinent to this review, is the "analysis of causes" of institutional changes. This consists of identifying particular instances of change and, for each, determining the dynamics of the system that led to the changes. The other is the "analysis of effects" of institutional changes where the analyst performs a comparative static analysis in order to bring out the consequences of changing from one set of institutions to another. An important point to note in the use of "the analysis of causes of institutional changes" is that the circumstances leading to one institutional change are seldom similar to those leading to another. Therefore, in order to reach the correct conclusions, the theory drawn upon in explaining the factors precipitating given change must be context-specific.

The framework also perceives the process of institutional change as a process of social, economic, and political changes resulting from changes in the balance of bargaining powers among distinct actors in the industry under review. This implies that for each instance of change identified in the history of the industry, the analyst should explicitly identify the following:(i) The organisations responsible for changes; (ii) The factors that may have moulded circumstances leading to the emergence of distinct actors in the industry; and (iii) Factors that may have led to change in the balance of bargaining power to give a party or parties some latitude against the other(s).

The rest of this chapter is organised according to three phases discernible in the history of Kenya's dairy policy development. The first phase covers the colonial era, and coincides with the period when the country's formalized dairy institutional and organisational frameworks were initiated. The second extends from the country's attainment of political independence in 1963 to 1991, and corresponds to a period of incremental changes from a farmer-controlled dairy industry to one tightly controlled by the government. These two phases provide a chronology of events that lead to the third phase, which runs from 1992 to the present and has been a period of changes to a more liberalized market.

1.4.2 The Origins of Kenya's Dairy Marketing Institutions: Colonial era

Kenya's modern dairy marketing policies trace back to the introduction of commercial dairying by the colonial government at the beginning of the 20th century. In the early years and until the attainment of political independence in 1963, the major actors in the industry were the European dairy farmers and the colonial administration. As Leys (1975) and Bates (1989) have pointed out, European farmer settlement was the advocacy of the colonial administration as a strategy of accomplishing the task assigned by the mother government to make the Kenya-Uganda railway, completed in 1901, profitable. It can therefore be deduced that the pursuit of profitable commercial agriculture by the settler-farmers yielded joint returns for both the settlers and the administration. It is therefore reasonable to assume that the reciprocity in gains engendered in the set-

tler-farmers a capacity to influence the design and implementation of policies relating to the profitability of commercial agriculture in the colony.

Indeed, the administration acquiesced to colonial settlers' demands to confine Africans to "reserves" and to exclude them from participating in the commercial agricultural process. This, coupled with imposition of hut and poll taxes payable in cash[2], constituted a strategic design to force the indigenous people to provide cheap labour for the settler-farmers. The design, as Leys (1975) and Zwanenberg (1975) explain, was necessitated by the fact that the settlers, at the time, had neither the knowledge nor the capital to farm the large tracts of lands alienated from Africans. However, in trying to understand why settler-dairy farmers banded together into an organised group, we have to consider several factors. One reasonable factor identified by Bates (1989) is the production externalities existing in rearing of exotic breeds along-side local breeds. To establish commercial dairying, the settlers imported higher-yielding exotic breeds, which they crossed with indigenous breeds to build resistance to diseases endemic in the country (Hills, 1956; Zwanenberg, 1975). However, control of tick-borne diseases proved a big challenge. Tick control has a network externality resulting from the fact that the larger the number of contiguous neighbouring farms adopting control programs, the greater the effectiveness. The challenge, nevertheless, was made bigger by the fact that low yielding local breeds reared by Kenya's pastoral farmers had built strong immunities against

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[2] Hills (1956) reported that, work-for-wages was alien to the indigenous people and that they considered it a demeaning thing to engage in. Consequently, settler farmers potentially faced acute labour shortages, which in effect turned the labour question into a major economic and political issue.

tick-borne diseases and, therefore, pastoral farmers had little incentive to abide by any tick-control programs.

The above socio-political circumstances inevitably separated cattle farmers into two disparate groups: the commercial dairy farmers and the indigenous pastoralists. However, the origins of formalized organisation of settler dairy farmers may have been directly influenced by knowledge transferred from the learning and experiences of dairy farmers in countries where production and marketing were already advanced. *The Commission of Inquiry Report, 1965* reports that by early 1910s the dairy producers began organizing "--- on the Australian and New Zealand pattern---" into area-based cooperative societies, each with a creamery to process and market dairy products for its members. The first such creamery was founded in 1911 in Lumbwa (presently, Kipkelion). This was followed in 1925 and 1928 by the incorporation of the Kenya Co-operative Creamery (in Naivasha) and the Nanyuki Co-operative Creamery (in Nanyuki), respectively (Hills, 1956; Troup, 1956).

Following the collapse of international prices for dairy products during the Great Depression of 1930s, however, distributional conflicts emerged regarding market share allocation in the domestic and export markets. This is explicitly identified in *The Commission of Inquiry Report, 1965*:

"---competition developed as to who should supply the home market with better returns and who should be left with the lower returns from export."

The need to resolve this conflict was for the next three decades to increasingly shape the country's milk marketing institutions. Of particular importance is the

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fact that it compelled the three area-based cooperative creameries to merge form-
ing the Kenya Co-operative Creameries Limited (KCC). This is explicitly re-
ported in Troup (1956):

> " --- competition between the creameries, for a small market, became intense. This led to
> an agreement between the parties to and eventually amalgamation took place in 1931 to
> form the Kenya Co-operative Creameries Ltd."

A fundamental assumption on which an explanation for the merger might
be constructed derives from the inherent characteristics of the distributional con-
flicts faced by the area-based cooperative creameries. The market-share distribu-
tion problem defines a situation where the competing dairy cooperative creamer-
ies exerted interdependent influences on domestic market shares and prices. In
the situation, increases in the domestic market share of one cooperative creamery
inevitably led to decreases in the share of the others. On the other hand, uncoor-
dinated market supply necessarily led to oversupply in the market and conse-
quently a decrease in the market prices for all. This diagnosis leads to the con-
clusion that the competing area-based co-operative creameries faced a zero-sum
distributional conflict. In other words, no group could have gained without the
others losing.

Viewed this way, the need to escape the zero-sum situation emerges as
the main motivation for the merger of the three area-based creameries to form the
KCC. Obviously, the market distributional conflicts had a more encompassing
scope and required solutions to be sought at a more organised level. The search
for a co-ordination mechanism in which one party's activity is made compatible
with the actions of others is consistent with the expectations of behaviour under

situations of scarcity (Ricketts, 1994). Indeed, Czada (1998) has demonstrated that distributional conflicts of the kind identified above can induce the competing parties to enter into co-operative agreements geared at escaping the zero-sum situation. The escape, as Czada (1998) explains, can be achieved in two ways. One entails the establishment of hierarchical power-dependencies among the competing parties to facilitate the more co-ordinated approach appropriate in re-solving the core issues underlying the conflicts. The other method of overcom-ing the problem is to introduce compensatory side-payments. However, Czada (1998) concedes that compensatory transfers among groups are seldom voluntary but require a legitimate authority to impose compliance. In the case discussed here, the two escape routes were actually sought. Hill (1956) reports that:

> "Aided by the circumstances of the times an agreement ----was soon reached by the boards of the three companies whereby the Lumbwa Co-operative Creamery and the Nanyuki Co-operative Creamery would go into voluntary liquidation and the Kenya Co-operative Creamery would purchase the assets of each company. -----the directors re-solved to change the name to Kenya Co-operative Creameries Ltd, a change to the plu-ral----"

The merger was effected in February 1931 and it appears to have en-hanced the bargaining status of the farmers. This is evidenced by the fact the KCC (as the agency of the member-farmers) was able to mount a lobby for statu-tory control (Troup, 1956). This, however, was not granted (Troup, 1956). In-stead, the government enacted the Butter Levy Ordinance of 1931 requiring all non-KCC members supplying butter to the local market to pay a levy (Hills, 1956).

> " the proceeds of which levy was distributed among exporters in order to bring the ex-port realisation nearer to the internal price" (Kenya, 1965).

The merger of the creameries can therefore be seen as a strategic structural

change that, by introducing a hierarchy between the primary societies and an apex processing creamery, made possible the inter-organisation of the societies to allow decision at a single leadership level. An apex organisation was also necessary to provide the executive leadership requisite under the emerged voluntary co-operation. The KCC also provided scope for representing farmer's problems to the administrative authority.

An opportunity for the settler dairy farmers to further press for statutory control of prices presented itself in the World War II. The circumstances prevailing in the war serve to illustrate the argument by Eggertsson (1998) and North (1995) that, forces exogenous to a system may function to upset the balance of bargaining power between actors and triggering a wave of reactions culminating in economic changes. The war opened an opportunity for settler dairy farmers to successfully lobby the government for statutory control of agricultural prices, at least for the period of the war. Faced with the need for large food supplies to feed its fighting forces, the British Government directed the colonial state to contribute in provisioning forces positioned in North Africa and Middle East (Bates, 1989). This translated into pressure on the white settlers not only to increase agricultural production but to also sell to the state. Thus, the balance in the bargaining power for statutory control was shifted in favour of the farmers, with demands for the government to insure them against price risks. The government conceded by controlling prices and, consequently, the voluntary levy adopted in the early 1930s was rendered redundant and was withdrawn.

The wartime demand coupled with controlled higher prices and corresponding reductions in price uncertainties served as major stimuli to the industry resulting in large expansions in primary production and in processing capacity (Troup, 1956). After the war, therefore, and with the withdrawal of the government as a major buyer, the contentious issue of how to share the domestic market appears to have resurfaced with greater intensity. This is clearly evidenced by the fact that the KCC found it necessary to alter its contract with its farmer-members. Thus, rather than resume the pre-war levy, a more complex institutional arrangement of quota-based contracts was designed and adopted in 1954. The change probably suggests that the distributional conflict had intensified far too high to be addressed by the levy. The quota-based contractual arrangement was designed to use conditional payments to create producer incentives as well as offset costs borne by producers in sustaining supplies during off-peak season. This was implemented through a three-tier quota that allowed the payment to depend upon the costs of production as described below:

1. "Milk for human consumption" was defined as requiring a steady flow on a-daily-basis supply. Those contracting for a quota in this market (a year-round quota — i.e. guaranteeing off-season supplies) had to maintain the guaranteed daily quantity throughout the year. This entailed a relatively more capitalised production system involving the intricate management and appropriate staggering of breeding, and investments required to maintain production during off-season periods (e.g., irrigation equipment, feed production and preservation, etc). This market, therefore, commanded

the highest price to compensate for the higher production cost.

2. "Whole milk for manufacture": Those contracting for this market did not have to maintain a regular supply.

3. "Cream for butterfat:" This left skimmed milk on the farm for other uses, e.g., provisions to labourers. It thus commanded the lowest price.

Viewed from an institutional perspective, the quota-based contractual arrangement emerges as a strategic formulation of choices designed to induce self-selection among the farmers into three groups of producers "justly deserving" the respective price levels. Such strategies are, as explained by Rothschild and Stiglitz (1976) and Ricketts (1994), common in markets where individuals or commodities are not easily or "costlessly" distinguishable. In the case discussed here, the market quotas were designed in such a way as to induce producers to distinguish themselves according to abilities to sustain continual supplies of milk to KCC. By emphasising the differentials in production costs, the problem was, in effect, transformed from one of market choice to one of choice of production system. This left the choice to the individual farmer, which was easy, given the fact that the farmers were, obviously, already differentiated into different production groups by differentials in their resource endowments. The design and implementation of the new contractual arrangements also serves to illustrate the potentials of changes in economic conditions in originating institutional changes.

The analysis this far demonstrates that the settler dairy farmers were committed to the reduction of market uncertainty and were willing to forge voluntary cooperation to do so. They were, as well, willing to engage in direct nego-

tiations to define marketing coordinating contracts. However, the ability of a group to organise to forge such cooperation or to hold direct negotiations depends on its structural variables, including size of group, size distribution of their production firms, and heterogeneity of participants (Bates, 1981; Ostrom, 1998). The commercial dairy farmers comprised a homogenous group of white settlers operating large farms. This, however, changed with the implementation of the Swynnerton plan of 1954.

Up to the early 1930s, imperial governments regarded their colonies merely as sources of raw materials to feed an expanding industrialisation in the imperial countries (Boahen, 1987). However, the advent of the Great Depression and the collapse of international trade forced them to consider developing markets in the colonies. This led to the introduction of import-substitution industrialization (ISI) in the colonies. In the case of Kenya, ISI was introduced in the early 1950s. This in turn required a large and growing local market. Accordingly, a case was successfully advanced for intensification of agricultural production of African smallholders (Swynnerton Plan, 1954). As one of the Plan's recommendations, commercial dairy production was opened-up to the indigenous people. This in turn introduced a dual structure of commercial dairy production comprising large and small-scale producers. Further, the integration of smallholder dairy farmers into the market posed a challenge to the KCC's efforts of maintaining distributional balance in sharing out the local dairy market. While settler-dairy farmers had high stakes in the asset-specific milk processing plants operated by the KCC, the new entrants did not. Therefore, the small-scale pro-

ducers could not be expected to favour the voluntary cooperation forged by members of the KCC. The heterogeneity introduced may also have made it difficult to enforce rules informally. Consequently, it may have introduced potentials for opportunistic behaviour among settler dairy farmers. It is conceivable that uncontrolled marketing by the indigenous people could have created conditions conducive for self-interested settler farmers to divert sales from the KCC to sell to raw milk markets through their African farm hands. Indeed, Troup (1956) reports that such markets were thriving in urban areas.

The above diagnosis depicts underlying distributional conflicts between the settler dairy farmers and the African smallholder dairy farmers. It can also be deduced that unlike the distributional conflicts discussed earlier, which involved a more homogenous group of farmers, this one involved a more differentiated actors. The structural variability introduced by the opening-up of commercial dairying to the indigenous people may have weakened the ability to coordinate the dairy products markets through direct negotiation and voluntary cooperation of farmers. The resultant environment for dairy products market may thus have been typified by a non-conciliatory state of affairs and hence increasing the need for a legitimate authority to formulate the rules of the market and to monitor, sanction, and enforce compliance and facilitate problem-resolutions. This may explain why the settler-dairy farmers resumed, in 1956, their demand for statutory control of the industry. It is also worth noting that the marketing structure that the settlers wished to establish was greatly informed by the structure in their mother country. This is reflected in the fact that in 1956 the KCC invited the

Secretary to the Milk Marketing Board of England and Wales to review the industry and give recommendations.

Following from the 1956 review, the KCC successfully lobbied the colonial government to institute statutory measures in the interest of maintaining its dominance in the market. Accordingly, the Kenya Dairy Industry Act— Chapter 336 of the Laws of Kenya — enacted in 1958 accorded substantial protective powers to the KCC. Under the Act, the Kenya Dairy Board (KDB) was established as the state agent in regulating the industry. Further, the Act zoned the country into "scheduled" and "unscheduled" areas and, most significantly, the KCC was appointed the Board's prescribed agent in milk processing, packaging and sale in the scheduled areas, which tended to correspond closely to urban areas. The Act also established regulations (the Dairy Industry Regulations expressly keeping raw milk out of the scheduled areas; the consumers in scheduled areas were to be served by the formal marketing channel. In addition, the creation of any new processing capacity by potential competitors was controlled through restrictive licensing policy. Growth of small-scale milk bars and sale of bulk raw milk to institutions, hotels and restaurants were discouraged. Hence, the statutory measures granted the KCC preferential access to urban markets, thus reinforcing the dominance of the dairy industry by large-scale farmers.

1.4.3 Changes Following Political Independence

The preceding narrative shows that the institutions inherited at independence developed out of collective experience of large-scale dairy farmers' attempt

to organize production and marketing to their best advantage. Immediately following independence in 1963, the performance of the country's agriculture, especially with regard to the marginal market participation by smallholders, became an issue of political and developmental concern. There was need to give greater confidence and predictability to smallholder market participation in all areas of agricultural production as a means of enhancing equity in welfare and livelihood for all farm households. Consistent with the then government's commitment to a development policy based on statutory control, the way forward was seen to primarily exist in developing single-channel marketing systems. To achieve this, the institutions inherited from colonial powers were identified to represent the most logical vehicles of government intervention and implementation of statutory controls necessary for the adopted approach to development.

With regard to marketing of dairy products, the established institutions, including the Dairy Industry Act, the KDB, and the KCC, formed the basis for further institutional changes in the industry. With respect to increasing smallholder dairy farmers (SDF) participation in dairy production and marketing, the government saw its major priority as being to redress the inherited inequalities in producer prices and market opportunities between the large and small-scale dairy producers. This is reflected in the terms of reference of a commission of inquiry, which was constituted under the authority of Gazette Notice No. 31 of July 1964. The main objective of the inquiry was to formulate appropriate measures of facilitating all dairy farmers in the country to participate fully in the development of dairy production and marketing. The terms of reference included, *inter alia*,

"to ensure that equitable price structure is established taking into account the interest of all dairy farmers"(Kenya, 1965).

The inquiry judged that the existing institutional arrangements were very complex and that they favoured large-scale producers over SDF. Indeed, a general direct consequence of the three-tier quota pricing system discussed earlier was to introduce a large-scale-farmer bias. For although the policy was directed by the need to resolve a distributional conflict, the SDF came worse-off since they could not meet the guarantees required. Further, since it was increasingly becoming difficult to qualify for a quota, the system conferred relative benefits on those already awarded quotas through creation of a goodwill value in the transference of quotas from one farmer to another.

To resolve these problems, the inquiry recommended a statutory control of prices. Consequently, the quota system was abandoned in 1971 and replaced with uniform pricing (pan-seasonal and pan-territorial) as part of broad instruments designed and implemented to ensure both seasonal price stability and spatial egalitarianism and of eliminating market bias against smallholder farmers. The KCC was identified as the vehicle[3] through which to implement the statutory controls. In this respect, the KCC 's legal monopoly was re-affirmed. In order to guarantee market outlet to all smallholder dairy farmers, the KCC was mandated to accept all milk delivered to its plants subject to a minimum specification of quality and specified time of delivery. Accordingly, the KCC's capacity was ex-

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[1] This probably reflects the proximate-role played by institutions and organisations inherited from the colonial administration; if there already existed a formalized organisation/institution, it made economic sense (both in term of time and resources) to adopt it and adapt for the advancement of the objectives of the new government.

panded to form the national network required for its new role. The outcome, however, was a system centred on large-scale milk processing facilities and characterised by extensive transportation that could not be sustainable over the long run.

The potential benefits of the above institutional arrangements to SDF can best be understood if viewed from a transaction costs perspective. Institutionalisation has the advantage of widening the time-horizons of actions and of stabilising the rational expectations of individuals (Czada, 1998) as well as fostering regularity and order in the solution of frequently recurring problems (pesaran, 1987). These are desirable features in smallholder dairy production and marketing, given that the high perishability of milk and the pattern of flow of the output require that market be secured for full lactation periods. Furthermore, the arrangements had the merit of allowing the establishment of a routine operating procedure, a crucial feature given the highly repetitive task of milk sales activities, and the consequent need for regularity. This was, as will be explained shortly, designed and implemented through a network of primary dairy farmers' cooperatives societies (DFCS) with well-defined network of milk bulking for pooled transportation to KCC processing and cooling plants.

The net result of the changes recounted here was that the KCC was implicitly identified as a public organization charged with specific roles. In effect, the KCC entered an implicit contract with dairy producers, committing it to pay for all accepted deliveries of milk promptly and regularly at month-end. Although the KCC was incorporated as a public limited company in 1925 and regis-

tered as a cooperative in 1932, the net effects of the institutional changes designed and implemented after independence as related here was to transform it to a *de facto* parastatal. Other social roles entrusted to it included: (i) the maintenance of a strategic stock of milk, (ii) being a buyer of last resort, and, (iii) being an agent of the Ministry of Education in implementing a School Milk Program introduced in 1979. Together with these roles, any autonomy the shareholders had in running their organisation was gradually eroded and taken over by government. This may however be attributed to the change in the organisation's size and membership structure. As already noted, initially the KCC represented the interest of influential large-scale farmers. However, its size, membership, and composition changed remarkably with the increased access by smallholder farmers. Such changed as Bates (1989) has explained tend to give the benefits sought by the affected organisation a public goods character.

The funds required by the KDB in discharging its responsibility were to be contributed by the members. Accordingly, the Act empowered the KDB to levy cess on all milk handled commercially. To effect the collection of the cess, the KDB delegated its agent —the KCC — to collect the cess from those supplying its plants. However, by 1972 the KCC was already experiencing trading losses to which the government responded by allowing it to retain 50 percent of the cess collection. Later, in 1984 it was allowed to retain the total cess collection. In 1982, the KDB lost its Dairy Development section to the Ministry of Agriculture and the Nutrition Section to the KCC and thus its role in the industry significantly reduced

Apart from retaining its cess collection, the KCC had managed to secure other monopoly privileges. These included representation on the KDB's Licensing Committee (DANIDA/MALD, 1990) through which it exerted restrictive control over the issuance of licences to potential entrants and limitations on the quantity of raw milk supplies that a licensed processor had access to (Coughlin, 1992). The control over raw milk supply operated as follows: all other licensed milk processors were denied the right to procure raw milk supplies directly from farmers. Instead, they were required to place an application with the KCC, which then arranged for a number of farmers to deliver *a specified* amount of milk to the applicant. The KCC then invoiced the processor for a price that left a margin for the "services" rendered the processor. The effect of all this was that other processors were at considerable competitive-disadvantage when compared to KCC.

Performance of social roles by KCC inevitably meant that some of its operations were inconsistent with cost minimisation strategies. For instance, operation of a national network of large-scale facilities meant a low overall operating capacity (FAO, 1991). Yet, as DANIDA/MALD (1990) noted, although the plants were under-utilised during the low production periods, labour was mainly on permanent terms and, therefore, could not be flexibly managed to cut losses. As well, DANIDA/MALD (1990) noted that during wet seasons, the KCC's off-loading-bays would be heavily congested with long queues of milk-trucks waiting to offload. This, in effect, lengthened the time between milking and delivery. The congestion often resulted in high rates of milk spoilage, the cost of which

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was passed to producers through rejected milk together with its transfer costs. High transportation costs were also incurred during heavy production periods in extensive re-routing of milk from plants receiving in excess of capacities to those receiving below capacity (DANIDA/MALD, 1990). In addition, the KCC often had to carry heavy inventories of processed products, which commanded lower pricing margins apart from the tied capital.

With time, the KCC started experiencing serious performance and efficiency problems, including accumulation of indebtedness to both farmers and the government. FAO (1991) reports that the KCC's running costs were high and on the increase, increasing by 121 percent between 1985 and 1989. The causal factors for the increased costs are detailed in DANIDA/MALD, 1990. It suffices here to note that these problems cannot be abstracted from the losses made in its performance of the social roles. With time, the problems were manifested in persistent breaches of promissory obligations to pay promptly for milk deliveries and the KCC started falling into arrears with farmers' payments.

Irregular and delayed payments were perhaps the most damaging consequences of the KCC 's operational inefficiencies and were the greatest source of pressure for deregulation of dairy products markets. Directly affected were DFCS through erosion of their capacities to extend services to members. This becomes evident when it is taken into account that the institutional settings in force constrained DFCS's marketing activities to intermediation between the KCC and dairy farmers. Essentially, DFCS provided the chief means of organizing SDF for collection and transportation of milk to the KCC and of transmitting

payments to members. In other words, the DFCS were not in the market as active participants but as passive agents of the KCC. To perform this agency role effectively, a specialized operating system was developed that functioned as summarized below.

Each DFCS established well-defined milk collection routes comprising several bulking points. At each bulking point, small marketable surpluses from numerous SDF were bulked into 50-litre churns that were then picked-up along the route by cooperative owned or hired trucks for pooled delivery to the nearest KCC plant. The bulking points were also centres at which DFCS could sell milk to customers in the local area. Such sales were commonly termed *local sales* to signify that they occurred within the co-operative's *area of operation*[4]. Members were individually responsible for delivering their marketable surpluses to these points. Milk-recording clerks employed by the DFCS received, weighed and entered quantities delivered per farmer in respective farmer's milk-record cards as well as in the cooperative's milk record journals. The farmer retained the record card as an invoice against which payments were made.

Transfer cost of milk from the farm to the KCC plants was on the account of the farmer. This and the cost of other member-oriented services were financed through commissions charged on member's sales proceeds. A standard operating

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[4] Before liberalisation of the industry, the catchment from which a dairy farmers' co-operative society could collect milk (co-opt members) was well delineated and termed the co-operative's "area of operation". Such were also the areas in which the society, other than deliver milk to the KCC, could sell milk However, with liberalisation, this delineation is implicitly void. Therefore, where these areas are still observed, it is done tacitly through self-enforcing agreements. The term, however, has persisted, this time to signify all sales to non-processor markets.

procedure of paying farmer-members a minimum of 80 percent[5] of sales proceeds was used. Identifiable services included co-ordination of collection, facilitating and processing of farmer payments, and transmission of farmer payment through personal account maintained with commercial banks. Thus, the DFCS paid farmers the residual of the difference between price paid by the KCC and the cost incurred in transferring milk from the bulking points to the nearby KCC plant and the cost of running the DFCS. Thus, despite the objective of pan-territorial pricing, producer prices varied from area to area based on the percentage of "local sales", quality of road infrastructure, transfer costs to the KCC plant, and management efficiency of the respective DFCS.

Irregular flow of payments from the KCC translated to cash-flow problems at DFCS. Operation of milk transportation by DFCS, by far the most crucial and expensive, was adversely affected. However, the way in which the problem was weighed differed with opportunities for "local sales" markets. As shown in Figure 1-1, the share of total milk collected by cooperatives in Kiambu that was sold in the raw milk markets rose steadily from less than 40 percent before 1992 to about 88 percent by 1993/94. By comparison, Figure 1-2 shows that cooperatives in Nyandarua were still very dependent on KCC as a market outlet. Those in Nakuru, on the other hand, sold about 60 of their total milk collection in the raw milk markets. The higher raw market share for Kiambu probably reflects the economic advantages created by the physical proximity of the

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[5] This was a guideline set by the Ministry of Co-operative Development (personal communication with Secretary Managers, various DFCS. DANIDA/MALD, 1990)

populous city of Nairobi. As Ngigi (1995) explains, a number of cooperatives in Kiambu were by 1994 participating directly in sale of raw milk in the city.
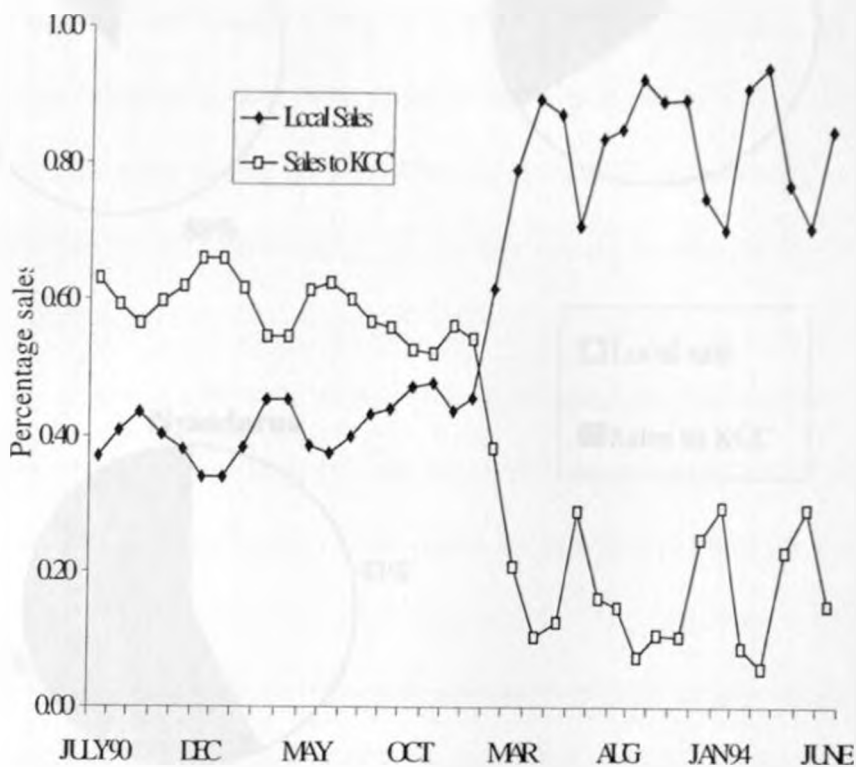
Figure 1-1: Trend in Milk Allocation between 'Local Sales' and Sales to KCC for Cooperatives in Kiambu, July 1990 to June 1994

Source: Adapted from Ngigi (1995)

This may illustrate the influence of relative flexibility (and therefore transaction costs) of haulage as compared to dairy production activity. While vehicles can easily be transferred from milk transportation to other businesses, dairy producers cannot exit from production easily. Therefore, in order to sustain the flow of the raw commodity input, KCC needed to pay transporters promptly.
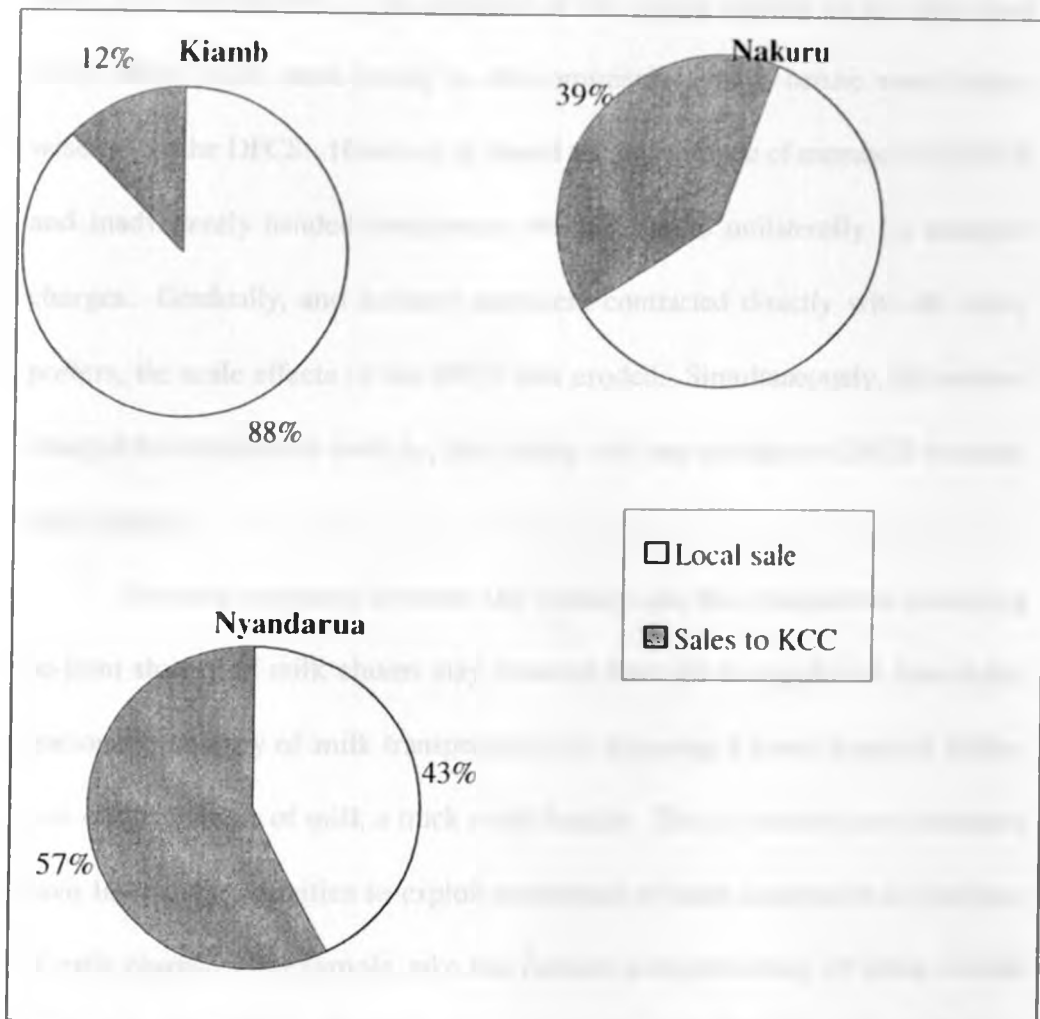
Figure 1-2: Milk Allocation between "local Sales and KCC Sales by Co-operatives in Kiambu, Nakuru, and Nyandarua, respectively, 1993/94

Source: Adapted from Ngigi, 1995

Transporters, however, may have contributed to weakening of DFCS. As Ngigi (1995) explains, the procedure prescribed by KCC was for prospective transporters to negotiate contractual agreements with a meeting of members of specific DFCS and the KCC area directors. The contracts specified charges per litre of milk transported, monetary penalties in case of breach, and time-length of notice required of any party wishing to effect changes. However, transporters

sought to by-pass the cooperatives to establish contractual arrangements with the individual smallholders. This appealed to the private interest of the individual since he/she made some saving on the commission charge he/she would otherwise pay to the DFCS. However, it altered the dependence of members on DFCS and inadvertently handed transporters the freedom to unilaterally fix transport charges. Gradually, and as more producers contracted directly with the transporters, the scale effects of the DFCS was eroded. Simultaneously, the amount charged by transporters went up, thus eating into any savings on DFCS commission charges.

Personal contracts between the farmers and the transporters restricting co-joint sharing of milk churns may however have led to significant loss of operational efficiency of milk transportation by imposing a lower physical limitation on the volume of milk a truck could handle. This is because such contracts have limited opportunities to exploit economies of scale achievable in joint use of milk churns. For example, take two farmers each delivering 25 litres of milk through a cooperative. Through the co-joint use of milk churns, the milk from the two farmers would be handled in one churn. However, under personal contracts with private transporters where each farmer uses own churn, the milk would be handled in two separate churns and, thus, occupy a larger physical space in the truck. It is evident, therefore, that in a system where a large number of smallholder farmers contract directly with transporters and use own milk churns, the operational efficiency of milk handling is likely to be lower than one involving co-joint use of collectively owned milk churns.

1.4.4   Liberalisation and Changes in Milk Marketing Structure

With time, farmers became increasingly disillusioned with the formal marketing channel. By early 1990s, the farmers near large consumption centres had reacted by diverting their produce from the official channel to serve informal urban markets of raw milk. However, as Jaffee (1995) explains, what brought the KCC's performance problems to a climax was its failure to address milk shortages caused by a drought that hit the country early 1992. This revealed the need to restructure the industry to improve the flow and level of returns to farmers and to make it less vulnerable to shocks in domestic production. Hence, the timing of the announcement of deregulation in mid-1992 serves to illustrate that the type and occurrence of an adverse circumstance, given the state of affairs of an industry, can play a considerable part in bringing policy makers to face up to the realities. By now, the policy-makers were persuaded that the statutory control of the industry had failed in its fundamental objective of fostering smallholder market participation.

The main policy reform entailed creation of a "level playing ground" by removal of statutory controls that protected the KCC's monopoly. Measures taken to achieve this include:

(i)   Removal of producer and consumer price controls.

(ii)   Removal of the KCC's legal monopoly and the licensing of more firms to process, package and distribute dairy products.

(iii)   Decriminalisation, at least in part, of raw milk marketing, through the

licensing of milk bars in urban and rural market centres.

Perhaps the most visible aspects of the deregulation of the dairy industry have been the noticeable increases in private milk processing investment and the spontaneous expansion of vending of raw milk in urban areas (VRM. These are discussed briefly below.

1.4.5   Private Processing

Since 1992, a number of private and co-operative milk-processing plants have emerged. Their development first started on large-scale dairy farms (including Brookside, Illara, and Delamere Dairies), which afforded a head start through foundational supplies from own herds. These progressed fast into taper integration— sourcing some fraction of raw milk input from their own vertically integrated dairy farms and the balance from market supply from farmers. The number of processors has also increased over the years (to include Tuzo, Limuru dairy, Premiere dairy, Molo dairy) and they all depend heavily on market supply from farmers. As shown in Figure 1-3, the processing capacity installed by the emerging processors had, by 1999 reached about 500 thousand litres per day.
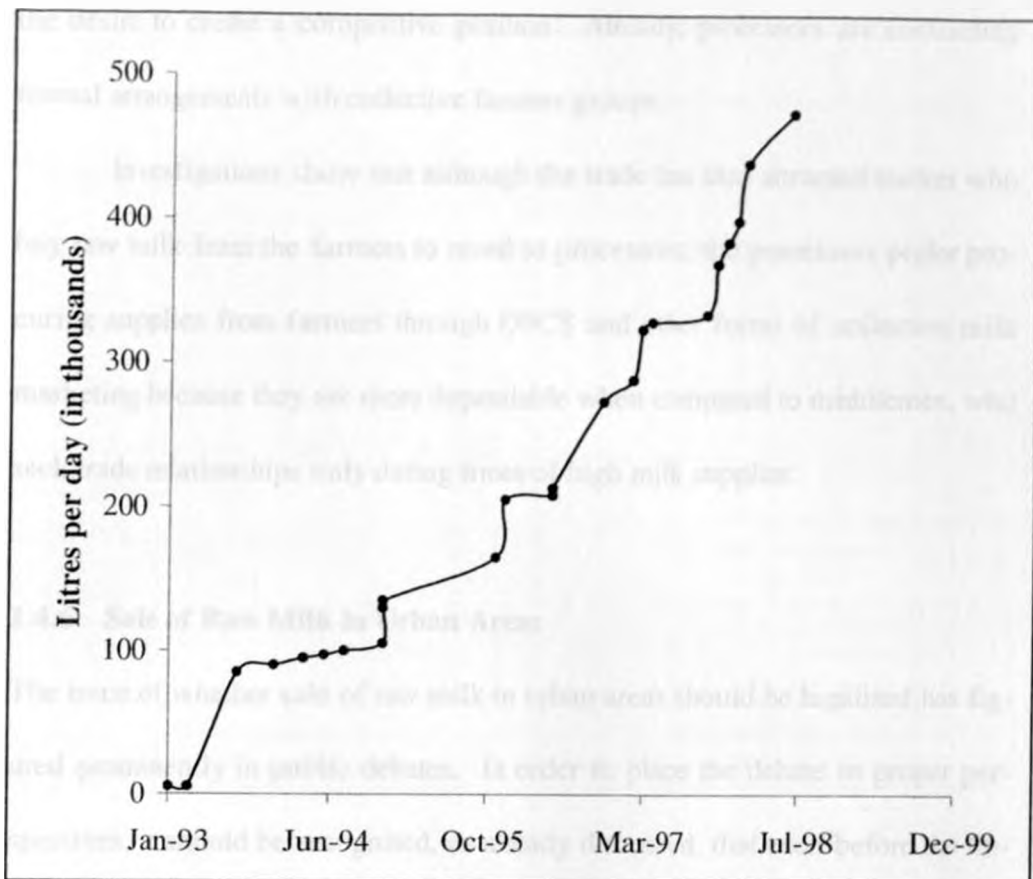
Figure 1-3: Installed Non-KCC Milk Processing Capacity, 1992-1999
Source: Author's compilation based on KDB's register of milk processors

Initially, the private processors favoured at-factory-gate deliveries of raw

milk supplies. However, increases in individual and combined capacity, and the

attendant competition for supplies, placed a challenge for an increased ability by

individual processors to guard against under-utilisation of installed capacity. In-

dividual processors are thus faced with the pressure to actively cultivate pro-

curement arrangements favourable to creating steady milk supply relations with

farmers. This may well lead to invariable linkages between milk procurement

and inputs and services delivery systems as processors act under the stimulus of

the desire to create a competitive position. Already, processors are contracting formal arrangements with collective farmers groups.

Investigations show that although the trade has also attracted traders who buy raw milk from the farmers to resell to processors, the processors prefer procuring supplies from farmers through DFCS and other forms of collective milk marketing because they are more dependable when compared to middlemen, who seek trade relationships only during times of high milk supplies.

1.4.6 Sale of Raw Milk in Urban Areas

The issue of whether sale of raw milk in urban areas should be legalised has figured prominently in public debates. In order to place the debate in proper perspectives, it should be recognised, as already discussed, that even before the liberalisation of the industry in 1992, sale of raw milk was a legal activity in the "unscheduled" areas as defined in the Dairy Industry Act. As shown in Figure 1-4 panel (a), estimates done just prior to the liberalisation of the industry show that raw milk sales accounted for about 53 percent of the total milk marketed surplus (≈ 20 percent of total milk production). We should however hasten to caution that the estimates in panel (a) were based on official statistics. The estimates, therefore, are expected to understate the significant of raw milk sale and, hence, to underestimate marketed production since most SDF output is sold in local markets not covered by official statistics. Nevertheless, the statistics serve to emphasis the fact that raw milk sales activities are not a consequence of the liberalized market. These sale mainly comprised milk sold by producers to milk

deficit households and institutions in the neighbourhood of the producing house-
holds and by DFCS to households, institutions, hotels and restaurants in DFCS
"areas of operation". In principle, this raw milk sales activity is still acceptable;
it is the indiscriminate handling and sale of raw milk in urban areas that has been
an area of public concern.
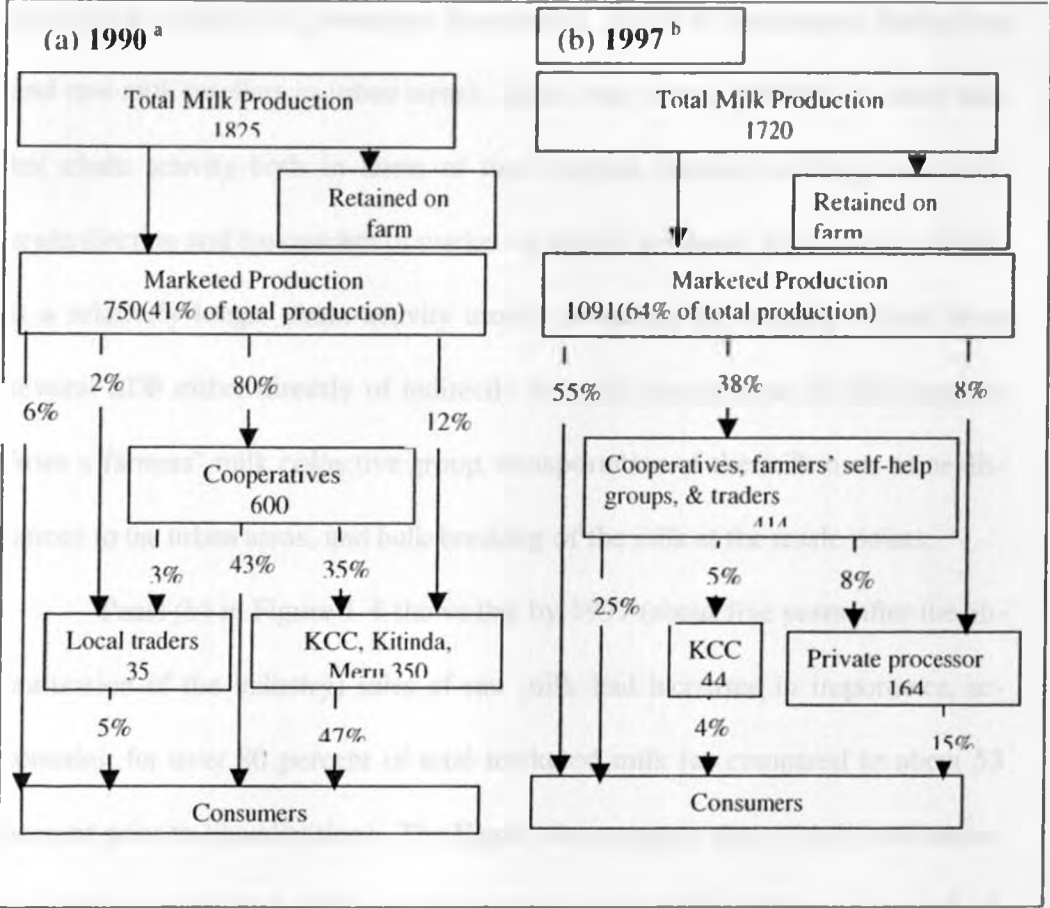
**Figure 1-4 Milk Marketing Channels in Kenya Before and After Liberalisation of the In-
dustry (million Litres)**

Source: [a] adopted from FAO, 1991
        [b] adopted from Omore *et al*
Notes: Percentage marketed flows are calculated on marketed production

As already implied, two types of raw milk sales activities are distinguishable. One, which we will term retailing raw milk in rural areas (RRMR), comprises sale of milk by producing households to milk deficit households in the neighbourhood or by farmers' collective groups to rural consumers calling at the group's milk-bulking points. The other, which we will term vending of raw milk in urban areas (VRMU), involves rural-to-urban sale of raw milk to non-processing outlets (i.e., consumer households, hotels & restaurants, institutions and raw milk resellers in urban areas). By its very nature, RRMR is a short market chain activity both in terms of time elapsed between milking and delivery/collection and the number of marketing agents involved. By contrast, VRMU is a relatively longer chain activity usually involving the bulking of milk from several SDF either directly of indirectly through procurement of milk supplies from a farmers' milk collective group, transportation of the milk over some distances to the urban areas, and bulk-breaking of the milk at the resale points.

Panel (b) in Figure 1-4 shows that by 1997 (about five years after the liberalisation of the industry) sales of raw milk had increased in importance, accounting for over 80 percent of total marketed milk (as compared to about 53 percent prior to liberalisation). The Figure also suggests that, with liberalisation, the proportion of total milk production that is marketed may have increased. It should, however, be noted that these figures are only indicative of the changes that actually took place, for as already mentioned, the figures in panel (a) may have underestimated the importance of raw milk sales activities. Nevertheless, it can be deduced that since RRMR was, as already discussed, a thriving activity,

any increases in raw milk sale that may have resulted from the liberalization of the industry is attributable to expansions in VRMU. This is plausible given that, in many areas, the cooperative-to-KCC milk transportation operation described earlier only operated for milk harvested in the morning ('morning' milk). A number of studies had actually revealed "forced" on-farm milk consumption (MALD, 1992; FAO, 1991) owing to the non-procurement of milk harvested in the afternoons ('afternoon' milk). By contrast, raw milk trade operates twice a day in correspondence with a twice-a-day milking. It is possible, therefore, that together with eating into procurement markets that previously supplied the KCC, VRMU may have helped to ease the 'forced' on-farm milk consumption.

Increases in the proportion of total milk production that is marketed may also be attributed to the fact that some of the modes of transport used by raw milk traders are able to access areas that may be inaccessible to milk processors. By virtue of large raw supplies requirement, delivery of milk to processors is heavily dependent on motorised transport. Thus, areas with poor road infrastructures may be inaccessible to the processors. Such areas, however, may be accessible to small-scale raw milk traders on bicycles or on foot. Bicycles are also used in making home deliveries in the urban areas. The upsurge in VRMU has also been attributed to wide pricing margins (Ngigi, 1995). Since processors have to include the cost of expensive pasteurisation and packaging into their margins, the raw milk traders procuring milk within peri-urban areas can compete profitably within the processor's margins. Indeed, Staal and Mullins (1996)

have reported that the differentials in market prices reflected the unwillingness on the part of consumers to pay for added costs of processing milk.

A related factor, but one that requires further research, is the possibility that some consumers have a taste and preference for raw milk relative to processed milk. In a study to assess the determinants of dairy consumption in coastal Kenya, Staal and Mullins (1996) found that the consumers, even in urban areas, expressed higher preferences for raw milk. However, due to restricted supply of raw milk in urban areas, the stated preferences for raw milk by urban consumers were not reflected in their milk consumption patterns. It can therefore be inferred that the previous system of regulations imposed constraints on urban consumers; though they preferred raw milk, its supply was restricted.

The factors favouring the growth of VRMU may undoubtedly limit market entry of private milk processors. Indeed, even dairy co-operative societies, which for years have been promoted by government as the preferred economic link between smallholder dairy farmers and the formal milk marketing channels, are now active participants in the raw milk marketing activities (Ngigi, 1995; Owango et al, 1996). However, the major areas of concern with VRMU are: (i) the relative longer time lapse between milking and purchase by the final consumer enhances microbial growth in the milk, especially under the tropical ambient temperatures; (ii) multiple handling of milk makes the milk exchange more and more impersonal with consequent increases of chances for adulteration of the milk. Indeed, a study by Omore et al (2001) comparing milk qualities between raw milk samples collected at milk exchange and consumption points in rural

areas, on one hand, and in urban areas, on the other, showed milk qualities in the latter to be poorer in terms of microbial counts, butterfat content and adulteration with water. These findings show that the public concerns with VRMU are pertinent with respect to the potential public health hazard that the activity poses.

The question of whether to legalise VRMU or not is, however, not a simple one. First, it should be recognised that the widespread expansion of VRMU was not an officially intended direction of change. Proponents of reforms may have been too preoccupied with the inefficiencies of the KCC to anticipate and define regulatory measures for this other development of liberalized market. Unfortunately, the damaging consequences of the inefficiencies of the KCC may have been left until so late that as already explained, farmers had grown disillusioned with the single channel. However, installing adequate processing capacity to handle marketable surpluses from all the suppliers the KCC was losing to disillusionment was not a short-term reality. Time was required to secure funds, conduct search for equipment and price quotations, and for shipment and installation. Thus, the VRMU may have initially started as a stopgap measure but has become an entrenched market activity given the advantages it confers to producers and consumers as already discussed.

From the forgoing paragraphs, it should be clear that the concern for VRMU is two sided. On the one side are the economic implications for market opportunities for SDF, coupled with milk market advantages enjoyed by consumers. On the other side, this mode of milk handling bears potentials for creating a public health hazard with great policy implications. The current legal situa-

tion, with respect to the activity, is not clearly defined. Implementation of quality standards is difficult; the numerous numbers of rural-to-urban raw milk traders involved and their small sizes of operation make monitoring and enforcement very difficult. The KDB's regulatory activities have been *ad hoc* and reactive in nature, generally involving impromptu confiscation of milk destined for the raw milk markets.

However, given the persistency of other informal open food markets in the country, the VRMU should be expected to be a long lasting activity. As long as the trade is profitable, *ad hoc* regulatory measures may be less successful and may only succeed in increasing transactions costs incurred by the traders in avoiding losses from encounters with the KDB officials. Furthermore, there is the danger that measures ostensibly instituted for health hazard reasons may actually be protective of processors against competition from raw milk traders. Instead, the KDB should take a more proactive role, principally to educate consumers about the potential health hazards of raw milk.

Before finalising this section, it is worth recognising that the prominence of raw milk trade is not unique to Kenya. Figure 1-5 depicts milk-marketing channels for Tanzania and Uganda. The figure shows that in these countries too, over 80 percent of the marketed milk reaches the consumers in the raw form.

Total Milk Production
188

Total Milk Production
420

Marketed Production
126(67% of total production)

Marketed Production
234(56% of total production)

33%   5%   3%

47%   11%

Vendors & kiosks
42

Dairy Corporation
25

1%   1%

8%

Cooperatives
6

Agents
129

Private processors
4

Agent/Retailer
2.5

60%   31%   4%   2%   2%

42%   55%   3%

Consumers

Consumers
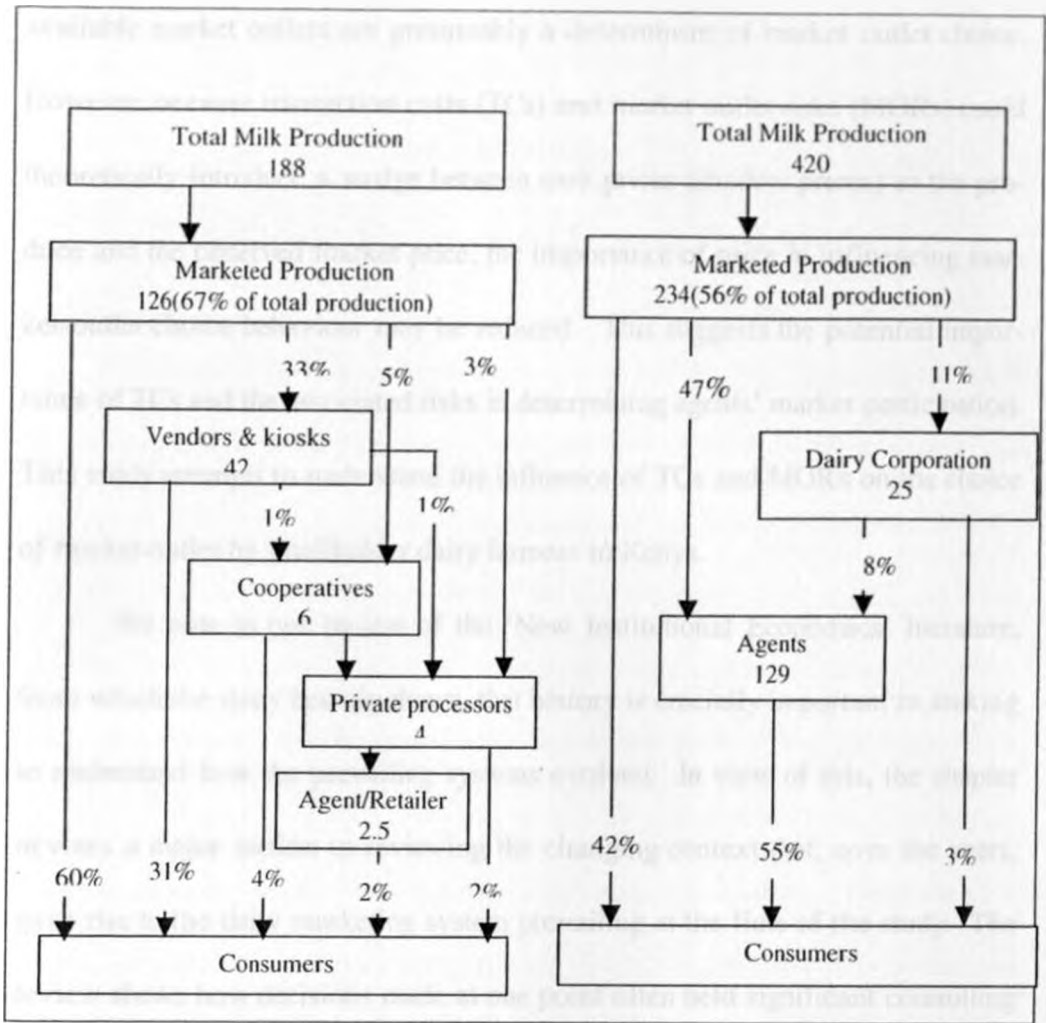
Figure 1-5 Milk Marketing Channels: Tanzania & Uganda (Million Litres)

Source: [a] adapted from MOAC, SUA & ILRI. 1998
[b] adapted from ILRI. MAAIF. NARO & Makerere University
Notes: Percentage marketed flows are calculated on marketed production

1.5 Summary

An important aspect of recent agricultural market liberalisation is the growing diversity in market outlets, reflected in widely diversified contractual arrangements. In such circumstances, the farmer must choose the contractual arrangement that offers the highest net benefits. Differentials in prices among

available market outlets are presumably a determinant of market outlet choice. However, because transaction costs (TCs) and market outlet risks (MORs) could theoretically introduce a wedge between true prices (shadow prices) to the produce and the observed market price, the importance of price in influencing market-outlet choice behaviour may be reduced. This suggests the potential importance of TCs and the associated risks in determining agents' market participation. This study attempts to understand the influence of TCs and MORs on the choice of market-outlet by smallholder dairy farmers in Kenya.

We note in our review of the 'New Institutional Economics' literature, from which the study heavily draws, that history is crucially important in seeking to understand how the prevailing systems evolved. In view of this, the chapter devotes a major section to reviewing the changing context that, over the years, gave rise to the dairy marketing system prevailing at the time of the study. The review shows how decisions made at one point often held significant controlling influences over subsequent decisions. The review has also shown that valuable insights into forces that influenced the specific forms of change can be gleaned from the analysis of the circumstances under which the changes.

Chapter 2

Literature Review and Conceptual Model

2.0 Overview

Advances in theoretical and empirical works of the 'New Institutional Economics' (NIE) have added new contexts for the analysis of economic exchange mechanisms. The fundamental insights derive from relaxation of restrictions imposed on the neoclassical theory by the assumptions of perfect and costless information, and of perfect and complete markets (Alt and Shepsle, 1990). The result has been an enlarged field's view of the study of human interactions (Nabli and Nugent, 1989), and the emergence of a number of theoretical frameworks explanatory of diverse structures of exchange mechanisms. These theories include principal-agent theory (Bergen et al, 1992); the collective action dilemma (Olson, 1971, Ostrom, 1997); transaction costs theory (Williamson, 1975, 1985, Grossman and Hart, 1986); and the property rights theory (Barzel, 1989).

Of particular relevance to this study is the transaction costs theory of exchange. This derives from the thesis that when the costless information and near-zero transaction costs (TCs) assumptions of the neoclassical model are relaxed, both the rare nature of impersonal markets (spot market contracts) and the economic significance of relational contracts become apparent (Williamson, 1996; Streeck, 1992;). In this context, institutions emerge as significant endogenous devices that have evolved to resolve problems of incomplete and missing markets that are caused by informational asymmetries (Rothschild and Stiglitz;

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Hirshleifer and Reiley, 1979; Kreps, 1990; de Janvry, Fafchamps and Sodoulet, 1991; Hirshleifer and Reiley, 1992; Hoff *et al* 1993; Rickettts, 1994) and high TCs (Timmer, 1996; North, 1984; Eswaran and Kotwal, 1986; de Janvry and Sadoulet, 1992). Within this framework, the market is conceptualised as an institution forming through dynamics of rational self-seeking individuals intent on maximising their advantages through the medium of contracts (Streeck, 1992). Similarly, both the expectations and preferences exhibited by economic agents are assumed to form endogenously and to be based on structures of choice and opportunity sets.

This chapter seeks to understand the theoretical underpinnings of positive information and transactions costs and how these can be applied to explain the differentials observed in market choice behaviours of smallholder farmers. The rest of the chapter is structured as follows: section 2.1 reviews the theory of transaction costs. Then, based on the understanding deriving from the review, we explore, in section 2.2, the relevance of TCs-analysis to agricultural production in general and more specifically to the production and marketing of milk by smallholder dairy farmers (SDF). Additionally, section 2.2 uses deductive theory to identify characteristics of dairy production and marketing that constitute potential sources of TCs and market outlet risk (MORs) that are likely to influence the participation of SDF in milk markets. From the theoretical analysis, some general considerations as to the role of the existing marketing system and farm-household socio-economic attributes are derived, which are used in section 2.3 to construct conceptual models for empirical examination of the milk market outlets choice behaviour of SDF in Kenya. Section 2.3 also

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choice behaviour of SDF in Kenya. Section 2.3 also provides arguments for choice of longitudinal data collection design and of random effects estimations with respect to the study.

2.1   A Review of Transaction Costs Theory

The literature on the NIE provides useful explanatory theories on sources and manifestations of TCs. The sources are traced in a complex interplay of two types of uncertainties. One, environmental uncertainties refer to the uncertainties that arise because agents are unable to perfectly predict the state of nature. The other, behavioural uncertainties are associated with the uncertainties that arise because agents are incapable of perfectly anticipating the behaviour and actions of others in the market place (Pesaran, 1987). Briefly, these uncertainties are defined to include all those factors that make it impossible to perfectly specify *ex ante* the circumstances surrounding an exchange, or to verify *ex post* the performance of agents. The development of the theory has been greatly influenced by works done independently by Ronald Coase (1937), Mancur Olson (1971), Williamson Oliver (1971; 1985), and Douglass North (1990) (see Allen, 2000, Doner and Schneider, 2000). Milgrom and Roberts (1990) have also made remarkable contributions.

Williamson's (1986) works are based on implications of incompleteness of information concerning the future and the consequent uncertainty about future events and actions and reactions of economic agents. More specifically, he recognises that future actions are shroud in uncertainties that make it impossible to

perfectly anticipate all possible contingencies likely to impinge on the parties' ability to perform or the cost of performing as promised. He argues that contingencies may also be very complicated or too difficult to define precisely. He attributes observed differences in TCs to differentials in the degrees to which dimensions of TCs are operative in an exchange situation and the implications of the differences in designing and implementing appropriate governance structures. He identifies the major dimensions of TCs as: asset specificity, uncertainty, opportunism, and frequency of transactions.

Asset specificity refers to inflexibility and difficulties of transferring the use of assets from one production process to another without declines in value. The concept hinges on the aspect of concurrent presence of asset durability and specialisation for a particular production or trade relationship (Williamson, 1985; Anderson 1988). This aspect is exemplified in a variety of relations, including those involving specialised human capital, specialised physical capital, brand name capital, and site specificity (Rindfleisch, 1997; Monteverde and Teece 1982 Shelanski and Klein, 1995). The basic postulate of the transaction costs theory is that asset-specific investments expose an economic agent to post-contractual behavioural and environmental uncertainties regarding continuity of exchange relationships (i.e., such investments renders the agent vulnerability to hold up). The implications of this are that such assets require the creation of mechanisms for sustaining contractual relationships by specific identity of parties. In other words, the continual usage of asset-specific investments in their prime production requires to be safeguarded through appropriate governance structures.

The theory further contends that the analysis of institutional arrangements should be informed by the assumption that human behaviour is subject to bounded rationality and opportunism. Bounded rationality, a concept popularised by Simon (1957), comprises a modification of the neoclassical concept of rationality. It assumes that although economic agents often intend to act rationally, their intentions are constrained by limited cognitive abilities. This, interpreted within the TCs economics framework, means that although the parties to a transaction strive for opportunities to realise efficiency, they are limited in their quest by informational incompleteness, coupled with limited computational and communication abilities.

Additionally, Williamson (1986b) adopts the term opportunism to extend the usual assumption of self-interest to bring out a behavioural tendency he terms " self-interest with guile". The tendency, he explains, gives rise to behavioural uncertainties attributed to strategic non-disclosure, disguise, or distortion of information. Shaffer *et al* (1985) have clarified this as behaviour that brings immediate reward to the individual but imposes great costs on the system, leaving everyone less well off in the end than they would otherwise be. We should also be quick to mention that behavioural uncertainties are distinct from uncertainties that arise from lack of communication of decision-makers planning individually but concurrently in response to market signals.

Frequency of transactions, the fourth dimension, is identified as a relevant factor in the twin objective of minimizing TCs and the neoclassical production cost aspects. The premise is that specialised governance, though suited to gov-

ernance needs of non-standard transactions, is costly and therefore of greater benefits to transactions that are supported by heavy investments in transaction-specific assets where the frequency of transaction is high.

In contrast to Williamson's (1986) focus on contracts extending to the future, Milgrom and Roberts (1990) have considered the implications of informational problems in negotiating comprehensive short-term contracts. They identify the activity of bargaining as constituting a major source of transaction costs. Bargaining costs, they have specified, include co-ordination failures, measurement costs, and private information regarding preferences. Co-ordination failure, they explain, arises where, because of multiplicity of mutually consistent, self-interested patterns of transactions, the market fails to ensure that only the efficient transactions are undertaken. On the other hand, measurement costs are associated with the self-interest that is exhibited under standard short-term negotiations. Buyers and sellers in such contracts engage in the evaluation of and the haggling over each market offer. This expends resources in acquisition of information. In addition, since the haggling parties may fail to reach an agreement, duplication of effort and resource waste continues in subsequent negotiations. The third source of bargaining costs, i.e., private information about preferences, agrees well with Williamson's behavioural uncertainty. It involves cases where a delay or a failure to reach an agreement may arise from the parties' strategic misrepresentation of their value assessment of market offers.

North (1990) bases his TCs theory on the implications of asymmetric information structures and incompleteness of information. He observes that infor-

mation on valued attributes of goods and services on offer and on the perform-ance of agents are often asymmetrically distributed. Consequently, he argues, buyers must expend costs in screening the relative values potentially accruable to them from market offerings. Similarly, sellers must expend costs in designing and implementing market-signalling mechanisms (e.g., investments in public re-lations and advertising, money-back guarantees, etc). Further, in an argument for the modification of the neoclassical concept of rationality, he concedes that it is presumptuous to expect that economic "actors possess cognitive systems that provide true models of the world about which they make choices". He concedes that since the acquisition of information entails costs, valued attributes are never completely measured or specified. Therefore, markets are often characterised by incomplete informational structures. This engenders possibilities of strategic be-haviour by the economic agents and precipitates opportunistic behaviours akin to those identified by Williamson (1986b). This in turn gives rise to incentive and enforcement problems.

Implicit in informational problems is the notion that informational incom-pleteness and asymmetries create TCs constraints associated with the role of pri-vate incentives and inherent efficiency losses. Depending on the context of ex-change, informational problems create conditions conducive to one of a number of uncertainty-based problems, including moral hazard and adverse selection as discussed below:

(i)   *Moral Hazard*

Moral hazard is the problem that arises when the set of incentives charactering an

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exchange situation motivates individuals to engage in actions that though privately beneficial, result in undermining the welfare of the system. The problem is prevalent in exchange situations where informational problems make it difficult or impossible to monitor the actions of economic agents (Philips, 1988; Newbery, 1989; Hoff *et al*, 1993; Bates, 1995; Holmström, 1979). Under such circumstances, the use of forcing contracts is precluded. Consequently, agents with opportunistic tendencies can be deceptive, safe in the knowledge that chances of being detected or suffering the full damage caused by their actions are slim.

(ii)   Adverse Selection

Adverse selection is the problem that arises in situations where one side of the market (either the seller or buyer) is more informed, compared to the other, about the properties of the goods and services being traded (Philips, 1988). The classical case commonly referred to as the market for "lemons" (Akerlof, 1970; Varian, 1992), presents a market characterized by goods of variable quality and hence uncertainty. In such a market, returns for good quality goods accrue to the entire group of sellers. This induces incentive for sellers to market poor quality goods with the consequence that quality fades out of the market, hence the market for "lemons".

The common theme emerging, both from theoretical constructs and empirical works, is that in exchange situations shroud in informational asymmetries, economic agents, in their rational self-seeking endeavours, attempt to minimise the inherent risks and uncertainties. This entails what Shelanski and Klein

(1995) have termed an "efficient sort" between contracting on the market for goods and service, on one hand, and governance structures, on the other. For this reason, existing relationships can be explained as evolving out of economic agent's desire to mitigate conflicting interests and to coördinate exchanges efficiently. This entails the use of resources — thus giving rise to transaction costs.

The conceptualisations also suggest a multi-dimensional approach to TCs within which such objective factors like financial costs and prices are defined broadly to include such subjective variables like risks and shared preferences. Further, the concept makes a distinction between two main levels of TCs differentiated according to whether the costs are incurred *ex ante* or *ex post* to the conclusion of an exchange contact (Eggertsson, 1990; North, 1990; Hoff *et al*, 1993; Bromley, 1993; Rindfleisch and Heide, 1997). The two levels can be expounded as follows:

(i)   Ex ante costs:

These are costs that must of necessity be expended before a transaction can be concluded. For instance, sellers must often incur information costs (time and resources) in searching for alternative market opportunities and screening alternative opportunities for potential gains. They often also have to incur market-signalling cost (e.g., promotion, public relation, etc). On their part, buyers often must incur information costs of measuring the valued attributes of goods and services. Additionally, both parties in an exchange must often incur bargaining costs in negotiating terms of agreements (i.e., prices and discounts, quality, quantities, and delivery schedules).

(ii)   *Ex post* costs:

This defines costs that must be expended at the specific time of exchange or in coordinating repeat dealings. They include time and effort expended in scheduling deliveries to coincide with the agreed upon delivery schedules, and enforcement costs incurred in monitoring and policing agreements or bargains arrived at.

The advances in the conceptualisation of TCs theory have spurred interests in the strategic roles that contractual arrangements play in conveying economic benefits intrinsically important to exchange-partners. A central proposition of the conceptualisation is that the choice of one contractual form over other forms is based on TCs of the context of exchange (Binswanger and Rosenweig, 1984; Rindfleisch, 1997; Hayami and Otsuka, 1993; Cheung, 1989; Cheung, 1992; Hubbard, 1997) as well as differentials in potential utilities (Ganesan, 1994; Heide and John, 1990). This has especially found wide applications in explaining the wide variety of economic relationships observed in practice (Shelanski and Klein, 1995).

In particular, contractual arrangements have come to be seen as falling in a continuum accounted for by the operational context of the various dimensions of TCs. At one extreme are spot markets where goods and services are exchanged with price as the sole market coordinating mechanism. At the other extreme are vertical integrations coordinated through hierarchical structures forged to safeguard asset-specificity (Williamson, 1986, Rindfleisch, 1997; Shelanski and Klein, 1995). Dwyer *et al* (1987) and de Jasay (1990) make further distinctions

regarding time-orientation of exchange relations. They characterise spot market contracts as one-off interactions executed with little time lapse— with the promise and performance being virtually simultaneous. Conversely, relational contracts extend over appreciable time-periods (Dwyer *et al*, 1987) and are mainly founded on trust (de Janvry, Fafchamps and Sadoulet, 1991; Fafchamps, 1996; Doney and Cannon, 1997 Garbarino and Johnson, 1999) and safeguarded by contracts which may either be in explicit or implicit forms (Dwyer, Schurr and Oh, 1987).

In this context, trust is conceptualised as the confidence a party in an exchange places on the credibility and reliability of his exchange-partner (Morgan and Hunt, 1994; Moorman, *et al* 1993). Further, Ganesan (1994) argues that participation in a relational transaction demonstrates " an expectancy held by an individual that the partner's word or written statement can be relied on". This implies that it is possible for relational contracts to be potentially useful, yet undesirable if a party in an exchange has misgivings about the credibility and reliability of the exchange-partner. Of major implication for the analysis of relational contracts is that situations characterised by TCs induce the emergence of institutional arrangements designed to circumvent potential market failures (Williamson 1990; North 1984; Eswaran and Kotwal, 1985). In consequence, market outlet risks (MORs) and uncertainties are reduced while exchange is facilitated. Transaction costs, therefore, are not necessarily manifested in market failures but in ingenious market-failure circumventing devices.

The use of institutional conceptual framework allows the market analyst to broaden his scope beyond price incentives to include other challenges facing smallholders — the TCs and MORs — and to view institutional arrangements from the perspectives of both price and non-price incentives. It also permits the analysis of both horizontal and vertical TCs-minimising arrangements evolving with the changing market environment. For instance, shared preference by smallholders for regular payment by fixed schedules (such as monthly or fortnightly) and for given modes of transmission of the payment (such as through personal bank savings accounts) coupled with expectations regarding the reliability of buyers may be of more importance to them than the level of prices. This then may influence the choice of outlet and shape the evolution of institutional arrangements. Farmers may for instance seek to market through institutions designed to concentrate bargaining power in factor and produce markets and in enforcing payments for the produce delivered.

A focus on TCs concedes that "getting prices right", as advocated by the standard package of the on-going market reforms, may not constitute a sufficient condition for improving smallholder farming. Price distortions are unlikely to be the only constraint to smallholder market participation. Therefore, the widened scope permitted by TCs-analysis offers a more proactive response to marketing and performance problems as opposed to merely reacting to the standard prescriptions offered by Structural Adjustment Programmes (SAPs). For, although one of the primary issues with SAPs is "ensuring adequate supply response to improved incentives framework" (Mills, 1989), implementation has been criti-

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cised as being heavily preoccupied with standard prescriptions (Bromley 1993; Hewitt de Alca'ntara, 1993; Mills, 1989; Thompson, 1991). This poses the danger of disregarding the nature and dynamics of institutional arrangements within specific economies. As Hewitt de Alca'ntara (1993) argues, what may be needed is to temper the economic prescription with a sound understanding of market circumstances facing various groups of rural producers. She argues that the market institution needs to be studied not as hypothesised to function in neo-liberal economics but as it is made operative through the interaction of real social groups as they continually develop new modalities of minimising constraints facing them.

This view is indeed gaining currency against the ongoing removal of state control of markets. We now more than ever before expect growth in heterogeneity and specialisation of goods and services as hitherto captive sellers and buyers articulate their values and perceptions in a liberalised market environment. Accordingly, new institutional structures are expected. As Jones (1996) points out, effective policy formulation can only result from a clear assessment of TCs, and a strong understanding of the emerging new market forms and their impacts on market performance.

The alternative conceptual framework, which emphasises perfect competition as the norm against which to evaluate marketing efficiency, may not be well suited for the current study. Apart from failing to explicitly recognise the importance of TCs and MORs in shaping market competitiveness, it gives little attention to interdependence of activities at different levels of the marketing system and the fact that many transactions are based on more than price (Hoff *et al*,

1993; Riley & Staatz, 1993). Riley and Staatz (1993) have further criticised the approach for often exaggerating the importance of improving physical infrastructures of marketing systems relative to the importance of changing institutions, standard operating procedures of firms and government agencies, and market rules.

In the next section, we use the TCs theoretical framework developed thus far to present a theoretical deduction to identify antecedents of TCs and MORs that are likely to influence the participation of smallholder dairy farmers (SDF) in milk markets. This approach is becoming a standard initial step in TCs studies. The aim is to first establish the existence and the types of TCs operational in an exchange situation under analysis and to draw some implications for optimal contractual arrangements. Dwyer *et al* (1987) have advanced an argument for the assessment of antecedent conditions and processes of relationship in understanding buyer-seller relationships. Riker (1990) also argues strongly in favor of this procedure and contends that a scientific explanation should not stop merely at the explanation of how an event came about. It should further seek to identify which antecedents of the events are " necessary or sufficient or both for the event to occur and which are merely coincidental and irrelevant". For this reason, Riker (1990) argues that empirical laws alone cannot have the necessary and sufficient character of an explanation. Rather, a lot of convincing support from deductive theory is called for.

Jaffee (1993) has demonstrated the practical usefulness of this approach. In an analysis of Kenya's horticultural exports, he first drew out theoretical de-

ductions, which proved to have great explanatory powers as to why relational contracts were the optimal exchange arrangements in "trading highly perishable and quality variable commodities over long distances in a market which features multiple prices for very similar commodities". He deduced that in the context of opportunism induced by informational problems, relational contracts were favourable because they enhanced trust and reduced cost of information.

2.2 Antecedents of TCs and MORs influencing SDF Market Participation: A Theoretical Diagnostic Approach

Certain features of agricultural production and marketing are critically associated with TCs. To start with, animals and crops have specialised climatic and soil requirements. This, when coupled with the often raw material nature and high-bulk-to-value ratio characteristic of most agricultural commodities, induces site-specificity relationship between primary and secondary production activities. Within this context, site-specificity relationships, as Shelanski and Klein (1995) have agued, are designed to minimize transport and inventory cost. Second is the high perishability, especially of higher-value commodities. This is especially underlined for tropical climates (Delgado, 1997; Jaffee, 1995) where hot temperatures in combination with poor market accessibility result in relatively higher market losses. Third is the lengthy biological lags characteristic of most agricultural commodities. This, in combination with lumpy initial investments, induces inflexibility in supply responses to economic changes. Another feature is the seasonal variability in output (Staal et al, 1997) that, for non-storable com-

modities, increases dependence on relational contracts especially between suppliers of raw materials and processors. Moreover, as Jaffee (1993) has observed, physical asset specificity is common especially in large-scale post-harvest processes requiring specialised plants, equipment, materials, transport facilities, and knowledge.

Apart from the direct antecedents to TCs identified above, Williamson (1986b) identifies, as another source, the opportunity cost of adopting inferior governance structures. Yet, statutory market controls impose a system of public and legal private monopsonies on producers in diverse production settings. It is inconceivable that such a system can be optimal for all concerned. Indeed, as has already been discussed, transaction costs economics posits that organisational suitability varies with TCs. Specifically, relational contracts are presumed to become more optimal with increased investments in specific assets and that high asset specificity should lead to internalisation. The latter perhaps explains why, with liberalisation, a number of large-scale dairy farms in Kenya (e.g. Delamere Dairies, ILARA, Kilifi Plantation, etc) have, as pointed out in chapter 2, been quick to integrate dairy processing into their primary production activities.

Moreover, imposition of transaction-specific exchanges may suppress private creativity. This is clearly demonstrated in the emergence of small-scale milk processing technology based on equipment fabricated from locally available materials (Ngigi, 1995). Finally, TCs are incurred in securing licences or in avoiding trade prohibition. These TCs comprise monetary and opportunity cost of time spent in securing licences and fiscal resources spent in administrative ex-

penses of enforcing compliance. In addition, where established regulations expressly outlaw some trade practices, and if such practices are beneficial to some participants, then such participants may be willing to incur added TCs associated with avoiding law enforcement and potential consequences of failure to do so.

Of policy significance is the need to encourage smallholders to form organisational arrangements geared to spreading fixed TCs over large numbers of households. The need arises because various costs expended in marketing activities have low marginal costs over large quantities of marketable surplus. For example, transportation, market search, and screening costs do not necessarily increase proportionately with the size of marketable surplus. Instead, per unit cost of marketing may decrease with increase in the quantity of marketed volumes. This in turn implies that smallholders may individually incur relatively higher TCs than the large-scale producers may. Delgado (1997) has argued that in countries at their early stages in agricultural transformation, small and large farm households do not necessarily have access to the same technology, information, asset base, input supplies, or market outlets. He holds that the same may be true for farm households of similar size in different locations. Under such conditions, he maintains, different farm households are likely to face different exchange relationships with local merchants. Abbot (1993) also argues that because of their small-quantity input requirements and small-quantity marketable output, and because they may be less informed on market opportunities, smallholders may face higher TCs than large-scale farmers may.

Market failures attributable to TCs have also been identified as being a severe constraint to smallholders' ability to respond to price incentive and other external shocks (de Janvary *et al* 1991). At this time, therefore, when governments are being pressured to curtail their support to agriculture under SAPs, empirical work on influences of TCs on smallholder market participation is crucial for informing policy formulation, hence, the justification for this study. For the topic at hand, an important question arises from the aforementioned antecedents of TCs in agricultural production and marketing: what are the elements predictive of relatively higher TCs for smallholder dairy marketing? A theoretical investigation of this question forms a logical link to data and information needed for the study and this is the subject of the rest of this section, which focuses on the following topics:

(i) Quantity constraints and the implications for market outlet choice

(ii) Market outlets risks, preference for flow of payment and implication for contractual forms

(iii) Informational asymmetries

2.2.1 Quantity Constraints: Implications for Market Access and Market Outlet Choice

Sale of small-quantity marketable surpluses entails relatively higher marketing costs. This implies that the costs may, if the market outlet is not carefully chosen, exceed value of exchange, and that scale is a factor with respect to TCs. Quantity constraint is thus a plausible key decisive factor in the individual farm

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household's market outlet choice behaviour, one whose influence can possibly play down the importance of price as a consideration in the choice of market outlet. Accordingly, the smallholder's choice of market outlet may be limited and the farm household precluded from obtaining the most remunerative outlets. Direct sales to deficit households and to institutions and catering businesses in rural market-centres often fetch the highest net prices. However, this neighbourhood demand varies from area to area and from farmer to farmer and may involve high payment enforcement costs. Moreover, neighbourhood demands for food commodities are often too small to absorb the entire marketable food surpluses. Hence, smallholders often need to "export" substantial amounts of their marketable surpluses to major urban centres, which are distances away from the area of production.

However, sales in urban markets may entail high market search, screening, transfer and payment enforcement costs. Furthermore, the high perishability of raw milk, coupled with is high-bulk nature, places heavy demands for vehicular transport. This, coupled with the high frequency of market sale/delivery, means that rural-to-urban sales of milk is characterised by high transport-intensity. However, the daily marketable surplus from most smallholder farmers is often small in relation to capacities of available means of transport and in relation to market demand. Smallholder farm-households may therefore not be able to individually make economical use of handling and transport facilities. The implication is that distance has, for SDF, the effect of introducing economies of scale to market transfer activities, with the per unit cost of market transfer de-

creasing with increase in volume handled. Marketing activities of milk (and indeed of most food commodities) by smallholder farmers are, therefore, primarily limited to destinations that are easily accessible on foot, by bicycle or animal transport. Nevertheless, even for these short distances, the high perishability of milk and the associated high frequency of sales exert high TCs.

The above accounts imply that quantity constraints often bias sales by individual SDF in favour of collective dairy marketing groups (CDMG) as a means of reducing TCs and MORs and, therefore, of extending their geographical market reach. Such horizontal cooperation of farmers may be in form of societies or other forms of collective marketing groups that are often instituted to: (i) facilitate coordinated assembling of small lots of marketable surpluses from the individual farmers into central bulking/collection points from where the commodity can be handled collectively to the market, or sold to wholesalers and rural-to-urban itinerant traders calling at the points, (ii) search for markets and transact business on behalf of the member-farmers, thus expanding the geographical reach of member's market, (iii) monitor, enforce and transmit payments to farmers, and (iv) overcome social distances[6] between member-farmers and the markets, especially processor markets.

Viewed from the perspective of market intermediaries, collective milk marketing by SDF may be advantageous to the extent that it ensures steady supplies of large amounts of supplies while reducing TCs associated with procure-

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[6] In the present context, social distance is primarily defined as the separation between the farmer and the market. It includes (spatial) distance, knowledge, and market information differentials between the smallholder farmer and the market.

ment of supplies. For instance, the cost to processors of screening, monitoring and coordinating transactions across space with a large number of small-scale suppliers can be greatly reduced if transactions are mediated through the managements of collective groups. Likewise, the cost to wholesalers and itinerant traders of searching and screening for supplies and building economical market loads can be greatly reduced if surpluses are procured at central bulking/collection points. Mediating procurement activities through the management of organised groups may also reduce the administrative costs to market intermediaries of computing, arranging, and transferring payments to large numbers of small-scale suppliers. Moreover, in cases where the quality of the commodity is very variable and potentials for moral hazards exist, quality verification can be expensive to the buyer if the supply is received in small amounts from a large number of small-scale producers. Furthermore, farmers in a collective marketing group can monitor and enforce prudent handling of the commodity through such mechanisms as peer monitoring.

For the bulked commodity to be easily accessed by market intermediaries linking producers with urban markets, the bulking/collection points should be located at destinations that are accessible to motorised transport. Collective groups, processors, wholesalers and bulking-cum-transporting agents should be able to drive down the food commodity collection routes, pooling the bulked commodity into transportation trucks for onward shipment to resale markets or processing plants. In areas well served with public transport, procurement of the

bulked commodities by itinerant traders is facilitated if the bulking/collection points are placed close to public vehicle passenger drop-off/pick-up points.

Following from the above arguments, it can be inferred that the following are the important determinants of smallholder market access and market outlet choice: (i) the size of market in the local neighbourhood, (ii) distance and quality of road networks linking the producing households to important commodity sales/delivery points, and (iii) farmer's ability to access market information.

2.2.2 Smallholder Marketing Constraints and Risks: Implications for Contractual Forms

The commodity and production characteristics of milk by smallholders are reminiscent of high TCs and MORs. Production involves specialised, lumpy investment in dairy animals to primarily produce milk for home consumption and sales. Raw milk is a highly perishable (non-stock) commodity with a daily flow (once or twice-a-day harvest) of marketable streams that extend for at least a full lactation period (about a year). The frequency of market transactions and, therefore, the level of market transaction costs tend to be very high. Hence, it is reasonable to presume that there is value in contractual forms designed to: (i) widen the time-horizons of milk production and sales; (ii) foster regularity and order in milk sales/delivery activities; and (iii) offer market assurance to producers that purchases of the streams will be maintained, especially during the rainy season

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when milk is plentiful in the market and producers are faced with the risk of not being able to sell the non-storable (for them) commodity (Jaffee 1995).

From the deduction of the preceding paragraph, it is expected that the farmer does not search for market outlets one transaction at a time. Rather, the farmer is expected to engage in purposive efforts to secure transactions over the horizon of at least one full lactation period (about one year). This suggests that repeat transactions under a contractual arrangement are preferable to many farmers when compared to simple spot transactions. Another feature of particular significance is, as discussed in section 3.2.1, the typically small quantities of individual daily marketable surpluses. This, coupled with the characteristically high banking transaction costs (resulting from lack of rural banking institutions), and the practice of paying bills and wages at the months-end, place a great significance on the time pattern of milk payments. Regular lumpy settlements may be intrinsically valuable where liquidity flow is required in lumps to match lumpy expenditures (e.g., school fees, farm labourer's wages, animal feed, etc) and there is little financial intermediation. Furthermore, receiving small daily payments for small transactions has obvious disadvantages in any society, especially without banks, over reliable regular lumpy settlements. It is, therefore, logical to presume that contractual arrangements that combine repeat transactions with the ability to accumulate daily payments (so as to hand to the farmer a lump sum amount at week's, fortnight's or month's-end) are preferable to the receipt of a daily stream of small amounts of money.

Closely associated with the reliability-of-outlet constraint for small-holders is the problem for buyers/market agents of volume unpredictability inherent in procuring large amounts of milk from smallholders. A large buyer, of necessity, must procure from a large number of smallholders. However, the amount of marketable surplus from a smallholder farmer varies with the day-to-day milk requirements of his household and social obligations. Furthermore, production is often based on only one or two cows raised on rain-fed pastures and crop residues, with little or no supplementation with concentrate. Marketable surplus is thus subject to daily and seasonal variations.

The informational incompleteness inherent in the volume unpredictability suggests that in exchanges between smallholders and large-scale buyers, there are difficulties in defining operational volume-based contracts. Under such situations, the theory of TCs predicts that the parties in exchange would value flexible arrangements. The appropriateness of flexibility becomes more understandable when the number of suppliers is considered. The large numbers of small producers that a large buyer has to deal with mean that it is difficult to monitor and enforce exclusive deals. Furthermore, the farmer can sell in a number of different market outlets. In these respects, therefore, milk sales contracts between small-holder dairy farmers and large buyers (processors and large-scale raw-milk resellers) are often incomplete in that they do not specify the quantity of milk that the producer and seller are contractually bound to deliver and accept, respectively.

Small quantities of individual marketable surpluses also mean that the cost (time, effort, and monetary) of drawing up explicit contracts may be high

relative to the value of sales. This, coupled with the problem of fluctuations in production, suggests that implicit[7] contracts may be more appropriate for SDF as compared to explicit[8] ones. This in turn means that SDF may have little or no recourse to legal enforcement but must instead, rely on whatever leverage is engendered in reputational enforcement. Indeed, Friedman (2000) has pointed out that reputational enforcement may be the most important method for enforcing agreements even in more developed societies.

The foregoing theoretical analysis suggests that, from the perspective of SDF, price level alone is not sufficient in reflecting the utility content of a sales arrangement. As de Janvry et al (1991) point out, the real price to the farmer (i.e., shadow price) is a function of the market price and transaction costs. In the context of this study, it is important to view the value of exchange from two other mutually inclusive dimensions: the presence or absence of a pledge of repeat transactions; and, the time pattern of payments for milk. Based on these two dimensions, the contractual arrangements obtainable in the sale of milk by smallholders predictably fall into three categories as illustrated in Table 2-1.

On-credit-sales (OCS) contracts are of the type termed by de Jasay (1989) as "half-spot half-forward contract". By agreement, daily milk payments are deferred to accumulate over a specified unit of contractual period (e.g., a week, a fortnight, or a month) at the end of which the payments are settled in a lump sum. The total length of contractual period may be either definite or open-ended. Such

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[7] Implicit contracts are a non-written form that are defined to occur where both parties in an exchange are clear about the conditions of exchange, but where an explicit contract is not possible or desirable.

[8] Explicit contracts are a written specification of terms and conditions agreed upon and voluntarily signed by both parties in an exchange. It is thus easy to verify and enforce legally.

contracts have the advantage of promising a guaranteed market outlet to the farmer for at least one unit of contractual period. However, they have certain inherent risks, which suggests that to safeguard himself, the farmer will seek on-credit-sales only with buyers who have high stakes in the trade and who, therefore, have a motive to build and maintain a good reputation in the market. The risks include delayed payments, non-payments, occasional loss of the entire amount of milk to non-collection of milk by buyer or to undue rejection of milk delivered to the buyer. These problems are briefly discussed below.

Table 2-1: Contractual Arrangements Characterizing sale of Milk by the Smallholder Dairy Farmers

Type of contractual arrangement	Time pattern of payment	Pledge for repeat exchange
On-credit-sale (OCS)	Lump sums by regular fixed schedules (i.e., weekly, fortnightly, monthly etc)	Yes
Cash-sale single transactions (CSST)	On spot	No
Cash-sale repeat transactions (CSRT)	On spot	Yes

Source: Theoretical deductions by author, 2002
Notes: The relative importance of each dimension is only obtainable from empirical analysis, which is the task of the proceeding chapter.

(i)   Delayed payments:

In all OCS, the smallholder enters a contractual arrangement with imperfect information, both on the buyer's ability to pay and on his opportunistic tendencies. The smallholder, therefore, faces the potential risk that the buyer may act opportunistically and delay payments such that the farmer is paid after *t+n* days instead of the agreed fixed period of *t* days. This in effect forces the farmer into a situation where he or she is an involuntary creditor to the buyer, albeit,

with no interest on the "credit". Furthermore, uncertainty can arise if *n* varies greatly from one contractual time unit to another; the farmer becomes uncertain of the payment date as a result of which planning for the sales proceeds is disrupted.

(ii)   Non-payment:

All OCS are, as de Jassay (1989) explains, structurally vulnerable to default unless by defaulting the party committing to forward performance is likely to worsen his/her payoff or to fall into disrepute. For instance, the buyer, purely due to unforeseen circumstances, might be unable to pay. On the other hand, the buyer may also be tempted to default. Non-payment in effect forces the farmer into a situation where he or she is an unsecured creditor of the buyer. Therefore, farmers who highly value lump-sum payments are likely to seek outlets whose operators have high stake in the business and command high trust.

(iii)   Non-collection/undue rejection of milk:

As discussed earlier, repeat transactions with large buyers, such as large milk processors, are typically non-volume based. The difficulties of designing volume-based contracts in effect mean that the buyer is not contractually bound to buy any quantity of milk from the farmer. This in turn leaves the farmer vulnerable to the risks of losing entire marketable surpluses to non-collection of milk by the buyer. This is because the buyer is not contractually bound to accept any specified amount of milk from the farmer. The SDF also faces the potential risk that the buyer may unduly[9] reject milk as unwholesome[10].

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[9] Indeed, staal *et al* (1996) report that anecdotal evidence showed that KCC would, during flush

The buyer only pays for milk collected or received subject to minimum specifications of quality. Thus, the farmer bears full loss if the buyer fails to collect or if milk is rejected as unwholesome

Where risks are relatively high, the farmer may opt for cash-sale single transactions (CSST) or cash-sale repeat transactions (CSRT). These two contracts are similar in that they both entail the exchange of milk for cash on the spot. However, while CSST promises no repeat contracts, CSRT has explicitly specified repeat transactions. It should, however, be noted that cash-sale payment and OCS are not mutually exclusive. The farmer can apportion his or her marketable surplus to OCS and spot cash markets such that a proportion θ (where $0 \leq \theta \leq 1$) is sold in the spot cash market and the remaining $1 - \theta$ is sold in the OCS market.

From the forgoing account, it can be inferred that, in addition to factors identified in 3.2.1, the following are also important determinants of smallholder market participation: (i) the highly repetitive task of milk sales activities, and the consequent need for regularity; (ii) the characteristically small daily marketable surpluses coupled with high rural banking TCs, and the consequent need for regular lumpy settlements; and (iii) the expectation regarding the reliability of buyers.

period, overly reject milk from farmers as a way of dealing with oversupplies.
[10] NB the high perishability of milk makes verification of quality by the farmer difficulty.

2.2.3 Information Asymmetries, Imperfect Enforcement and Uncertainties Arising From Seasonality of Production

Both moral hazard and adverse selection problems are present in all channel levels where raw milk is traded. The potential extent of these problems is more fully appreciated when it is taken into account the small quantities of individual household's marketable surpluses and the associated need to gather small lots of milk from a large number of SDF into single handling containers to make economical market loads. This provides SDF with incentives to adulterate milk with water to increase volumes of sale.

Ngigi (1995), in a descriptive analysis, cites the problem of deliberate adulteration of milk to be serious enough for by-laws of many CDMG to include stipulations of fines to offenders. However, given the large numbers of producers, each with small amounts of marketable surplus, monitoring presents major logistical problems. The problem, she explains, is nurtured by procurement systems based on sharing of collectively owned churns. The sharing is in itself a device to deal with quantity constraints. Marketable surpluses from most smallholder farmers are too small for individual farmers to economically utilise the standard 50 litres milk churns. Unfortunately, the sharing makes it difficult to identify and place full penalties on those adulterating milk. Where individual smallholders can contract directly with private transporters, as in parts of Nyandarua and Nakuru districts, the moral hazard of adulteration may be reduced since each farmer uses his/her own personal churns or shares only with trusted

neighbours. However, Ngigi (1995) argues that the practice fosters co-ordination failure in that it limits the opportunities to exploit economies of scale achievable in joint use of milk churns. The trade-offs, she argues, might actually lead to loss of operational efficiency in milk collection and transportation, resulting in high unit transportation costs. The practice also increases the problem of pilferage of milk from milk churns.

The above discussion implies that the nature of raw milk presupposes wide variations in quality and high costs of quality inspection. This is unlike the case of packaged processed milk where processing and packaging produce what — to borrow from Markus *et al* (1996) — can be described as "standard, off-the-shelf products " and where branding protects buyers and sellers from quality un-certainties. Therefore, while packaged standardised products are typical of spot market contracts, the buyer of raw milk is susceptible to moral hazard problems. The problems further underscore the importance of understanding the impact of opportunism on the operational efficiency and the social norms guarding against pervasive incentives. Such understanding would offer guidance to policy makers in formulating legal frameworks supportive of the evolution of efficient market institutions. Problems of opportunism have indeed been identified as being con-tributory to poor smallholder's market participation in other agricultural com-modities. For instance, Nyoro (1993) cites opportunistic buyer-seller activities as a major frustration to contract farming in Kenya's horticulture industry. Jaffee (1993) also identifies opportunism as being contributory to poor integration of the Kenya's smallholders in horticulture export marketing.

The potential for the problems predicts that procurement of milk by low-volume buyers (e.g., household consumers, kiosks, small scale itinerant raw milk traders, etc) are likely to be oriented to relational contracts as a means of coping with information problems and of mitigating the moral hazard problem. On the other hand, procurement of raw milk by large-volume buyers is likely to entail various forms of quality inspection methods. The high costs associated with such methods can, however, be minimised through procurement of milk from organised groups of farmers. Large dairy farmers' cooperative societies can also organise churn sharing around small groups of neighbours.

Empirical studies in rural credit markets and labour relations (Hoff *et al* 1993) — markets that are characterised by problems similar to those discussed here — provide compelling evidence for the role of relational contracts, and, of small self-forming groups in mitigating informational and private incentive problems. This is especially because the incentives to comply with the stipulations of a contract are likely to arise endogenously from interactions of agents over time. Indeed, self-forming groups are based on knowledge about individual's reputation and expectation about their behaviour, coupled with powerful social sanctions. This ensures that members honour their commitments and are prepared to cooperate, accommodate, and develop a spirit of trust and goodwill. In milk marketing, relational contracts are also likely to be motivated by the buyer's need to develop operational screening mechanisms and/or the seller's need to signal his/her credibility in the eyes of the buyer.

Briefly, the foregoing account suggests that, from the perspective of informational asymmetry, the following are likely to be important determinants of smallholder market participation: (i) potential problems of moral hazard and the consequent need for buyer to monitor quality; (ii) the characteristically high costs of monitoring quality of small lots of milk from large numbers of producers and the associated need for relational contracts designed to mitigate informational and private incentive problems.

2.3 CONCEPTUAL MODEL

The foregoing theoretical deductions present an overwhelming support for the potential usefulness of TCs-analysis in revealing the qualitative nature of contractual arrangements involving sale of milk by smallholders. This section develops a conceptual model for analysing the determinants of SDF milk market participation in the study area. We use market choice behaviour to operationalize market participation. In particular, two aspects of market choice behaviour are identified, namely: (i) choice of market outlet; and (ii) relative preference of cash as compared to on-credit-sales. The aim is to construct explicit functional relationships suitable in assessing the relative independent effects of the respective TCs and MORs on both the choice of market outlet and on the choice of mode of payment. To derive the behaviour of the system, the section proceeds from the premise that the context of the food commodity marketing system in which the smallholder finds himself, in interaction with TCs specific to his household, delimits his potential market opportunities and defines his marketing constraints.

The premise is centred on the basic assumptions that: (i) the feasible market outlet choice set $S = \{1, 2, ..., J\}$ from which the individual farm-household chooces is fixed and exogenously determined by the existing marketing system; (ii) in making the market outlet choice, the household assesses its strategic situations with respect to its marketing environment and seeks to maximize expected gains, i.e. the farm household's market behaviour is rational; (iii) differences in food commodity market behaviour across individual farm-households are attributable to exogenous differences in the level and characteristics of household-specific factors that engender TCs and, therefore, differentials in utilities potentially obtainable from the different market outlets availed by the marketing system; (iv) the aggregate effects of the choices made by the individuals both influence and are influenced by the by existing marketing system.

Central to the above premise is the recognition that although smallholders in a given area, producing and selling a given food commodity, are presented with the same marketing system, they may nevertheless experience differentials in their abilities to utilize the marketing opportunities obtainable in the system. In other words, household-specific attributes may act as conditioning factors explanatory of differentials in market behaviour across households. This is consistent with the evidence emerging from researches on farm household's market behaviour. For instance, Holden *et al* (1998) and de Janvry *et al* (1991) have shown that TCs are household-specific rather than commodity-specific. The fact bears an important implication for TCs-analysis. In particular, it implies that

market choice behaviour is endogenous —i.e., price is a determinant as well a consequence of market outlet choice. Endogeneity of market choice behaviour in turn implies strong endogeneity of TCs and MORs associated with household's effective market behaviour.

The foregoing paragraph introduces a conceptual problem arising from two conceptually separable levels of TCs, which we will refer to as causative and effective TCs. The two arise from the recognition that TCs are the originating cause of market behaviour exhibited by the individual households, which in turn determines the TCs MORs effectively faced by the household, i.e. TCs play the role of cause and effect of market choice behaviour. This means that the observed TCs and MORs are unlikely to bear any relation with the causative TCs. For instance, the observed time schedule of a transaction and the time and travel costs incurred in effecting a market exchange are determined primarily by the market outlet chosen and have no relation to the causal TCs that produced the choice. Thus, the observed time schedule and costs cannot be used in an empirical analysis to explain the market behaviour with regard to the choice of the market outlet used. An additional and related problem arises from the fact that households did not furnish information for market outlets they did not use on the given day. This introduces a censoring problem associated with the fact that the negativity of outlets not used was not captured.

The above problems can, however, be addressed. The censoring problem can, as explained latter, be taken care of with Tobit models. Non-observability of the causative TCs and the endogeneity of observed TCs can be addressed

through replacement of the endogenous TCs with proxy variables, determined by theory or *a priori* assumed to be both correct determinants of the TCs and plausibly exogenous to the market outlet choice behaviour. In particular, we recognize that, in the context of this study, variations in farm household socio-economic characteristics, including differentials in market accessibility across individual farm households, may represent variations in causative-TCs. In other words, farm household socio-economic characteristics and market accessibility are related to choice of market outlets through the influence they have on causal TCs that produce market outlet choice. They thus form a set of reasonable explanatory variables that represent or serve as proxies for hypothesized determinants of TCs.

At the level of an individual household, certain factors are likely to affect market participation. These include factors pertaining to the head of household's gender, age, level of education and experience in dairy production and marketing and opportunity cost of time. Another is the number of active workers on the farm. Smallholder farms use relatively more family labour whose participation on the farm is likely to vary periodically, especially because, for part of the year, children and young adults' labour may be less available. The amount of marketable surplus may be an important factor. In general, large amounts of marketable surplus are likely to be associated positively with greater desire for stable market outlets and, therefore, with need for continuous contractual sales.

Market accessibility constitutes another element of crucial importance in household's market participation. This is because it defines a household's ability to utilize a market outlet availed by the marketing system. The utility, to a farm household, of a market outlet can be conceptualised as being the net result of its potential economic gains and its accessibility. In other words, farm household's market choice behaviour is likely to be conditioned by market accessibility. In the context of this study, market accessibility is primarily defined as the ability of the farm-household to make market contacts with potential buyers or marketing facilitating agents. This follows from Deichmann's (1997) definition of accessibility as the ability to interact with sites of economic or social opportunities.

Apart from the household-specific factors, the farm household is likely to compare market outlets against the contractual elements offered. Some outlet-specific factors suggest the attractiveness of some outlets when compared to others. For instance, collective dairy marketing groups (CDMG) provide, to varying degrees, some marketing support services to their members. These include co-ordination of milk collection, transportation, market search and sale of milk in diverse outlets, cash advances for emergencies, and input credits. For instance, Kilungo et al (1994) reported that 70 percent of SDF in Kiambu district obtained financial credit from their dairy co-operative societies and that 84 percent of the farmers felt that the societies rather than the government extension services were the most appropriate organisation in providing dairy inputs and services. Further, Odima et al (1994) reported relatively better reproductive performance of animals belonging to members of Limuru Dairy Co-operative Society in Kiambu

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district because of provision of Artificial Insemination (AI) services by the society. Ngigi (1995) and Owango *et al* (1996) have also reported that most dairy co-operative societies in Kiambu district search for and sell their members' milk in better paying outlets.

Hence, the services provided by CDMG, the use of the services, and the differentials in prices charged members and non-members for the services and inputs provided are all likely decision variables in the choice of a market outlet. Other associated factors likely to be important are the farmer's CDMG membership status, the distance of the household from the CDMG milk collection centre, delays in payment, and the means of transmitting payment to farmers.

Put together, the foregoing conceptualisations suggest that a comprehensive analytical assessment of smallholder market participation should appropriately proceed in four steps: (i) elaboration of factors relevant to smallholder market participation, in which the factors that combine to determine the locales of the market contact points are examined; (ii) a comprehensive description of the marketing system to identify the objective market outlet choice set available to the smallholder, the major market participants, the major marketing functions performed in moving the commodity from the producer to the final consumer, and the market participant(s) mainly responsible for performing each of the identified functions; (iii) a comprehensive description as well as analysis of statistical association between market outlet choice and various household-specific attributes hypothesised to be significant determinants of "causative" TCs; and, (iv) the assessement of the relative independent effects of the respective TCs and market

accessibility measures on market outlet choice.

To assess the influences of TCs and MORs on choice of market outlet, the following assumptions are modelled: (i) on a typical day, the farm household has q litres of marketable milk surplus; (ii) available to the household is a variety of market outlets defined by the objective choice set $S = \{1, 2, ..., J\}$ within which the household has a choice of which market outlets to use and in what proportions to allocate the marketable milk surplus; (iii) the choice among the outlets is based on their relative utilities such that in its strategic sales decision, the rational farm household chooses to sell to the market outlet set $C = \{j_1, j_2, ..., j_n\}$ where, $C \subset S$, in such way as to maximize its utility.

It should, however, be noted that as implied by the observed market outlet set C, farm households may exhibit multiple preferences. In other words, the choices are unlikely to be mutually exclusive. It is plausible to think of a farm household allocating its marketable milk surplus to more than one market outlet. The question that this raises is: what determines the share of allocation of marketable surplus among the chosen market outlets? Our hypothesis posits that the allocation is influenced by relative preferences of available modes of payments primarily defined by time patterns of payments. Thus, the farm household may allocate a portion of its marketable surplus to spot-cash markets and the other portions to markets that pay by fixed schedules. However, the factors that influence the allocation of milk among outlets may differ from those that influence choice of market outlet.

The above conceptualisation in effect means that the mode of payment choice behaviour is analytically separate from the market-outlet choice behaviour. We argue that on a typical day, the q litres of marketable milk surplus can be allocated between two types of markets available to the farmer that are differentiated according to the flow of payment. In particular, the farmer may sell milk on markets that offer lump-sum payments coming regularly after a predetermined period of delivery of milk on credit or he/she can sell in markets that exchange milk for cash on the spot. Thus, the farmer can sell the entire marketable surplus (sold daily) to one or the other market, or apportion it between them such that a proportion θ (where $0 \leq \theta \leq 1$) is sold in the cash-sale market and the remaining $1-\theta$ is sold in the credit market. Hence, the proportion θ can serve as a good proxy for measuring the degree of participation in the cash-sale market and, conversely, the proportion $1-\theta$ serves as a proxy for measuring participation in the sale-on-credit markets.

The rest of the chapter focuses on constructing models to analyse the two types of behaviours.

2.3.1 Model of Market Outlet Choice

The market-outlet choice problem presents, for the individual farmer, a discrete choice problem. We, therefore, resort to the random utility theory to explain the SDF's market outlet choice behaviour. The basic concepts of the theory assert that when an individual is presented with several discrete choices, he assigns ordinal utilities across the choices (Henderson and Quandt: 1980, Griffiths

and Judge; 1993). He then ranks the choices according to their assigned utility potentials and picks on the one that offers the highest potential. Such choice behaviour is conceptualised to involve the maximization of an unobserved random utility function, which is postulated to have two components: (i) a deterministic component that is generally assumed to be a function of the characteristics of the choice (in this case the market outlets) and of observable attributes of the individual (in this case the individual farm-household); and (ii) a stochastic dispersion that takes account of unobserved attributes of the individual, including differentials in taste among individuals and uncertainties in behaviour.

To apply the random utility model, on the market-outlet choice facing the individual farm household, we start by assuming that the utility of market outlet j is a linear function of a set of explanatory variables that represent or serve as proxies for hypothesized determinants of TCs and MORs, and has a stochastic component ε. We therefore can specify, as shown in equation 2-1, that:

$$U_{ijt}^{*} = \alpha'X_{it} + \beta'Z_{ijt} + \lambda'W_{jt} + \varepsilon_{ijt};$$
$$i = 1,...,N; \quad j = 1,...,J; \quad t = 1,...,T$$

....................Equation 2-1

The latent vector U_{ijt}^{*} comprises the net utility that the farm household i associates with the choice of market outlet j at time t. The explanatory variables are distinguished into three groups according to how they vary across households and /or market outlet combinations as follows: (i) Z is N× k matrix of observations on explanatory variables that vary across both the households and the available market outlets. These include time spent on milk sale/delivery and the distance

to selling point; (ii) **X** is an N×h (where h is the number of households observed) matrix of observations of variables that vary across households but do not vary across market outlets. These include age of head of household, sex of head of household, education level of the head of household, amount of marketed surplus, occupation of head of household and the experience the head of household has in production and marketing of milk; and (iii) **W** is an N×j (where j is the number of market outlets observed) matrix of observations on variables that vary across market outlets but do not vary across household. These include price. Finally, **α, β,** and λ are vectors of parameters to be estimated while ε is a vector of stochastic error terms.

A major practical problem with the concept of utility is that the individual's utilities are not observable. This drawback, however, is often overcome by resorting to the theory of revealed preference (Henderson and Quandt, 1980, Varian, 1982, 1985). The theory postulates that though the utilities are not observable, they are nevertheless exemplified in the choice(s) that individuals make. More specifically, the revealed preference theory regards observed behaviour as revealing the individual's preference ordering and to coincide with utility maximizing behaviour. In particular for the case considered here, the observed choice set $C = \{j_1, j_2, ..., j_n\}$ where, $C \subset S$, represents the utility maximising choice. Therefore, we can specify that farm household i chooses the market outlet j at time t if and only if j offers the highest utility among the alternative market outlets available, i.e., $U_{ijt} > U_{ikt}$ for all $k \neq j$.

As the discussion above clearly demonstrates, the revealed preference theory bears a very important implication for analysis of choice behaviour. It provides the formal basis for using observed behaviour to make inference about the individual's preference ordering without resorting to the complications of having to make parametric assumptions of the non-observable utility function. In the context of this study, the observable outcome is the market outlet used by the farmer. We define a discrete random variable Y that takes on j unordered levels corresponding to the number of elements in the objective choice set $S = \{1, 2, ..., J\}$. The revealed preference theory implies that $pr(Y_{ijt}) = 1$ iff $U_{ijt} > U_{ikt}$ for all $k \neq j$; otherwise $pr(Y_{ijt}) = 0$. This in turn means that the causal relationship between the observed market outlet choice and the explanatory variables cannot be assessed by the usual linear regression, which is commonly used to determine causal relationships in cases where the regressand is a continuous variable. Instead, discrete choice models, which specify the probability of a given choice as a function of the explanatory variables, provide appropriate modelling techniques for the market-outlet choice behaviour.

The derivation of discrete choice models from the underlying individual behaviour as done here (i.e., utility maximising behaviour) permits credible interpretations of their parameters (Cramer, 1991; Greene, 1997). Discrete choice models are applied in analysing a wide range of choice decisions (see Schnitkey et al (1992); Morey et al 1993; Widerstedt, 1998: Monteverde and Teece (1982). Two sets of discrete choice models, the probit and logit models, are popular, but the relative ease of estimating a logit model renders its common usage, especially

in cases like the present one that involve multinomial choices. If the assumption is made that the stochastic components are identically and independently distributed (IID) over i and j with a mean of zero and variance σ^2 (i.e., $\varepsilon_{ij} \sim N(0, \sigma^2)$), then the probability that farmer i chooses market outlet j on day t out of the objective choice set $S = \{1, 2, ..., J\}$ can be modelled by the multinomial logit model (MNL) (Cramer, 1991; Greene, 1997) given by the following specification in equation 2-2:

$$p_{ijt} = \frac{\exp(\alpha' \mathbf{X}_{it} + \beta' \mathbf{Z}_{ijt} + \gamma' \mathbf{W}_{it})}{\sum_{j=1}^{J} \exp(\alpha' \mathbf{X}_{it} + \beta' \mathbf{Z}_{ijt} + \gamma' \mathbf{W}_{it})}; \qquad \ldots\ldots\ldots\ldots\ldots\text{Equation 2-2}$$

$$i = 1, ..., N; \quad j = 1, ..., J; \quad t = 1, ..., T$$

The MNL, however, has a number of drawbacks. First, the property of Independence of Irrelevant Alternatives (IIA) does not permit the odds ratio between any two alternatives to vary with changes in the size of the feasible choice set (Cramer, 1991). Yet, it is inconceivable for the relative utilities of two market outlets to be unaffected by the presence or absence of another outlet. For instance, it was explicitly explained in chapter two that the emergence of bulking-cum-transporting agents and of rural-to-urban itinerant traders has reduced the relative utilities of dairy farmer's cooperative society and of Kenya Cooperative Creameries respectively.

Secondly, MNL assumes that repeat choices made by a respondent are independent of each other. Yet, this may render inaccurate representations of market choice behaviour if there is state dependence in individual's choice behaviour. A more realistic assumption is that while observations across different

households are typically independent, the individual farm household milk-marketing behaviour is unlikely to be in steady state. Instead, market choice behaviour for an individual farm household is likely to be characterised by heterogeneity in discrete choice. Further, temporary serial correlations may arise from temporary changes in an individual household's market behaviour. For instance, if a farm labourer allocated the duties of delivering milk to a milk-sale/delivery point of the farm-household's market-outlet of choice terminates his services without notice, the affected household may temporarily deviate from the outlet to another that is less demanding of labour until a replacement of the farm labourer is found. This in turn implies that, for a given household, neighbouring observations may be more heavily correlated than observations widely separated in time. It also implies that a household market behavior is likely to vary with unobserved variations in household-specific factors.

Recognition that heterogeneity can result in biased parameter estimates, and hence incorrect conclusions, has important implications both for appropriate data collection designs and for model estimation. With respect to data collection design, it suggests that since appreciably long histories of individual market behavior are required in making consistent estimates, the behavior of a representative cross-section sample of farm households should be studied over a reasonable period of time. Accordingly, longitudinal data collection design is the reasonable choice with respect to the empirical interests of this study. Longitudinal data embodies two sources of variability, viz., the variability within a farm household and the variability between farm households, which may occur due to unobserved

heterogeneity. The models used to analyze the data must therefore account both for correlation of observations within farm-households (unit-specific) and for independence of the observations between the farm-households. In other words, models that control both for observed and unobserved heterogeneity are more appropriate.

As discussed by Greene (1997), Diggle *et al* (1994), and Stevens (1996), econometric theory now has models that incorporate the above features explicitly. Specifically, there are two different methods of modelling the variance components discussed above. These are: (i) the fixed-effects estimators, and (ii) the random-effects estimators. Fixed-effects estimators treat the unit-specific error as fixed and constant. Thus, the error term in fixed effects model is decomposable into a fixed, constant component and the usual stochastic error i.e., $v_{it} = \alpha_i + e_{it}$, where α_i is fixed and e_{it} is stochastic. The fixed error term, α_i, enters the model as coefficients of unit-specific 0/1 dummy variables. Random-effects estimators, on the other hand, treat unit-specific errors as uncorrelated with the exogenous variables included in the model. Thus, the error term in random effects models is decomposable into a unit-specific stochastic component and the usual stochastic error i.e. $v_{it} = u_i + e_{it}$, where u_i is an unobserved, stochastic component associated with correlation of unit-specific error and e_{it} is a stochastic variable that is IID across both the units and time. Both u_i and e_{it} are random variables with $var(u_i) = \sigma_i^2$ and $var(e_i) = \sigma^2$ implying that $var(v_{it}) = \sigma_i^2 + \sigma^2$.

The choice between fixed and random effects models depends on whether the unit-specific error is a constant or a stochastic effect. Another criterion, and one that was deemed of great significance in this study, is the need to include observed time-invariant exogenous variables in the model. The use of unit-specific dummy variables does not allow such variables to be captured in the fixed effects model. Nevertheless, such variables may, as hypothesised in our case, be very crucial explanatory variables for the system being estimated. As already discussed, it is plausible that market choice behaviour is significantly influence by such time-invariant variables as age and level of education of the head of household, and distance of the household from the main road. Based on this argument, we chose to use a random-effects logit model as specified in equation 2-3 below.

$$P_{ijt} = \frac{\exp(\alpha'X_{it} + \beta'Z_{ijt} + \gamma'W_{it} + \tau_{it} + \varepsilon_{it})}{\sum\limits_{j=1}^{j} \exp(\alpha'X_{it} + \beta'Z_{ijt} + \gamma'W_{it} + \tau_{it} + \varepsilon_{it})};$$ ....Equation 2-3

$$i = 1,..N; \quad j = 1,...,J; \quad t = 1,...,T$$

Such models have been widely used to analyse data from longitudinal data collection designs. Cassel *et al* (1996) have used longitudinal data and fixed effects logit model to empirically examine how specifications of Swedish sickness insurance influenced worker's choice of being absent. Staffan *et al* (1998) have also used longitudinal data and mixed logit model to empirically examine how consumers choose between different transport alternatives.

2.3.2 Model of Milk Allocation between Cash and Credit Markets

The second model focuses on contractual arrangements from a flow-of-payment perspective. We proceed from the assumption that on a given day t, the household can apportion its marketable surplus between two contractual arrangements (cash-sale versus on-credit-sales) such that a proportion θ (where $0 \leq \theta \leq 1$) is sold in the cash-sale markets and the remaining $1 - \theta$ is sold in the credit markets. We define a variable Y that takes on a value of one if the parameter θ is greater than zero (i.e., some proportion of q is sold in the cash-sale markets) and a value of zero if q is exclusively sold to the credit markets. The proportion, θ, which the farmer can possibly sell through the cash-sale markets, ranges from 0 to 1. Hence, market apportionment (Y) is doubly censored at zero (all milk is sold to the credit market) and at one (all milk is sold to the cash sale market). Under this structure, SDF decisions of whether to sell to the cash-sale or to the credit markets, and what proportion of milk to allocate to each, should be examined simultaneously. This is because the choice of mode of payment comprises a decision of not only whether to sell to the cash-sale or to the credit markets, but also of the share of marketable surplus to sell to each. It should be noted that the former is a yes/no decision while the latter is a question of the amount to sell in the cash-sale markets conditional on a decision to sell in the market.

Choice decisions of the type outlined above are appropriately modelled by Tobit models. Tobit models provide an approach to account for censoring (see Greene, 1997; Goetz 1995; Goodwin and Schroeder, 1994). The underlying

principle of the models is the separation of *the likelihood* of a subject undertaking a given action from *the level* of the action. The major assumption is that factors influencing the "likelihood" of the subject undertaking an action do not necessarily explain the level of the action. This necessitates the second step, which appraises factors that determine the level of the activity, conditional on the subject undertaking the action. The "likelihood" evaluates the distinctive set of factors that induce a subject to undertake a given action. For the problem under analyses here, the two-limit random-effect Tobit model specified in equation 2-4 was used. The reasons for using a random effects model have already been presented. The two-limit specification was appropriate to account for the fact that the market apportionment (Y) was doubly censored.

$$Y_{it} = \begin{cases} 0 & \text{if } 0 \geq X_{it}\beta + e_{it} \\ X_{it}\beta + e & \text{if } 0 < X_{it}\beta + e_{it} < 1 \\ 1 & \text{if } 1 \leq X_{it}\beta + e_{it} \end{cases} \quad \text{..Equation 2-4}$$

The dependent variable Y_{it} is the observed proportion of the total milk that is sold to the cash-sale markets by household i on day t. Vector X_{it} comprises the explanatory variables of which marketable surplus, measured as the absolute volume of milk sold by household i on day t, and household-specific socio-economic characteristics affecting marketing comprised the primary explanatory variables of interest. Vector β comprises unknown parameters to be estimated while e_{it} is a residual error assumed to be normally distributed with mean zero and a constant variance.

2.4 Summary

This chapter presents a review of literature and begins with a discussion of the basic theory that forms the foundation of the study. We note that the influence of TCs and their associated risks on economic-exchange institutions has been the subject of an increasing body of theoretical and empirical literature. What is emerging is that TCs and the associated risks bear important conditioning effects over the appropriateness of the institutional frameworks within which market exchanges take place and that, as pertains to agricultural production and marketing, they are household-specific rather than commodity specific.

Next, the chapter uses theoretical deductions to identify antecedents of TCs and market outlet risks (MORs) likely to influence the participation of smallholder dairy farmers (SDF) in milk markets. This, we note is becoming a standard initial step in TCs studies. Finally, a conceptual model for analysing the determinants of SDF milk participation in the study area is developed. Two aspects of market choice behaviour are used to operationalize market participation: (i) choice of market outlet; and (ii) relative preference of spot-cash transactions as compared to transactions which defer daily payments to accumulate over a specified unit of contractual period, at the end of which the payments are settled in a lump sum. The two aspects are modelled using random-effects logit and Tobit, respectively. The random-effects approach is determined by the state-dependence characteristic of household market behaviour. The approach provides a methodology for controlling household-specific heterogeneity while at

the same time controlling for household-specific fixed effects (i.e., missing or unobserved) effects that may be correlated with the explanatory variables.

Chapter 3

Sample Design and Data Collection Methods

3.0 Study Area

Central Kenya was selected as the study area due to the heavy emphasis placed on smallholder dairying in this part of the country. Three administrative districts, namely Kiambu, Nakuru, and Nyandarua, were purposively selected as representatives of this area — their location in relation to the rest of the country is shown in figure 4-1. The choice of the three districts was based on their known differentials in factors that are crucial to market participation by smallholder dairy farmers (SDF). These include market accessibility and the organisation of milk collection and transportation. Kiambu and Nakuru districts have a fast developing market-oriented dairy production system, fostered by relatively large consumer markets. By contrast, Nyandarua, though one of the highest milk producing districts in Kenya, has a relatively poor transportation infrastructure that hampers procurement of milk from the area.

Following liberalisation and consequent legitimisation of more market outlets, the three districts offered diversified and highly differentiated market outlets and market-access characteristics. In particular, they provided a great opportunity to assess differentials in market participation between rural and peri-urban farmers as well as a chance to contrast milk procurement arrangements between dairy farmers cooperatives societies (DFCS) and itinerant traders of raw milk. Moreover, for milk handled collectively, the districts provided differentials in the level of cooperation. Ngigi (1995) observed that, in Nakuru and Nyanda-

rua, transportation of milk to processor markets was characterised by direct contractual arrangements between the individual smallholder farmer and private bulking-cum-transport facilitating agents. This was in contrast to Kiambu where greater levels of cooperation were observed in collection and transportation of milk through DFCS. Investigations across the three districts, therefore, provided a chance to study the role of collective milk marketing institutions in providing marketing links between SDF and urban consumers and processor markets.
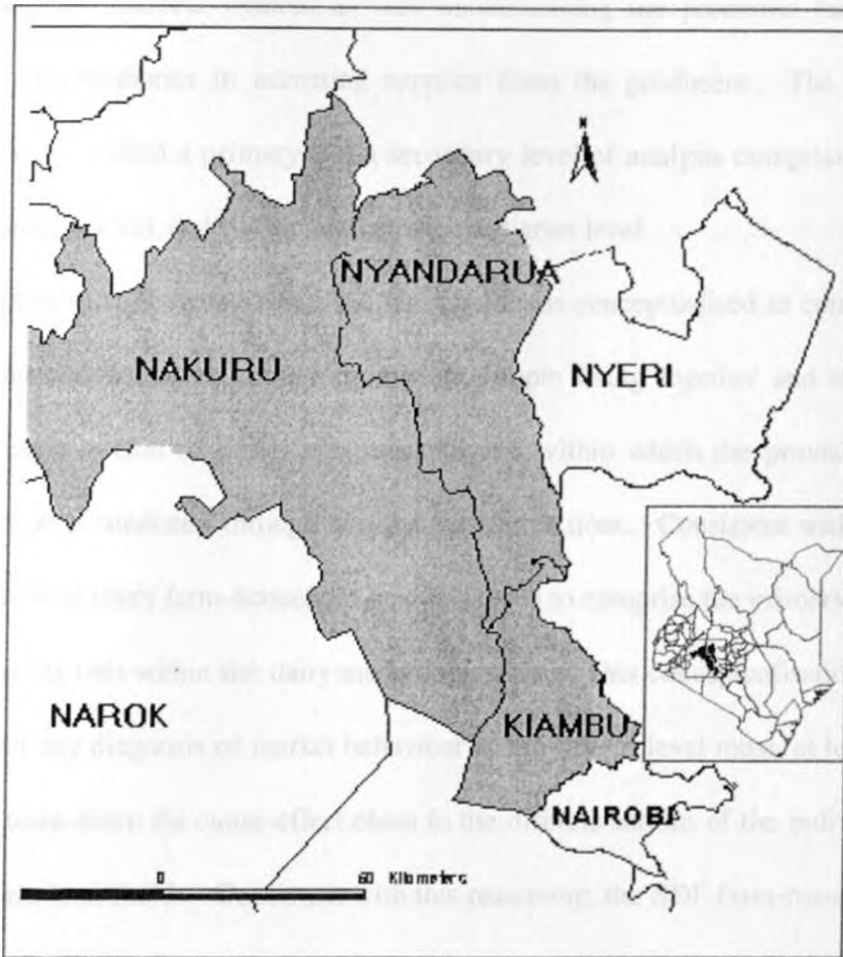
Figure 3-1: Location of the Study Area

3.1 SURVEY AND SAMPLE DESIGN

As highlighted in chapter 1, the major objective of this study was to characterize smallholder dairy marketing system and assess the influence of transaction costs (TCs) and market outlet risks (MORs) on the participation of SDF in dairy products markets. This, in effect, required a two-ended evaluation since it is not possible to fully comprehend the problems faced by producers in accessing the markets without as well understanding the problems faced by market intermediaries in accessing supplies from the producers. The study, therefore, identified a primary and a secondary level of analysis comprising: (i) the producers level, and (ii) the market intermediaries level.

Following Bryants (1990), the household was conceptualised to constitute the fundamental unit of society comprising people living together and sharing resources in pursuit of utility maximisation and within which the provision of satisfaction is mediated through non-market transactions. Consistent with this, the individual dairy farm-household was perceived to comprise the primary decision-making unit within the dairy marketing system. This conceptualisation implied that any diagnosis of market behaviour at the system level must, at least in theory, trace down the cause-effect chain to the discrete actions of the individual dairy farm-households. Consistent with this reasoning, the SDF farm-household was identified to be the most appropriate primary sampling unit. Hence, the primary study population comprised all smallholder dairy households in the study area during the survey period.

The city of Nairobi and major urban centres in the three districts were identified to comprise the major market outlets for milk produced in the study area. Accordingly, the secondary study population comprised all milk market intermediaries sourcing raw milk from SDF in the study area for resale or processing in the identified market. These included collective dairy marketing groups (CDMG), private raw milk resellers, milk bars, hotels, and restaurants. For the purpose of the study, CDMG were defined to include all forms of horizontal co-operation of SDF designed with the purpose of facilitating collective handling of milk. The expression "collective dairy marketing groups" was coined for the purpose of the study in recognition of the formation, in recent years, of collective efforts of SDF commonly referred to as "self-help" groups or clubs that are involved in collective handling of milk but which do not seek legal registration as cooperative societies.

The study was based on the analysis of data from surveys conducted by the Smallholder Dairy Project (SDP) between 1997 and 2000. The SDP is a collaborative research project between the Kenya Agricultural Research Institute (KARI), the Ministry of Agriculture, Livestock Development and Marketing (MALDM), in Kenya and the International Livestock Research Institute (ILRI). Consistent with the expectations of this level of organisations, the surveys were designed to support the analysis of wide aspects of smallholder production and marketing and covered a large part of Kenya. Specifically, the surveys covered nine administrative districts in central Kenya and were designed to support research and interventions focussed on a wide range of topics, including: (i) the

assessment of tradeoffs between dairy and crop intensifications; (ii) nutrient cycling; and, (iii) the topic of this study, which, as already outlined, focuses on evaluation of the impacts of transaction costs and market outlets risks on the participation of SDF in dairy products markets.

Consistent with the wide range of the survey's focus, the instruments used in gathering data were typically multipurpose, yet comprehensive enough for the purpose of this study. In particular, the survey adopted the production-to-consumption approach, which according to Belcher (1994), Rey *et al* (1993), and, Gockowski and Baker (1996) entails a comprehensive characterisation of the entire chain of activities from farm production methods (including linkages with input markets) right through to market linkages with the final consumer. Accordingly, the survey gathered data at the farm, market, and consumption levels.

The analysis in this study is restricted to the three districts identified in section 4.2 and the relevant subsets of the data gathered by the SDP's surveys. In particular, the study used subsets of three data sets generated by the survey. These are: (i) a farm-level cross-sectional data set gathered by the KARI/ILRI/MALDM Dairy Characterization Survey: Kiambu District Pilot Survey, and, the KARI/MoA/ILRI Collaborative Smallholder Dairy Project (R&D): Characterization Surveys 1998 (ii) a farm-level longitudinal data set gathered by the KARI/MALDM/ILRI Whole-Farm Monitoring, and (iii) a market-level cross-sectional data set gathered by the Smallholder Dairy (R&D) Project: Assessment of Informal Milk Market Performance and Associated Public Health Risks in

Kenya (refer to appendices 1,2, 3 for the respective questionnaires). The choice of the three data sets was consistent with the study's data needs as identified in the conceptual framework developed in chapter 3. More specifically, the two cross-sectional data sets (farm-level and market-level) provided appropriate data needed for a comprehensive description of the marketing system in which the SDF operates. The farm-level longitudinal data set provided data needed to model the smallholder dairy farm-household's market choice behaviour.

The rest of the chapter presents the sample designs and data collection methods used in the collection of the data used in the study. As already acknowledged, the data was collected by the SDP[11]. The samples and data collection methods were designed by the project. What will be given here is a summary of the salient points.

3.1.1 The Farm-level Cross-sectional (Characterization) Survey

Information availability on the structure and distribution of a study's target population often puts restrictions on the sampling design that can be used (Kish, 1965). In the present case, actual figures on the number of smallholders and on their distribution across the study area were not available; the country had not conducted a comprehensive agricultural census that could provide an accurate sampling frame. Accordingly, the choice was made to use multistage probability sampling since it offers the best method of generating unbiased samples under the situation besides generating self-weighting sample and, thus, overcoming the

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[11] The sample design and data collection methods are presented here to the best of the author's

need to compute weights (see Kish, 1965 and Deaton, 1997). The specific method used is detailed in Staal *et al* (1998). What will be presented here is a summary of the most salient points.

As a starting point, for each the administrative districts included in the survey, a four-stage probability sampling was used to generate a sub-sample of representative smallholder farm-households. The four stages are briefly described below and summarised in table 4-1:

- First, the main land-use systems were identified. As guidelines for this task, the Agro-ecological zones (AEZ) as identified and described by Jaetzold and Schmidt (1983) were used, complemented by field experiences accumulated by ILRI over the years.

- Second, a sample of administrative sub-locations was selected from each included land-use system through simple random procedures.

- Third, random transects were generated in each of the selected sub-locations.

- Fourth, the sample of smallholder farm households was selected from the included transects. The selection of farm households for inclusion in the sample did not distinguish among the types of farm enterprises.

The first step towards the generation of the random transects mentioned above entailed generation of survey maps for each of the selected sub-locations. These were done using ILRI's geographical information systems (GIS) database, using ArcInf software. (For details, see Staal *et al*, 1998.) The survey enumera-

understanding.

tors, who had previously been trained in the use of the survey instrument, visited the sub-location, and marked on the sub-location map the main landmarks (a landmark was defined as any permanent feature like a trading centre, a school, a church, or a factory). Two pairs of landmarks were then selected at random for each sub-location, and line transects were drawn joining each pair. Sampling was thereafter done following as closely as possible the marked transects. Every fifth household on the left and on the right was interviewed, regardless of whether they were agricultural or kept dairy animals. In this way, a random sample of all sub-location households was obtained. Determination of the sample size was based on the National Population Census of 1989.

Table 3-1: Summary of Sample Design: Characterisation Survey

Stage	List used	Sampling method
One	Land-use systems	Stratification
Two	Administrative sub-locations	Random sampling within land-use systems
Three	Transects	Random sampling within sub-locations.
Four	Farm households	Random sampling within transects

Source: Adapted from research methodology provided in Staal *at al*, 1998

Data were colleted from the sample of farm households through personal interviews using structured questionnaires. A wide range of data on smallholder socio-economic and demographic factors was covered in the questionnaires, including the amount of milk produced, marketed surplus, market outlets used, and CDMG membership status. With respect to eliciting observations on market outlet choices, each SDF in the sample was asked to specify the market outlets used the previous day and for each outlet, the amount of milk sold.

The survey included a total of 871 farm-households in the study area, comprising 365, 393, and 113 respectively in Kiambu, Nakuru, and Nyandarua. Table 3-2 reveals that about 67 per cent of all smallholder farmers in the study area operated a dairy enterprise. However, the proportion of SDF varied between districts; Nyandarua had the highest (80%), followed by Kiambu (70%), while Nakuru had the lowest (60%). Out of 587 SDF, 457 comprising 196, 185 and 76 from Kiambu, Nakuru, and Nyandarua respectively, reported milk sales activities. This sub-sample provided three independent random samples of SDF from the three respective districts used in this analysis to characterize smallholder milk marketing activities in the study area.

Table 3-2: Sample Size; Farm-level Cross-section Data

District	Sample size	With dairy	Reporting milk sales activity
Kiambu [1]	365	261 (72%)	196
Nakuru [2]	393	232 (60%)	185
Nyandarua [2]	113	94 (80%)	76
Total	871	587 (67%)	457

Source: [1] Derived from Staal *at al*, 1998
[2] Derived from survey data of the KARI/MoA ILRI CHARACTERIZATION SURVEY, 1998

In addition to the survey interviews, all households in the survey were geo-coded, thus facilitating the systematic assessment of each household's location in relation to important milk sales/delivery points. Four milk sales/delivery points were identified. These are: (i) the nearest main road, (ii) the nearest milk marketing collective group, (iii) nearest urban centre as defined by administrative boundaries, and, (iv) the city of Nairobi. These points, as will be illustrated later, were defined to reflect the meaning of milk market access in the study area. For each of the households, data on one-way travel distances to each of the four milk-

sales/delivery points were generated using geographical information system (GIS). This sub-data set provided exogenous variables on travel distances useful in computing indices of household's access to milk markets.

The use of GIS has been recommended for its consistency in distance measures as compared to distances reported by respondents, which are likely to be influenced by the respondent's cognitive distance[12] (Deichmann's; 1997). In taking the measurements, recognition was taken of the fact that the road networks linking the farm households to the respective milk sales/delivery points comprised distinct sections of varying physical qualities and, therefore, differentials in milk markets accessibility scales. These sections were identified with the help of available road quality information maps. According to the maps, the roads were classified into three classes, namely: (i) all-weather tarmac roads (road type 1), (ii) all-weather-loose-surface (*murrum*) roads (road type 2), and, (iii) dry-weather-dirt roads (road type 3). Travel distance measurements were segmented according to this classification.

3.1.2   The Farm-level Longitudinal Survey

Data generated by the farm-level cross-sectional survey described in 4.1.2 was suitable for characterising the marketing system in which the SDF in the study area operated. A primary empirical interest of the study, however, was the

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[12] Cognitive distance is defined as the mental representation of actual distance moulded by an individual's social, cultural, and general life experiences.

need to understand the farmer market behaviour. This, as already explained, required appreciably long histories of individual market behavior. A major logistical problem, however, remained to be addressed. This was the fact that the target population was, as is characteristic for smallholder agriculture, large and widely dispersed in space. Yet, it was essential that the farm household's milk market behaviour be observed repeatedly. It was, therefore, important to use a sampling method that combined coverage with cost-effectiveness. Hence, the choice was made to use a principal components analysis (PCA) based cluster sampling.

Under the logistical problem identified above, PCA with clustering provides a useful preliminary step to sampling since it generates clusters that are characterised by minimal variation between members of a cluster but maximum differences between clusters. This offers the advantage that the resulting clusters, which become the base sampling units, ensure that the population targeted for a study can be represented by a small sample comprising a few representative units of each cluster.

Specifically, the survey used a two-stage cluster sampling. First, the sub-sample of dairy farm-households drawn in the characterization survey was partitioned into clusters using the PCA method. The criteria along which to cluster the sub-sample were constructed from three broad categories of household's socio-economic factors identified *a priori* as constituting the major source of variability across dairy farm households. These included (i) level of intensification of the dairy enterprise, (ii) resources ownership, and (iii) access to output

and input service. The elements selected to indicate the level of each of the three

socio-economic factors are outlined in Table 3-3.

Table 3-3: Elements Used to Define the Principal Components along Which the SDF were Clustered

Level of intensification of the dairy enterprise	Resources ownership	Access to output and input service
Acreage of maize planted per TLU	Sex of head of household	Distance to Nairobi in Km
Acreage of napier grass planted per TLU	Proportion of adult (>16) household members who worked primarily off-farm	Availability of cooperative AI services
Concentrates feed purchased(in Ksh per kg)	Level of cash income from all sources	Average price in Ksh per litre of milk received in the most recent dry season
Fodder purchased (in Ksh) per TLU	Total acres of land held by household.	Cooperative membership (yes=1, no=0)
Total household land per TLU of cattle.		Reported milk sales to non-cooperative outlets in a period of 12 month.

Source: Staal et al, 1998

The PCA was based on the assumption that there was a common measure of dairy household's performance, defined on the weighted interaction of the three socio-economic factors. The objective of the analysis was, therefore, to effectively weight the influence of the factors on dairy households and to partition the sub-sample into clusters of homogeneous dairy farm households. Table 3-4 summarises the stages used in the selection of the dairy households for longitudinal monitoring. The longitudinal data collection design was favoured because, as pointed out in chapter 3, SDF market behaviour was not expected to be in a steady state but to vary depending on variations in a number of factors, including the amount of marketable surplus. Specifically, it was relevant in assessing changes in flow variables and consequent adjustments in the household's production and marketing activities. Further, since variability in farm-household's mar-

ket behaviour may occur because of unobserved variability, longitudinal data collection design has the advantage of avoiding omitted variable bias.

Table 3-4: Summary of Sample Design; Farm-level Longitudinal Data

Stage	List used	Sampling method
One	Cluster of SDF	Stratification
Two	Farm households	Random sampling within clusters

Source: Adapted from research methodology provided in Staal *at al.* 1998

The result was a sample of 43 SDF farm households comprising 21 in Kiambu and 11 each in Nakuru and Nyandarua. The whole farm activities of these were monitored for a 13 months period, with a recall period of 3 to 4 days with questions repeated at each interview. Of relevance to this study, each farm-household in the sample was asked, for each milk transaction concluded on a given day t, to specify the following: the buyer-type; the amount of milk involved; the quantity unit of measure used; the location at which the milk sale/delivery took place; the distance from the farm household to the milk delivery/sales point; the time taken to transport milk to the delivery/sales point (i.e., the first point of sale); whether it was a 'morning' or 'afternoon' milk; the unit of measure used; the price per unit ; the time pattern of payment; and, contractual specification regarding time of payment and whether there was a delay in payments.In addition, a checklist on the size and structure of each household's family was maintained and updated on a seasonal basis. The list also recorded detailed information on the occupation of each household member. In total, the survey generated 21,054 observations on milk sales transactions, of which 26% were sales transactions through DFCS and SHG combined, 26% with processors,

7% with itinerant traders, 26% with local-market-based traders, 18% with house-

hold consumers, and 4% with wholesalers.

3.1.3 Market-level Survey:

This survey covered all major dairy farmers' co-operatives and self-help

groups in Kiambu and Nakuru. However, the target population of traders was

large and was appropriately studied through a sample selected using a three-stage

sampling as summarised in table 3-5.

Table 3-5: Summary of the Sample Design; Market-level Survey: Market-level Survey

Stage	List Used	Sampling method
One	Land use systems	Random sampling of administrative sub-location within land use systems
Two	Shopping centre	Purposive — selected the main shopping centre
Three	Traders	Purposive, based on willing to cooperate together with having the time to complete the data collection interview

Source: Adapted from research methodology provided in Staal *at al*, 1998

The administrative sub-locations selected in the second stage of the 3-

stage multiple sampling of farmers described in 3.1.2 provided the basic sam-

pling unit for the selection of traders. Next, the main shopping centre in each

selected sub-location was identified. Third, traders handling raw milk, including

shops/kiosks, milk bar and hawkers, were identified and selected for inclusion in

the sample. The inclusion criteria were that the trader dealt in raw milk, was

willing to cooperate, and had sufficient time to provide the required data, which

was collected through personal interview using structured questionnaires. For

good quality data, cooperation of the traders interviewed was more important

than the number covered in a centre. Data from farmers' dairy cooperative socie-

ties and self-help groups were collected through personal interviews with the

group's secretary manager. Table 3-6 presents the size and structure of the sample. In addition to the surveys detailed above, various participatory rural appraisals (PRA) were conducted as well as farmers' feedback meetings to validate the data.

Table 3-6; Size and Structure of the Market-level Survey Sample

Type of trader	District			
	Kiambu	Nairobi	Nakuru	All
CDMG	15	-	8	23
Milk bars	20	71	38	129
Hawker	10	17	28	55

Source: Derived from survey data of the Smallholder Dairy (R&D) Project: Assessment of Informal Milk Market Performance and Associated Public Health Risks in Kenya

3.2 Summary

The study covered three districts —Kiambu, Nyandarua, and Nakuru— purposively selected as representative of central Kenya. It was based on data collected by the Smallholder Dairy Project (SDP), a collaborative research project between the Kenya Agricultural Research Institute (KARI), the Ministry of Agriculture, Livestock Development and Marketing (MALDM) in Kenya, and the International Livestock Research Institute (ILRI). Two types of sample designs were used: (i) a cross-section household survey, designed to give a broad-based overview of smallholder agriculture in the study area; and (ii) a longitudinal household survey, designed to allow an intensive household monitoring of a representative sample of the study population of smallholder dairy farmers. The cross-sectional data set was useful in characterising the marketing system in which the SDF operated while the longitudinal data set was useful in investigating SDF milk market behaviour. The longitudinal data set was especially suit-

able for the analysis of smallholder dairy farmers' market behaviour, given the fact that household market behaviour is state-dependent rather than steady.

Chapter 4

Results and Discussion

4.0 Overview

Chapter 2 drew a number of conceptualisations about smallholder market behaviour. Major among these is that the individual farm-household's market choice behaviour is best analysed within the context of situational and household-specific constraints to marketing. This has important implications with respect to the sequence of analysis leading to the understanding of SDF market behaviour. In particular, it implies that as an important step, the analysis should begin by sketching out the context of the marketing system within which the household operates. This forms the broad objective of this chapter. The aim is to obtain insights into the marketing system facing the SDF in central Kenya during the time of the study. More specifically, the chapter uses the data subsets discussed in chapter 3 with the following specific objectives:

(i) To delineate the milk marketing system under which the smallholder dairy farmers (SDF) in the study area operated during the period of the study;

(ii) To evaluate the statistical association between market outlet choice and various household socio-economic factors (including market accessibility) hypothesised to be significant sources of TCs and MORs that influence SDF participation in dairy products markets

(iii) To assess the relative independent effects of the respective socio-economic factors on market outlet choice

The chapter is organised as follows: section 4.1 presents a comprehensive description of the marketing channel observed in the study area. The section also attempts to offer explanations for the differentials observed in the structural aspects of the marketing system among the three administrative districts included in the study. Section 4-2 assesses the SDF market accessibility in an attempt to gauge the SDF reliance on the different market outlets. Section 4-3 presents a descriptive analysis of SDF household socio-economic attributes that are hypothesised to have a conditioning effect on the household's choice of market outlet. The section also evaluates the statistical association between market outlet choice and the various household socio-economic factors. Section 4-4 identifies the major contractual elements involved in the exchange of milk between SDF and the market. In section 4.5, we explore the factors that determine the level of producer prices. Section 4.6 presents an empirical evaluation of how the marketing system in which the farm-household finds itself interacts with its (the household's) socio-economic attributes to determine its milk market behaviour.

4.1   Milk Marketing System in the Study Area:
4.1.1   Major Milk Marketing Channel

Figure 4-1 depicts milk-marketing channels observed in the study area. The figure shows, for each of the administrative districts included in the study, the major market outlets available to the SDF during the survey period. To gauge the relative dominance of the different market outlets in the respective dis-

tricts, volumes of marketed milk flowing through or to the respective channel levels are shown expressed as percentages of the total milk marketed by the SDF.

From the figure, it can be inferred that the feasible market outlet choice set comprises one's own CDMG (if a member); rural-to-urban itinerant raw-milk traders; local-market-based raw-milk traders (i.e., general provision shops, milk-bars, and kiosks located in rural shopping centres); deficit local households in the neighbourhood of the producing household as well as hotels and restaurants in the local shopping centres; and milk processors[13]. Although all these market outlets operate in all the three districts, the figure, however, reveals certain differences among the districts' marketing structures that suggest that the region of residence has a great influence on the number and types of feasible market outlet alternatives available to the individual smallholder dairy farm-household. Expressed in another way, the substitution possibilities that exist between different market outlets for the individual farm-households may vary from one production area to another.

Figure 4-1 further shows that two forms of collective dairy marketing groups (CDMG) are in operation in the study area. These are dairy farmers co-operative societies (DFCS) and a form commonly referred to as farmers' self-help groups (SHG). These two forms are similar in many aspects. In particular, they both constitute the act of coming together by SDF to form legally and economically independent enterprises administered by a management committee with the objective of facilitating the achievement of member-farmer common

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[13] Sales to private processors in fact can and do by-pass cooperatives entirely.

objective of accessing milk markets. The CDMG as well provide other services (e.g., artificial insemination and veterinary services) and supplies (e.g., stores of drugs, fertilizers, feed concentrates, and farm implements) ancillary to farmer's core objective of increasing farm productivity.

Figure 4-1: Milk Marketing Channels for the Respective Districts in the Study Area

Source: [1]Ngigi *et al* (2000). [2]Author's compilation from survey data
Notes: [a] Lumps together rural-to-urban raw milk resellers, local-market-based and raw-milk traders, milk bars, shops and kiosks as raw-milk resellers. [b] Lumps together household consumers, hotel and restaurant as final consumers

objective of accessing milk markets. The CDMG as well provide other services (e.g., artificial insemination and veterinary services) and supplies (e.g., stores of drugs, fertilizers, feed concentrates, and farm implements) ancillary to farmer's core objective of increasing farm productivity.
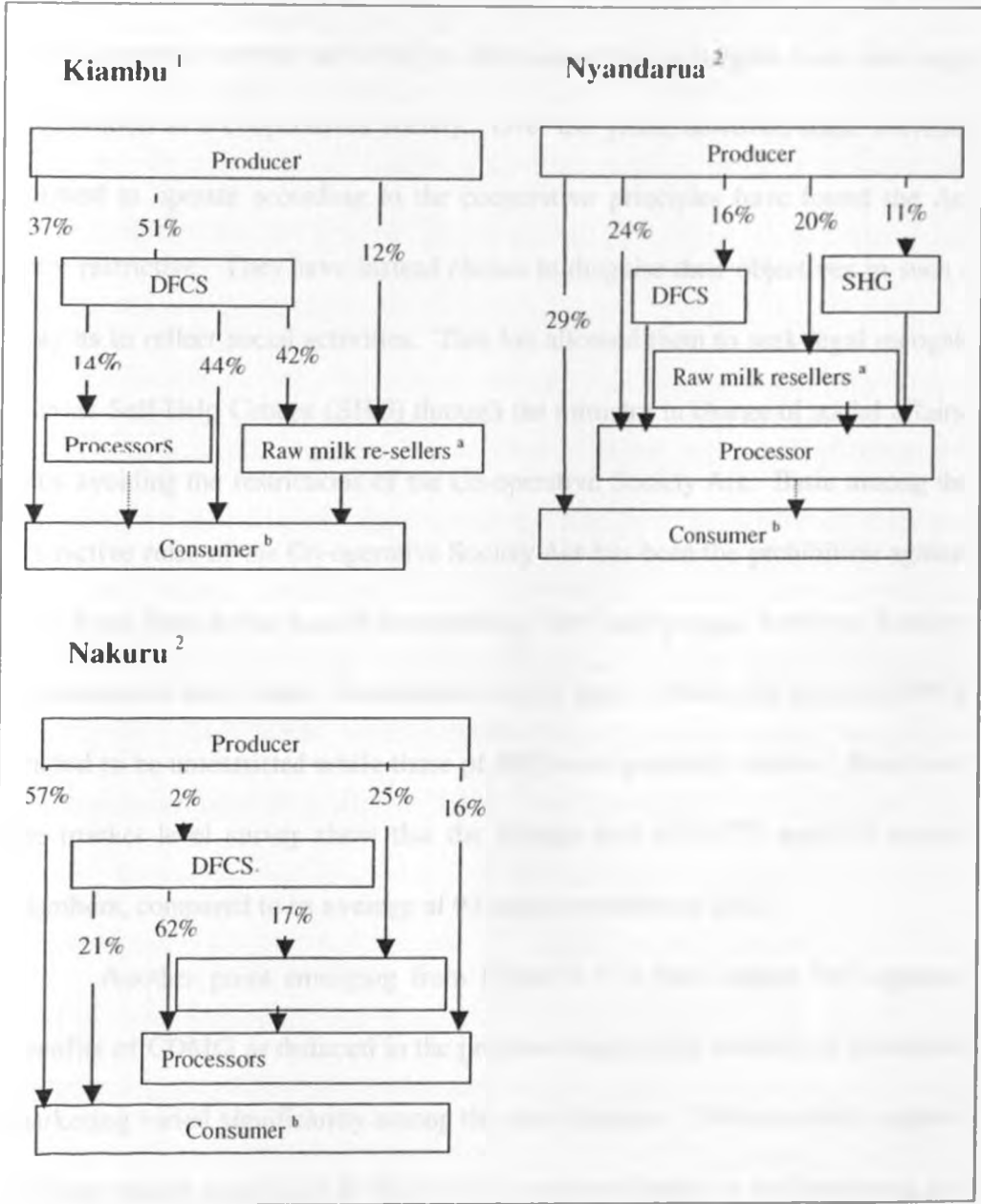
Figure 4-1: Milk Marketing Channels for the Respective Districts in the Study Area

Source: [1]Ngigi *et al* (2000). [2]Author's compilation from survey data
Notes: [a] Lumps together rural-to-urban raw milk resellers, local-market-based and raw-milk traders, milk bars, shops and kiosks as raw-milk resellers. [b] Lumps together household consumers, hotel and restaurant as final consumers

What makes them different, however, is their process of formation, size-control and the administrative authority through which legal recognition is sought. Accordingly, the Co-operative Society Act— Chapter 490 of the Laws of Kenya — requires that any society formed with the objective of promoting members economic interests according to the co-operative principles must seek legal registration as a cooperatives society. Over the years, however, some societies formed to operate according to the cooperative principles have found the Act very restrictive. They have instead chosen to disguise their objectives in such a way as to reflect social activities. This has allowed them to seek legal recognition as Self-Help Groups (SHG) through the ministry in charge of social affairs, thus avoiding the restrictions of the Co-operative Society Act. Basic among the restrictive rules of the Co-operative Society Act has been the prohibition against fixing any limit to the size of membership. Self-help groups, however, form by self-selection and, hence, membership is not open. Thus, the sizes of DFCS tended to be unrestricted while those of SHG were generally smaller. Results of the market level survey show that the average size of DFCS was 967 active-members, compared to an average of 93 active members in SHG.

Another point emerging from Figure 4-1 is that, despite the apparent benefits of CDMG as deduced in the previous chapter, the intensity of collective marketing varied significantly among the three districts. Collective milk marketing was mainly significant in Kiambu but only moderately so in Nyandarua, accounting for over 50 percent and 27 percent of all the milk marketed by SDF in the two districts, respectively. By sharp contrast, collective marketing was insig-

nificant in Nakuru District, accounting for only 2% of total milk marketed by the district's SDF. The study also observed notable differences between DFCS in Kiambu and CDMG in the other two districts regarding the functions of the collective groups. Collective groups in Nakuru and Nyandarua mainly served as members' agents for bulking and delivery of milk to processor markets. In sharp contrast, DFCS' milk bulking/collection points in Kiambu provided the major milk procurement points for itinerant traders serving the city of Nairobi with raw milk. Further, the DFCS were themselves directly involved in distributing and selling raw milk in the city.

The demand for bulking-cum-transporting services is, as deduced in chapter 2, created by the need to overcome physical and costs limitations imposed on marketing by quantity constraints. The need can, as already discussed here, be addressed through horizontal cooperation of farmers into cooperatives and self-help groups charged with these roles. Private agents can also provide the service. Such agents were observed to be major market links between the processor markets and the SDF in Nakuru and Nyandarua districts, but they were clearly absent from Kiambu District. Investigations revealed that the bulking-cum-transporting agents have emerged purely from private entrepreneurs' response to business opportunities in milk transportation business. Business is solicited from both SDF and the processor markets. The entrepreneur first identifies a prospective milk producing area (i.e., an area with a potential to support a profitable milk transportation business) and then signals his offer both to the SDF and to prospective processors. Signalling typically takes the following form: the

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prospective agent organises a few SDF into an informal representative group to take on the responsibility of searching and negotiating for market with prospective processors. The agent facilitates the group's task through providing free transport to and from the prospective processors as well as by participating actively in the search and negotiation as part of the group.

A successful search concludes with a processor accepting to receive milk from the SDF through the bulking-cum-transporting agent. On their part, each individual farmer agreeing to sell milk to the processor signs a contract authorising the processor to pay the bulking-cum-transporting agent from the sales proceeds and remit the net to the farmer. Through such arrangements, individual SDF, through their objective need to access the processor market, deliver milk to designated milk bulking/collection points along milk collection routes designated by the agent, either in consultation with the processor or with the farmers or both. This way, common carrier arrangements have developed where small lots of marketable surpluses from a large number of smallholder farmers are aggregated and transported collectively to designated processing plants.

The arrangements discussed above have the advantage of allowing smallholders to link up over distances to transact exchanges with the processor market. A point to note, however, is that because of the spatial distribution of processing plants, bulking-cum-transporting agents are processor-specific, at least in the short-run. This is necessitated by the need to minimize transportation costs. Furthermore, the nature of smallholder milk production means that the market for

bulking-cum-transporting services is very thin. Therefore, the individual SDF cannot easily switch from one processor to another.

Raw milk wholesalers were also observed in Nakuru and Nyandarua districts. These are distinguished from bulking-cum-transporting agents by their participation in milk ownership flow. Unlike bulking-cum-transporting agents who provide milk transportation services from SDF to processor markets for a fee, wholesalers buy milk to resell to itinerant traders or to processor markets for a profit. A notable point about the wholesalers is that they emerged with the deregulation of the industry. Their formation is, therefore, a good illustration of one area where the private sector has become involved in performance of marketing functions in response to business opportunities.

4.1.2 Differentials in Marketing Structure across the Study Area: Attempt at Explanation

This section would be incomplete without attempting to explain the differentials observed in the preceding sub-section regarding the structural aspects of the marketing system. We, however, hasten to state that what we offer here is just that— an attempt— and the explanations given may require further empirical research. Indeed, we recognise that, as discussed in chapter 2, such differentials may actually be caused by omitted area-specific variables. The observed differentials, marketing among the three districts, in the structure of milk are attributable to a number of factors, including regional differences in: (i) densities and

quality of road infrastructures; (ii) densities of milk production; (iii) local milk demand and supply conditions; and (iv) organizational resources and capabilities.

High-density production, together with a reasonably dense network of fairly good quality roads, endows an area with larger organizational capabilities in the sense that the costs of bulking small lots of marketable surpluses from smallholders and market transportation are relatively lower. As a consequence, the operational costs of farmers' collective marketing efforts are also relatively lower in such areas and, hence, the organizational capabilities of farmers may be relatively high. Further, as predicted by the Von Thünen theory of 1896, differentials in local proximities of consumption centres may have great influences in the type of market structures developing in different areas. We expect areas with easy access to urban markets to support a heavy operation of private rural-to-urban traders. By comparison, areas further removed from urban markets are likely to have a higher demand for bulking-cum-transportation services.

Comparisons among the three districts as shown in figure 4-2 and table 4-1 show that although Nyandarua has the highest milk production density among the three districts, however, it had the poorest road infrastructure in terms density and quality. Kiambu has a relatively better road density and a moderate milk production density beside its physical proximity to the city of Nairobi. These factors may explain the relatively higher collective milk marketing activity observed in Kiambu compared to the other two districts. Further, comparisons suggest that Nakuru has the highest proportion of deficit dairy households, which may explain why, despite its better road infrastructure when compared to Nyan-

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darua and a higher milk density when compared to Kiambu, it nevertheless has

the lowest collective milk marketing activity but a higher intensity of direct milk

sales activities.
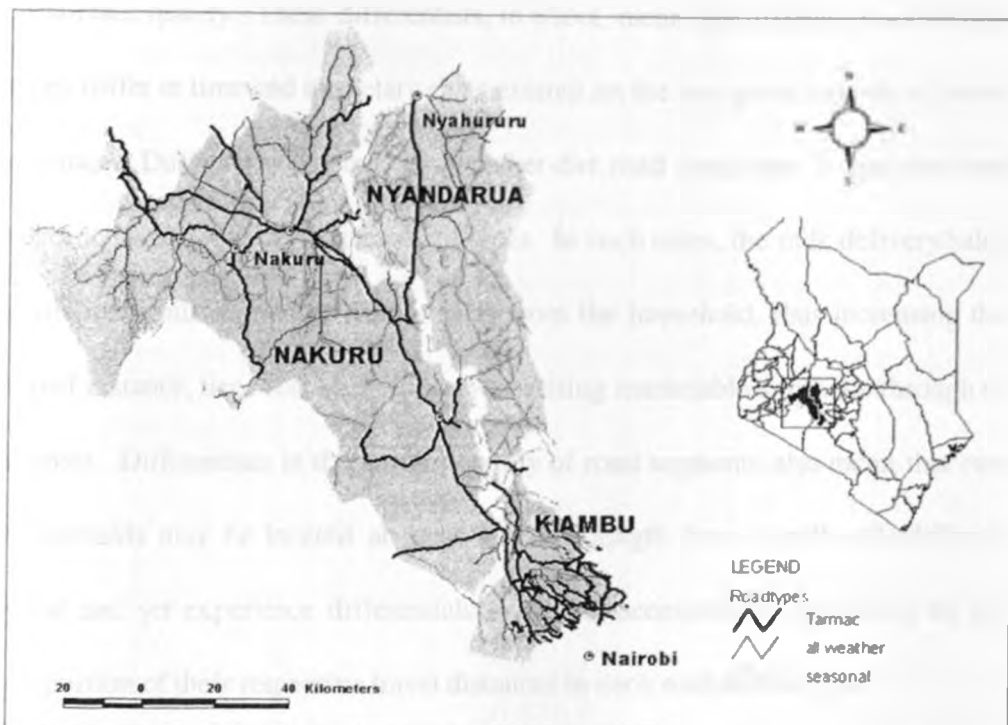
Figure 4-2: A Comparison of Road Network density in the study Area
Source: Authors compilation from survey data, 2001

Table 4-1: Differentials in Milk Production Densities across the Study Area

Variables	Kiambu	Nakuru	Nyanda-rua
Proportion of farm households with a dairy enterprise	0.72	0.59	0.83
Proportion of dairy household with a marketed milk surplus	0.54	0.47	0.67
Mean milk harvested per household with a marketed surplus (litre/day)	10.2	9.8	12.9
Mean milk marketed per household with a marketed surplus (litre/day)	7.4	9.7	8.9

Source: Authors compilation from survey data, 2001

4.2 Market Accessibility

As discussed in chapter 3, the travel distance from a farm household to a given milk-market contact point comprised different road sections differentiated by surface quality. These differentials, in effect, mean that different road section types differ in time and monetary costs exerted on the user per kilometre of travel distance. During wet seasons, dry-weather-dirt road (road type 3) sections may become impassable to vehicles of all types. In such cases, the milk delivery/sales point may shift to a point further away from the household, thus increasing the travel distance, time cost and drudgery of getting marketable surpluses through to market. Differentials in the surface quality of road segments also mean that two households may be located at equal distance-length from a milk sale/delivery point and yet experience differentials in market accessibility, depending on the proportion of their respective travel distances in each road section type.

The above arguments imply that mean physical proximities of milk sales/delivery points is not appropriate in making comparisons of market accessibility among households. Doing so would implicitly imply that a kilometre of travel distance exerts the same cost to the user regardless of road section type. Instead, the appropriate accessibility measure should accurately reflect the two dimensions, i.e., travel distance and road quality. Furthermore, the measure should take into account that, based on the perspective of the producer, the road section types constituting the total travel distance to the sales/delivery point are not independent of each other and cannot therefore be evaluated independent of

each other. Rather, the appropriate measure should aggregate the road sections into a single measure of market accessibility.

The most appropriate method of computing such measures is to convert the travel distances into expenditures of either time or money by weighting the respective distances by their average travel time or average travel monetary costs, respectively. This allows the translation of the distances travelled on the respective road section types into a measure of market accessibility as well as allowing the road segments to be meaningfully summed up as illustrated in equation 4-1. This in turn allows the analyst to implicitly make inter-household market-accessibility comparisons.

$$mktacc = \sum aD_1 + bD_2 + cD_3; a \neq b \neq c \quad \text{..Equation 4-1}$$

Where: *mktacc* is a market access indicator; D_1, D_2 and D_3 are distances (in kilometre) travelled on road types 1, 2, and 3, respectively; and a, b and c are constant travel time/monetary costs per kilometre on road types 1,2 and 3, respectively.

To compute the time/monetary-cost-based accessibility indicator discussed above, data on time/monetary cost is necessary. However, such data was not available for this study. Instead, we opted to use a z-scores based indicator as an alternative method of making inter-household market-accessibility comparisons. The z-score is a summary measure that entails a statistical technique to linearly transform a set of individual measures into a standard form in such a way that the mean of the distribution assumes a value of zero score while each individual measure is expressed in terms of standard deviates (z-scores) above or be-

low the mean (0 score). This is done for each variable, in this case being the distance measures on road types 1, 2, and 3 for the respective milk-market contact points. For each of the resulting set, the standardised variables are summed up to give an operational index useful in making numeric comparison across the units of analysis.

In our case, the results comprised physical accessibility indicators from dairy household's farm gate to: a CDMG; two nearest urban markets; and, to the city of Nairobi. The computation formula is specified in equation 4-2 below:

$$Z_d = \sum Z_s = \sum \frac{(X_s - \mu_s)}{\sigma_s} \quad\text{..Equation 4-2}$$

Where, Z_d is the market accessibility index to milk-market contact point d, Z_s is the Z score for distance travelled on road section type i to milk-market contact point d; X_s, μ_s, σ_s are the travel distance (in Km) travelled on road type i, mean and standard deviation, respectively. The resulting market-accessibility indicators bear an inverse relationship with market accessibility; large positive indicators imply low accessibility to the respective market contact point. Conversely, large negative indicators imply high accessibility to the respective market contact point. The resulting mean accessibility indices are shown in Table 4-2. For comparison, Table 4-3 shows the means of the travel distances measured in kilometres.

Table 4-2: Z-score based Market Accessibly Indicators of the SDF in the Study Area

Variable	Kiambu	Nakuru	Nyandarua
Accessibility index to CDMG	-0.6(0.9)	0.7(1.4)	-0.1(1.6)
Accessibility index to Nairobi	-1.1(0.2)	1.5(2.3)	0.1(0.3)
Accessibility index to urban centres	-0.1(1.2)	-1.4(1.9)	1.2(1.1)

Source: survey results, 2001

The indicators offer practical proxies for the direct time and monetary costs that SDF in the study area incurred in transporting/delivering milk to the respective sale/delivery point during the period of the study. They also serve as useful gauges of the likelihood of reliance on the respective markets. Comparison between Tables 4-2 and 4-3, given the results of Figure 4-1, clearly show that mean physical proximities of milk sales/delivery points are not appropriate in making comparisons of market accessibility among households because they do not evaluate accessibility in terms of differentials in distances travelled on the various road types. Thus, for instance, Table 4-3 suggests that farmers in both Kiambu and Nyandarua had about equal access to the collective dairy marketing groups of about 9.5 km. The Z-score performs better in that it implicitly reflects differentials in market access.

Table 4-3: Mean Travel Distance from The SDF Household to Major Market Contact Points

Variable	Kiambu [1]	Nakuru [2]	Nyandarua [2]
Distance to the nearest CDMG offices			
Km travelled on road type 1	6.0(3.8)	7.8(8.8)	1.8(2.3)
Km travelled on road type 2	2.0(2.5)	6.3(5.5)	0.1(0.2)
Km travelled on road type 3	1.4 (1.9)	2.0(2.8)	7.6(5.9)
Mean total distance to CDMG	9.4(4.6)	16.1(8.5)	9.5(6.4)
Distance to Nairobi			
Km travelled on road type 1	18.2(11.1)	162.7	92.1(35.1)
Km travelled on road type 2	1.6(2.5)	(19.3)	3.0(5.1)
Km travelled on road type 3	1.6(2.0)	6.3(10.2)	8.0(5.8)
Mean total distance to Nairobi	20 (12.1)	171 (19.9)	102(40.9)
Distance to other urban centres			
Km travelled on road type 1	32.5(6.5)	22.1(9.9)	23.6(11.7)
Km travelled on road type 2	1.7(2.5)	5.6(7.4)	3.7(4.9)
Km travelled on road type 3	1.5(1.7)	1.4(2.2)	8.1(5.8)
Mean total distance to urban centres	35 (8.7)	29(14)	36(8.5)

Source: Survey results; 2001
Figures in parenthesis are standard deviations
[1]KARI/ILRI/MALDM dairy Characterization survey: Kiambu District Pilot Survey.
[2]KARI/Moa/ILRI Collaborative Smallholder Dairy Project (R&D): Characterization Surveys 1998

As regards accessibility to CDMG, the results in Table 4-2 are consistent with the structure revealed in Figure 4-1. Comparisons across the three districts show that accessibility to CDMG was highest for SDF in Kiambu while those in Nakuru had the least access. Hence, in agreement to the structure revealed in Figure 4-1, these results suggest that SDF in Kiambu relied relatively higher on CDMG, while those in Nakuru had the least reliance on CDMG. Equally in agreement with Figure 4-1, the results suggest that Nakuru had the highest access to urban markets (other than Nairobi) among the three districts. The notable consistency between these results and Figure 4-1 shows that the market accessibility measures reflect realistically the differential, across the districts, of structural aspects of the identified marketing systems.

It must, however, be pointed out that the market accessibility measures discussed here are, of necessity, composite measures. They thus bear the weakness that they cannot be used in making evaluations of relative impact of each road section type on market accessibility. Their values mainly lie in providing appropriate inter-farm household comparisons of market accessibility. Further, it must be emphasised that, unlike the measures based on travel-time cost and travel-monetary costs, the Z-score based market accessibilities are ordinal measures and are therefore mainly useful in making descriptive comparisons as opposed to evaluative ones. A weakness common to both measures is that, like most performance measures, they suffer from lack of a standard against which the market accessibility indicators can be compared and evaluated.

Before concluding this section, it is worth acknowledging that it is possible, depending on the amount of available GIS-derived information, to use many other complex but more encompassing market accessibility indicators (for a detailed discussion on this, including the pros and cons of composite ordinal market accessibility measures as compared to simpler cardinal measures, see de Wolff *et al*, 2000).

4.3 *Household Socio-economic Characteristics*

As deduced in chapter three, household-specific attributes may act as conditioning factors explanatory of differentials in market behaviour across farm households. The objective of this section is to characterise the marketing system according to socio-economic factors of the producers as well as to evaluate the statistical association between market outlet choice and the factors. The analysis of statistical association entailed here is simple tests of independence between the household socio-economic factors and the choice of market outlet. The aim is to characterise the marketing system with respect to the socio-economic factors. The test of independence also serves as a preliminary step to analysis in the proceeding chapter where the precise nature of the relationship between the choice of market outlet and the respective socio-economic attributes is investigated.

Table 4-4 presents means and standard deviations of a selected farm household's socio-economic attributes of SDF in the study area. The results reveal that an average SDF in the study area harvested about 11 litres of milk per

day and marketed about 9 litres. These amounts are notably small and illustrative of the quantity constraints characteristic of smallholder milk marketing. The daily mean milk marketable surplus of 9 litres is well below the capacity (50 litres) of milk churns used to handle milk to processor markets. It is also well below the capacities commonly handled by individual small-scale rural-to-urban itinerant raw milk traders, which, as discussed latter, ranged between 35-150 litres.

Table 4-4: Summary Statistics of the SDF Household Socio-economic Attributes

Variable	Kiambu [1]	Nakuru [2]	Nyandarua [2]	All
Average land size (ha)	1.23(1.1)	2.59(3.4)	6.06(8.5)	2.54(4.4)
Milk harvest litres/day	10.2(7.9)	9.8(9.8)	12.9(13.5)	10.5(9.9)
Milk marketed litres/day	7.4(8.2)	9.7(16.5)	8.9(6.4)	8.6(12.1)
Age of head of household (in years)	60(13.2)	52(13.8)	48(15.6)	51.1(13.9)
No of years since farm was established	20.7(13.0)	16.8(7.0)	19.0(11.7)	18.7(10.7)
Years of schooling completed	9.6(4.2)	6.8(4.1)	7.4(3.2)	8.1(4.2)
Years of experience in Dairy production	21.1 (13.0)	15. 6(9.8)	19.0 (12.3)	18.5 (11.9)

Source: Survey results; 2001
[1]KARI/ILRI/MALDM dairy Characterization survey: Kiambu District Pilot Survey.
[2]KARI/MoA/ILRI Collaborative Smallholder Dairy Project (R&D): Characterization Surveys 1998
Notes: figures in parenthesis are standard deviations

The average number of years of schooling completed shows that most household heads had completed primary level of education, which in Kenya is eight years. However, there are some differentials among the districts in mean educational level; farmers in Kiambu district appear better educated, while those of Nakuru appear to be the least. If it is assumed that households with higher education have better quality information on which to base market decisions, then differentials among the districts in mean years of schooling completed by SDF may differentiate among market behaviors in the districts. This argument

also applies to experience. If it is assumed that decision-making improves with experience, differentials in experience may explain differentials among the districts. The SDF's experience with milk marketing was measured by the number of years the household had operated a dairy enterprise. The results show that the SDF in the three districts had appreciably long experiences with dairy enterprise.

Univariate analysis of covariance (ANACOVA) for independence of means was used to determine the strength of association between market outlets choice and the quantitative attributes of the farm household. This is a statistical technique used to decompose the variation of a response variable into the component explained by a given continuous variate and that attributable to chance. The equality of the two variations is then tested using the F distribution. For the qualitative attributes, the chi-square (χ^2) test of independence was used. With respect to qualitative attributes, each farm household can be classified by the attributes and its choice of market outlets. For each attribute, the sample data can be arranged in a two-way contingency table as in Table 4-5.

It follows from the basic theorem of probability (Kimenta, 1986) that, if the choice of market outlet is independent of the attribute, then $P_{ij} = P_j * P_i$. In other words, the probability of the choice of market outlet M_j, given the farm household is characterised by attribute A_i, is equal to the product of the marginal probabilities. Therefore, in a sample of n market transactions, the expected frequency (E_{ji}) of choice of market outlet M_j, given farm attribute A_i, is given by $n * p_j * p_i$, where n is the total number of market transactions; and p_j and p_i are

the marginal probabilities of event. If o_{ji} is the observed frequency of j given i,

then $\sum_{1}^{2} (o_{ji} - \varepsilon_{ji})^2/\varepsilon_{ji}$ has approximately a chi-square distribution, with degrees of

freedom $(c-1)*(r-1)$, where c is the number of market outlet choices and r is the

number of levels of the given attribute.

Table 4-5: Probability Cells showing Independence for Milk Market Choice

Attribute classifica-tion	Market outlets					
	M_1	M_2	.	.	.	M_j	
A_1	P_{11}	P_{21}	.	.	.	P_{j1}	P_1
A_2	P_{12}	P_{22}	.	.	.	P_{j2}	P_2
A_3	P_{13}	P_{23}	.	.	.	P_{j3}	$P3$
	.	.				.	
	.	.				.	
	.	.				.	
A_i	P_{1i}	P_{23}	.	.	.	P_{ji}	P_1
	P_1	P_2				P_j	1

For both tests, 95% confidence intervals were used to determine the

strength of association between the respective farm household attributes and the

market outlet choice. Significant associations were found between the choice of

milk market outlet and the following factors: - Marketable surplus (F=2.31; $p<$

0.01); years of experience in dairying (F=7.02; $p=0.00$); number of years since

establishing the farm (F=5.41; $p<0.05$); years of schooling completed (F=2.43;

p< 0.05); accessibility to Nairobi (F=58.73; p=0.00); accessibility to a main road

(F=12.33; p=0.00); accessibility to other urban markets (F=22.63; p=0.00); ac-

cessibility to a CDMG (F=13.49; p=0.00); sex of head of household (chi^2=8.41;

p<0.1) and district of residence (chi^2=175.44; p=0.00).

The notable association between the choice of milk market outlet and district of residence reinforces inferences from Figure 4-1 that areas of residence may have influenced the feasible market outlet alternatives available to an individual farm household. When combined, these two findings suggest that differentials of marketing structures among the districts can be explained in relation to differentials in districts characteristics pertaining to the factors summarised in Table 4.4. To further understand the factors underlying these differentials, ANOVA for independence of means was used to compare the three districts. The results suggested that years of experience in dairying ($F = 10.50$; $p=0.00$); number of years of schooling completed ($F=24.07$; $p=0.00$); number of years since establishment of the farm ($F=12.13$; $p=0.00$); accessibility to Nairobi ($F=2086$; $p=0.00$); and accessibility to other urban markets ($F=31.11$; $p=0.00$) had significant influences on differentials among the districts' marketing systems. However, milk harvested ($F=2.97$; $p>0.05$); marketed surplus ($F=1.66$; $p>.10$); and age of head of household ($F=1.68$; $p>.10$) did not significantly differ among the districts.

4.4 *Major Sales Arrangements*

The essence of marketing is the exchange of values (Boone & Kurtz, 1992; Kotler, 1988). The application of this broader perspective of marketing concept raises the basic question as to what is being exchanged in the market situations under analysis. This in turn has important implications for the application of TCs analysis to marketing. In particular, it implies that, as a first step towards a com-

prehensive understanding of the transactions under analysis, it is crucial to iden-

tify the contractual elements that come into play in the exchange. Consistent

with this, this section uses the data from the longitudinal monitoring to identify

the major sales arrangements operating in the study area during the period of the

study.

4.4.1 Major Units of Measures Used

As shown in Table 4-6, there was some variation among the outlets as

regards the most used unit of measure. Sales to CDMG and processor markets

were exclusively measured in kilograms.

Table 4-6: Percentage, by Buyer-type, of Transactions measured using the Respective Unit of Measures

Buyer-type	N*	*Unit of Measure*				
		Litre	KG	"Treetop bottle" (≈ 750 ml)	Large Cup (≈500)	Small cup (≈350 ml)
Farmer's Co-operative/self-group	5294	-	100	-	-	-
Processor	3471	-	100	-	-	-
Itinerant trader	4180	18.4	71.3	3.2	0.03	7.1
Local-market-based traders	1493	3.2	43.5	13.4	-	40.0
Household consumers	4485	12.0	6.5	58.9	1.8	20.9
Wholesalers	1141	19.7	79.3	1.0	0.1	-

Source: Survey results; KARI/MALDM/ILRI Whole-Farm Monitoring. 2001

The kilogram also ranked as the major unit of measure in sales to itinerant raw

milk traders and to wholesalers. In marked contrast, volumetric measures

ranked as the major units of measure in direct sales to households. In particular,

the "tree-top" bottle (common reference to a 0.750 ml bottle) ranked as the ma-

jor unit of measure in sales to households. This may be explained by the fact

that the bottle serves as a convenient handling container that also comes stan-

dardised, thus overcoming the need to measure out the milk; one only needs to fill the bottle.

4.4.2 Major Milk Sales/Delivery Points

As suggested by Table 4-7, proximity to a main-road or a rural market centre had major influences on SDF's access to milk markets. Of the 21,054 transactions observed, 34 percent, and 30 percent involved sales/delivery to a rural market centre and to a nearby main-road, respectively.

Table 4-7: Major Milk Sales/Delivery Points by Buyer-type (N=20116)

Buyer type	N*	Sales/Delivery Point				
		Farm-gate	Neighb our	Market centre	Nearby town	Nearby road side
Farmer's Co-operative/self-group	26	-	-	53	-	47
Processor	26	-	-	34	-	66
Itinerant trader	7	16	63	17	0	4
Local-market-based traders	22	1	-	93	6	-
Household consumers	18	30	41	2	26	0
General shop/kiosk	4	31	0	27	0	42
Wholesalers	4	-	-	43	0	57
Total	100	11	19	34	6	30

Notes: N* Percentage number of sales transactions observed on the respective outlet
Source: survey results: KARI/MALDM/ILRI Whole-Farm Monitoring, 2001

The table also depicts another point that is worth noting. This is the involvement of rural residents in rural-to-urban itinerant sale of milk. Of 3,310 transactions involving sale to itinerant traders, 2,082 (63 percent) were to persons residential in the rural area. This implies that itinerant trade in raw milk is mainly an activity of the rural people.

4.4.3 Differentials between Morning and Afternoon Milk Sales Activities

Although milking is commonly done twice a day, marketing constraints may make it impracticable to sell or deliver milk more than once a day. Table 4-8 shows differentials among the three districts of sales activities of milk from the respective milking times (commonly referred to as 'morning' and 'afternoon' milk). The table demonstrates remarkable differentials between activities in Kiambu and the other two districts. In Kiambu, morning- and afternoon-milk sales/delivery activities took place at appreciably the same degree. In contrast, the other two districts had more milk sale activities in the mornings than afternoons.

Table 4-8: Comparison of AM and PM Milk-Sales Activities across the Study Area (N=21054) (as a percentage of the total transactions observed in the Study)

	Kiambu (N=12,249)		Nakuru (N=49,69)		Nyandarua (N=4,846)	
	AM	PM	AM	PM	AM	PM
Farmer's Co-operative/self-group	29	24	0	0	3	-
Processor	3	3	23	0	39	-
Itinerant trader	4	4	28	15	8	4
Local-based-trader	6	3	8	0	0	0
Household	8	10	8	10	12	19
General retail shops/kiosks	4	2	0	0	1	0
Wholesalers	-	-	8	0	15	0
Total	54	46	75	25	78	23

Source: Survey results; KARI/MALDM/ILRI Whole-Farm Monitoring, 2001

The differentials revealed above regarding morning- and afternoon-milk sales activities may be attributed to differences in milk market accessibility. Indeed, investigations revealed that it was not practicable in Nyandarua and most parts of Nakuru for market intermediaries (including collective groups) to transport milk collected in the morning to the markets and be back on time for the cleaning of milk churns and the collection and transportation of afternoon milk to

the market. In contrast, co-operatives in Kiambu were able to collect and sell morning milk and be on time to clean the milk churns, collect and sell the afternoon milk.

The investigations also revealed that it was not practicable for itinerant traders in Nakuru and Nyandarua to collect milk in either the morning or afternoon and get it to the market on time. The common practice was that milk collected in the afternoon was marketed the following morning while that collected in the morning was sold in the afternoon. Scheduling of milking activities in the three districts was set to tie in with the demands of sales/delivery activities. In areas with one milk-sale per day, milking hours were set in such a way as to lengthen the feeding period relative to the "harvesting" of the milk destined for the market. Figure 4-3 presents the schedules of milk collection activities by raw milk traders. The figure shows that 'morning milk ' collection activities commenced at about 3.00 am and ran on until 12 am, with the peak at 6.00 am, and that over 70 percent of milk procurement transactions were completed by 8.00 am. Collection of 'afternoon milk' began at about 1.00 pm and continued until 9.00 pm, with the peak at 5.00 pm. Over 94 percent of the 'afternoon' milk procurement transactions were completed by 6.00 pm.

These results are consistent with the findings of other studies. Observations in Kenya and Ethiopia (Staal *et al* 1996) show that even where smallholders are able to sell "morning milk", "evening milk" has to be consumed at home or sold at lower prices. Other surveys have reported "forced" on-farm consumption

(MALD, 1992; FAO, 1991), but little has been done in the way of assessing the impact of TCs on its magnitude.
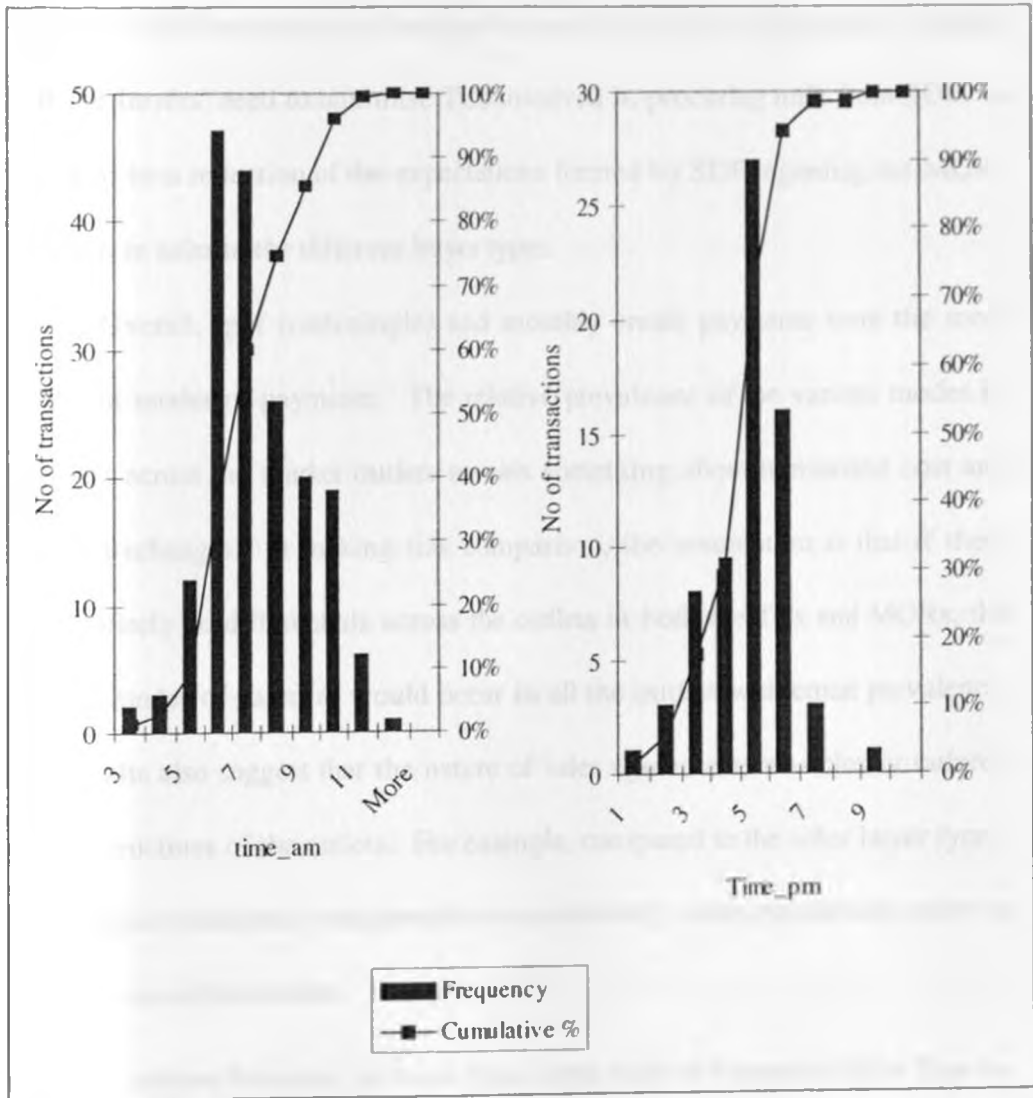
Figure 4-3: Schedules of Milk Collection Activities

Source: Survey results, 2001

4.4.4 Time Pattern of Payments

Table 4-9 draws attention to the variety of modes of payments that obtained in the sale of milk by the SDF in the study area during the period of the study. It also contrasts the prevalence of the different types of payments modes

across the market outlets. The table shows that the marketing system offered different sets of time patterns of payments. This may be interpreted as the market's response to differentiated producer-preferences for modes of payments, coupled with the buyers' need to minimise TCs involved in procuring milk from SDF. It may also be a reflection of the expectations formed by SDF regarding the MORs involved in sales to the different buyer types.

Overall, spot (cash-single) and monthly credit payments were the most prevalent modes of payments. The relative prevalence of the various modes of payment across the market outlets reveals something about transaction cost and risk of exchanges. In making this comparison, the assumption is that if there were entirely no differentials across the outlets in both the TCs and MORs, the various modes of payment would occur in all the outlets with equal prevalence. The results also suggest that the nature of sales agreements was closely tailored to risk structures of the outlets. For example, compared to the other buyer types, cash-single contractual arrangements were relatively more prevalent in sales to itinerant raw-milk resellers.

Table 4-9: Relative Prevalence, by Buyer Types, of the Mode of Payment by Buyer Type (as Percentage of Total)

| Buyer type | N* | Cash | | | On Credit Sales | | |
		Spot	Repeat	In-kind	Weekly	Fortnightly	Monthly
Coop/SHG	5,289	0	0	0	0	0.4	99.6
Processor	3,698	0	0	0	0	7.7	92.4
Itinerant trader	3,346	34.2	7.0	0.4	10.1	8.9	39.3
Local-based-market	1,493	27.7	7.1	0.0	1.1	64.8	0.0
Household	4,485	24.0	1.6	0.6	8.5	2.2	63.1
Shop	819	7.6	1.3	85.4	2.6	0	3.2
Wholesalers**	1,138	10.6	2.46	0	18.6	1.4	66.9

Notes:
* N is the number of transactions observed under the respective type
**Wholesalers was absent in Kiambu
Source: survey results: KARI/MALDM/ILRI Whole-Farm Monitoring. 2001

This can be attributed to characteristics of itinerant trade that are important risk factors for producers. Major among these is the ease of entry and exit from itinerant sale of milk. Compared with milk processing, resale of raw milk does not require large capital investments. A raw-milk trader only requires milk-handling cans and a reasonably functioning public transport service or private transport (e.g. a bicycle). Furthermore, itinerant traders may not be resident in the milk producing areas, but they may live in the nearest major urban centres in which case they commute to and from production areas to procure milk. Thus, unlike in the case of local-market-based traders, who because of living among the smallholders and being well known among the local community have a lot invested in social capital, reputational enforcement may not be feasible with itinerant traders. All this, coupled with the mobile nature of the trade, implies that itinerant traders have a relatively higher chance of defaulting if milk is sold to them on-credit.

Contractual arrangements with processors, dairy farmers' co-operative societies, and household consumers mostly involved on-credit-sales, and the unit of contractual period was typically a month. The contract period for local-market-based traders, however, was typically a fortnight. This may be a reflection of relative degree of trust placed on the different market outlets.

Cooperatives and processors offered sales arrangement generalised for all sellers. However, sales arrangement with all other outlets offered wide ranges of contractual arrangements. This can partly be explained by the relative ease of negotiating customized contracts in cases involving direct contacts (one-to-one)

between the seller and the buyer and partly by geographical segmentation of these buyer markets. For instance, the household consumer market is likely to be geographically segmented. Selling households are likely to have private information about the creditworthiness of buying households in their neighbourhood and local-market-based traders. Such information depends on unobserved characteristics, such as honesty, that are revealed only over time. In addition, the selling and the buying household, or the selling household and the local-market-based trader, may be characterized by a close long-term relationship. The value of market exchange may lie in the nature of this long-term relationship and its resulting effect on the selling household's ability to enforce contracts. Therefore, sales to neighbouring households and local-market-based traders are likely to be more oriented to credit sales. On the other hand, sales to households in further-away market centres and to non-resident itinerant traders may be more oriented to cash-sale contracts.

Finally, smallholder options for selling to large buyers are likely to be limited to implicit contracts on credit. Large buyers face adulteration risks in pooling milk daily from many small sellers, in addition to market risks of throughput shortfall, and they, therefore, confine themselves to regular trusted sources (Staal, Delgado and Nicholson, 1997). This renders itself to periodic payment for cost minimization reasons.

4.5 Producer prices

Based on the foregoing discussion on contractual elements, the contractual arrangements obtaining for the SDF can be viewed as comprising "utility bundles" differentiated by a number of separable qualitative attributes. In the context of this study, the notion of utility entails any benefit obtaining from the chosen contractual arrangement. By this concept, therefore, being able to choose a preferred mode of payment adds to the utility of the exchange. The objective of this section is to make comparisons of values across the observed modes of payment. As is usual in such comparisons, we use money, in this case the monetary price per litre of milk, as a common denominator in the measurement of value. Accordingly, and in order to overcome the problem of incomparability of goods exchanged for milk, we imput a shilling value to in-kind payments.

The objective is to decompose producer prices by the various elements of contractual arrangements in order to assess the relative influence of attributes that were thought to be important in price determination. A priori, we expect prices to vary across the contractual arrangements according to compensating differentials in MORs and TCs. To specify the model, we start by recognising that variability in observed producer prices is attributable to a number of influences. Prices are set under widely varying contexts. In particular, prices are set within the context of different modes of payment, which are in turn defined within different market outlets. Within this hierarchy, prices may vary with local supply-demand conditions, and across geographical locations of production and trade. Further, because of indivisibility of the volumetric units of measures used in ex-

changes with some of the market outlets, prices, expressed in a common unit of measure, vary across the units of measures used. Succinctly put, we expect the formation of producer prices to be differentially influenced by a number of factors whose effects can be conceptualised to operate in a hierarchical fashion.

To achieve the objective outlined above, we use a statistical price decomposition model specified in Equation 4-3. The model is based on ordinary least squares (OLS) regression with fixed effects for the time of the year, market outlet, mode of payment, geographical location and unit of measure. The effects are incorporated in the model by use of complete sets of dummy variables for each of the different effects.

$$p_{ijkt} = \mu + \delta_1 \text{main road distance} + \delta_2 \text{district}_k + \delta_3 \text{payment mode}$$
$$+ \delta_4 \text{unit}_l + \delta_5 \text{size*outlet}_i + \delta_6 \text{month} \qquad \text{.........Equation 4-3}$$
$$+ \delta_7 \text{payment mode}_j | \text{outlet}_i | \text{district}_k + \varepsilon_{ijt}$$

The model describes producer prices as the outcome of the additively separable effects of the various influences. The dependent variable p_{ijkt} is the unit price (in Ksh per litre) observed at market outlet i for payment mode j in district k and time t. Outlet, district, Month, and Unit are fixed effects of market outlet, geographical location of production and trade, month of the year, and unit of measure, respectively, expressed as 1/0 dummy variables. Size of transaction and distance to the nearest main road are continuous variables expressed in litres and kilometres, respectively. To explicitly account for differentials in the consideration sets available for SDF in the different market outlets, the modes of payment were nested within the market outlets. Differentials in consideration sets were the result of the fact that the modes of payment choice set was not uniform across

all market outlets. Thus, as already noted earlier, the household consumer markets offered a wider selection of modes of payment while CDMG and processor markets mainly offered monthly payments only.

To identify the model, one set of the possible combinations of alternative effects was selected the base or comparison set (CS). For each set of effects, therefore, the size of the set of dummy variables was set one less the number of possible alternatives. Specifically, we set CS={Nyandarua, household consumer market, spot-cash mode of payment, litre}

The model is structured such that the parameters of the fixed effects variables measure the residual errors of the respective effects, hierarchically, over the intercept as shown in Figure 4-4 while the coefficients of the continuous variables are a measure of the response of price to a unit change in the respective variables. Since the excluded combination of alternative effects at the intercept is CS={Nyandarua, household consumer market, spot-cash mode of payment and litre}, μ gives the estimated mean spot-cash price (per litre of milk) paid to the SDF in Nyandarua by household consumer markets. The coefficients at the level of district effects give indication of the variations of spot-cash prices (per litre) in household consumer markets in Nakuru and Kiambu, respectively, over those in Nyandarua. Finally, the coefficients at the level of modes of payment effects are a measure of the mean price variations of respective modes of payments and alternative market outlet over spot-cash price in the household-consumer-markets.

From *a priori* assumptions, the market was expected to set higher prices for sales to occasional customers and bad credit risks in order to compensate pro-

ducers for higher risks and market search costs. Conversely, the market was expected to set lower prices for good credit risks and steady buyers since sales to such buyers offer better market outlet assurances and predictability in the flow of payments. This reduces uncertainty and allows the SDF to effectively plan for sales receipts. Producer prices were expected to vary negatively with increases in the distance from the farm gate to major centres of contact with buyers. In this model, we used the distance of the farm gate to the main road as a proxy of market accessibility.

μ (=Spot-cash per litre paid to SDF by Household Consumer Markets, Nyandarua)

$+\delta$ *Nakuru*

$+\delta$ *Kiambu*

= Spot-cash per litre paid to SDF by Household Consumer Markets. Nakuru

= Spot-cash per litre paid to SDF by Household Consumer Markets, Kiambu

$+\delta$ *payment$_j$ |outlet$_i$* in the respective district

=Price per litre by sets of modes of payment market, market outlet and district
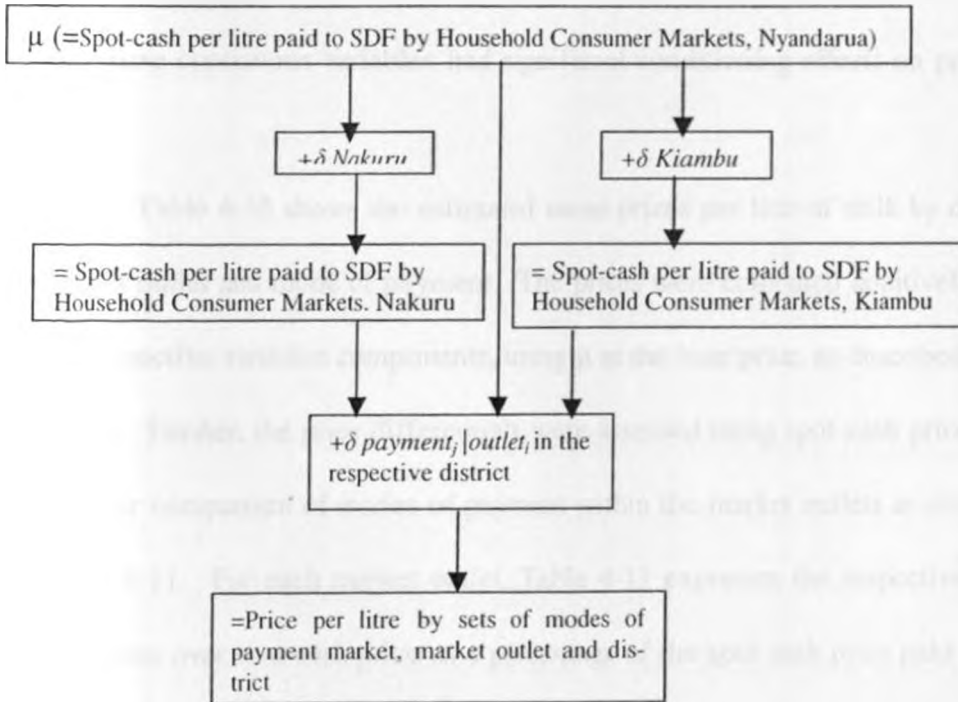
Figure 4-4: Hierarchical computation of mean estimated price

The results of the model are presented in appendix I. Overall, the results are satisfactory; the adjusted R-squared is 0.84, suggesting that well over 80 percent of producer price variations are explained by the model. The results show that prices varied significantly by market outlets and within each market outlet, by mode of payment. This finding implies that mode of payment in terms of time pattern of payments played an important role in the determination of producer prices of milk in the study area and that there were market-outlet-specific conditioning effects probably based on differentials in MORs. Further, the coefficients of the fixed effects were not constant but varied with the unit of measure used, size of transaction and distance of the homestead to the main road. This implies that these continuous variables had significant conditioning effects on producer prices.

Table 4-10 shows the estimated mean prices per litre of milk by district, market outlet and mode of payment. The prices were computed additively from the respective variation components, using μ as the base price, as described in the earlier. Further, the price differentials were assessed using spot-cash prices as a base for comparison of modes of payment within the market outlets as shown in Table 4-11. For each market outlet, Table 4-11 expresses the respective price variations over spot-cash price as a percentage of the spot-cash price paid by the outlet. The results reveal significant differences between spot-cash prices and prices in other time patterns of payment. The table shows a definite pattern that suggests that even within the same market outlet, spot-cash prices were generally higher than prices paid in transactions involving the other time patterns of pay-

ment. At a first glance, the findings in Table 4-11 that spot-cash prices were invariably higher than prices paid in the other time patterns of payments appear to be at variance with the predictions of the concept of time value of money.

Table 4-10: Mean Estimates of Milk Prices Received by the Smallholder Dairy Farmers at the Time of the Study (by District, Market Outlet, and Mode of Payment)

District	Market	Mode of payment					
		Cash-repeat	Fortnightly	In-kind	Monthly	Spot-cash	Weekly
Kiambu	CDMG	-	-	-	16.36	-	-
	Household consumer	18.77	16.88	19.27	18.65	21.67	18.85
	Itinerant trader	18.21	-	16.80	19.37	19.09	17.77
	Local-market-based trader	17.59	18.30	21.67	-	20.60	20.11
	Processor	-	-	-	15.94	-	-
Nakuru	Household consumer	-	11.50	14.86	13.55	14.51	14.39
	Itinerant trader	10.94	11.15	-	13.59	13.22	12.65
	Local-market-based trader	-	-	-	-	15.08	-
	Processor	-	-	-	15.93	-	-
	Wholesaler	-	-	-	12.58	13.63	-
Nyandarua	CDMG	-	15.12	-	14.46	-	-
	Household consumer	12.21	10.91	11.55	12.81	14.49	13.50
	Itinerant trader	11.55	-	12.94	12.69	12.73	12.54
	Local-market-based trader	-	-	-	14.77	-	-
	Processor	-	14.41	-	15.14	-	-
	Wholesaler	13.78	12.90	-	13.27	14.60	13.07

Notes: The prices are controlled for unit of measure and month of the year.
Source: Estimate from the results of the price decomposition model presented in appendix 1

However, when viewed within the contexts of this study, the price differences are explicable as presumptive evidence of differences in TCs and MORs among the modes of payments. In particular, the differentials can be interpreted as revealing the compensating differentials across the contractual arrangements with respect to market search, market assurance, and savings utility. Spot-cash markets for the highly perishable commodity exposes the SDF to greater risks of non-sale. On the other hand, contractual arrangements involving payments at

regular fixed schedules implicitly define repeat contracts which give the farmer greater assurance for subsequent sales as well as savings utility.

Table 4-11: Mean Price Differentials between Cash-sale and Prices Paid in Other Time Patterns of Payment, by Market Outlet and District (in % of the Respective Cash-spot Prices)

District	Market	Mode of payment				
		Cash-repeat	Fortnightly	In-kind	Monthly	Weekly
Kiambu	CDMG					
	Household consumer	-13	-22	-11	-14	-13
	Itinerant trader	-5	-	-12	1	-7
	Local-market-based trader	-15	11	5	-	-2
	Processor	-	-	-	-	-
Nakuru	Household consumer	-	-21	2	7	-1
	Itinerant trader	-17	-16	-	3	-4
	Local-market-based trader	-	-	-	-	-
	Processor	-	-	-	-	-
	Wholesaler	-	-	-	-0.08	-
Nyandarua	CDMG					
	Household consumer	-16	-25	-20	-12	-7
	Itinerant trader	-9	-	2	-	-1
	Local-market-based trader					
	Processor	-	-	-	-	-
	Wholesaler	-6	-12	-	-9	-10
Overall		-10	-18	-3	-7	-5

Notes: The prices differentials are controlled for unit of measure and month of the year.
Source: computed from the results of the price decomposition model presented in appendix

These findings further support the view expressed earlier that the contractual arrangements obtaining for the SDF comprise "utility bundles" that are separable (at least conceptually). Viewed this way, the price differential emerges as the amount of money that the SDF were willing to pay for benefits in one mode of payment relative to the other modes. In relation to spot-cash prices, negative variations from spot-cash payment reveal the amount of money per litre of milk that SDF were willing to sacrifice to receive payment in the respective time pattern of payment relative to receiving payments on the spot. Thus, on the

overall, the SDF appear to have been willing to sacrifice the highest amount (18%) per litre of milk for the benefits of fortnightly payments, next highest sacrifice (10%) was for cash-repeat payments, followed by monthly (7%) and weekly payments (5%) and least (3%) was for in-kind payments.

In an important sense, the analysis suggests the general preference ordering for the difference time patterns of payments. The ordering suggests that the utility that SDF derive from receiving payments fortnightly is the highest among the possible alternatives. Cash-repeat ranks second while in-kind payment is the least preferred. Caution must, however, be exercised in assigning value rank to in-kind payments in view of the relatively small proportion of in-kind payment transaction out of the total number of transactions observed (cf. Table 4-9). Furthermore, the goods offered in-kind varied widely and included consumer items, fodder, and labour.

Other results from appendix I show that prices were consistently higher in Kiambu as compared to those in the other two districts. As already explained, district dummies are included in the model to capture regional consequences brought about by differences in marketing structure across the study area. Area specific fixed-effects help to explain why prices are not constant over a given mode of payment. Thus, the higher prices observed for Kiambu possibly reflects the economic advantages created by the physical proximity to the populous city of Nairobi. Further, the results show that the distance of the homestead to the main road, unit of measure, and location of production and trade were all central considerations in price determination. As expected, the results show a negative

relationship between price and the distance of the homestead to the main-road; a 10 km increase in the distance of the homestead to the main road reduced prices by Ksh 0.03.

4.6   The Role of Market Outlet in Determining Terms for Milk Sales by Smallholders in Kenya

The chapter thus far has evaluated and specified in details the particular milk marketing system in which the smallholder dairy farmers (SDF) in each district in the period of this study operated. Our major focus in this section is to use data from the longitudinal monitoring to evaluate how the system interacted with socio-economic attributes of the farm household to determine the household's milk market behaviour. To accomplish this task, we apply the two models constructed in chapter 2 corresponding to the twin task of analysing market outlet and payment mode choice as conceptualised in the chapter. The first is a random-effects logit model constructed to empirically assess the relative independent influences of household's socio-economic attributes on the choice of market outlet. The second is a random-effects Tobit model constructed to empirically test the influence of household socio-economic attributes on the choice of payment mode (cash versus credit).

4.6.1 Determinants of household's market choice behaviour

In chapter three, we hypothesised that the household's market behaviour can be predicted through two categories of factors. These are:

(i)   *Outlet-specific factors:* These include the relative producer prices, differentials in distances from the farm household to milk selling/delivery points; differentials in time costs required to sell or deliver milk to the milk selling/delivery points; and, mode of payment and transmission of payment to the farmer.

(ii)   *Farm household-specific factors:* These include amount of marketable surplus, household's stock of human capital, experience in dairying, and market accessibility.

A practical problem however, was encountered with regard to outlet-specific factors arising mainly from the fact that information on market outlets not used on a given day *t* was not observable. This means that since information was only recorded for outlets used, the negativity of outlets not used was not captured. This gave rise to a censoring problem. A second and related problem arises from the fact that the observed market outlet variables are specific to the market outlets used. In other words, they are endogenous to the market outlet choice. Hence, it emerges that the observed locations of and the distances to the respective milk delivery/sales points are internal variables (determined together with the respective market outlets selected) while the prices received by the smallholder as well as the time expended in milk sales activities were output variables of the respective market outlets selected.

In brief, market outlet observations made on a given day t are specific to the market outlet used on that day and provided no information to compare across outlets. In other words, the variables are not useful in explaining why one choice was made and not another. However, we recognised that since the SDF are individually price takers, the price endogeneity problem could be addressed by predicted prices. Accordingly, it is possible to address the price endogeneity problem by using the prices predicted by the price-decomposition model in the previous chapter in place of the observed prices.

As regards household-specific socio-economic factors, they are character-ised by the fact they vary across households but pre-exist as observations on the response variables in the two models (the logit and Tobit models). They thus comprise the major group of predictor variables of the models. It must also be recognised that the data conforms to the assumption that on a given day t, the milk-marketed surplus of dairy household i is predetermined and exists as the excess of total milk harvested over the total household consumption (i.e., mar-keted surplus is exogenous to the choice of market outlet). The only problem with household-specific variables was encountered with the market accessibility variables. The Z-score-based market accessibility indicators computed in the previous chapter have the major disadvantage in that their parameters cannot be interpreted quantitatively. In other words, the value of their parameters in evalu-ating the impact of market accessibility on market-outlet choice behaviour does not go beyond their signs.

Finally, we also considered the possibility that, even after allowing for farm household socio-economic attributes and relative producer prices, household's marketing behaviour is likely to vary with omitted area-specific factors. Indeed, the previous chapter revealed remarkable differences, across the three districts in the study area, in structural aspects of the marketing system. Area-specific factors are exogenous to the choice but are constant across smallholder dairy farmers living in a given area and across market-outlets available in the area. A common method of controlling for such factors is, as explained in chapter three, to use a set of binary categorical control variables coded 0/1 to control for the fixed effects. However, for reasons discussed in chapter three, we chose to omit the area-specific dummy variables and treat the area-specific controls as random effects.

Table 4-12 presents summary statistics for the variables used in the models. In addition to the overall variations in marketable surplus and the proportion of total marketed surplus sold in cash-sale markets, the table also shows the decompositions of the two variables into 'between' and 'within' farm household variations. All the other variables were time-invariant.

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Table 4-12: Summary Statistics and Definitions of Variables used in Models for Analysis of the Determinants of the Smallholder Dairy Farmers' Choice of Market Outlet and of Mode of Payment

Variable	Mean	Std. Des	Min	Max
Marketed surplus in litres				
• Overall	6.67	9.57	0.35	100.1
• Between	-	8.94	1.01	55.53
• Within	-	4.09	-28.86	63.70
Proportion of total marketed milk that is sold in cash-sale market				
• Overall	0.24	0.40	0.00	1.00
• Between	-	0.33	0.00	1.00
• Within	-	0.25	-0.55	1.24
Years of experience in dairying in number of years	22.33	9.60	5	40
Sex of head of household (1 is female; 0 if male)	-	-	-	-
Age of head of household in years	53.42	12.76	28	76
Number of years of school completed	7.91	3.87	0	13
Number of children aged below 9 years	1.24	1.33	0	5
Number of children aged below between 9 and 14 years	1.03	1.09	0	4
Number of children aged below between 14 and 22 years	1.84	1.45	0	6
Number of household members aged above 22 years	3.11	1.48	1	8
Distance to nearest main road (in Kilometres)	4.29	5.83	0	21
Distance (in Km) travelled to Nairobi on road type 1	81.90	67.40	5.51	171.34
Distance (in Km) travelled to Nairobi on road type 2	2.79	4.74	0.00	15.02
Distance (in Km) travelled to Nairobi on road type 3	3.30	5.99	0.00	25.41
Distance (in Km) travelled to urban market* on road type 1	22.18	11.67	0.83	41.76
Distance (in Km) travelled to urban market* on road type 2	3.94	5.34	0.00	15.29
Distance (in Km) travelled to urban market* on road type 3	3.37	5.93	0.00	22.93
Distance (in Km) travelled to CDMG on road type 1	6.42	4.27	0.78	15.71
Distance (in Km) travelled to CDMG on road type 2	3.20	3.79	0.00	13.73
Distance (in Km) travelled to CDMG on road type 3	3.14	5.28	0.00	20.84
Flow of off-farm income (1 if regular; 0 otherwise)	-	-	-	-
Holiday (1 if day t falls on a Sunday or a public holiday, 0 otherwise)	0.14	0.35	-	-

Note: distance to urban market was based on average distance to two urban markets closest to the farm.
Source: Survey results, 2001

To obtain results with generalised comparisons across the entire study area, the market outlets identified in Figure 5.1 were viewed as falling into three broad categories:

(i) The local neighbourhood markets (LNM): This was defined to capture sales to outlets within the production area, including sales to local-market-based

traders (e.g. general shops and kiosks, milk bars, hotels & restaurants, etc);
and direct sales to households. These were mainly low-volume buyers/end-
users within walking distance of the smallholder dairy farm households.
Milk was delivered by the farm household, either on foot or on bicycle, or
picked at farm-gate by the buyer.

(ii) The rural-to-urban raw milk resellers (R-t-U): This was defined to include
both the itinerant raw milk traders procuring milk from SDF to retail to final
consumers in urban consumption centres, and wholesalers buying to resell to
processors, itinerant traders, and urban-market-based raw milk traders (e.g.
milk bars, shops and kiosks, etc).

(iii) Rural-to-urban-bulking-cum-transporters of milk (B-c-T), defined to include
all sales requiring bulking-cum-transporting services, irrespective of whether
the services were provided by farmers' dairy cooperative societies/self-help
groups, private bulking-cum-transporting agents, or by processors.

The distinction among the above three categories of milk market participants
was based on the conceptual logic of giving functional consequence to the re-
sponsibility for procurement and the requirement or non-requirement of vehicular
transport. More importantly, the classification had the advantage of avoiding
categorization merely based on common references used in the market but which
do not bear contextual differences in terms of market contracts. Thus, the classi-
fication allowed the model to be more consistent with the underlying contractual
elements in the exchange of milk between SDF and the markets.

The model was computed as a conditional logit model. This entailed, as a first step, the restructuring[14] of the data to conform to the 1/0-response variables appropriate for conditional-type logit model. This ensured that the observation made on a given day t comprised a set of three records corresponding to the three distinct market outlet alternatives, i.e., LNM, R-t-U, and B-c-T. The appropriate response variable was then generated into the data. The variable, as appropriate, took the dichotomous code 1/0 defined as one if the given farm household used market outlet j on the given day and zero if the outlet was not used.

The data records resulting from the above restructuring were indexed by i, j and t for appropriate identification with the farm household from which the observations were made, the relevant market outlet category under which the sale fell, and the day for which the observations were made, respectively. To identify the model, the parameters of the explanatory variables were normalized to zero for the B-c-T category of market outlets. The other two categories (i.e., LNM and R-t-U) of market outlet alternatives entered the model as explanatory variables expressed as 1/0 dummies. These were also interacted with the farm household-specific explanatory variables to ensure that the latter do not fall out of the probability function (see Greene. 1997 and Cramer, 1991) and, more importantly, to ensure that parameter estimates of the household socio-economic attributes varied across the market outlets.

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[14] This was done by recoding the market outlet variable in accordance with the three market outlet categories defined in the previous paragraph, followed by conversion of the data into its long form using the **reshape long** command of STATA 6.0.

4.6.2 Empirical Analysis of Factors Influencing Smallholder Dairy Farmer's Choice of Market Outlet

A *priori*, we expect the probability of selling to LNM relative to B-c-T (i.e., CDMG and processors markets) to be negatively related to increases in the amounts of marketable surpluses. As the household's marketable surplus increases, the transaction costs of selling to a larger number of low-volume buyers in the LNM outlets increase relative to those of single-exchange transaction offered in sales to B-c-T. However, the relative influence of increases in marketable surpluses on sales to R-t-U relative to B-c-T could not be clearly determined *a priori*. Direct sales to R-t-U typically involved procurement at farm-gates. To minimise their transaction cost, buyers were expected to favour large suppliers. On the other hand, it was expected that B-c-T outlet category offered more steady markets than R-t-U and was, therefore, likely to entail relatively less MORs.

It was also hypothesised that differences among households in market outlet preference were attributable to differences, across households, in stocks of human capital. To assess this, we used the years of education of the head of household as a proxy. Household's stock of human capital was expected to have an influence on market outlet preference through influences on search and screening costs. Search and screening costs must of necessity be expended before a market choice decision can be reached. This makes them sunk cost in relation to the choice made and therefore unobservable in revealed preference data. However, it was expected that, in relative terms, households with higher stocks

of human capital had better quality information on which to base market deci-sions. On the other hand, farm households with low stocks of human capital were likely to give inappropriately low weights to TCs and MORs.

The attitude and approach to marketing may also vary from household to household, depending on the household's experience in dairying and the impor-tance of dairy relative to other farm enterprises. Two closely related aspects of experience were expected to be in play in influencing the SDF choice of market outlet. First, farmers who had had long experience with the former system of single-channel market outlet were expected to show less preference for emerging outlets. This is because they may still be living by the expectations created by the formal sector of the 70s and early 80s and may in retrospect overvalue the positive elements of the formal channels and undervalue the negative elements. It was also expected that farmers who had had prolonged experience with CDMG may have stabilised their market behaviour, with new reasons being internalised to justify reasons to market through organised groups. Therefore, in those areas where CDMG are active, it was expected that most of the active-members are the same ones who were active members of such organisations even before the liber-alisation of the industry. Secondly, the duration of stay in an area was expected to increase a farm household's social capital invested with other farmers and hence the probability of being involved in collective activities with the other farmers. Therefore, the number of years since a farm household established farming in an area was expected to influence market outlet choice. The age of

the head of the household was used as a proxy for experience since the two aspects were highly correlated with age.

As already discussed, SDF marketing activities are primarily limited to destinations that are easily accessible on foot, by bicycle or on animal back. Marketing activities to B-c-T markets typically start with the households delivering milk to bulking/collection points designated by CDMG or private bulking-cum-transporting agent. Such points, as already identified in the previous section are typically located along main roads. Households located beyond walking distances to the designated bulking/collection points often designate an intermediate bulking point from where milk is collected by smaller vehicles or donkey carts for transportation to the designated points. Thus, relative to B-c-T, we expected sales to R-t-U to be negatively related to increases in distance from the main road.

Parameter estimates of the random-effects logit model[15] are reported in Table 4.13. The logit choice model used expresses the probability that a farm household i will market its marketable milk surplus in market outlet j (where $j=1,2$ in correspondence to the two outlets LNM and R-t-U) relative to the comparison outlet B-c-T. In the context of the analysis, the odds ratios are used to express the marginal effects of the given variates on the choice of the outlet in question (LMN/R-t-U) relative to the comparison category (B-c-T). Specifically, the odds ratio signifies the change in the probability of using the outlet in question, relative to the comparison category, given a unit change in the respective

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[15] The model was solved using the xtlogit, re command of STATA 6.0

variate. The odds ratio is one if a given variate has no influence on the choice of a given market outlet as compared to its influence on the comparison category. With the exception of the market accessibility indicators, variates with an odds ratio greater than one are positively associated with the choice of the market outlet in question relative to the comparison market outlet. Conversely, variates with an odds ratio of less than one are negatively associated with the choice of the market outlet in question as compared to the comparison category. The greater the odds ratio differs from one, the larger the association. As already discussed, parameters of the Z-score based market accessibility indicators could not be interpreted quantitatively. Instead, the results only show the sign of the respective indicator's association with the market outlet in question relative to the comparison category.

Generally, the model fit was good (Log likelihood $= -16141.724$; Wald chi^2 (41) =7028.06; Prob $>$ chi^2 $= 0.000$). The likelihood test indicates that panel-level variance component (rho) was significantly different from zero (Likelihood ratio test of rho=0; chi^2 (1) = 13549.27; Prob $>$ chi^2 = 0.000). More importantly, the model results show reasonable evidence that the *a priori* hypotheses regarding household's market choice behaviour were supported by the data. In accordance with the expectations of price theory, price appears to have significant influences on household's market choice behaviour. The results show that, other things being equal, the odds of using a given market outlet increased by 1.65 for every unit increase in price relative to the prices offered by the other out-

lets. The results also clearly demonstrate that marketable surplus had a significant influence on household's market choice behaviour. As hypothesized, increases in quantities of marketable surpluses appeared to make LNM significantly less attractive relative to B-c-T but to make R-t-U significantly more attractive. The parameter estimates show that for every unit increase in milk marketable surplus, the odds that the farm household sold in the LNM decreased by 0.83 while the odds that it sold to R-t-U increased by 1.07.

Further, the results suggest that household's market choice behaviour differed markedly with physical proximity to major milk sales/delivery points. The further a farm household was from a main-road, the more likely that LNM was used relative to B-c-T, and the less the likelihood that R-t-U was used relative to B-c-T. For every one kilometre increase in the distance from the farm household to the main road, the odds of the farm household selling in the LNM markets increased by 1.78 relative to the odds of selling to B-c-T while the odds of selling to R-t-U decreased by 0.8. In addition, increased access to urban markets increased the reliance on LNM but had no significant effect on R-t-U, while the more accessible the city of Nairobi was, the less attractive were both R-t-U and LNM outlets relative to B-c-T. The positive association between accessibility to urban markets and choice of LNM, as observed here, is perhaps attributable to the fact that human density, and hence LNM, increases as one moves from the rural areas towards an urban centre. Recent trends in the country have seen large expansions into peri-urban areas. On the other hand, negative association between accessibility to the city and both LNM and R-t-U is explainable by the fact

that increased access to the city reduced the effective costs of transporting milk to the city, thus increasing the net prices offered by B-c-T, which were relatively more reliable markets as compared to LNM and R-t-U.

Table 4-13: Estimated Random-effects-Logit Model Results for the Smallholder Dairy Farmers' Choice of Milk Outlets

	Local Neighbourhood Markets (LNM)		Rural-to-urban Resellers Markets (T-t-U)	
	Odds Ratio	P>|z|	Odds Ratio	P>|z|
Marketable Surplus	0.83	0.00	1.07	0.00
Distance to the main-road	1.78	0.00	0.80	0.00
Years of education completed	0.91	0.00	0.75	0.00
Age of head of household	0.89	0.00	1.07	0.00
Sex of household head	0.09	0.00	1.57	0.00
Sundays & holidays	1.44	0.00	1.97	0.00
Access to Nairobi	-ve	0.00	-ve	0.00
Accessibility to other urban centres	+ve	0.00	-ve	0.68
Accessibility to a CDMG	+ve	0.00	+ve	0.00
Rainfall (in inches)	1.00	0.29	1.00	0.00
Constant	0.58	0.32	0.03	0.00
Price Odds Ratio=1.65				
/lnsig2u= 0.533 P>|z|=0.000				
Sigma_u= 1.306				
Rho= 0.630				

Source: Computed from Survey Data, 2001

The results also indicate the importance of household's socio-economic factors in conditioning market-outlet choice behavior. Differentials among the households in human capital, sex and age of head of the household were signifi-cantly important in explaining differences observed across household's market choice behavior. Households headed by older, less educated, females were more likely to sell to R-t-U relative to B-c-T, *ceteris paribus*. Conversely, households headed by younger, more educated males were more likely to sell through B-c-T, *ceteris paribus*. Another notable result was that, on Sundays and holidays, SDF were more likely to sell milk to LNM and R-t-U markets relative to B-c-T mar-

kets. This result is contrary to general claims made by B-c-T to the effect that one of the disadvantages of selling to R-t-U markets is that they do not generally operate on Sundays and holidays.

Taken together, these results suggest that remote locations from the main roads and urban markets make SDF more reliant on collective efforts of bulking and transportation functions and on processor markets as the major market outlet. Conversely, physical proximity to a main road and to urban markets appears to make farmers more reliant on R-t-U markets. The results further suggest that with respect to R-t-U physical proximity of the markets is a more important aspect relative to motor-road quality-based market accessibility. This is a plausible finding given the structure of R-t-U raw milk reseller markets and their characteristics with regard to mode of transport. As shown in Figure 4-5, R-t-U raw milk reseller markets are characterised by numerous small-scale operators. The Figure shows that about a half of the traders interviewed in Nairobi and Nakuru dealt in between 5 and 50 litres of milk per day. Only about 13 percent handled more than 200 litres of milk per day in Nairobi, while in Nakuru only about 30 percent handled more than 80 litres a day.

Nairobi

Nakuru

Frequency   Cumulative %
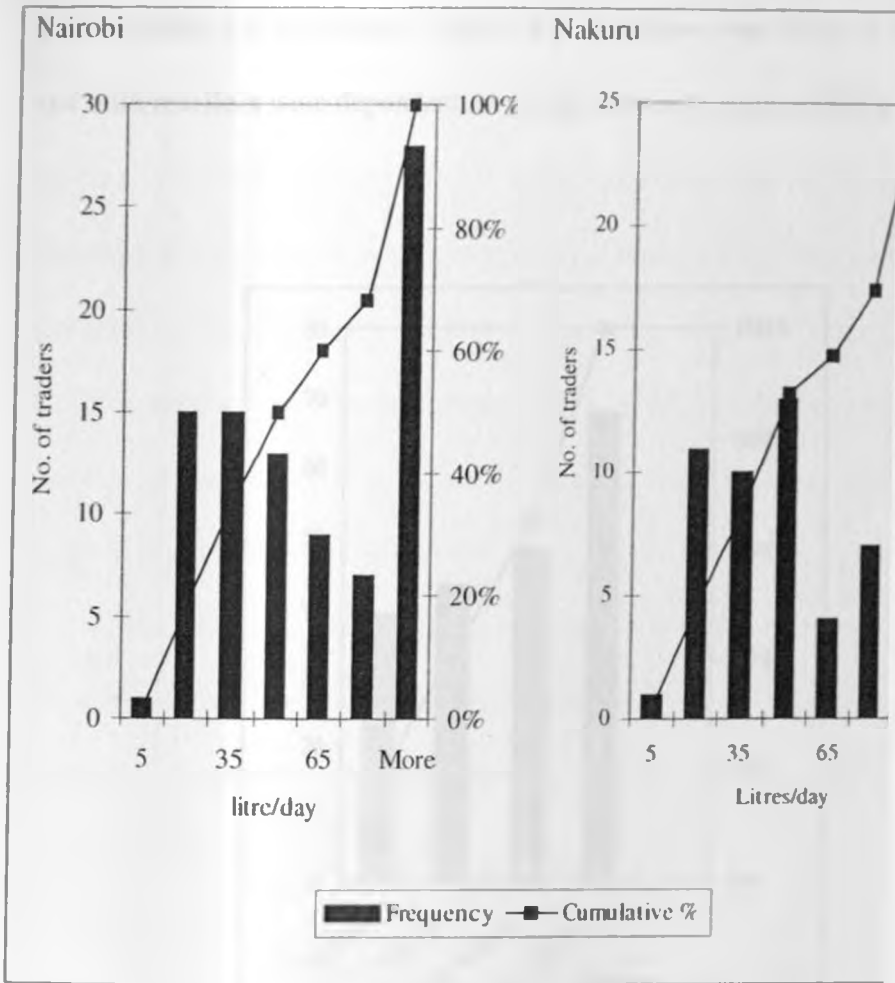
Figure 4-5: Size distribution of R-t-U raw milk traders
Source: Author's compilation from survey data

Due to small sizes of operations, the traders are dependent

motorised transport. Figure 4-6 shows that about 40 percent of the

traders interviewed in the study area transported milk on foot or by bi

expected that the quality of motor-roads did not have much influence

percent of R-t-U raw milk traders since these modes of transportation

essarily flow on motorways. Investigations in Nakuru indeed showed

on bicycles travelled along paths that led more directly to the urban m

tive to motorways and whose travel distance was, therefore, shorte

travel distance on motorways. Figure 4-6, also shows that about 24 % of R-t-U raw milk resellers were dependent on public transport vehicles (PSV).
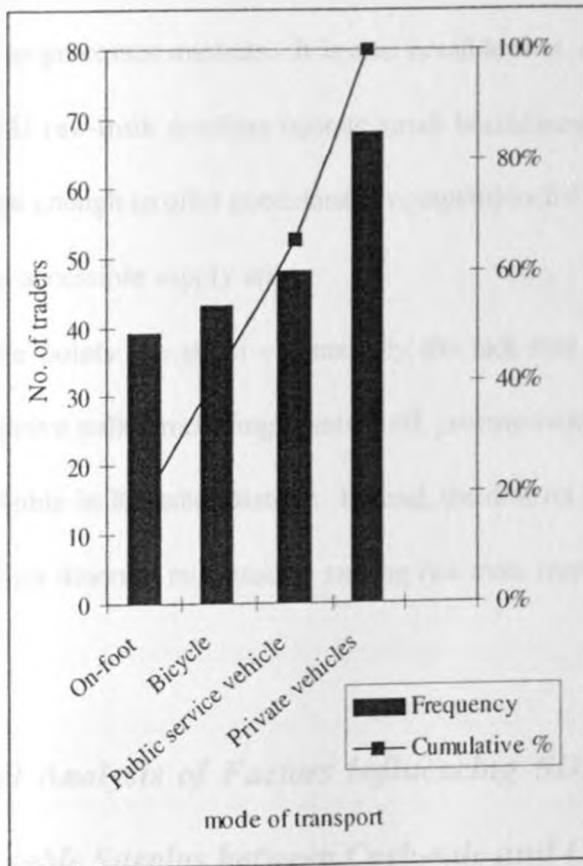
Figure 4-6: Types of modes of transport used by R-t-U raw milk traders
Source: Author's compilation from survey data

Small sizes of operations, coupled with the high dependence on the modes of transportation discussed above imply two things: (i) the cost of transporting milk over long distances may be too high relative to the values of the businesses operated by a major segment of R-t-U reseller market: (ii) the geographical reach of supply markets may be constrained by the physical limitations imposed by the modes of transport used by the major segment of R-t-U reseller

markets. These implications in turn mean that the larger proportion of R-t-U re-seller markets can only operate profitably within easy reach of milk procurement sources. This, coupled with the structure of the market further implies the possibility that R-t-U traders have targeted easily accessible milk supply areas, leaving peripheral areas to processor markets. It is also possible that, even though individually the R-t-U raw-milk resellers operate small businesses, combined, their activities are large enough to offer considerable competition for processors and to push them to less accessible supply areas.

The above points are given credence by the fact that apart from dairy farmers' co-operative milk-processing plants, milk procurement by private processors was negligible in Kiambu District. Instead, the district was a major procurement source for itinerant milk traders serving raw milk markets in the city of Nairobi.

4.7 Empirical Analysis of Factors Influencing SDF's Allocation of Marketable Surplus between Cash-sale and Credit Markets

From *a priori* assumptions, the relationship between the proportion (θ) of marketed surplus sold through cash-sale market and the amount of marketed surplus (q) is expected to be negative. This follows from the perishability and the daily production flow of milk, which implies that the larger the amounts of marketable surplus, the less attractive the markets that do not promise guaranteed outlets for marketable streams of milk and the greater the investments in market outlets that offered such guarantees.

Age of the head of the household may influence household's market-outlet choice behaviour in a major way. A young farmer is likely to be at the life-stage where he/she is making major investments on the farm. Alternatively, he may have school-going children. Hence, households headed by younger persons are more likely to prefer lump-sum liquidity flow to spot-cash payments. Further, younger farmers are more likely to be open to new forms of exchange and more aggressive in seeking new markets and taking risks. Older farmers may still be influenced by the expectations created by the regulated formal markets of the 70s and 80s, which might overvalue, in market terms, the positive elements of selling through dairy farmers' co-operatives.

Similarly, higher educational levels are expected to increase willingness to engage in credit-based contracts, *ceteris paribus*. As distance from market centre increases, smallholders are expected to use cash-sale markets more, since the enforcement of credit based sales becomes more problematic.

Choice of payment mode, once an outlet is chosen, was expected to vary with the structure and size of family. Producer households with school-age children are more likely to prefer lump-sum liquidity flow to facilitate payment of school-fees and similar payments. On the other hand, milk consumption in producer households with younger children and infants is higher and marketable surplus is more likely to be sold in the higher return cash market. Since the penalty for not being able to sell milk is for one self to consume it, such households may be relatively less concerned about the risk of not having a market outlet available in the glut season.

4.7.1 Results and Discussions of the Payment Mode Choice Model

The Tobit model expresses the proportion of marketed surplus that a farm household i will sell to cash-sale markets. As explained earlier, Tobit models separate the likelihood of undertaking an action from the level of the action. The parameter coefficients express the marginal change in the proportion of marketable surplus sold to cash-sale markets given a unit change in the respective variates, *ceteris paribus*. The results also show both the conditional and unconditional effects.

Parameter estimates for the model[16] are reported in Table 4.14. The overall model fit was good (Wald chi^2=1996.12; prob>chi^2=0.000). The likelihood ratio test indicates that panel-level variance component (rho) was significantly different from zero (chi^2=1773.81; prob>chi^2>0.000). Overall, the model results lend support to the *a priori* hypotheses regarding payment mode and allocation of milk between cash-sale and on-credit markets. As expected, the size of marketable surplus (β=-0.64; p=0.00), number of children aged between 9 and 14 years (β=-1.22; p=0.00) and the number of household members aged between 14 and 22 years had significant negative effects on the proportion of milk sold in the cash-sale markets. There is also strong evidence that age of the head of household (β=0.03; p=0.00), distance to the nearest main road (β=0.22; p=0.00), and the number of children below 9 years of age (β=0.19; p=0.00) had a significant positive effect on the proportion of milk sold in the cash-sale markets. However, holidays (β=0.03; p=0.61) and years of schooling completed (β=-0.1; p=0.42)

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[16] The model was solved using the **xttobit, re** command of STATA 6.0.

were not significantly related to payment-mode choice, although the evidence was generally in the predicted direction. A unit increase in the number of children aged between 9 and 14 decreased the proportion of sales in the cash-sale markets, subject to being censored, by 20% and the probability by 12% while a corresponding increase in the number of household members aged between 14 and 22, increased the proportion by 12% and the probability by 7%. A unit increase in marketable-surplus decreased the proportion of milk marketed in cash-sale markets by 11% and the proportion by 6%. Distance to the nearest main road was also found to play an important role in determining the choice of mode of payment; a unit increase in the distance decrease the proportion by 4% and the probability by 2%.

On the whole, these results suggest that marketable surplus, the structure and size of producer family, and the accessibility to milk sales/delivery point were by far the most important factors influencing SDF allocation of milk between cash-sale and credit markets. The negative association of the quantity of marketable surplus with cash-sale markets is attributable to the fact that production of large amounts of the highly perishable commodity demands relatively reliable market outlets of the kind promised by on-credit markets. As suggested in chapter 3, on-credit sales contractual arrangements implicitly imply repeat deals, thus, guaranteeing the farmer of a market outlet at least for the period of one unit of the contractual period (e.g., for a month, fortnight, etc). Repeat deals in turn implicitly imply a routine operating procedure, which as already discussed is cru-

cial given the highly repetitive task of milk sales activities. Besides, large marketable surpluses may demand the services of permanent in order to facilitate specifications of the labourer's daily routines as well as to ease monitoring of his/her duty performance.

Table 4-14:Estimated Random-effects-Tobit Model Results for The Smallholder Dairy Farmers' Choice of Mode of Payment

Variable	Coef.	Std. Err.	P>|z|	Marginal Effects at Observed Censoring Rate		
				Y/δX*	Y/δX**	pr***
Price difference	0.09	0.01	0.00	0.01	0.01	0.01
Marketed surplus	-0.64	0.02	0.00	-0.06	-0.11	-0.06
Age of head of household	0.03	0.00	0.00	0.00	0.00	0.00
Distance to market centre	0.22	0.01	0 00	0.02	0.04	0.02
Education	-0.01	0.01	0.42	0.00	0.00	0.00
Children aged below 9 yrs	0.19	0.02	0.00	0.02	0.03	0.02
Children aged >9 yrs ≤14 yrs	-1.22	0.04	0.00	-0.11	-0.20	-0.12
Children aged >14 years ≤22	-0.73	0.03	0.00	-0.07	-0.12	-0.07
Household members > 22 yrs	0.12	0.02	0.00	0.01	0.02	0.01
Access to Nairobi	-0.88	0.05	0.00	-0.08	-0.14	-0.09
Access to Urban Market	-1.42	0.07	0.00	-0.13	-0.23	-0.14
Access to a Coop/farmer group	0.15	0.02	0.00	0.01	0.02	0.01
Holiday	0.03	0.07	0.61	0.00	0.01	0.00
Rainfall	0.00	0.00	0.41	0.00	0.00	0.00
Constant	0.07	0.16	0.65	0.01	0.01	0.01
/sigma_u	1.66	0.04				
/sigma_e	1.69	0.04				
rho	0.49	0.01				

Notes: N = 16182

Log likelihood =-8363.2741; Wald chi2 (71) 1433; prob>chi2=0.000,

Likelihood ratio test of sigma_u=0: Likelihood ratio test of sigma_u=0: chi2(1)   =8892.77; prob > chi2=0.000

* Unconditional Expected Value

** Conditional on being Uncensored

*** Probability Uncensored

1476 uncensored observations

9836 left-censored observations

4876 right-censored observations

Source: Computed from survey data

The allocation of milk between cash and credit market depended also on the structure and size of the family. The negative association of the number of children aged between 9 and 22 years with cash-sale markets is indicative of the correlation between the need for lumpy liquidity flows and the choice of payment mode. Households with school-age-children appear less likely to favour cash-sale markets.

4.8 Discussion

Previous studies provide evidence regarding the importance of regional consequences and of individual and household's socio-economic attributes on the behaviour of economic agents. Rubin and Perloft (1993), for example, identify the influential impacts of individual worker's demographic characteristics and area-specific variables in the decision whether to work piece- or time-rate agricultural jobs. Goodwin and Schroeder (1994) showed that human capital accumulation had significant influences over the adoption of forward-pricing techniques by farmer in Kansas. Further evidence to support the importance of individual's demographic variables is found in Gart *et al* (1992). They offer evidence that farmer-specific socio-economic attributes were important modifiers of information preference by farmers in Ohio.

The studies cited above take the socio-economic attributes of the economic agent as having direct effects on choice decisions. The present study add to an increasing body of empirical literature that have extended this line of research by proposing complementary sources of influence on the behaviour of

economic agents. The study proposes that the regional context in which an economic agent finds himself interacts with his socio-economic attributes to delimit his opportunities and to define his constraints. The resultant complex of interactions imposes certain costs and risks on the agent that in turn determine his economic choices. Specifically the primary goal of the study is to investigate how the transaction costs (TCs) and market outlet risks (MORs) imposed by the complex interaction of market- and farm-level circumstances of a smallholder dairy farmer-household in central Kenya influences the household's participation in domestic milk markets.

Our approach to conceptualising the determinants of the economic agent's choice-decisions is founded in the 'New Institutional Economics' which has provided new insights to explain observed exchange institutions. Further, our findings agree with those of a growing body of empirical research. The approach agrees with the conjecture by Holdens *et al* (1998) and de Janvry *et al* (1991) that there is no reason to suppose that all economic agents face identical TCs and risks. If this were the case, there would only be one choice-decision offering the highest benefits to all economic agents engaged in the exchange of particular goods and services. The conjecture has been confirmed in a number of agricultural marketing studies. In an analysis of the effects of TCs on grain market institution in Ethiopia, Gabre-Madhin (1999) has shown that costs associated with searching for a trading partner varied across traders, according to where trader operated, the type of transaction they conducted, and their individual characteristics.

Hobbs (1996), in analysis of choice of marketing channel by UK cattle farmers, finds significant impact of TCs and MORs over farmers' choice of market outlet and over their allocation of cattle sales between markets outlets. She finds evidence that monitoring costs arising from grade uncertainty have a positive impact on the proportion of cattle sold through auction, relative to direct-to-packer sales. Conversely, reductions in costs of negotiating with packers, resulting from good relationship between the farmer and procurement officers of their local packing plant, has a positive impact on the proportion sold to packers. Further, she finds that, other things being equal, an increase in the risk that cattle offered for auction may not reach the producer's reservation price and would thus have to be transported back to the farm to be sold at a latter date, has a negative impact on the proportion sold through auction. As regards costs of negotiating auction sales, she finds evidence that an increase in the opportunity costs of attending sale has a negative impact on the proportion sold through auction.

Hobbs (1996) has also shown that the characteristics of the farm have significant influence on farmer's market behaviour. She finds that differences in scales of operation across farms, as reflected by average lot sizes in which cattle are sold, is an important factor explanatory of differentials in farmers market behaviour. Size, she demonstrates, has a negative impact on the proportion sold through auctions. Similarly, the composition of the sales-herd has important influences over market behaviour; presence of bulls in the herd increases the proportion sold through auction. Also important is membership to a farmers' livestock organisation. Incentive arrangements contracted on behalf of member-

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farmers of such organisations and packers makes sales to the latter relatively more attractive as compared to sale through auction.

A number of studies have also demonstrated that observed contractual arrangements are institutional responses to TCs and associated risk. For instance, Heide and John (1990) have demonstrated that the utility of relational contractual arrangement in industrial markets derives from the ability to safeguard relation-specific investments and to facilitate adaptation to uncertainty. Ganesan (1994) has demonstrated that trust and dependence play key roles in determining long-term orientation of both retail and buyer and their suppliers. In an assessment of U.S. food industries, Frank and Henderson (1992) have shown that TCs are a primary motivation to vertically coordinate via non-market arrangements.

4.9 Summary

This chapter presents and discusses the results of the study. First, the chapter describes the principal aspects that characterised the marketing system in which the smallholder dairy farmers (SDF) in central Kenya operated during the period of the study. The results show that the system is characterised by multiple milk market-outlets and that different modes of payment (reflected in differentials in time patterns of payment) coexisted within the same market outlet. The results also reveal certain differences among the districts' marketing structures that suggest that the substitution possibilities, which exist between different market outlets for the individual farm-households, may vary from one production area to another.

Next, the chapter examines several factors that are important in determining producer milk prices in the study areas. We take the notion that the contractual arrangements entailed in sales of milk by the SDF can be perceived as comprising "utility bundles" differentiated by a number of separable qualitative attributes. The dairy farm-household chooses the arrangement that offers the highest net benefits. We adopt the monetary price per unit of milk as a common denominator in making a comparison of values among the contractual arrangements on offer to the SDF. The analysis of market price formation for the utility bundles (i.e., value formation for the utility bundles) then proceeded by expressing the observed producer milk prices as a function of the of the separable attributes of observed contractual arrangements. In order to control for unobserved time-invariant effects, we estimate a fixed-effects model. Results of the model suggest that time pattern of payment had significant influences on price levels. We interpret this result as evidence of differences in transaction costs (TCs) and market outlet risks (MORs) among the different modes of payment. The differentials in prices are interpreted as revealing the compensating differentials across the contractual arrangements with respect to market search costs, market assurance, and savings utility.

Finally, the chapter investigates the relationship between the household's socio-economic attributes and participation in the milk markets. The results offer significant evidence that the attributes have crucial influences over the household's choice of market outlet, and over the household's allocation of milk between cash-sale and credit market.

Chapter 5

Summary, Conclusion and Implications

5.0 Overview

This thesis posits that the marketing system in which the farmer operates, in interaction with socio-economic factors specific to his household, delimits his potential market opportunities and defines his constraints. Transaction costs (TCs) and market outlet risks (MORs) imposed on the farmer by the complex interactions of market- and farm-level circumstances determine market exchange conditions for the farmer and, hence, his/her market outlet choices. Using Kenya's smallholder dairy marketing as a case study, this thesis has assessed the influence of TCs and MORs on dairy farmer's market participation with respect to market-outlet choice behaviour.

The thesis starts with a critical review of the evolution of Kenya's dairy marketing policy since the introduction of commercial dairying in the country at the beginning of the 20th century. The importance of history in conditioning future institutional structures makes such a review particularly crucial in understanding and placing the prevailing marketing system in proper perspective. Economic actors, including organisations, receive special attention as the prime instigators of institutional changes. Our main explanations for institutional changes at each identified turning point have focused on the conditions under which the changes emerged, including the social forces that influenced the specific forms of change.

The review is followed by a descriptive analysis, based on primary data, of TCs and MORs considerations that are now shaping SDF's participation in dairy-products markets. The complex interactions of market-level factors with household-specific socio-economic attributes are seen as constituting the starting point in the analysis of the farmer's market-outlet choice behaviour. Since market-outlet choice behaviour is not expected to be in a steady state, the study uses longitudinal farm-level data.

5.1 Summary of Findings

Documented evidence traces the origins of Kenya's formalized dairy marketing institutional and organisational frameworks to the colonial era. A notable historical development is the establishment of the Kenya co-operative creameries limited (KCC) in 1931, an organisation that was to become the major agent of institutional change in the industry for the next six decades ending in 1992. However, what emerges as particularly important in the context of policy evolution is the observation of how pressure stemming from economic changes has over the years interacted with socio-political realities to induce institutional changes.

The KCC was itself established under the pressures of the great depression of the 1930s. Before 1931, Kenya's marketing of dairy products was mainly organised along a few area-based co-operative societies that operated independent of each other. Production, which was the preserve European (British mainly) of settler farmers, was mainly export-oriented. The advent of the depression and consequent collapse of the export markets forced the farmers to redirect their in-

terest to the domestic market. However, demand in the domestic market was low — a situation mainly attributed to colonial discriminative policies that created and reinforced a highly concentrated development pattern in which the indigenous people, who comprised the larger part of the domestic population, had little role in commercial activities and, hence, very low purchasing power.

The area-based co-operative creameries thus found themselves forced into a situation characterized by distributional conflicts in the sharing of a small market. This prompted them to engage in co-operative negotiations aimed at formulating appropriate methods of co-ordinating the market to escape the conflicts. The ensuing consultations resulted in a resolution to merge the area-based creameries to form the KCC. This, interpreted within an institutional context, emerges as a strategic structural change to introduce hierarchy between the primary societies and an apex co-operative in order to provide the executive leadership requisite under the emerged voluntary co-operation. The net effect was that the dairy farmers were, under the co-ordination of the KCC, able to pursue regulatory measures designed to prevent disruptive competition, and to stabilize prices. They were also able to reform the measures with changing circumstances. The KCC also provided scope for representing farmer's problems to the administrative authority.

The next significant change was triggered by imperial policy change with respect to the economic position of its colonies. In the early 1950s, the imperial government introduced import substitution industrialization (ISI) in the colony. This required a large and growing local market. Accordingly, a case was suc-

cessfully advanced for intensification of agricultural production, including commercial dairying, on African farms. The resultant structural change in the dairy industry prompted the KCC to seek statutory protection. This led to the enactment of the Kenya Dairy Industry Act in 1958. Under the Act, a state regulatory agency, the Kenya Dairy Board (KDB) was instituted.

The Act also zoned the country into scheduled and unscheduled areas. Scheduled areas, which tended to correspond closely to urban areas, were designated as areas where only formal marketing channels would operate. What is more notable, however, is that the KDB appointed the KCC its prescribed agent in procurement, processing, and distribution of milk in the scheduled area. This in effect, coupled with a quota pricing system used by KCC since 1954, granted the KCC preferential access to urban markets, thus reinforcing the dominance of the dairy industry by large-scale farmers.

With respect to the post-independent period, the Act and its attendant regulatory and implementation organisational frameworks were the most remarkable developments to emerge from the colonial era. These provided the context within which the post-independent dairy policies were fashioned mainly through a process of incremental modifications. A basic goal of the new government was to improve the economic position of the indigenous people. With respect to the dairy industry, the government adopted a dairy marketing policy intended to achieve greater market participation by all dairy farmers. Statutory price controls, implemented through a single-channel marketing system, were deemed the best way to achieve the objectives.

As happened in most such situations, the institutions and organisations inherited from the colonial administration (i.e., the Kenya Dairy Industry Act, the KDB and the KCC) were identified as the vehicles through which to implement the new policy. In consequence, the KCC's legal monopoly was re-emphasised. Subsequently, the KCC acquired a more public status and was increasingly entrusted specific social and economic roles. Major among these was that the KCC entered an implicit contract with dairy producers, committing itself to accept all milk delivered to its plants, subject to minimum quality specifications, and to pay for all the deliveries, promptly and regularly at month-end.

A consequence of the changes discussed above was that the dairy farmers invariably found their autonomy of action reduced and actions that might have been open to them in dealing with pricing and market sharing became foreclosed. However, the system emerging from the changes was not sustainable over the long run. With time, the KCC was plagued with inefficiency problems culminating in persistent breaches of promissory obligation to pay promptly for milk deliveries. As a result, it started falling into arrears with farmers' payments, thereby prompting calls for reforms of the marketing system. Moreover, this coincided with global changes in the perspective regarding the extent of government control of and intervention in production and marketing processes. Within the context of the resulting broad structural adjustment programs (SAPs), a decision to liberalise the industry was reached in 1992.

By the time of this study, considerable strides had already been made towards liberalisation of the industry from the hitherto single-channel formal mar-

keting system. However, a lot remained to be understood about the marketing activities at the first point of sale. Using descriptive analysis, the study has indicated the major characteristics of the system, including the following:

(i)   The system offers the SDF a variety of market outlets, including:

   • Local neighbourhood markets (LNM) comprising deficit neighbouring households, and, shops, kiosks, milk bars, hotels, restaurants, and institutions (schools, etc) within the areas of production;

   • Rural-to-urban raw milk resellers (R-t-U) comprising itinerant raw milk traders procuring milk from SDF to retail to final consumers in urban consumption centres, and wholesalers buying to resell to processors, itinerant traders, and urban-market-based raw milk traders (i.e., milk bars, shops, kiosks, etc);

   • Rural-to-urban-bulking-cum-transporters of milk (B-c-T) comprising collective dairy marketing groups (CDMG), private bulking-cum-transporting agents, and, milk processors;

(i)   The system also offers the SDF a variety of modes of payment comprising spot-cash, repeat-cash weekly, fortnightly, and monthly.

An interesting observation of the study is that although the participation of Dairy Farmers' Co-operative Societies (DFCS) seems to be on the decline, other forms of collective dairy marketing have emerge. These can be distinguished between those forming through the initiative of the farmers and those initiated by private entrepreneurs. The findings clearly illustrates that collective marketing services can either, be provided by farmers' enterprises (i.e., co-

operatives/ self-help groups), or by private agents.

Next, the study has sought to assess the utility attached by the SDF to the different modes of payments. We took the assumption that the contractual arrangements obtaining for the SDF comprise "utility bundles" that are separable (at least conceptually). In this context, being able to choose a preferred mode of payment adds to the utility of the exchange. As is usual in such comparisons, we have used money, in this case the monetary price per litre of milk, as a common denominator in the measurement of value. We have used a price decomposition model based on ordinary least squares (OLS) regressions to make the assessment. The results of the model provide strong evidence that unit prices vary significantly by market-outlet type and, within each market-outlet type, by modes of payment. Spot-cash prices are generally higher than prices paid in transactions involving the other time patterns of payment.

In the context of the study, the price differentials are interpreted as revealing compensating differentials across the contractual arrangements with regards to market search, market assurance and savings utility. Spot-cash markets for the highly perishable commodity expose the SDF to greater risks of non-sale. On the other hand, contractual arrangements involving payments at regular fixed schedules implicitly define repeat contracts that 'routinize' milk sales/delivery tasks, offer greater assurance to the farmer for subsequent sales, as well as creating savings utility. Accordingly, the price differentials, across modes of payments, is an indication of the money that the SDF are willing to pay for benefits of one mode of payment relative to the other modes. The results suggest that relative to spot-

cash payments, the SDF are willing to accept 18 percent less for fortnightly payments, 10 percent less for cash-repeat arrangements, 7 percent less for monthly payments, and 5 less for weekly payments.

The above findings suggest the general order of preference attached by SDF on the different modes of payment. However, analysis of the relative prevalence of the modes across market outlets suggests that the decision to sell on credit is linked to the risk structure of the market outlets, both in terms of reliability throughout the year and the likelihood of being paid at the end of the contract. The results suggest that low credit risks and steady customers were supplied for less, and settled on credit. High credit risks or only occasional customers needed to pay cash and higher per unit prices. Large purchasers, such as cooperatives and processors, paid the lowest per unit prices (about 4 percent below prices paid by household consumers paying on credit). This is attributable to the fact that they can consistently buy the entire daily household output and purchase in glut times as well as during the dry season. If all these dimensions of price are collapsed to the price of milk by location, it is not surprising that there is quite a bit of apparent lack of market integration. The conclusion is not that the markets per se are not integrated, but that producing households face different transactions costs and may have differential perceptions of risks.

Further analysis suggests that household-specific socio-economic factors had significant conditioning effects on preferences for the modes of payment. Household-specific transaction costs are proxied by observable household socio-economic characteristics, including demographics, education, and market acces-

sibility. Random-effects logit and Tobit models are used to assess the relative influence of TCs and MORs on the choice of market outlet (s) and on the allocation of marketed surplus between cash and credit sales. The results suggest that younger, more educated producers were more likely to accept sales on credit. Older producers with more experience but less formal education were more likely to sell for cash rather than credit, *ceteris paribus*. The results also suggest that the desired liquidity flow was an important criterion for market-outlet choice behaviour. Where liquidity flow was required in lumps to match lumpy expenditures, on-credit sales were preferred.

5.2 *Conclusions and Implications*

A basic conclusion emerging from the review of the dairy industry is that a critical analysis of the events that make up the history of an industry has important implications for understanding the origins and significance of institutions and organisations that have shaped the industry. Our review of the evolution of Kenya's dairy marketing institutions suggests that the explanations of change must go beyond the examination of economic conditions. It must also examine social and political forces and how these interact with economic forces to determine both the timing and the specific form of change.

Further, the study clearly demonstrates that adopting a TCs perspective in marketing research does help achieve a better understanding of smallholder market behaviour. An important conclusion arising from the study is that smallholder's market-outlet choice behaviour is not based on the levels of price alone;

it is also influenced by some other important contractual elements of exchange. This has important implications for market analysis. Market outlets availed to smallholders by the marketing system should not be compared on the levels of price alone without distinguishing among other important contractual elements of exchange. The comparisons should instead be based on sound and objective theoretical and empirical analysis of differentials in benefits derived by the smallholders from the different contractual arrangements offered by the system. As illustrated by the results, a particularly important contractual element relates to the time pattern of payments. Others include market assurance and savings utility.

Though the activity of dairy farmers' co-operative societies has been on the decline in the last decade, the spontaneous emergence of new and diversified organisational forms of collective marketing clearly implies the continued importance of collective marketing. Collective marketing continues to be the major means of reducing quantity constraints faced by SDF as well as of expanding the farmers' geographical market reach. Evidently, the spontaneity in the emergence of organisational forms different from that which has for years been promoted by the government, imply that exogenously prescribed organisational structures may not be as effective and responsive as farmer-evolved processes. We therefore recommend that government policy should promote an environment that induces farm households to make incremental innovations in organisational types and governance structures appropriate for the diverse market outlet types and modes

of payment. Individual private entrepreneurs should also be encouraged to work closely with the farmers in developing efficient forms of collective marketing.

Bibliography

Abbott, J.C. (1993). Marketing, the Rural Poor and Sustainability. In J.C. Abbott (Ed.), *Agricultural and Food Marketing in Developing Countries.* C.A.B International/ Technical Centre for Agriculture and Rural Co-operation ACP-EEC.

Ahmed, R.H., & Rustagi, N. (1993). Agricultural Marketing and Price Incentive: A Comparative Study of African and Asian Countries. In J.C. Abbott (Ed.), *Agricultural and Food Marketing in Developing Countries.* C.A.B. International/ Technical Centre for Agricultural and Rural Co-operation.

Akerlof, G. (1989). The Market for "Lemons": Quality Uncertainty and the Market Mechanism. In P. Diamond & M. Rothschild (Eds.), *Uncertainty in Economics: Readings and Exercises.* (pp. 235-251). San Diego, California: Academic Press, Inc.

Algers, S., Bergstrom, P., Dahlberg, M., & Dillen, J.L. (1998). Mixed Logit Estimation of the Value of Travel Time. *Working Paper 1998:15, Department of Economics, Uppsala University,*

Allen, D.W. (2000). Transaction Costs. In B. Bouckaert & G. De Geest (Eds.), *Encyclopaedia of Law and Economics.* (pp. 893-926). Chelthenham: Edward Elgar press.

Alston, J.L. (1996). Empirical Work in Institutional Economics: An Overview. In L.J. Alston, T. Eggertsson, & D.C. North (Eds.), *Empirical Studies in Institutional Change.* Cambridge: Cambridge University Press.

Anderson, E. (1988). Transaction Costs as Determinants of Opportunism in Integrated and Independent Sales Forces. *Journal of Economic Behaviour and Organisation, 9,* 247-264.

Anderson, E. (1996). Transaction Cost Analysis and Marketing. In J. Groenewegen (Ed.), *Transaction Cost Economics and Beyond.* Boston: Kluwer Academic Publishers.

Barbara Grosh. (1994). Contract Farming in Africa: an Application of new Institutional Economics. *Journal of African Economics, volume 3 Number 2. October,* 231-261.

Barzel, Y. (1989). *Economic Analysis of Property Right.* Cambridge: Cambridge University Press.

Bates, R.H. (1981). *Markets and States in Tropical Africa: The Political Basis of Agricultural Policies.* Berkeley: University of California Press.

Bates, R.H. (1989). *Beyond the Miracle of the Market.* Cambridge: University Press.

Bates, R.H. (1995). Social Dilemmas and Rational Individuals: An Assessment of the New Institutionalism. In J. Harriss, J. Hunter, & C.M. Lewis (Eds.), *The New Institutional Economics and Third World Development.* London and New York: Routledge.

Bergadall, T.D. (1993). *Methodology of Active Participation: Experience in Rural Development from East and Central Africa.* Nairobi: Oxford University Press.

Bergen, M.. Dutta, S., & Walker, O.C.J. (1992). Agency Relationships in Marketing: A Review of the Implications and Applications of Agency and Related Theory. *Journal of Marketing, 56,* 1-24.

Binswanger, H.P., & Rosenzweig. M.R. (1984). Behaviour and Material Determinants of Production Relations in Agriculture. *Journal of Development Studies, 22(3),* 503-539.

Boahen A.Adu. (1987). *African Perspective on Colonization.* Baltimore: The John Hopkins University Press.

Bressler, R.G., & King, R.A. (1970). *Market Prices and Inter-regional Trade.* Network: John Wiley and Sons.

Bromley, D.W. (1989). *Economic Interests and Institutions: The conceptual Foundations of Public Policy.* Oxford: Blackwell.

Bromley, D.W. (1993). Reconstituting Economic System: Institutions in National Economic Development. *Development Policy Review, 11,* 131-151.

Bryant, W.K. (1990). *The Economic Organisation of the Household.* Cambridge: University Press.

Carlsson F. (1999). The Demand for Intercity Public Transport: The Case of Business Passengers. *Working Paper in Economics no 12. Department of Economics Goteborg University,*

Casel C.M., Johansson, P., & Palme, M. (1996). A Dynamic Discrete Choice Model of Blue Collar Worker Absenteeism in Sweden 1991. *Stockholm School of Economics Working Series in Economics and Finance, 129.*

Cheung, S.N.S. (1989). Transaction Costs, Risk Aversion, and the Choice of Contractual Arrangements. In P. Diamond & M Rothschild (Eds.), *Uncertainty in Economics.* (pp. 377-398). San Diego, California: Academic Press, Inc.

Cheung, S.N.S. (1992). On the New Institutional Economics. In L. Werin & H Wijkander (Eds.), *Contract Economics.* (pp. 48-65).

Coase, R.H. (1991). 1991 Nobel Lecture: The Institutional Structure of Production. In O.E. Williamson & S.G. Winter (Eds.), *The Nature of the firm.* New York: Oxford University Press.

Conelly, T.W. (1998). Colonial Era Livestock Development Policy. *World Development, 26,* 1733-1748.

Cornick, J., Cox, T.L., & Gould, B.W. (1999). Fluid Milk Purchase: A multivariate Tobit Analysis. *American Journal of Agricultural Economics, 76,* 74-82.

Coughlin, P. (1992). Development Policy and Inappropriate Product Technology: The Kenyan Case. In P. Coughlin & G.K. Ikiara (Eds.), *Industrialization in Kenya: In Search of a Strategy.* (pp. 143-163). London: East African Education Publishers Ltd

Cramer, J.S. (1991). *The Logit Model: An Introduction for Economists.* Newcastle upon Tyne: Atheneaum Press Ltd.

Czada, R.M. (1998). Interest Groups, Self-Interest, and the Institutionalisation of Political Action. In A. Heritier & H. Keman (Eds.), *Institutions, and Political Choice: On the Limits of rationality. Amsterdam.* (pp. 229-256). VU press.

DANIDA, & Ministry of Livestock Development. (1990). <u>Kenya Dairy Master Plan.</u> (un pub)

DANIDA., & Ministry of Agriculture. (1995). <u>Agricultural Sector Review: The role and Functions of Agricultural Co-operatives in a Competitive Market Economy.</u> (un pub)

de Janvry, A., Fafchamps, M., & Soudoulet, E. (1991). Peasants Household Behaviour with Missing Markets: some Paradoxes Explained. *The Economic Journal, 101,* 1400-1417.

de Jassay, A. (1989). *Social Contract Free Ride: A Study of the Public Goods Problems.* Oxford: Clarendon Press.

de Wolff, T., Staal, S., Kruska, R., Ouma, E., Thornton, P., & Thorpe, W. (2000). Improving GIS derived Measures of Farm Market Access: An Application to Milk Markets in the East African Highlands. (un pub)

Deaton, A. (1997). *The Analysis of Household Surveys: a microeconomic approach to development policy.* Boltimore: The Johns Hopkins University Press.

Deichmann, U. *Accessibility Indicators in GIS.* 1997. A Report Prepared for United Nation Statistics Division, Department of Economic, and Policy Analysis, New York.

Delgado, C. (1997). The Role of Smallholder Income Generation from Agriculture in Sub-Saharan Africa. In L. Haddad (Ed.), *Achieving Food Security in Southern Africa.* Washington, D.C.: International Food Policy Research Institute.

Doner, R.F., & Schneider, B. (2000). *The New Institutional Economics, Business, and Development.* Geneva: International Institute of Labour Studies, ILO.

Doney, P.M., & J.P.Cannon. (1997). An Examination of the Nature of Trust in Buyer-Seller Relationships. *Journal of Marketing, vol. 61,* 35-51.

Dwyer, R.F., Schurr, P.H., & Sejo, O. (1987). Developing Buyer-Seller Relationships. *Journal of Marketing, vol. 51,* 11-27.

Eggertsson, T. (1990). *Economic Behaviour and Institutions.* New York: Cambridge University Press.

Eggertsson, T. (1996). A Note on the Economics of Institutions. In L.J. Alston, T. Eggertsson, & C. North (Eds.), *Empirical Studies in Institutional Change.* (pp. 6-24). Cambridge University Press.

Esawaran, M., & Kotwal, A. (1985). A Theory of Contractual Structure in Agriculture. *American Economic Review,* 352-365.

Fafchamps, M., de Janvry, A., & Sadoulet, E. (1995). *Transaction Cost, Market Failures, Competitiveness, and the State, in Agricultural Competitiveness: Market Forces and Policy.* England: Dartmouth Publishing Company.

FAO/World Bank Cooperative Programme. (1991) Kenya Dairy Development Project. (unpub)

Fitzhugh, H.A. (1998). Global agenda for livestock research. *British Society of Animal Science Occasional Publication,* 11-17.

Frank, S.D.& Henderson, D.R. (1992). Transaction Costs as Determinants of Vertical Coordination in the U.S. *American Journal of Agricultural Economics,* (Nov) 941-949.

Freeland, G. (1998). Setting Donor Research Agenda. *British Society of Animal Science Occasional Publication,* 5-10.

Friedman, D.D. (2000). *Law's Order: What Economics has to do with Law and why it Matters.* Princeton University Press.

Ganesan, S. (1994). Determinants of Long-Term Orientations in Buyer-Seller Relationships. *Journal of Marketing, vol. 58,* 1-19.

Garbarino, E., & Johnson, M.S. (1999). The Different Roles of Satisfaction, Trust, and Commitment in Customer Relationships. *Journal of Marketing, vol. 63,* 70-87.

Gabre-Madhin, E.Z. Transaction Costs and Market Institutions: Grain Brokers in Ethiopia. Paper presented at the annual meetings of the American Agricultural Economics Association, Tampa, Florida, USA, January 31 August 3, 2000,

Gockowski, J.J., & D.Baker. Targeting Resource and Crop Management Research through an Eco-regional Methodology for the Humid Forest of Central and Western Africa. Paper presented at 1996 Biennial Meeting of Rockefeller Social Science Research Fellows, August, 15, 1996, Nairobi

Goetz, S.J. (1995). Markets, Transaction Costs, and Selectivity Models. In J.S. Gregory (Ed.), *Prices, Products, and People; Analysing Agricultural Markets in Developing Countries.* Boulder, Colorado: Lynne Reinner Publishers Inc.

Goodwin, B.K., & Schroeder, T.C. (1994). Human Capital, Producer Education Programs, and the Adoption of Forward-Pricing Mthodes. *American Journal of Agricultural Economics, 76,* 936-947.

Greene, W.H. (1997). *Econometric Analysis.* New Jersey: Prentice-Hall, inc.

Griffiths, W.C.& Judge, J. H. (1993). *Learning and Practising Econometrics.* Wiley.

Grossman, S.J., & Hart, O.D. (1986). The Costs and Benefits of Ownership: A Theory of Vertical and Lateral Integration. *Journal of Political Economy, 94,* 691-719.

Haessel, W. (1975). The price and income elasticities of some consumption and marketed surplus of food grains. *American Journal of Agricultural Economics., 57,* 111-115.

Heide, J.B., & John, G. (1990). Alliances in Industrial Purchasing: The Determinants of Joint Action in Buyer-Supplier Relationships. *Journal of Marketing Research, vol. XXVII,* 24-36.

Henderson J.M., & Quandt, R.E. (1980). *Microeconomic Theory.* McGraw-Hill, Inc.

Hewitt de Alca'ntara, C. (1993). Introduction: Marketing in Principles and Practice. In C. Hewitt de Alca'ntara (Ed.), *Real Markets: Social and Political Issues of Food Policy Reforms.* Geneva: Frank Cass & Co. Ltd.

Hey, J.D., & Peter, J.L. (1987). *Surveys in the Economics of Uncertainty.* Basil Blackwell.

Hills, M.F. (1956). *Cream Country: The Story of the Kenya Co-operative Creameries Limited.* KCC, Nairobi.

Hirshleifer, J., & Riley, J.G. (1979). The analytics of uncertainty and information: An expository survey. *Journal of Economic Literature, 17,* 1375-1421.

Hirshleifer, J., & Riley, J.G. (1992). *The Analytics of Uncertainty and Information.* Cambridge, England: Cambridge University Press.

Hobbs, J.E. (1996). Transaction Costs and Slaughter Cattle Procurement: Process's Selection of Supply Channels. *Agribusiness, 12,* 509-523.

Hobbs, J.E. (1997). Measuring the Importance of Transaction Costs in Cattle Marketing. *American Journal of Agricultural Economics., 79,* 1083-1095

Hoff, K., Braverman, A., & Stiglitz, J. (1993). *The Economics of Rural Organisation: Theory, Practice, and Policy.* Oxford University Press.

Holden, S.T., Taylor, J.E., & Hampton, S. (1998). Structural adjustment and market imperfections: a stylised village economy-wide model with non-separable farm households. *Environment and Development Economics, 4,* 69-87.

Holmstrom. H. (1979). Moral Hazard and Observability. *Bell Journal of Economics,* 74-91.

Hosmer, D.W., & Lemeshow, S. (1989). *Applied Logistic Regression.* New York: John Wiley and Sons.

Hubbard, M (1997). The 'New Institutional Economics' In Agricultural Devel-

opment: Insights and Challenges. *American Journal of Agricultural Economics., 48,* 239-249.

J. Johnson. (1997). *Econometric Methods.*

Jaetzold, R., & Schmidt, H. (1983). *Farm Management Handbook of Kenya, Volume II.* Ministry of Agriculture, Kenya.

Jaffee, S. (1993). Kenya Horticultural Export Marketing: A Transactions Cost Perspective. In J.C. Abbott (Ed.), *Agricultural and Food Marketing in Developing Countries.* C.A.B International/Technical Centre for Agriculture and Rural Co-operation ACP-EEC.

Jaffee, S. (1995). Perishable Profits: Private Sector Dairy Processing and Marketing in Kenya. In S. Jaffee & J. Morton (Eds.), *Marketing Africa's High-value Foods: Comparative experience of an emergent private sector.* Dubuque1A: Kendal/Hunt publishing Company.

Jones, S. (1996). Creating Markets: Food Policy and Agricultural Reform in the Transition. *American Journal of Agricultural Economics, 78,* 810-814.

Kenya. Government. The Dairy Commission of Inquiry Report. Ministry of Agriculture. (1965). DAIRY/INQ/A/64.

Kenya Government. (1965). *African Socialism and its Application to Planning: Sessional Paper number 10.* Nairobi: Government Printer.

Kenya Government. (1979). *Development Plan 1979-1983.* Nairobi: Government Printer.

Kenya Government. (1980). *Economic Prospects and Policies. Sessional Paper No.4.* Nairobi: Government Printer.

Kenya Government. (1982). *Development Prospects and Policies. Sessional Paper No. 4.* Nairobi: Government Printer.

Kenya Government. (1984). *Development Plan 1984-1988.* Nairobi: Government Printer.

Kenya Government. (1986). *Economic Management for Renewed Growth. Sessional Paper No. 1.* Nairobi: Government Printer.

Khols, R.L., & Uhls, J.N. (1985). *Marketing of Agricultural Products.* MacMillan Publishing Company.

Kilungo, J.K., McDermott, J.J., Oluoch, W.K., & Omore, A.O. (1994). Socio-Economics of Smallholder Dairy Production in Kiambu. *The Kenya Veterinarian, 18,* 247-249.

Kish, L. (1965). *Survey Sampling.* New York: Wiley and Sons, Inc.

Kmenta, J. (1986). *Elements of Econometrics.* New York: The Macmillan Company.

Kotler, P. (1988). *Marketing Management; Analysis, Planning, Implementation and Control.* New Jersey: Prentice/Hall inc., Englewood cliff.

Kreps, D.M. (1990). *A Course in Microeconomic Theory.* New York: Harvester Wheatsheaf.

Leys, C. (1975). *Underdevelopment in Kenya: The political Economy of Neo-colonialism.* Berkeley and Los Angeles: University of California Press.

Louise, B.E., & Kurtz, D.L. (1992). *Contemporary Marketing.* Fort Worth, Texas: The Dryden Press.

Lutz, C. (1994). *The Functioning of the Maize Market in Benin: Spatial and Temporal Arbitrage on the Market of a Staple Food Crop.* University of Amsterdam.

Madalla, G.S. (1983). *Limited-dependence and Qualitative Variables in Econometrics.* Cambridge: University Press.

March, J.G. (1988). *Decisions and Organisations.* Basil Blackwell.

Markus, N., Campbell, A.J., & Verbek, A. (1996). Can market-based contracts substitute for alliances in high technology markets? *Journal of International Business Studies,*

Milgrom, P., & Roberts, J. (1990). Bargaining Costs, influence costs, and organisation of economic activity. In J.E. Alt & K. A. Shepsle (Eds.), *Perspectives on Positive Political Economy.*

Mills, C.A. (1989). *Structural Adjustment in Sub-Saharan Africa.* A World Bank Report on a Series of Five Senior Policy Seminar Held in Africa 1987-88.

MOAC, SUA, & ILRI. (1998). The Tanzania Dairy Sub-sector: A Rapid Appraisal. (1998).

MoALDM. (1993). *Kenya's Dairy Development Policy: A strategy Towards the Development of a Self-Sustaining Dairy Sector in Kenya.* Nairobi: MoALDM.

MoALDM. (1997) National Dairy Development Project-Pilot Privatisation Project: Foundation Knowledge on Community Based Private AI service. (unpub)

Monteverde, K., & Teece, D.J. (1982). Supplier Switching Costs and Vertical Integration in Automobile Industry. *Bell Journal of Economics, 13,* 206-213.

Moorman, C., Deshpande, R., & Zaltman, G. (1993). Factors Affecting Trust in Marketing Relationships. *Journal of Marketing, vol. 57,* 81-101.

Morey, E.R., Rowe, R.D., & Watson, M. (1993). A Repeated Nested-Logit of Atlantic Salmon Fishing. *American Journal of Agricultural Economics, 75,* 578-592.

Morgan, R.M., & Hunt, S.D. (1994). Commitment-Trust Theory of Relationship Marketing. *Journal of Marketing, vol. 58,* 20-38.

Muthee A.M. (1995). The Adjustment Gap. MRAS Technical Paper No. 1. Draft. (un pub)

Ngigi. (1995). Liberalisation and Dairy Industry. In Egerton University, Njoro, Kenya. Proceedings of Conference on Towards 2000,

Ngigi, M.W., Delgado, C., Staal, S., & Mbogoh, S. (2000). The Role of Market Outlet in Determining Terms for Milk Sales by Smallholders in Kenya. Paper presented at the annual meetings of the American Agricultural Economics Association, Tampa, Florida, USA, January 31 August 3, 2000,

North, C.D. (1989). Institutions and economic growth: A historical introduction. *World Development, 17,* 1319-1332.

North, C.D. (1990). *Institutions, Institutional Change and Economic Performance.* Cambridge: University Press.

North, C.D. (1995). Five Propositions about Institutional Change. In Knight & Sened (Eds.), *Explaining Social Institutions.* Ann Abor: University of Michigan.

North, C.D. (1996). Epilogue: economic performance through time. In L.J. Alston, T. Eggertsson, & D.C. North (Eds.), *Empirical Studies in Institutional Change.* Cambridge: University Press.

North, D.C. (1984). approaches to the study of institutions. In D.C. Colander (Ed.), *Neoclassical Political Economy.* Ballinge: Cambridge, Mass., USA.

Nyoro, J. (1993). "Production of Horticultural Exports in Kenya" in Proceedings of Conference on Agricultural Exports and Market Development.; Njoro: Egerton University.

Odima, P.A., McDermott, J.J., & Mutiga, E.R. (1994). Reproductive performance of dairy cows on smallholder dairy farms in Kiambu District, Kenya: Design, methodology, and development consideration. *Kenya Veterinarian, 18,* 366-368.

Olson, M. (1971). *The Logic Collective Action: Public Goods and the Theory of Groups.* Cambridge: Harvard University Press.

Omore, A., Arimi, S., Kange'the, E., McDermott, J., Staal, S., Ouma, E., Odhiambo, J., Mwangi, A., Aboge, A., E.Koroti, & R.Koech. (2001). Assessing and Managing Milk-borne Health Risks for the Benefit of Consumers in Kenya. (un pub)

Ostrom, E. (1998). A Behavioural Approach to the Rational-Choice Theory of Collective Action. *American Political Science Review, 92, no. 1,*

Owango, M., Staal, S., Kenyanjui, M., Lukuyu, B., & Thorpe, W. (1996). Liberalisation in the Livestock Industry: Evidence of Impact from Dairy Co-operative Societies in Central Province, Kenya. (un pub)

Reggiani, A. Nijkamp P and Tsang, P. W. F. European Freight Transport Analysis Using Neural Networks and Logit Model. Swedish Working Papers in Economics.

Reiley, H.M., & Staatz, J.M. (1993). Food System Organisation Problems. In J.C. Abbott (Ed.), *Agricultural and Food Marketing in Developing Countries.* C. A. B. International/ Technical Centre for Agricultural and Rural Co-operation ACP-EEC.

Rey. B., Thorpe, W., Smith, J., Shapiro, B., Osuji, O., Mullins, G., & Agyemang, K. (1993). Improvement of dairy production to satisfy the growing consumer demand in Sub-Saharan Africa. International Livestock Centre for Africa. .

Ricketts, M. (1994). *The Economic of Business Enterprise: An introduction to economic organisation and the theory of the firm.* New York: Harvester Wheatsheaf.

Riker, W.H. (1990). Political Science and Rational Choice. In J.E. Alt & K.A. Shepsel (Eds.), *Perspective on Positive Economy.* Cambridge: University Press.

Rindfleisch, A., & Heide, J.B. (1997). Transaction Cost Analysis: Past, Present, and Future Applications. *Journal of Marketing. 61,* 30-54.

RoK. (1995). Agricultural Sector Review. MoALDM; ASIP Secretariat.

Rothschild, M., & Stiglitz, J. (1976). Equilibrium in competitive insurance markets: An essay on the economics of imperfect information. *Quarterly Journal of Economics, 90,* 629-650.

Rubin, D.K., & Perloft, J.M. (1993). Who works time rate. *American Journal of Agricultural Economics, 75,* 1036-1043.

Ruigu, G.M. (1976). Smallholder Milk Production and Marketing: Opportunities and Problems. (un pub)

Ruthenberg, H. (1966). *African Agricultural Production Development Policy in Kenya 1952-1965.* Berlin-Heidelberg-New York: Springer-verlag.

Schnitkey, G., Batte, M., Jones, E., & Botomogno, J. (1992). Information Preference of Ohio Commercial Farmers: Implications for Extension. *American Agricultural Economics Association,* 486-496.

Shaffer, J.D., Michael, T.W., Harold. M.R., & John, S. (1999). Designing Marketing System to Promote Development in Third World Countries. In D.R. Mohan, V. Kumbe, & P. Sunhir (Eds.), *Agricultural Markets in the Semi-Arid Tropics.*

Shelanski, H.A., & Klein, P.G. (1985). Empirical Research in transaction Cost Economics: A Review and Assessment. *Journal of law, Economics and Organisation, 11,* 335-361.

Staal, S., Delgado, C., & Nicholson, C. (1996). Smallholder Dairying Under Transactions Costs in East Africa. *World Development, 25,* 779-794.

Staal, S., & Mullins, G.R. (1996). Dairy Consumption and its Determinants in Coastal Kenya. (un pub)

Staal, S., Chege, L., Kenyanjui, M., Kimari, A., Lukuyu, B., Njubi, D., Owango, M., Tanner, J., Thorpe, W., & Wambugu, M. (1998). Characterisation of Dairy Systems Supplying the Nairobi Milk Market. (un pub)

Streeck, W. (1992). *Social Institutions and Economics Performance: Studies of Industrial Relations in Advanced Capitalist Economies.* London, Newbury Park, and New Delhi: SAGE Publications ltd.

Subramanian, S., Sadoulet, E., & de Janvry, (1994). Structural Adjustment and Agriculture: African and Asian Experience. A Report prepared for FAO, Economics, and Social Development. Paper No. 124,

Swynnerton, R.J.M. (1954). *A Plan to Intensify the Development of African Agriculture in Kenya.* Nairobi: Government Printer.

Taylor, R.D., & Pasto, J.K. (1968). An Economic Model for Integrated and multiple Pricing Based on Maple Syrup Industry. *Agricultural Economic Research, 20,*

Thompson, A. M. (1991). Institutional Changes in Agricultural Product and Input Markets and their Impacts of Agricultural Performance. A report prepared for Policy Analysis Division, FAO. Rome.

Timmer, C.P. (1996). Liberalization of agricultural markets in low-income economies: Discussion. *American Journal of Agricultural Economics, 78*, 830-832.

Tomek, W.G., & Robinson. K.L. (1993). *Agricultural Product Prices.* Cornell University Press.

Toquero, Z., Duff, T., Anden-Lacsina, T., & Hayami, Y. (1975). Market-surplus functions for a subsistence crop: rice in the Philippines. *American Journal of Agricultural Economics, 57*, 705-709.

Troup, L.G. (1956). *A Report of the Committee of Inquiry into the Dairy Industry.* Nairobi: Government Printer.

Varian, H.R. (1992). *Microeconomic analysis.* W.W. Norton & Co.

Widerstedt, B. (1998). Moving or Staying?: Job Mobility as a Sorting Process. *Umea Economics Studies, No. 464,*

Widetstedt, B. (1998). Moving or Staying?: Job Mobility as a Sorting Process. *Umea Economic Studies, Umea University, No. 464,*

Williamson, O.E. (1975). *Markets and Hierarchies: Analysis and Antitrust Implications.* New York: Free Press.

Williamson, O.E. (1985). *The Economics Institutions of Capitalism.* New York: Free Press.

Williamson, O.E. (1986). The economics of governance: Framework and implications. In R.N. Langlois (Ed.), *Economics Process: Essay in the New Institutional Economics.* (pp. 171-202). Cambridge: University Press.

Williamson, O.E. (1986). *Economic Organisation: Firms, Markets, and Policy Control.* Great Britain: Wheatsheaf Books Ltd.

Yagci, F., Karin, S., & Rosenbaum, V. (1985). Structural Adjustment Lending: An Evaluation of Program Design. *World Bank Staff Working Paper, 735,*

Zwanenberg, R.M.A. (1975). *Colonial Capitalism and labour in Kenya 1919-1939.* Kampala, Nairobi, Dar es Salaam: East African Literature Bureau.

APPENDIX 1: **Estimated Price Decomposition Model Results for Factors Determining the Level of Prices Received by the Smallholder Dairy Farmers from Sale Milk**

Variable	Coef.	Std. Err.	t	P>|t|
Mean	14.49	0.12	118.81	0.00
District effect				
Kiambu	7.18	0.12	57.68	0.00
Nakuru	0.03	0.13	0.21	0.83
Nyandarua (Base category)				
Unit of measure				
Kilogram	-0.13	0.04	-2.94	0.00
'Treetop' bottle	2.61	0.05	47.72	0.00
Large cup (500 ml)	1.45	0.14	10.06	0.00
Small cup (350 ml)	1.80	0.06	29.48	0.00
Litre (Comparison category)				
Distance to the main road	-0.03	0.00	-8.52	0.00
Holiday (=1 if holiday; 0 otherwise)	-0.02	0.02	-0.78	0.44
Size of transaction*market outlet				
Farmers' collective group (CDMG)	0.01	0.00	4.75	0.00
Itinerant trader	0.05	0.01	7.23	0.00
Local-market-based trader	-0.05	0.01	-3.92	0.00
Processor	0.00	0.00	-2.86	0.00
Wholesaler	0.06	0.00	20.80	0.00
Household consumer	-0.18	0.02	-9.77	0.00
Market outlet| mode of payment| district				
Monthly| CDMG| Kiambu	-5.30	0.08	-66.98	0.00
Monthly| CDMG| Nyandarua	-0.03	0.15	-0.21	0.83
Monthly| Itinerant trader| Kiambu	-2.30	0.12	-19.75	0.00
Monthly| itinerant trader| Nakuru	-0.93	0.10	-8.94	0.00
Monthly |itinerant trader| Nyandarua	-1.80	0.19	-9.49	0.00
Monthly| local-market-based trader| Nyandarua	0.29	0.26	1.09	0.28
Monthly| processor| Kiambu	-5.73	0.09	-65.03	0.00
Monthly| processor| Nakuru	1.42	0.10	13.70	0.00
Monthly| processor| Nyandarua	0.65	0.09	7.05	0.00
Monthly| wholesaler| Nakuru	-1.94	0.12	-16.38	0.00
Monthly| wholesaler| Nyandarua	-1.22	0.11	-11.27	0.00
Monthly| household consumer| Kiambu	-3.02	0.06	-46.57	0.00
Monthly| household consumer| Nakuru	-0.96	0.09	-10.31	0.00
Monthly| household consumer| Nyandarua	-1.68	0.09	-18.37	0.00
Fortnightly |CDMG| | Nyandarua	0.63	0.30	2.13	0.03
Fortnightly| local-market-based trader| Kiambu	-3.36	0.10	-33.89	0.00
Fortnightly| processor| Nyandarua	-0.08	0.12	-0.66	0.51
Fortnightly| wholesaler| Nyandarua	-1.59	0.16	1.27	0.20
Fortnightly| household consumer| Kiambu	-4.79	0.14	-33.13	0.00

Appendix 1 continued

Fortnightly| household consumer| Nyandarua	-3.58	0.62	-5.80	0.00
Fortnightly| household consumer| Nakuru	-3.01	1.23	0.36	0.00
Fortnightly| itinerant trader | Nakuru	-3.36	0.13	-2.76	0.00
Weekly| itinerant trader| | Kiambu	-3.89	0.20	-19.77	0.00
Weekly| itinerant trader| Nakuru	-1.86	0.13	-14.08	0.00
Weekly| |itinerant trader| Nyandarua	-1.95	0.19	-8.31	0.00
Weekly| local-market-based trader| Kiambu	-1.56	0.21	-7.36	0.00
Weekly| wholesaler| Nyandarua	-1.42	0.13	-10.85	0.00
Weekly| household consumer| Kiambu	-2.82	0.10	-28.63	0.00
Weekly| household consumer| Nakuru	-0.12	0.17	0.72	0.47
Weekly| household consumer| Nyandarua	-0.99	0.63	1.58	0.12
Cash-repeat| itinerant trader| Kiambu	-3.45	0.26	-13.49	0.00
Cash-repeat| itinerant trader| |Nakuru	-3.57	0.27	-13.10	0.00
Cash-repeat| itinerant trader| Nyandarua	-2.94	0.15	-3.85	0.00
Cash-repeat| local-market-based trader| Kiambu	-4.08	0.15	-27.17	0.00
Cash-repeat| wholesaler| Nyandarua	-0.70	0.16	-4.50	0.00
Cash-repeat| household consumer| Kiambu	-2.90	0.20	-14.42	0.00
Cash-repeat| household consumer| Nyandarua	-2.27	0.71	-3.20	0.00
Spot-cash| itinerant trader| Kiambu	-2.58	0.09	-29.82	0.00
Spot-cash| itinerant trader| Nakuru	-1.30	0.11	-12.12	0.00
Spot-cash| itinerant trader| Nyandarua	-1.75	0.71	-2.45	0.01
Spot-cash| local-market-based trader| Kiambu	-1.07	0.15	-7.12	0.00
Spot-cash| local-market-based trader| Nakuru	0.57	0.12	4.57	0.00
Spot-cash| wholesaler| Nakuru	-0.88	0.87	-1.01	0.31
Spot-cash| wholesaler| Nyandarua	0.11	0.14	0.79	0.43
In-kind| local-market-based trader| Kiambu	0.01	0.09	0.06	0.95
In-kind | itinerant trader| Kiambu	-4.86	0.41	-11.73	0.00
In-kind | itinerant trader| Nyandarua	-1.55	0.56	-2.78	0.01
In-kind| household consumer| Kiambu	-2.40	0.37	-6.41	0.00
In-kind| household consumer| Nakuru	0.34	1.22	0.28	0.78
In-kind| household consumer| Nyandarua	-2.94	0.34	-8.69	0.00

Notes: Controls for fixed effects of month of the year not shown

KENYA AGRICULTURAL RESEARCH INSTITUTE.

MINISTRY OF AGRICULTURE

INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE.

COLLABORATIVE SMALLHOLDER DAIRY PROJECT (R & D)
CHARACTERIZATION SURVEYS 1998

FARMER'S NUMBER/___ / ENUMERATOR CODE /___ / DATE
(DD/MM /YY) /___/___/98

DISTRICTS[1]	DIVISIONS	SUB-LOCATIONS					
1 = MARAGUA	1 = KANDARA	1398	GITHUNGURI	1407	GITHUYA	1402	KAGUNDU /KARITI
		1408	KARIUA	1410	MUNGARIA		
2 = MURANG'A	2 = KANGEMA	1461	GACHARAIGU	1458	NYAKA-HURA	1481	ICHICHI
		1484	GACHARA-GEINI	1463	GIKUI	1485	KAIRO
	3 = KIHARU	1442	GATHERU	1453	KIMATHI	1440	KIRIA
		1454	NYAKIHAI	1436	KAHURO	1439	KAHUTI
3 = KIRINYAGA	4 = GICHUGU	1802	MIRICHI	1804	NGIRIAMBU	1813	KARIRU
		1807	NYANGENI	1812	THIRIKWA		
	5 = NDIA	1791	MUKUI	1785	KIANJEGE	1775	GITAKU
		1779	KAGUMO	1772	NGUGUINE		
4 = NAIROBI	6 = KASARANI	1118	KAHAWA NORTH	1116	KASARANI	1113	MATHARE
		1112	ROYSAMBU	1115	RUARAKA		
	7 = KIBERA	1091	GOLF COURSE	1092	KIBERA	1088	MUGUMOINI
		1089	NAIROBI WEST	1093	WOODLEY		
5 = MACHAKOS	8 = KANGUNDO	2537	KIBOKO	2584	ISINGA	2634	IIA-ITUNE
		2576	KAMBUSU	2577	SENGANI		
	9 = MWALA	2631	KAMWALA	2693	KITHAN-GAINI	2668	MITHINI
		2688	UTITHINI	2655	VYULYA		
6= NYANDARUA	10 = KINANGOP	1496	KARATI	1495	BAMBOO	1500	GATHARA
		1494	GITWE	1501	KAHURU /MURUAKI		
	11 = OL-KALOU	1546	KANJUIRI	1540	RURII	1544	MELANGINE
		1536	RUIRU	1550	MAWINGO		
7 = NAKURU	12 = BAHATI	1624	DUNDORI	1569	WENDO	1527	KIKIMA
		1631	KABATINI	1255	MUNANDA		
	13 = MOLO	1708	MARIOSHONI	1820	KERINGETI	1610	KIAMBIRIRIA
		1724	NDOSWA	1662	TURI		
	14 = NJORO	2082	SIAPEI	1656	NGATA	1839	LIKIA/TERET
		1774	NESSUIT	1694	NJORO		
	15 = RONGAI	1464	LENGINET	1402	KAMPI MOTO	1607	SHAWA
		1186	BANITA	1479	OL-RONGAI		
8 = NAROK	16 = MAU	1000	ENAIBOR AJIJIK	1002	OLOPITO	994	NTULELE
		999	SAKUTIEK	1003	TOWNSHIP		

RESPONDENT'S POSITION IN HOUSEHOLD

1=Husband
2=Wife
3=Son
4=Daughter
5=Housemaid/ boy
6 = Farm labourer
7 = Other (specify) _____

EDUCATION LEVEL

0=none
1 = Primary school
2 = Secondary school ('O' level)
3 = Post secondary school ('A' level)
4 = Technical college (Agric., Teacher's etc)
5 = Adult literacy education
6 = University_____
7 = Other (specify) _____

A/1 HH HEAD DETAILS PRIMARY ACTIVITY

0=None
1 = Farm management
2 = Civil servant
3 = Businessman
4 = Labourer
5 = Retired with pension
6 = Retired without pension
7 = Private business + 1.2
8 = Private business + 5 or 6
9=Other (specify) _____

RELIGION

1=Catholic
2=Protestant
3=Muslim
4=Hindu
5=Traditional
6 = Other (specify) _____

ETHINIC AFFILIATION

1=kikuyu
2=Luhya
3=Luo
4=Kissi
5=Kalenjin
6=Kamba
7=Mijikenda
8=Asian
9=European
10=Other Gikuyu (Embu, Meru)
11=Maasi

CODES FOR FARM OWNER/MANAGER

1=husband 2=Wife 3=Son
4=Doughter 5=Farm labourer
6=others (specifiy)_____

DAIRY CHARACTERIZATION

---

[1] An equivalent questionnaire was used for Kiambu district

FARMER'S NUMBER/__ __/   ENUMERATOR CODE /__ __/   DATE
(DD/MM /YY) /___/___/98

DISTRICT [___]

DIVISION [___]

SUB-LOCATION [___ ___ ___ ___]

CLOSEST TOWN _____ DISTANCE OF THE FARM TO CLOSEST TOWN [___ ___. ___] Km

DISTANCE OF THE FARM TO NAIROBI [___ ___. ___] KM

DISTANCE OF THE FARM TO:

1. A road open to vehicles all year 2. A seasonally passable road   3. Market/trading centre

[___ ___. ___] Km   [___ ___. ___] Km   [___ ___. ___] Km

FAMILY NAME _____

RESPONDENT'S NAME _____

POSITION IN HOUSEHOLD [___]

For non-agricultural households, only sections A, H, and J have to be completed
For agricultural household without dairy activities, the sections A, B, beginning of C, I, and J have to be completed
For agricultural household with dairy activities, all the questionnaire has to be completed, except sections H and I

SECTION A.   HOUSEHOLD COMPOSITION/ LABOUR AVAILABILITY AND USE

A/1.   Provide the following detail about the **household head**

Sex 1 = Male 2 = Female	Age (years)	Primary activity	Years of farming experience	Ethnic affiliation	Education level	Religion
[___]	[___ ___]	[___]	[___ ___]	[___]	[___]	[___]

A/2. Is the household head the **farm owner**? [___] 1=Yes 2=No. If not, who is the **farm owner**? [___]
If different from the farm owner, who is the **farm manager**? [___]

A/4 ACTIVITY OF ADULTS OTHER THAN HH HEAD   SEX   1 = Male 2 = Female

0 = None
1 = Farm management
2 = Civil servant
3 = Employee in private enterprise
4 = Businessman
5 = Labourer
6= Retired with pension
7 = Retired without pension
8 = Private business + 6 or 7
9 = Private business + 1, 2
10= Other (specify) _____

SECTION B: FARM ACTIVITIES
B/1 HOUSEHOLD RESPONSIBILITIES FOR PRIMARY ACTIVITIES
1 = Household head
2 = Adult Males (other than HH head)
3 = Adult Females (other than HH head)
4 = General Adults in Household
5 = General Household labour
6 = Children
7 = Long-term labourers
8 = Casual labourers

A/3. Give number of Household members (including HH head) living permanently on the compound:

Age Categories	Males	Female	Total
< 8 years	[___]	[___]	[___]
8 - 14	[___]	[___]	[___]
15 - 21	[___]	[___]	[___]
22 - 65	[___]	[___]	[___]
> 65 years	[___]	[___]	[___]
Total	[___]	[___]	[___]

* A person is in residence if they sleep in the house a majority of nights per week.

A/4. Activities of adults other than the Household head, including on and off farm.

Adult (> 15 years)	Sex	Type of employment
1. _____	[___]	[___]
2. _____	[___]	[___]
3. _____	[___]	[___]
4. _____	[___]	[___]
5. _____	[___]	[___]
	[___]	[___]

Be sure that all adults listed in A/3, except the household head, are listed above

A/5. IS THE HOUSEHOLD ENGAGED IN ANY AGRICULTURAL/LIVESTOCK PRODUCTION? [___] 1 = YES 2 = NO

IF NO, SKIP EVERYTHING ELSE AND GO TO SECTION H (AT THE BACK)

SECTION B- FARM ACTIVITIES AND FACILTIES

B/1. Indicate who in the household is **primarily responsible** for carrying out the following tasks.

DAIRY ACTIVITIES		
	1. Grazing and Collecting Feed	[___]
	2. Processing feed and Feeding	[___]
	3. Planting, weeding and manuring Forage	[___]
	4. Milking	[___]
	5. Marketing milk	[___]
	6. Spraying/Dipping	[___]
	7. Cleaning shed	[___]
	8. Obtaining AI/ Veterinary Services	[___]
	9. Fetching water for animals	[___]
NON DAIRY ACTIVITIES		
	10. Activities related to other live-stock	[___]
	11. Preparing Fields for Crops	[___]
	12. Planting Crops	[___]
	13. Weeding Crops	[___]
	14. Harvesting Crops	[___]

B/3 FARM TRANSPORT

1 = Bicycle
2 = Wheelbarrow
3 = Handcart
4 = Animal drawn transport
5 = Motorcycle
6 = Tractor
7 = Pick-up
8 = Car
9 = Other specify_____

B/7 LABOURERS

Main activity:

1 = Grazing and Collecting Feed
2 = Processing feed and Feeding
3 = Planting, weeding and manuring Forage
4 = Milking
5 = Marketing milk
6 = Spraying/Dipping
7 = Cleaning shed
8 = Obtaining AI/ Veterinary Services
9 = Fetching water for animals
10 = Activities related to other livestock
11 = Preparing Fields for Crops
12 = Planting Crops
13 = Weeding Crops
14 = Harvesting Crops

Unit of time

1 = half day
2 = day
3 = week
4 = month

B/2 Does the farm have:

Electricity supplied [____] A **telephone** connection [____] **Piped public Water** supply [____] 1 = YES 2 = NO
Do they **work**? Electricity [____] the telephone connection [____] the **piped public Water** supply [____] 1 = YES 2 = NO

B/3 Does the farm own **transportation** facilities [____] 1 = YES 2 = NO

If YES, which one (s) Item 1 [____] Item 2 [____] Item 3 [____]

B/4 What is your total land size now in acres [____ ____. ____] and **how many plots** is it divided into [____ ____]

B/5 **When** did you establish your farm? [19 ____ ____]

B/6 Was the total land size that year the same as today? [____] 1 = Yes 2 = No (Note: 1 ha = 2.5 acres)

If No, indicate the total land size **when you established your farm**, and the changes since that date up to now

Date	Total land size (in acres)
1. [19 ____]	[____ ____]
2. [19 ____]	[____ . ____]
3. [19 ____]	[____ ____]
4. [19 ____]	[____ . ____]
5. [19 ____]	[____ ____]

Check that the first year given in the table is the same as given in B/5

B/7 **Do you employ labourers?** [____] 1 = YES 2 = NO
If Yes, indicate their type, sex, their main activities on the farm, the percentage of time spent on dairy activities on a typical day and their wage.

Labourer	Type 1 = Casual 2 = Long term	Sex 1 = Male 2 =Female	Main activity			Percentage of time spent on dairy activi-ties	wage per unit of time (Ksh)	unit of time	number of units per year
			1	2	3				
1	[____]	[____]	[____]	[____]	[____]	[__.__ %]	[____ ____ ____]	[____]	[____ ____]
2	[____]	[____]	[____]	[____]	[____]	[__.__ %]	[____ ____ ____]	[____]	[____ ____]
3	[____]	[____]	[____]	[____]	[____]	[__.__ %]	[____ ____ ____]	[____]	[____]
4	[____]	[____]	[____]	[____]	[____]	[__.__ %]	[____ ____ ____]	[____]	[____]
5	[____]	[____]	[____]	[____]	[____]	[__.__ %]	[____ ____ ____]	[____]	[____]

Does the wage include lodging? [____] Meals? [____] 1 = YES 2 = NO

B/8 **Was the number of adults living on the farm** when you established your farm **the same as today**? [____] 1 = Yes 2 = No

If No, indicate the number of adults on the farm **when you established your farm**, and the modifications since that date up to now. Indicate as well if you hired labour.

Year	Total number of adults living on farm	Number of household adults working on farm	Did you hire labour? 1 = No 2 =casual labourer 3 = permanent labourer
1 [19 ____ ____]	[____ ____]	[____ ____]	[____]
2. [19 ____ ____]	[____ ____]	[____ ____]	[____]
3. [19 ____ ____]	[____ ____]	[____ ____]	[____]
4. [19 ____ ____]	[____ ____]	[____ ____]	[____]
5. [19 ____ ____]	[____ ____]	[____ ____]	[____]

Check that the first year given in the table is the same as given in B/5
B/9 CROPPING SEASONS

1= One   (monomodal rainfall)
2= Two   (bimodal rainfall)
3= Three (bimodal rainfall + irrigated land cropped in dry season)

LAND TENURE/ LAND USE

CODE 00 FOR the homestead, the stall, boma, and stores....

B/10 PLOT TABLE

FOOD CROPS	CASH CROPS	FORAGES
01= maize	22 = coffee	36= napier grass
02= sorghum / millet	23 = tea	37= desmodium
03 = cassava	24 = cut flowers	38= lucerne
04= beans	25 = wheat	39= oats
05= Irish potatoes	26 =fruit/tree crops	40 = fodder beet
06= sweet potatoes	27= pyrethrum	41 = vetch
07= cabbage, cauliflower	28 = barley	42 = fodder trees
08= kale	29 = sunflower	43= fallow and planted pasture
09= tomatoes	30 = cotton	44= other specify _____
10 = onions	31 = rice	
11= French beans	32 = rye	
12= carrots	33 = sugarcane	**LAND TENURE**
13= bananas	34 = simsim	1 = Traditional
14= arrow roots	35 = groundnuts	2 = Freehold (has title deed)
15 = Soya beans		3 = Rented from another individual
16= cucumber		4 = Share cropping
17 = green pepper		5=Roadside/Collateral (informally held)
18 = paw paw		6 = Other (specify) _____
19 = pigeon peas		
20 = cow peas		
21 = other vegetables for market		

B/9 How many cropping/rainy seasons are there in your area per year? [___]

B/10 For each plot used by the household, including those rented to or from others, and informally held plots (such as roadsides) fill in one row for each patch or cropping pattern within each plot. Note: the definition of a plot is a single piece of land that is connected. Pieces of land not connected are considered separate plots.
Make sure that the sum of the proportions equals 1.
The first crop indicated has to be the major crop on that land, in term of density.

Plot 1	Plot size (acres) [___ __.__]	Land tenure [___] Rented from another? [__] 1=yes 2=no	If rented, rent paid per year [__ __ __ __]	Distance from homestead (Km) [___ __ __]	
	Crops present	Proportion of plot 1 allocated to this patch	Is Napier planted on contours? 1=yes 2=no	Use manure? 1=yes 2=no	Chemical fertilizer? 1=yes 2=no
Patch/cropping pattern 1	[_ _] [_ _] [_ _] [_ _]	___/___	[___]	[___]	[___]
Patch/cropping pattern 2	[_ _] [_ _] [_ _] [_ _]	___/___	[___]	[___]	[___]
Patch/cropping pattern 3	[_ _] [_ _] [_ _] [_ _]	___/___	[___]	[___]	[___]
Patch/cropping pattern 4	[_ _] [_ _] [_ _] [_ _] L	___/___	[___]	[___]	[___]
Patch/cropping pattern 5	[_ _] [_ _] [_ _] [_ _] L	___/___	[___]	[___]	[___]

Plot 1	Plot size (acres) [___ __.__]	Land tenure [___] Rented from another? [__] 1=yes 2=no	If rented, rent paid per year	Distance from homestead (Km) [___ __ __]	
	Crops present	Proportion of plot 2 allocated to this patch	Is Napier planted on contours?	Use manure? 1=yes 2=no	Chemical fertilizer? 1=yes 2=no
Patch/cropping pattern 1	[_ _] [_ _] [_ _] [_ _] [_ _]	___/___			[___]
Patch/cropping pattern 2	[_ _] [_ _] [_ _] [_ _] [_ _]	___/___			[___]
Patch/cropping pattern 3	[_ _] [_ _] [_ _] [_ _] [_ _]	___/___			
Patch/cropping pattern 4	[_ _] [_ _] [_ _] [_ _] [_ _]	___/___			
Patch/cropping pattern 5	[_ _] [_ _] [_ _] [_ _] [_]	___/___			
	Plot size (acres) [___ __.__]	Land tenure [___] Rented from another? [__] 1=yes 2=no			
	Crops present	Proportion of plot 3 allocated to this patch			
	[_ _] [_ _] [_ _] [_ _] [_ _]	___/___			
	[_ _] [_ _] [_ _] [_ _] [_ _]	___/___			
	[_ _] [_ _] [_ _] [_ _] L	___/___			
	[_ _] [_ _] [_ _] [_ _] L	___/___			
	[_ _] [_ _] [_ _] [_ _] L	___/___			

B/10 PLOT TABLE

FOOD CROPS	CASH CROPS	FORAGES
01= maize	22 = coffee	36= napier grass
02= sorghum / millet	23 = tea	37= desmodium
03 = cassava	24 = cut flowers	38= lucerne
04= beans	25 = wheat	39= oats
05= Irish potatoes	26 =fruit/tree crops	40 = fodder beet
06= sweet potatoes	27= pyrethrum	41 = vetch
07= cabbage, cauliflower	28 = barley	42 = fodder trees
08= kale	29 = sunflower	43= fallow and planted pasture
09= tomatoes	30 = cotton	44= other specify _____
10 = onions	31 = rice	
11= French beans	32 = rye	
12= carrots	33 = sugarcane	
13= bananas	34 = simsim	**LAND TENURE**
14= arrow roots	35 = groundnuts	1 = Traditional
15 = Soya beans		2 = Freehold (has title deed)
16= cucumber		3 = Rented from another individual
17= green pepper		4 = Share cropping
18= paw paw		5=Roadside/Collateral (informally held)
19 = pigeon peas		6=Other (specify) _____
20 = cow peas		
21 = other market vegetables		

IV/9 How many cropping/rainy seasons are there in your area per year? [__]

IV/10 For each plot used by the household, including those rented to or from others, and informally held plots such as roadsides: fill in one row for each patch or cropping pattern within each plot. Note the definition of a plot is a single piece of land that is connected. Pieces of land not connected are considered separate plots.
Make sure that the sum of the proportions equals 1.
The first crop indicated has to be the major crop on that land, in term of [____].

Plot 1	Plot size (acres) [__ __. __]	Land tenure [__] Rented from another? [__] 1=yes 2=no	If rented, rent paid per year [__ __ __ __ __]	Distance from homestead (Km) [__ __ __]	
	Crops present	Proportion of plot 1 allocated to this patch	Is Napier planted on contours? 1=yes 2=no	Use manure? 1=yes 2=no	Chemical fertilizer? 1=yes 2=no
Patch/cropping pattern 1	[__] [__] [__] [__] [__]	__/__	[__]	[__]	[__]
Patch/cropping pattern 2	[__] [__] [__] [__] [__]	__/__	[__]	[__]	[__]
Patch/cropping pattern 3	[__] [__] [__] [__] [__]	__/__	[__]	[__]	[__]
Patch/cropping pattern 4	[__] [__] [__] [__] [__]	__/__	[__]	[__]	[__]
Patch/cropping pattern 5	[__] [__] [__] [__] [__]	__/__	[__]	[__]	[__]

Plot 1	Plot size (acres) [__ __. __]	Land tenure [__] Rented from another? [__] 1=yes 2=no	If rented, rent paid per year [__ __ __ __ __]	Distance from homestead (Km) [__ __ __]	
	Crops present	Proportion of plot 2 allocated to this patch	Is Napier planted on contours? 1=yes 2=no	Use manure? 1=yes 2=no	Chemical fertilizer? 1=yes 2=no
Patch/cropping pattern 1	[__] [__] [__] [__] [__]	__/__	[__]	[__]	[__]
Patch/cropping pattern 2	[__] [__] [__] [__] [__]	__/__	[__]	[__]	[__]
Patch/cropping pattern 3	[__] [__] [__] [__] [__]	__/__	[__]	[__]	[__]
Patch/cropping pattern 4	[__] [__] [__] [__] [__]	__/__	[__]	[__]	[__]
Patch/cropping pattern 5	[__] [__] [__] [__] [__]	__/__	[__]	[__]	[__]

	Plot size (acres) [__ __. __]	Land tenure [__] Rented from another? [__] 1=yes 2=no	If rented, rent paid per year [__ __ __ __ __]	Distance from homestead (Km) [__ __ __]	
	Crops present	Proportion of plot 3 allocated to this patch	Is Napier planted on contours? 1=yes 2=no	Use manure? 1=yes 2=no	Chemical fertilizer? 1=yes 2=no
	[__] [__] [__] [__] [__]	__/__	[__]	[__]	[__]
	[__] [__] [__] [__] [__]	__/__	[__]	[__]	[__]
	[__] [__] [__] [__] [__]	__/__	[__]	[__]	[__]
	[__] [__] [__] [__] [__]	__/__	[__]	[__]	[__]
	[__] [__] [__] [__] [__]	__/__	[__]	[__]	[__]

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B/10 PLOT TABLE

FOOD CROPS	CASH CROPS	FORAGES
01 = maize	22 = coffee	36= napier grass
02= sorghum / millet	23 = tea	37= desmodium
03 = cassava	24 = cut flowers	38= lucerne
04= beans	25 = wheat	39= oats
05= Irish potatoes	26 =fruit/tree crops	40 = fodder beet
06= sweet potatoes	27= pyrethrum	41 = vetch
07= cabbage, cauliflower	28 = barley	42 = fodder trees
08= kale	29 = sunflower	43= fallow and planted pasture
09= tomatoes	30 = cotton	44= other specify _____
10 = onions	31 = rice	
11= French beans	32 = rye	
12= carrots	33 = sugarcane	
13= bananas	34 = simsim	**LAND TENURE**
14= arrow roots	35 = groundnuts	1 = Traditional
15 = Soya beans		2 = Freehold (has title deed)
16 = cucumber		3 = Rented from another individual
17 = green pepper		4 = Share cropping
18 = paw paw		5=Roadside/Collateral (informally held)
		6=Other (specify) _____
19 = pigeon peas		
20 = cow peas		
21 = other market vegetables		

Plot 4	Plot size (acres) [_____]	Land tenure [___] Rented from another? [__]1=yes 2=no	If rented, rent paid per year [__ __ __ __ __]	Distance from homestead (Km) [_____]
	Crops present	Proportion of plot 4 allocated to this patch	Is Napier planted on contours ? 1=yes 2=no	Use manure ? 1=yes 2=no	Chemical fertilizer ? 1=yes 2=no
Patch/cropping pattern 1	[__] [__] [__] [__]	___/___	[__]	[__]	[__]
Patch/cropping pattern 2	[__] [__] [__] [__]	___/___	[__]	[__]	[__]
Patch/cropping pattern 3	[__] [__] [__] [__]	___/___	[__]	[__]	[__]
Patch/cropping pattern 4	[__] [__] [__] [__]	___/___	[__]	[__]	[__]
Patch/cropping pattern 5	[__] [__] [__] [__]	___/___	[__]	[__]	[__]
Patch/cropping pattern 6	[__] [__] [__] [__]	___/___	[__]	[__]	[__]

Plot 5	Plot size (acres) [__ __.__]	Land tenure [__] Rented from another? [__] 1=yes 2=no	If rented, rent paid per year [__ __ __ __]	Distance from homestead (Km) [__ __ __]
	Crops present	Proportion of plot 5 allocated to this patch	Is Napier planted on contours ? 1=yes 2=no	Use manure ? 1=yes 2=no	Chemical fertilizer ? 1=yes 2=no
Patch/cropping pattern 1	[__] [__] [__] [__]	___/___	[__]	[__]	[__]
Patch/cropping pattern 2	[__] [__] [__] [__]	___/___	[__]	[__]	[__]
Patch/cropping pattern 3	[__] [__] [__] [__]	___/___	[__]	[__]	[__]
Patch/cropping pattern 4	[__] [__] [__] [__]	___/___	[__]	[__]	[__]
Patch/cropping pattern 5	[__] [__] [__] [__]	___/___	[__]	[__]	[__]
Patch/cropping pattern 6	[__] [__] [__] [__]	___/___	[__]	[__]	[__]

Plot 6	Plot size (acres) [__ __.__]	Land tenure [__] Rented from another? [__]1=yes 2=no	If rented, rent paid per year [__ __ __ __]	Distance from homestead (Km) [__]
	Crops present	Proportion of plot 6 allocated to this patch	Is Napier planted on contours ? 1=yes 2=no	Use manure ? 1=yes 2=no	Chemical fertilizer ? 1=yes 2=no
Patch/cropping pattern 1	[__] [__] [__] [__]	___/___	[__]	[__]	[__]
Patch/cropping pattern 2	[__] [__] [__] [__]	___/___	[__]	[__]	[__]
Patch/cropping pattern 3	[__] [__] [__] [__]	___/___	[__]	[__]	[__]
Patch/cropping pattern 4	[__] [__] [__] [__]	___/___	[__]	[__]	[__]
Patch/cropping pattern 5	[__] [__] [__] [__]	___/___	[__]	[__]	[__]
Patch/cropping pattern 6	[__] [__] [__] [__]	___/___	[__]	[__]	[__]

B/11 and B/12

FOOD CROPS		CASH CROPS	FORAGES
01= maize	15 = Soya beans	22 = coffee	36= napier grass
02= sorghum / millet	16 = cucumber	23 = tea	37= desmodium
03 = cassava	17 = green pepper	24 = cut flowers	38= lucerne
04= beans	18 = paw paw	25 = wheat	39= oats
05= Irish potatoes	19 = pigeon peas	26 =fruit/tree crops	40 = fodder beet
06= sweet potatoes	20 = cow peas	27= pyrethrum	41 = vetch
07= cabbage, cauliflower	21 = other vegetables for market	28 = barley	42= fodder trees
08= kale		29 = sunflower	43= fallow and planted pasture
09= tomatoes		30 = cotton	44= other specify _____
10 = onions		31 = rice	
11= French beans		32 = rye	
12= carrots		33 = sugarcane	
13= bananas		34 = simsim	
14= arrow roots		35 = groundnuts	

B/13 FODDER TREES
Which ones?
1 = Leucaena
2 = Sesbania
3 = Grevillea
4 = Calliandra
5 = Indigenous
6 = Other specify _____

B/14. WHICH TREES ARE USED FOR FODDER?
1 = Indigenous trees (specify) _____
2 = Fruit trees (specify) _____
3 = Woodlot trees (specify) _____
4 = Other (specify) _____

B/15 LEGUMES
Which ones?
1 = Desmodium
2 = Lucerne
3 = Vetch
4 = Microtyloma
5 = Other specify _____

From whom?
1 = Extension services agents
2 = Co-operative
3 = Neighbours
4 = Shop
5 = Others (specify) _____

B/16 MAIZE
How do you plant maize?
1 = in lines
2 = in holes
3 = broadcasting
4 = Other (specify) _____

Why more seeds?
1 = for livestock feeding (when thinning, maize is fed to livestock)
2 = in case one seed does not germinate
3 = to produce green maize for sale
4 = other (specify) _____

B/17 DEFOLIATE MAIZE LEAVES
1 = to feed livestock
2 = as mulch
3 = other (specify) _____

B/18 LAND PREPARATION
1 = Hoe (manual)
2 = Livestock
3 = Tractor (mechanised)

B/19 LIVESTOCK FOR LAND PREPARATION/TRACTION
0 = None
1 = Dairy cows
2 = Bulls
3 = Steers/Oxen
4 = Camels
5 = Equines
6= Other(specify) _____

[__ __] [__ __] [__ __] [__ __]
(see codes)

B/12 Which crops did you grow **10 years ago**, that you do not grow now? [__ __] [__ __] [__ __]
(see codes)

B/13. How many **fodder producing trees** do you have? [__ __ __] or what is the Hedge length? [__ __] metres

Which ones? First= [__] Second= [__] Third= [__]

Since when do you have fodder trees? [19 __ __]. **From whom** did you get the information on fodder trees? [__]

B/14 Do you use trees for fodder? 1 = Yes, 2 = No [__]
If Yes, which ones? First= [__] Second= [__] Third= [__]

B/15. Do you plant **forage legumes**? 1 = Yes, 2 = No [__]
If Yes, which ones? First= [__] Second= [__] Third= [__]

Since when did you start growing legumes [19 __ __]. **From whom** did you get the information on legumes? [__]

B/16. Do you plant maize? [__] 1= Yes 2 = No
If Yes, how do you plant maize? [__].
And do you plant more than one seed of maize per hole, or more seeds per line? 1 = Yes 2 = No [__]
If Yes, why? [__]

B/17. Do you **defoliate maize leaves**? 1 = Yes 2 = No [__]
If Yes, why? [__]

B/18. What do you use for **land preparation**? [__]

B/19. If livestock are used for **land preparation**, which one? [__]

SECTION C. LIVESTOCK INVENTORY
C/1. Record the number of animals for the different species kept on the farm (except cattle)

	Goats	Camels	Sheep	Poultry			Donkeys, horses	Pigs	Rabbits
Owned by HH	Local Dairy			Local	Layers	Broilers			
Milked ?	[__]	[__] [__]	[__]						
Adult males	[__]	[__] [__]	[__]	[__]	[__]	[__]	[__ __]	[__]	[__ __]
Adult females	[__]	[__] [__]	[__]	[__]	[__]	[__ __]	[__ __]	[__]	[__ __]
Immature	[__]	[__] [__]	[__]				[__ __]	[__]	
Kept not owned									
Adult males	[__]	[__] [__]	[__]	[__]	[__]	[__ __]	[__ __]	[__]	[__ __]
Adult females	[__]	[__] [__]	[__]	[__]	[__ __]	[__]	[__ __]	[__]	[__ __]
Immature	[__]	[__] [__]	[__]				[__ __]	[__]	
Total	[__]	[__] [__]	[__ __]	[__ __]	[__ __]	[__]	[__ __]	[__]	[__ __]

C/2. Does the Household have any cattle? [__] 1 = YES 2 = NO
(IF HOUSEHOLD DOESN'T HAVE ANY CATTLE, SKIP TO SECTION I AT THE BACK)
If Yes, how many? [__ __ __]. (IF THERE ARE MORE THAN 15, SKIP TO QUESTION E AND THEN PROCEED.)

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Record the precise population of **cattle** kept on the farm

Owned by HH		Local	Dairy Cross (50% or less dairy genes)	High grade dairy (more than 50% dairy genes)
Bulls (> 3 years, or regularly used for service)		[___]	[___]	[___]
Castrated adult males (> 3 years)		[___]	[___]	[___]
Cows		[___]	[___]	[___]
Immature males (< 3 years)		[___]	[___]	[___]
Heifers		[___]	[___]	[___]
Suckling calves	Male	[___]	[___]	[___]
	Female	[___]	[___]	[___]
Kept not owned				
Bulls (> 3 years, or regularly used for service)		[___]	[___]	[___]
Castrated adult males (> 3 years)		[___]	[___]	[___]
Cows		[___]	[___]	[___]
Immature males (< 3 years)		[___]	[___]	[___]
Heifers		[___]	[___]	[___]
Suckling calves	Male	[___]	[___]	[___]
	Female	[___]	[___]	[___]
Total		[___]	[___]	[___]

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C/3 REASON FOR SLAUGHTER OR DEATH

1 = Slaughtered for meat
2 = Slaughtered due to disease
3 = Slaughtered due to Injury, accidents
4 = Died due to disease
5 = Died due to Injury, accidents
6 = Died due to poisoning (acaricide. snake bite, bracken fern etc.)
7 = Bloat
8 = Stolen
9 = Unwanted (e.g. bull calves)
10 = Other (specify)_____

C/4 CATTLE SOLD

Reason:
1 = needs cash
2 = old age
3 = disease
4 = culled (poor performances)
5=   other   (specify)
_____

To Whom?
1 = individual
2 = butcher
3 = other (specify): _____

To Where?
1 = within the village
2 = within the sub location
3 = within the location
4 = within the division
5 = within the district
6 = outside the district

C/5 CATTLE PURCHASED

Reason:
1 = replacement
2 = to obtain manure for crop production / biogass
3 = social prestige
4 = to increase income through the sale of more milk
5   =   other   (specify)
_____

From Whom?
1 = individual
2 = co-operative
3 = large dairy farm (e.g. Delamere farm)
4 = other (specify). _____

From Where?
1 = within the village
2 = within the sub location
3 = within the location
4 = within the division
5 = within the district
6 = outside the district

C/6 ANIMAL IDENTIFICATION SYSTEM

1 = none
2 = name
3 = tag number
4 = branding/ notching
5 = colour (physical)
6 = other specify _____

C/3. In the last 12 months, did some cattle die or were slaughtered? [____] 1 = Yes 2 = No
If Yes, please record the number of cattle that died or were slaughtered in the last 12 months and the reason why?

	Number dead	Reasons	Other remarks
Bulls (> 3 years)	[__ __]	[____] [____]	_____
Castrated Adult males(> 3 years)	[__ __]	[____] [____]	_____
Immature males / steers (< 3 years)	[__ __]	[____] [____]	_____
Cows	[__ __]	[____] [____]	_____
Heifers	[__ __]	[____] [____]	_____
Pre- weaned (or suckling) — Male	[__ __]	[____] [____]	_____
Calves — Female	[__ __]	[____] [____]	_____

C/4. In the last 12 months, did you sell some cattle? [____] 1 = Yes 2 = No
If Yes, please record the number of cattle that were sold in the last 12 months?

		Number sold	Age (years)	Reasons for selling	To Where?	To Whom?	Average price Kshs.
Bulls (> 3 years)		[__ __]	[__]	[__]	[__]	[__]	[__ __]
Castrated Adult males (> 3 years)		[__ __]	[__]	[__]	[__]	[__]	[__ __]
Immature males (< 3 years)		[__ __]	[__]	[__]	[__]	[__]	[__ __]
Cows		[__ __]	[__]	[__]	[__]	[__]	[__ __]
Heifers		[__ __]	[__]	[__]	[__]	[__]	[__ __]
Pre -weaned (or suckling) calves	Male	[__ __]	[__]	[__]	[__]	[__]	[__ __]
	Female	[__ __]	[__]	[__]	[__]	[__]	[__ __]

C/5 In the last 12 months. did you buy some cattle? [____] 1 = Yes 2 = No
    If Yes, please record the number of cattle that were **purchased** in the last 12 months?

		Number	Age (years)	Reasons	From Where?	From Whom?	Average price Kshs
Bulls(> 3 years)		[___]	[___]	[___] [___]	[___][___]	[___][___]	[— — _]
Castrated Adult males(> 3 years)		[___]	[___]	[___]	[___][___]	[___][___]	[— — _]
Immature males (< 3 years)		[___]	[___]	[___]	[___][___]	[___][___]	[— — _]
Cows		[___]	[___][___]	[___]	[___][___]	[___][___]	[— — _]
Heifers		[___]	[___]	[___]	[___][___]	[___][___]	[— — _]
Pre -weaned (or suckling) calves	Male	[___]	[___]	[___]	[___][___]	[___][___]	[— — _]
	Female	[___]	[___]	[___]	[___][___]	[___][___]	[— — _]

    C/6 What kind of an animal **identification system** for cattle is used within your farm? [___]
    C/7 Do you keep **written records** of cattle production [___] (calving or milk production etc.)
                   1 = YES 2 = NO

D/I MAIN SYSTEM FOR KEEPING CATTLE

1= Only grazing (free-range or tethered)
2 = Mainly grazing with some stall feeding
3= Only stall feeding (zero grazing)
4= Mainly stall feeding with some grazing

D/3 FEEDING UNITS

1 = Kg
2 = Standard sacks
3 = Donkey cart load
4 = Hand cart load
5 = Pick-up load
6 = Single line planted 50 m length
7 = Area in acres
8 = Other (specify)_____

D/4 FEEDING UNITS

1 = Kg
2 = Standard sacks
3 = Donkey cart load
4 = Hand cart load
5 = Pick-up load
6 = Other (specify)_____

D/5 SEASON

1 = Long dry
2 = Long wet
3 = Short dry
4 = Short wet

D. FEEDING

D/1. What is your **main system for keeping cattle** now and what was it 10 years ago?

	Presently	10 years ago*
Cows	[___]	[___]___[___]
Young stock	[___]	[___]

*If on this farm less than 10 years state no. of years and ask same question.

D/2. Do you practice **Grazing**? [____] 1 = Yes 2 = No
If Yes, indicate the **number of hours per day** your animals graze.

Type	Source	Jan- Mar	Mar- May	Jun- Aug	Sept- Dec	All year
Grazing	Pasture on Own land	[___]	[___]	[___]	[___]	[___]
	Arable Own land	[___]	[___]	[___]	[___]	[___]
	Public land	[___]	[___]	[___]	[___]	[___]

D/3. Do you **Cut-and-Carry fodder and Crop residues** to your animals? [____] 1 = Yes 2 = No
If Yes, estimate the **total quantity per day for all your animals.**

Type	Source	Unit	Jan- Mar	Mar- May	Jun- Aug	Sept- Dec	All year
Cut-and-carry fodder and Crop residues	Own land	[__]	[___]	[___]	[___]	[___]	[___]
	Rented land	[__]	[___]	[___]	[___]	[___]	[___]
	Purchased	[__]	[___]	[___]	[___]	[___]	[___]
	Public land	[__]	[___]	[___]	[___]	[___]	[___]

D/4 Do you feed your animals with **Commercial feeds, or Agro-industrial by-products?** [____] 1 = Yes 2 = No
If Yes, estimate the **quantity per day given to all your animals.**

Type	Unit	Jan- Mar	Mar- May	Jun- Aug	Sept- Dec	All year
Commercial feeds	[__]	[___]	[___]	[___]	[___]	[___]
Poultry Waste	[__]	[___]	[___]	[___]	[___]	[___]
Other specify_____	[__]	[___]	[___]	[___]	[___]	[___]

D/5. Do you **experience a shortage of feeds** produced from your farm ? [___] 1 = YES 2 = NO

If Yes when ? Tick when appropriate and indicate the corresponding season.

	Jan- March	March- May	Jun- Aug	Sept- Dec	All Year
Which season?	[____]	[____]	[____]	[____]	
Now	[__]	[__]	[__]	[__]	[__]
10 years ago	[__]	[__]	[__]	[__]	[__]

D/6. Rank the 3 major strategies you apply during these periods of feed shortage and what you did 10 years ago ? (First - 3, second - 2, third - 1)

Strategy	Now	10 Years ago
Use stored forages	[__]	[__]
Feed less to all animals	[__]	[__]
Feed less to certain categories of animal	[__]	[__]
Rent grazing land	[__]	[__]
Send cattle on transhumance	[__]	[__]
Reduce herd size	[__]	[__]
Purchase fodder	[__]	[__]
Purchase concentrate feed	[__]	[__]
Feed tree leaves/forage not normally used	[__]	[__]
Others (specify) _____	[__]	[__]

D/7. What are you feeding or buying now that you were not feeding or buying 10 years ago? (TICK)

Specific	Feeding now but not 10 years ago	Feeding 10 years ago but not now	Buying now but not 10 years ago	Buying 10 years ago but not now
Napier grass	[__]	[__]	[__]	[__]
Maize stover green	[__]	[__]	[__]	[__]
Maize stover dry	[__]	[__]	[__]	[__]
Garden Weeds	[__]	[__]	[__]	[__]
Roadside grass	[__]	[__]	[__]	[__]
Other crop residues	[__]	[__]	[__]	[__]
Baled Straw	[__]	[__]	[__]	[__]
Grass Hay	[__]	[__]	[__]	[__]
Forage legumes	[__]	[__]	[__]	[__]
Commercial concentrates	[__]	[__]	[__]	[__]
Horticultural by-products	[__]	[__]	[__]	[__]
Maize bran	[__]	[__]	[__]	[__]
Maize germ	[__]	[__]	[__]	[__]
Wheat bran	[__]	[__]	[__]	[__]
Pollard	[__]	[__]	[__]	[__]
Oilseed by-products	[__]	[__]	[__]	[__]
Poultry waste	[__]	[__]	[__]	[__]
Pyrethrum marc	[__]	[__]	[__]	[__]
Brewer's waste	[__]	[__]	[__]	[__]
Proprietary minerals/salt	[__]	[__]	[__]	[__]
Other (specify) _____	[__]	[__]	[__]	[__]
Other (specify) _____	[__]	[__]	[__]	[__]
Other (specify)	[__]	[__]	[__]	[__]

D/8 FEED PURCHASE UNITS
1 = Kg
2 = Standard sacks
3 = Donkey cart load
4 = Hand cart load
5 = Pick-up load
6 = Single line planted 50 m length
7 = Area in acres
8 = Other (specify)_____

Frequency
1 = once per year
2 = once per month
3 = once per week
4 = other (specify)_____

D/8 FEED SALES UNIT
1 = Kg
2 = Standard sacks
3 = Donkey cart load
4 = Hand cart load
5 = Pick-up load
6 = Single line planted 50 m length
7 = Area in acres
8 = Other (specify)_____

FARMER'S NUMBER/__ __/   ENUMERATOR CODE /__ __/   DATE
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Seller type
1 = Individual farmer (s)
2 = Co-op society
3 = Trader/ Intermediary
4 = Self help/ farmer group
5 = Feed company
6 = Other (specify) _____

Source area
1 = the village
2 = the sub location
3 = the location
4 = the division
5 = within the district
6 = outside the district

Transport mode
1 = on- foot
2 = draught animals/ carts
3 = bicycle
4 = public vehicle/ matatu/ bus
5 = private pick-up, van, truck
6 = other (specify)_____

Nature of payment/ contract
1 = Cash sale - single sale
2 = Cash sale - informal contract (no formal agreement)
ment)
3 = On credit sale- single sale
4 = On credit sale- informal contract
5 = On credit sale- formal contract
6 = Other (specify) _____

Who transported?
1 = Self transport
2 = Seller transport
3 = Other (spec-
ify)_____
4 = Hand cart load
5 = Pick-up load
6 = Single line planted 50
m length
7 = Area in acres
8 = Other (spec-
ify)_____

Nature of payment/ contract
1 = Cash sale - single sale
2 = Cash sale - informal contract (no formal agreement)
3 = On credit sale- single sale
4 = On credit sale- informal contract
5 = On credit sale- formal contract
6 = Other (specify) _____

D/8. If you **purchase fodder or concentrates,** how much did you purchase in the **last 12 months** and what was the unit price? (If quantity/unit is uncertain record total cost).
For the **feed sellers,** indicate their type, where the feed comes from (source area), the average distance to the point where you buy, the nature of payment and some information about transportation.

B/9 If you sell fodder or concentrates, how much did you sell in the **last 12 months** and what was the unit price? (If quantity/unit is uncertain record total income).
D/8. If you **purchase fodder or concentrates,** how much did you purchase in the **last 12 months** and what was the unit price? (If quantity/unit is uncertain record total cost).

For the **feed sellers,** indicate their type, where the feed comes from (source area), the average distance to the point where you buy, the nature of payment and some information about transportation.

Specific Feeds types	Unit	Quantity	Unit price Kshs.	Total cost of purchase	Fre-quency	Seller type	Source area	Ave. distance to buying point (in Km)	Nature of payment	Transport Mode		
										Mode	Who?	Cost (Ksh)
Napier grass	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]
Maize stover green	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]
Maize stover dry	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]
Roadside grass	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]
Other crop residues	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]
Forage legumes	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]
Straw/Hay	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]
Concentrates e.g. dairy meal	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]
Maize bran	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]
Maize germ	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]
Wheat bran	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]
Pollard	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]
Oilseed by-products	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]
Poultry waste	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]
Pyrethrum marc	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]
Brewer's waste	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]
Minerals/salt	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]	[_]

B/9 If you sell fodder or concentrates, how much did you sell in the last 12 months and what was the unit price? (If quantity/unit is uncertain record total income).

Specific Feeds types	Unit	Quantity sold	Unit price Kshs.	Total income from sale
Napier grass	[__]	[_____]	[_____]	[_____]
Maize stover green	[__]	[_____]	[_____]	[_____]
Maize stover dry	[__]	[_____]	[_____]	[_____]
Roadside grass	[__]	[_____]	[_____]	[_____]
Other crop residues	[__]	[_____]	[_____]	[_____]
Forage legumes	[__]	[_____]	[_____]	[_____]
Straw/Hay	[__]	[_____]	[_____]	[_____]
Concentrates e.g. dairy meal	[__]	[_____]	[_____]	[_____]
Maize bran	[__]	[_____]	[_____]	[_____]
Maize germ	[__]	[_____]	[_____]	[_____]
Wheat bran	[__]	[_____]	[_____]	[_____]
Pollard	[__]	[_____]	[_____]	[_____]
Oilseed by-products	[__]	[_____]	[_____]	[_____]
Poultry waste	[__]	[_____]	[_____]	[_____]
Pyrethrum marc	[__]	[_____]	[_____]	[_____]
Brewer's waste	[__]	[_____]	[_____]	[_____]
Minerals/salt	[__]	[_____]	[_____]	[_____]

FARMER'S NUMBER/__ __/   ENUMERATOR CODE /__ __/
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E/2 SOURCE OF FIRST COW

1= Purchased cow from neighbour farmer/
market/ development project
2= Obtained cow from a development
project as gift/ loan etc.
3= Through purchased bull on heifer/cow.
4= Through AI on heifer/ cow
5= Through borrowed/rented bull on
heifer/cow
6= As a gift from relatives/friends
7=Other (specify) _____

E/3 DOMINANT DAIRY BREEDS

1 = Holstein Friesian
2 = Ayrshire
3 = Sahiwal
4 = Jersey
5 = Guernsey
6 = Boran (specify local breed
name)_____
7 = Local Zebu (specify local breed name)

_____
8 = Other (specify local breed name)
_____

REASON FOR SELECTING CERTAIN BREED

1= Better looking animals
2= Higher milk processing qualities
3= Lack of choice of semen
4= A condition to getting a loan

5= Higher milk yields
6= Stronger animals for traction etc.
7= Extensionist's advice
8= Other (specify)_____

E/4 REASON FOR WANTING IMPROVED ANIMALS

1= Better looking animals
2= Increased milk production for
home consumption
3= Stronger animals for traction
etc.
4= Extensionist's advice
5=   Other   (specify)
_____
6= Increased status /social standing, personal pride, fashionable trend (from neighbours)
7= Increased milk production for marketing
8= Lack of choice of AI services
9= A condition to getting a loan

E/5 REASONS FOR NOT INCREASING EXOTIC BLOOD

1= High cost of replacements
2= Animals not hardy enough
3 = animals already 100% exotic

4= Not enough feed
5= Logistical problems with AI service
6= Other (specify)_____

E/6 COW BREED
Use codes from Section E/3

SOURCE OF SERVICE
1 = Own bull   5 = Cooperative / Self Help Group AI
2 = Other bull   6 = Project AI
3 = Government AI   7 = Other (specify)_____
4 = Private AI

SEX OF CALF 1 = Male 2 = Female
WHERE IS CALF

1 = Present   4 = Sold   7 = Other (specify)_____
2 = Dead   5 = Given out
3 = Slaughtered   6 = Aborted

FARMER'S NUMBER/__ __/   ENUMERATOR CODE /__ __/
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SECTION E: DAIRYING

E/1. When did you
Start dairy farming ? [19 _ _] First start **selling surplus milk** ? [19 _ _] First get a Grade cow?[19_ _]

E/2. How did you get your **first dairy cow**? [_].

E/3 What are the **dominant breed (s)** in the herd [_] [_]   and **why** did you select these? [_]

E/4 Rank the reasons why you **wanted improved animals**? First [___] Second [___]   Third   [___]

E/5. Have you increased this year the % of dairy genes in your dairy ? [___] 1 = YES 2 = NO

If NO why not ? [___]

E/6. For each COW in the herd up to 5, fill a row. [If the number of cows is more than 5 then randomly select 5. If more than 10 select 6, if more than 15 select 7 etc.].

	COW		Cow Age (Years)	Number of Calvings	Age at 1st calving (Month)	Pregnant 1=Yes 2=No	Source of service	Last service date MM/YY (most recent)	Last calving date MM/YY	Second last calving date MM/YY	DAILY MILK PRODUCTION (in litres) AT			Date dried MM/YY	CALF		
NO.	Name	Breed									Calving	Today	Drying off		Sex	Where is calf?	Age disposed Unit [___] 1 = day 2 = month
1.	_____	[__]	[__]	[__]	[__]	[__]	[__]	[_/_]	[_/_]	[_/_]	[__]	[__]	[__]	[_/_]	[__]	[__]	[__]
2.	_____	[__]	[__]	[__]	[__]	[__]	[__]	[_/_]	[_/_]	[_/_]	[__]	[__]	[__]	[_/_]	[__]	[__]	[__]
3.	_____	[__]	[__]	[__]	[__]	[__]	[__]	[_/_]	[_/_]	[_/_]	[__]	[__]	[__]	[_/_]	[__]	[__]	[__]
4.	_____	[__]	[__]	[__]	[__]	[__]	[__]	[_/_]	[_/_]	[_/_]	[__]	[__]	[__]	[_/_]	[__]	[__]	[__]
5.	_____	[__]	[__]	[__]	[__]	[__]	[__]	[_/_]	[_/_]	[_/_]	[__]	[__]	[__]	[_/_]	[__]	[__]	[__]
6.	_____	[__]	[__]	[__]	[__]	[__]	[__]	[_/_]	[_/_]	[_/_]	[__]	[__]	[__]	[_/_]	[__]	[__]	[__]
7.	_____	[__]	[__]	[__]	[__]	[__]	[__]	[_/_]	[_/_]	[_/_]	[__]	[__]	[__]	[_/_]	[__]	[__]	[__]
8.	_____	[__]	[__]	[__]	[__]	[__]	[__]	[_/_]	[_/_]	[_/_]	[__]	[__]	[__]	[_/_]	[__]	[__]	[__]
9.	_____	[__]	[__]	[__]	[__]	[__]	[__]	[_/_]	[_/_]	[_/_]	[__]	[__]	[__]	[_/_]	[__]	[__]	[__]
10.	_____	[__]	[__]	[__]	[__]	[__]	[__]	[_/_]	[_/_]	[_/_]	[__]	[__]	[__]	[_/_]	[__]	[__]	[__]

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E/7 WAYS TO INCREASE MILK PRODUCTION

1= improve the grade of animals
2= produce more feed
3= buy more feed
4= increase number of dairy cows
5= increase number of dairy goats
6= spend more on controlling animal disease
7= depends on extensionist's advice
8 =Other_____
9=don't know

CONSTRAINTS TO INCREASED MILK PRODUCTION

1= My animals cannot produce more
2= Lack of credit to buy animals/feed
3= I cannot use more milk
4= The price of milk is too low
5= Lack of labour

6 = Not enough feed available for increasing production
7 = Buying more feed would be too expensive
8 = Dairy animals have poor health
9 = I cannot sell more milk
10= There is not enough reliable water available
11= Other specify _____

E/8 CALF SUCKLING

1 = Let it suckle all day

2 = Restrict the Suckling

3 = Bucket feeding

E/13 UNITS OF CONSUMPTION

1= Litre
2= Kg
3= Grams
4= Treetop bottle (750 ml)
5= Large Cup(500 gm)
6= Small-Cup (350 gm)
7= Other unit (specify conversion rate)

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E/7. Do you plan to increase the amount of milk you produce?[   ] 1 = Yes 2 = No

If yes, how do you plan to do it? First method [   ] Second method [   ]

IF No, why not? Main constraint   [   ] Second constraint [   ]_____

ASK QUESTIONS E/8 THROUGH E/13 EVEN IF NO CALVES ON FARM PRESENTLY

E/8 How do you feed your calves? [____]

E/9. If you let them suckle. how long do they continue suckling? give a period in months [___]

E/10 At what age in months do you wean the calves and at what age are they sold?
(put 0 if slaughtered before weaning)

Calves	Age at weaning	Age if sold
Females	[___.___]	[___.___]
Males	[___.___]	[___.___]

E/11. Do you castrate male calves not selected for breeding[___] 1 = YES 2 = NO

E/12 How many times do you milk in a day? [___]
(indicate a number)

E/13. What is the average amount of these products consumed **of own production by the Household** ?

	Unit	Quantity	Per day or week 1=day 2=week	Number months during the year
Fresh milk	[___]	[___]	[___]	[___]
Sour milk	[___]	[___]	[___]	[___]
Butter	[___]	[___]	[___]	[___]
Yoghurt	[___]	[___]	[___]	[___]
Cheese	[___]	[___]	[___]	[___]

E/14 In which months do you usually sell fresh or sour milk? (circle the months)

JAN   FEB   MAR   APR   MAY   JUN   JUL   AUG   SEP   OCT   NOV   DEC   ALL YEAR

E/15 In which months do you usually sell other dairy products? (circle the months)

JAN   FEB   MAR   APR   MAY   JUN   JUL   AUG   SEP   OCT   NOV   DEC   ALL YEAR

SECTION E:

E/16 TYPES OF BUYERS
1= Individual customers/consumers,
2= Private milk-traders,
3= Private dairy processor,
4= Parastatal collection point (KCC)
5= Cooperative collection point,
6= Farmer group/club/association,
7= Retail shop,
8= Hotel/restaurant/office.
9= Other specify_____

UNITS OF PRODUCTION AND SALE
1= Litre,
2= Kg.
3= Grams
4= Treetop bottle (750 ml)
5= Large Cup (500 gm)
6= Small Cup (350 gm)
7= Other unit (specify conversion rate)_____

E/16 How much of each of the products below do you sell to different **types of buyers**? Specify average amount to each **type now.**
(If more than 3 buyer types per season and per product, please select randomly 3).

NOW	Buyer Type 1					Buyer Type 2					Buyer Type 3				
PER DAY	Buyer Type 1	Avg. Qty Per DAY	How many of this type?	Unit	Recent price/ unit (Ksh)	Buyer Type 2	Avg. Qty Per DAY	How many of this type?	Unit	Recent price /unit (Ksh)	Buyer Type 3	Avg. Qty Per DAY	How many of this type?	Unit	Recent price /unit (Ksh)
Fresh milk	[__]	[__]	[__]	[__]	[___]	[__]	[__]	[__]	[__]	[___.]	[__]	[__]	[__]	[__]	[___.]
Sour milk	[__]	[__]	[__]	[__]	[___.]	[__]	[__]	[__]	[__]	[___.]	[__]	[__]	[__]	[__]	[___.]
PER WEEK	Buyer Type 1	Avg. Qty Per WEEK	How many of this type?	Unit	Recent price/ unit (Ksh)	Buyer Type 2	Avg. Qty Per WEEK	How many of this type?	Unit	Recent price /unit (Ksh)	Buyer Type 3	Avg. Qty Per WEEK	How many of this type?	Unit	Recent price /unit (Ksh)
Butter	[__]	[__]	[__]	[__]	[___.]	[__]	[__]	[__]	[__]	[___.]	[__]	[__]	[__]	[__]	[___.]
Yoghurt	[__]	[__]	[__]	[__]	[___.]	[__]	[__]	[__]	[__]	[___.]	[__]	[__]	[__]	[__]	[___.]
Other___	[__]	[__]	[__]	[__]	[___.]	[__]	[__]	[__]	[__]	[___.]	[__]	[__]	[__]	[__]	[___.]

How much of each of the products below do you sell to different **types of buyers**? Specify average amount to each **type during a typical dry season.**

DURING A TYPICAL DRY SEASON	Buyer Type 1					Buyer Type 2					Buyer Type 3				
PER DAY	Buyer Type 1	Avg. Qty Per DAY	How many of this type?	Unit	Recent price/ unit (Ksh)	Buyer Type 2	Avg. Qty Per DAY	How many of this type?	Unit	Recent price /unit (Ksh)	Buyer Type 3	Avg. Qty Per DAY	How many of this type?	Unit	Recent price /unit (Ksh)
Fresh milk	[__]	[__]	[__]	[__]	[__ __]	[__]	[__]	[__]	[__]	[__ __.__]	[__]	[__]	[__]	[__]	[__ __.__]
Sour milk	[__]	[__]	[__]	[__]	[__ __.]	[__]	[__]	[__]	[__]	[__ __.__]	[__]	[__]	[__]	[__]	[__ __.__]
PER WEEK	Buyer Type 1	Avg. Qty Per WEEK	How many of this type?	Unit	Recent price/ unit (Ksh)	Buyer Type 2	Avg. Qty Per WEEK	How many of this type?	Unit	Recent price /unit (Ksh)	Buyer Type 3	Avg. Qty Per WEEK	How many of this type?	Unit	Recent price /unit (Ksh)
Butter	[__]	[__]	[__]	[__]	[__ __]	[__]	[__]	[__]	[__]	[__ __.__]	[__]	[__]	[__]	[__]	[__ __.__]
Yoghurt	[__]	[__]	[__]	[__]	[__ __.]	[__]	[__]	[__]	[__]	[__ __.__]	[__]	[__]	[__]	[__]	[__ __.__]
Other____	[__]	[__]	[__]	[__]	[__ __]	[__]	[__]	[__]	[__]	[__ __.__]	[__]	[__]	[__]	[__]	[__ __.__]

E/17 INFORMATION ON BUYERS

Buyer Type
1 = Individual customers/ consumers
2 = Private milk-traders
3 = Private dairy processor
4 = Parastatal collection point
5 = Co-operative collection point
6 = Farmer group/ club/association
7 = Retail shops. kiosks. dukas. supermarkets
8 = Institutions. schools/hospitals
9 = Hotels/ restaurants/ offices
10 = Others (specify) _____

Transport mode
1 = on- foot
2 = draught animals/ carts
3 = bicycle
4 = public vehicle/ matatu/ bus
5 = private pick-up. van. truck
6 = other (specify)_____

Nature of payment/ contract
1 = Cash sale - single sale
2 = Cash sale - informal contract
3 = On credit sale- single sale
4 = On credit sale- informal contract
5 = On credit sale- formal contract
6 = Other (specify) _____

Who transported?
1 = Self transport
2 = Seller transport
3 = Other (specify)_____

Type of Milk Testing
1 = Not checked
2 = Lactometer (fluid milk only)
3 = Smear test
4 = Smell test
5 = Colour check
6 = Match check
7 = Alcohol gun test
8 = Thermometer test
9 = Several test (specify)_____

E/18 PRODUCT
1 = Sour milk
2 = Butter
3 = Cheese
4 = Yoghurt
5 = Other (specify) _____

OTHER CODES: SEE E/17_____

E/19 DAIRY PROCESSING TECHNOLOGY TYPES
1 = Traditional
2 = Improved traditional
3 = Modem technologies

E/20 AND E/21 SEARCHING FOR CUSTOMERS FOR MILK OR SELLERS OF FEED

Main reason:
1 = Find a better price
2 = Find a single buyer or seller of more quantity
3 = Want more buyers or sellers
4 = Find a "regular" buyer or seller
5 = Find better quality
6 = Other (specify) _____

E/22 MANURE

SOURCE OF MANURE
1 = Cattle
2 = Small ruminants
3 = Poultry
4 = Pigs
5 = Other (specify)_____

UNIT FOR SALE
1 = Standard sack
2 = Wheelbarrow
3 = Donkey cart load
4 = Pick-up load
5 = Lorry load
6 = Other (specify) _____

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E/17 Please give some information on the buyers of fresh milk

	Buyer type	Average distance to selling point (km)	Transport mode	Who transported?	Cost of transport (Ksh)	Nature of payment/ contract	Type of milk test
Buyer Type 1 now	[___]	[___ ___]	[___]	[___]	[___ ___ ___]	[___]	[___]
Buyer Type 2 now	[___]	[___ ___]	[___]	[___]	[___ ___ ___]	[___]	[___]
Buyer Type 3 now	[___]	[___ ___]	[___]	[___]	[___ ___ ___]	[___]	[___]
Buyer Type 1 dry season	[___]	[___ ___]	[___]	[___]	[___ ___ ___]	[___]	[___]
Buyer Type 2 dry season	[___]	[___ ___]	[___]	[___]	[___ ___ ___]	[___]	[___]
Buyer Type 3 dry season	[___]	[___ ___]	[___]	[___]	[___ ___ ___]	[___]	[___]

Check that for **all the buyers** indicated in the table E/16 information are given in this table, with their names repeated here.

E/18 Do you sell milk/dairy products other than fresh milk? [_____] 1 = Yes 2 = No
If **Yes**, please give some information on the **buvers** of these products

	Product	Buyer type	Aver. distance to selling point (km)	Transport mode	Who transported?	Cost of transport (Ksh)	Nature of payment/ contract	If milk, type of milk test
Buyer Type 1 now	[___]	[___]	[___ ___]	[___]	[___]	[___ ___]	[___]	[___]
Buyer Type 2 now	[___]	[___]	[___ ___]	[___]	[___]	[___ ___]	[___]	[___]
Buyer Type 3 now	[___]	[___]	[___ ___]	[___]	[___]	[___ ___]	[___]	[___]
Buyer Type 1 dry season	[___]	[___]	[___ ___]	[___]	[___]	[___ ___]	[___]	[___]
Buyer Type 2 dry season	[___]	[___]	[___ ___]	[___]	[___]	[___ ___]	[___]	[___]
Buyer Type 3 dry season	[___]	[___]	[___ ___]	[___]	[___]	[___ ___]	[___]	[___]

Check that for **all the buyers** indicated in the table E/16 information are given in this table, with their names repeated here.

E/19 What processing technology is used for dairy products?
No [___]   Butter [__]   Yoghurt [ ]   Other [ ]

E/20 Do you have difficulties selling your milk? [___] 1 = Yes, 2 = No
Are you searching for or bargaining with buyers? [___] 1 = Yes, 2 = No
If Yes, why? [___] [___] [___]

E/21 Do you have difficulties buying feed? [___] 1 = Yes, 2 = No
Are you searching for or bargaining with sellers? [___] 1 = Yes, 2 = No
If Yes, why? [___] [___] [___]

E/22 What is the source of the manure? [_____]
Do you sell manure? ? [___] 1 = Yes, 2 = No
If Yes, please indicate how much did you sell during these last 12 months? Quantity [___ ___ ___] and Unit [___]
Indicate the total value per year (Ksh) [___ ___ ___ ___]

FARMER'S NUMBER /__ __/   ENUMERATOR CODE /__ __/
DATE (DD/MM /YY) /___/___/98

SECTION F: LIVESTOCK MANAGEMENT AND HEALTH SERVICES

F/1 ENCLOSE THE ANIMALS
1 = Stall
2 = Boma
3 = Paddock
4 = Other (specify) _____

F/5. FLOOR OF PEN
1= Soil   2=Conrete 3=Srone
4=others (specify)_____

F/6 CATTLE BEDDING TYPE
1= Deep litter
2= Regularly clean

F/9 WATERING FREQUENCY
1= Once a day
2= Twice a day
3= Three times a day
4= Other (specify) _____

SOURCE OF WATER
1=Carted to farm
2=On-farm well/bore hole
3=piped public water supply
4= Other (specify) _____

F/11 SOURCE OF WATER
1= Carted to farm
2= On-farm well / bore hole
3 = Piped public water supply
4 = Other (specify) _____

F/14 MAJOR ANIMAL HEALTH PROBLEMS
1 = East Coast fever
2 = Anaplasmosis
3 = Other tick-borne diseases
4 = Respiratory / Pneumonia
5 = Diarrhoea's
6 = Intestinal worms
7 = Trypanosomosis
8 = LSD
9 = Other skin problems= Mortality in calves
10   mortality rate
11 = Mastitis
12 = Milk fever
13 = Reproduction (abortion, fertility)
14 = Foot problems
15 = Tick burdens
16 = Poisoning (acaricide, snake bite, bracken fern etc.)
17 = Anthrax
18 = Others (specify)_____

CLINICAL SIGNS
1 = Diarrhoea
2 = Cough
3 = Fever
4 = Lack of appetite
5 = Skin problems
6 = Swollen lymph nodes
7 = Weight loss
8 = Others (specify) _____

F/3 ROOFING
1= Without roof
2= Under semi-permanent roof ("makuti", thatch etc.)
3 = Under permanent roof (zinc "mabati" , concrete etc.)

F/4FEEDING THROUGH
ACCESS TO FEED TROUGH
1 = Have access to whole trough area
2 = Have restricted access to the trough

TYPE
1 = Whole trough area
2 = Separate trough area
3 = Other (specify) _____

F/13.   FREQUENCY   OF   FEEDING MINERALS
1. Ad lib in mineral box
2. Only through concentrate mix
3. Only as salt at weekly/ monthly interval
4. Very occasionally
5. None
6. Other specify _____ _____

REASONS OF IMPORTANCE OF DISEASE
1=Highest cause of sickness
2=Causes deaths
3=decreases milk yield
4=Affects milking cows
5=xpensive to prevent
6=Expensive to treat
7=Other (specify)_____

TREATMENT PROVIDER OF LAST CASE
1 = None
2= Veterinarian
3 = Animal Health Assistant AHA)
4 = Local traditional herbalists
5 = Local informal service provider
6 = Neighbour
7 = Self
8 = Other (specify)_____

SOURCE OF LIVESTOCK SERVICE
1 = Government vet dept (on official duty)
2 = Government vet dept (on private duty)
3 = Private vet practice
4 = Local traditional herbalists
5 = Co-operative
6 = Agrovet shop
7 = Chemist
8 = General shop
9 = Other (specify) _____

FARMER'S NUMBER/__ __/   ENUMERATOR CODE /__ __/
DATE (DD/MM /YY) /__ /__ /98

SECTION F LIVESTOCK MANAGEMENT AND HEALTH SERVICES

F/1 Do you enclose your animals? [____] 1 = Yes 2 = No If Yes. where? [____]

F/2. If you have a paddock, a boma, or a stall to enclose your dairy cattle. when did you build it? |19__

How much did it cost you?

Materials	Average Cost (Ksh)
Wood	[_____]
Cement	[_____]
Thatch	[_____]
Mabati	[_____]
Makuti	[_____]
Nails	[_____]
Fences	[_____]
Others	[_____]
Total	[_____]

And how much do you spend per year for its maintenance (Ksh)? [____ ____ ____ ____]

How many years do you think the stall or paddock will last? [____ ____]. And if you were to sell the materials of the stall now. how much do you estimate you can get (Ksh)? [____ ____ ____ ____]

F/3. If you are stall-feeding your cows under what type of roof are they kept [____]

F/4 In the pen have you constructed a feeding trough ? [____] 1 = YES 2= NO

If Yes, what is the type of the feeding trough? [____]

And if Yes how do the cows have access to the trough ? : [____]

F/5. From what is the floor of the pen mainly constructed ? [____]

F/6. Do you use bedding [____] 1 = YES 2= NO If Yes. what sort of bedding do you use? [____]

F/7. Do you store cattle faeces / urine before application to your field [____] 1 = YES 2= NO

F/8. Is water always available to your animals throughout the day [____] 1 = YES 2= NO

F/9. If No how frequently do you water your cows? [____]

F/10 Are all your cows provided water with the same frequency [____]1 = YES 2= NO

F/11 What is the source of this water ?: [____]

F/12 If you have to collect water what is the distance to the source [____ ____]km.

F/13. How often do you feed minerals? [____]

F/14 What are the 3 most important animal health problems affecting your herd (in order of importance)?

	Disease 1	Disease 2	Disease 3
Which Disease?	[__]	[__]	[__]
Reasons of importance (give 3)	[__][__][__]	[__][__][__]	[__][__][__]
Clinical signs (give 3)	[__][__][__]	[__][__][__]	[__][__][__]
Date when last case occurred (mm/ yy)	[__ /19__]	[__ /19__]	[__ /19__]
Age of animals when last case occurred 1 = months. 2 = year [____]	[____]	[____]	[____]
Treatment Provider of last case	[____]	[____]	[____]
Source of livestock service of last case	[____]	[____]	[____]
Outcome 1 = Died 2 = Survived	[____]	[____]	[____]
Total number of cases in last 12 months	[____]	[____]	[____]

FARMER'S NUMBER/__ __/   ENUMERATOR CODE /__ __/   232
DATE (DD/MM /YY) /__ /__ /98

F/15. HOW DO YOU USE ANTHELMINTICS?

1 = Only on individual sick animals
2 = As a routine preventive measure

F/16. VACCINATIONS

1= Foot and Mouth Disease (FMD)
2= Rinderpest
3= C.B.Pleuropneumonia (CBPP)
4= Anthrax
5= Black leg
6= Haemorrhagic septicaemia

7= Lumpy skin disease (LSD)
8 = Brucellosis
9 = Rift Valley Fever
10 =Other (specify) _____
11=Don't know

F/18 TICK CONTROL PRACTICES

WHICH PRACTICES?
1= None
2= Acaricide
3= Grazing restriction
4= Hand picking
5= Traditional treatments

FREQUENCY OF ACARICIDE USE
1= Irregularly
2 = Twice a week
3= Weekly
4 = Fortnightly
5 = Monthly

F/19 TRYPANOSOMOSIS CONTROL MEASURES

0 = No trypanosomosis in the region
1 = No control
2 = Control of Tse Tse flies (traps, etc..)
3 = Use of drugs/ chemo-therapeutics (Berenil, etc....)
4 = Bush clearing
5 = Vector control (pour-on, etc....)
6 = Other (specify) _____

F/15. Have you used anthelmintics in the last 12 months [____] 1 = YES 2= NO
If **Yes**, please state how and the number of treatments in the last 12 months

	Adults	Weaners	Suckling Calves
How ?	[___]	[___]	[___]
Frq/yr	[___]	[___]	[___]

F/16 Have your cattle been **vaccinated** in the last 12 months? [   ] 1 = YES 2= NO

If **YES** against which disease(s) ?

		First	Second	Third	Fourth
Zebu	[___]	[___]		[___]	[___]
Grade	[___]	[___]		[___]	[___]

F/17. When your animals need **management/health services**, are they available [____] 1 = YES 2= NO

If Yes, how many times did you use them in the last 12 months ?

	Number of yearly visits	Total expenses (per year in Ksh)
Self/ Neighbour with professional advice	[___]	[_____]
Self/ Neighbour without professional advice	[___]	[_____]
Government veterinarian/AHA	[___]	[_____]
Cooperative Vet	[___]	[_____]
Private veterinarian/AHA	[___]	[_____]
Traditional Herbalists	[___]	[_____]

Total expenses include all expenses, i.e. cost of drugs, professional fees, etc...

F/18   What **tick control** practices do you apply? [___]

If Acaricide is used which **technique** do you typically use. See code for frequency/year

	Adults	Young stock
Dipping	[___]	[___]
Hand spray	[___]	[___]
Hand wash	[___]	[___]
Pour-on	[___]	[___]
Other specify_____	[___]	[___]

F/19 which control measures do you apply for **Trypanosomosis**? [___]

FARMER'S NUMBER/__ __/   ENUMERATOR CODE /__ __/
DATE (DD/MM /YY) /___/___/98

F/21 CREDIT USES

1= To purchase improved dairy animals

2= For cattle housing

3= For purchase of feed

4 = For veterinary services

5 = For dairy equipment

6 = For establishing fodder

7= Other specify)_____

SOURCE OF CREDIT

1 = Government bank/agency

2 = Private source

3 = Co-operative

4 = Project / NGO

5 = Self Help group or savings club

6 = Other specify)_____

F/22 REASONS FOR NOT OBTAINING CREDIT

1 = Credit not available

2 = Did not need credit

3 = Credit has been too costly

4 = Lack of collateral

5 =Other (specify) _____

F/23. COST OF FEED DEDUCTED FROM MILK RECEIPTS
From whom?

1 = Co-operative

2 = Shops

3 = Individual

4 = Other (specify) _____

F/24 USE AND AVAILABILITY OF SERVICES

1 = Not available

2 = Available but not use

3 = Available and use

F/25 MAIN TOPICS BY EXTENSIONIST

1= Planted forages (napier and other grasses)

2= Feeding of the dairy cow

3= Forage/fodder conservation

4= Breed selection

5 = Milking

6= Gender awareness

7 = Fodder legumes (woody and herbaceous)

8 = Calf rearing

9 = Reproductive management

10= Health management

11= Milk processing

12= Farm judging

13 = Farm management/ economics

14 = Credit

15 = Food crop management

16 = Cash crop management

17 = Others (specify)_____

FARMER'S NUMBER/__ __/   ENUMERATOR CODE /__ __/

DATE (DD/MM /YY) /___/___/98

F/20. Have you obtained long-term credit for your dairying activity? [___] 1 = YES 2 = NO

F/21 If Yes for which credit components(s) and how   many years ago?

Credit needs	Years ago	Source of credit	As Money or Materials
[__]	[___ __]	[__]	[__]
[__]	[___ __]	[__]	[__]
[__]	[___ __]	[__]	[__]
[__]	[___ __]	[__]	[__]
[__]	[___ __]	[__]	[__]

F/22. If No, why not ? [__]

F/23. Do you get, feed the cost of which is deducted from the payment for the milk? [___] 1= Yes 2 = No
If Yes, indicate from whom, the amount of money, and when is the repayment due (after 1 week, 1 month....).

From whom?	amount of money (Ksh)	When is the repayment due? after	
		number	unit: 1 = week 2 = month
[__]	[___ __ __]	[__]	[__]
[__]	[___ __ __]	[__]	[__]
[__]	[___ __ __]	[__]	[__]

F/24. Indicate the use and availability of the following services in your area

	Veterinary services	Number of visits in last 12 months	AI Services	Number of visits in last 12 months	Extension Services	Number of visits in last 12 months
Government	[__]	[__]	[__]	[__]	[__]	[__]
Private Practitioners	[__]	[__]	[__]	[__]	[__]	[__]
NGO's (specify) ____	[__]	[__]	[__]	[__]	[__]	[__]
Cooperative	[__]	[__]	[__]	[__]	[__]	[__]
Agrovet	[__]	[__]	[__]	[__]	[__]	[__]
Informal	[__]	[__]	[__]	[__]	[__]	[__]
Neighbour/relative	[__]	[__]	[__]	[__]	[__]	[__]

F/25. Which main topic(s) of agriculture, livestock, and dairying were you advised on by Extensionist? [___]
[__] [__] [__]

F/26 How many times in the last 5 years have you attended a dairy field day ? [___]

FARMER'S NUMBER/___ ___/   ENUMERATOR CODE /___ ___/
DATE (DD/MM /YY) /___ /___ /98

SECTION G - HOUSEHOLD CASH INCOME AND CONSTRAINTS

G/1 For the different sources of income to the household , either rank or estimate amount per month or year.:
For ranking: 1= main source of income. 2= 2nd . 3 = 3rd .4 = smallest source of income

	RANK	INCOME Kshs.	PER MONTH OR YEAR 1=month 2=year
Income from all farm activities	[__]	[__ __ __ __ __]	[__]
Income from wages/salaries/non-farm activities	[__]	[__ __ __ __ __]	[__]
Income from remittances from absent family members and other external income	[__]	[__ __ __ __ __]	[__]
Income from rent (plots, house, etc...)	[__]	[__ __ __ __ __]	[__]

G/2. For the different sources of income from the farm activities. either rank or estimate amount per month or year.:
For ranking: 1= main source of income. 2= 2nd . 3= 3rd . 4= smallest source of income

	RANK	INCOME Kshs.	PER MONTH OR YEAR 1=month 2=year
Income from dairy activities	[__]	[__ __ __ __]	[__]
Income from sale of cash crop products	[__]	[__ __ __ __]	[__]
Income from sale of food crop products	[__]	[__ __ __ __]	[__]
Income from other farm activities (including bee keeping and beer brewing)	[__]	[__ __ __ __]	[__]

G/3. In which of the following groups do you estimate your total household. from all working members, business income, pensions, and remittances from elsewhere [   ]

TOTAL HOUSEHOLD CATEGORIES
1=<2500 Ksh / month
2=2500-5000
3=5001-10000
4=10001-20000
5=20001-30000
6=>30000

G/4. Among livestock products, compare the relative importance of their income to the household
1 = is < (less than), 2 is = (equal to), 3 is > (greater than)

Income from sale of live animals	[__]	Income from sale of dairy products
Income from sale of cattle manure	[__]	Income from sale of dairy products
Income from sale of skins / hides / wool	[__]	Income from sale of dairy products
Other : _____	[__]	Income from sale of dairy products

-- FOR DAIRY PRODUCERS-SKIP TO SECTION J-

Thank you, Asante ...

FARMER'S NUMBER/__ __/   ENUMERATOR CODE /__ __/
DATE (DD/MM /YY) /__ /__ /98

1/2 REASONS FOR STOPPING DAIRYING

1 = My animals could not produce more
2 = Buying more feed was be too expensive
3 = Dairy animals had poor health
4 = I could not sell more milk
5 = There wasn't enough reliable water available
6 = Other cash needs (had to sell animals)
7 = Labour constraints

8 = There wasn't enough feed available
9 = Lack of credit to buy animals/feed
10 = I could not use more milk
11 = The price of milk was too low
12 = Other profitable enterprises
13 = Theft of animals
14 = Other specify

_____

1/4 FEED PURCHASE UNITS

1 = Kg
2 = Standard sacks
3 = Donkey cart load
4 = Hand cart load
5 = Pick-up load
6 = Single line planted 50 m length
7 = Area in acres
8 = Other (specify)_____

1/8 UNIT FOR SALE OF MANURE

1 = Standard sack
2 = Wheelbarrow
3 = Donkey cart load
4 = Pick-up load
5 = Lorry load
6 = Other (specify) _____

WHERE DOES THE MANURE COME FROM?

1 = the village
2 = the sub location
3 = the location
4 = within the district
5 = outside the district

FARMER'S NUMBER/__ __/   ENUMERATOR CODE /__ __/
DATE (DD/MM /YY) /__ /__ /98

SECTION II - FOR NON-AGRICULTURAL HOUSEHOLDS

II/1 In which of the following groups do you estimate your total household and farm income from all working members, business income, pensions, and remittances from elsewhere [____]

HOUSEHOLD INCOME CATEGORIES

1=<2500 Ksh / month
2=2500-5000
3=5001-10000
4=10001-20000
5=20001-30000
6=>30000

II/2. What is the total land owned by households in acres (for those not doing agricultural activities): [__ __]

II/3. What is the main use of that land [____]
MAIN LAND USE
1= homestead
2= rental
3= business

END OF SECTION FOR NON-AGRICULTURAL HOUSEHOLDS. GO TO SECTION J.

Thank you, Asante ...

SECTION I - FOR FARM HOUSEHOLDS WITHOUT DAIRY ANIMALS

I/1. Did you have dairy animals 10 years ago? [____] 1= Yes 2= No

I/2. If Yes, give reasons why you stopped dairying? [____] [____] [____]

I/3. Do you sell fodder? [____] 1= Yes 2= No

I/4. If Yes: In last 12 months, what is estimated total value of fodder sold of each of these types:
Napier (Ksh)   [____]
Maize stover (Ksh) [____]
Banana pseudostems   [____]
Other (specify) _____ [____]

I/5. Did you grow fodder 10 years ago? [____] 1= Yes 2= No

I/6. If Yes, what was the acreage then (including roadside[__ . __]acres.

I/7 In which of the following groups do you estimate your total household, from all working members, business income, pensions, and remittances from elsewhere [____]
HOUSEHOLD INCOME CATEGORIES
1=<2500 Ksh / month
2=2500-5000
3=5001-10000
4=10001-20000
5=20001-30000
6=>30000

I/8 Do you purchase manure? [____] 1 = Yes 2 = No
If Yes, how much did you buy during these last 12 months? Quantity [__ __ __] and Unit [____]
Indicate the total cost per year [__ __ __ __].
Where does the manure come from? [__]

--END OF SECTION FOR FARM HOUSEHOLDS WITHOUT DAIRY ANIMALS. GO TO SECTION J.
Thank you, Asante ...

FARMER'S NUMBER/__ __/   ENUMERATOR CODE /__ __/
DATE (DD/MM /YY) /__ /__ /98

SECTION J

J/3 REASONS NOT DELIVERING MILK CURRENTLY
1 = Dry cows
2 = Sold all cows
3 = Cows died
4 = Selling milk elsewhere at a better price
5 = Consuming all the milk
6 = Other (specify) _____

J/8 ZERO GRAZING PROJECT
1 = government
2 = NGO, specify _____
3 = University Project, specify ___
4 = Others (specify) _____

J/9 UNITS OF CONSUMPTION
1= Litre
2= Kg
3= Grams
4= Treetop bottle (750 ml)
5= Large cup (500 gm)
6= Small-cup (350 gm)
7= Other unit (specify conversion rate)

SECTION J - TO BE ASKED BY ALL HOUSEHOLDS WHETHER A FARMER OR NOT

J/1 Are you a registered member of a **dairy co-op** or not? [   ] 1=Yes 2= No. If Yes, since when? [19 __ __]. And what is the **name** of the co-op? _____

J/2 If yes, are you currently **delivering** milk to that society? [____] 1 = Yes, 2 = No

J/3 If you are not currently delivering milk, **why not**? [___]

J/4 Are you a member of a **Self Help Group** that collects milk? [   ] 1=Yes 2= No. If Yes, since when? [19 __ __]
(A Self Help Group is registered with Social Services, not with Min. of Co-operative Dev.).
And what is the **name** of the self-help group? _____

J/5 If yes, are you currently **delivering** milk to that group? [____] 1 = Yes, 2 = No

J/6 If you are not currently delivering milk, **why not**? [____]

J/7 What **services** of the dairy co-op or the Self Help Group **do you use**? Place an **X** in boxes that correspond to responses.

Services	Dairy co-op	Self Help Group
Milk marketing/ processing		
Selling of Inputs		
Provider of AI		
Credit for feeds		
Credit for AI		
Insurance		
Others (specify) _____		

J/8 Did you participate in a **zero-grazing project**? [____] 1 = Yes 2 = No. If Yes, when? [19 __]
If Yes, which one? [____]

J/9 If there are any **milk or dairy purchases**, what is the **average** amount of these products consumed by the Household?

	Per day or week 1=day 2=week	Unit	Quantity	Number of months during the year
Fresh milk	[__]	[__]	[__]	[__]
Sour milk	[__]	[__]	[__]	[__]
Butter	[__]	[__]	[__]	[__]
Yoghurt	[__]	[__]	[__]	[__]
Cheese	[__]	[__]	[__]	[__]

Thank you, Asante ...

FARMER'S NUMBER/__ __/   ENUMERATOR CODE /__ __/

DATE (DD/MM /YY) /__ /__ /98

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Kenya Agricultural Research Institute   Ministry of Agriculture   International Livestock Research Institute

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DAY/ DATE TODAY_____

DAY/ DATE OF LAST VISIT_____

DISTRICT   ___

DIVISION   ___

SUB-LOCATION _____

NAME OF RESPONDENT _____
ENUMERATOR_____

FARMER NUMBER _____

WEEK NUMBER _____

DISTRICT[1]	DIVISIONS	SUB-LOCATIONS					
6 = NYANDARUA	11 = OL-KALOU	1546	KANJUIRI	1540	RURII	1544	MELANGINE
		1536	RUIRU	1550	MAWINGO		
7 = NAKURU	15 = RONGAI	1464	LENGINET	1490	KAMPI MOTO	1607	SHAWA
		1186	BANITA	1479	OL-RONGAI		

NON-CROP ACTIVITY
A = Dairy cattle
B = Dairy goats
C = Local goats/sheep
D = Poultry
E = Donkeys
F = Home production for sale
G = Other (specify)_____

INPUT PURCHASE UNIT
0 = Count (No. of Items)
1 = Kg
2 = Standard sack
3 = Donkey cart load
4 = Hand cart load
5 = Pick-up load
6 = Wheelbarrow
7 = Other (specify) _____
8 = Kimbo or Kasuku tin (2 Kg)

INPUT TYPE
1 = Wet manure
2 = Dry manure
3 = Compost manure
4 = Inorganic fertiliser (specify)_____
5 = Poultry manure
6 = Herbicide
7 = Insecticide
8 = Fungicide
9 = Seed (specify)_____
10 = Other (specify)_____

INPUT APPLICATION UNIT
1 = Kg
2 = Standard sack
3 = Donkey cart load
4 = Hand cart load
5 = Pick-up load
6 = Wheelbarrow load
7 = Single line planted 50 length
8 = Area in acres
9 = Other (specify)_____
10 = Kimbo or Kasuku tin (2 kg)
11 = Bucket (debe)

SOURCE OF INPUT
1 = Own farm
2 = Purchased from co-operative
3 = Purchased from other shops
4 = Purchased from vendor
5 = Was given by neighbour,
family members
6 = Gathered from public area
7 = Other (specify)_____

FORM 1 - INPUTS

APPLICATION of Inputs per Activity or Plot/Patch since Last Visit (Example: fertiliser, manure, seed, pesticide)

―――――――――――――――――――

[1] An equivalent questionnaire was used for Kiambu District

Day/Date	Non-crop activity	Plot No.	Patch No.	Input type	Input application unit	Quantity of input applied	Source of input	Remarks

PURCHASE of Inputs/Equipment since Last Visit (Example: tools, fertiliser, manure, seed, pesticide, etc.)

Day/Date	Non-crop activity	Input type	Input purchase unit	Quantity of input purchase	Price per unit	Source of input	Remarks

SOURCE OF WATER
1 = Own farm well/borehole/dam
2 = On-farm piped water
3 = Off-farm piped water
4 = Off-farm well/borehole/dam
5 = River
6 = On-farm roof catchment

UNIT OF WATER
1 = 20 litre bucket
2 = 120 litre Drum
3 = Litre
4 = Other (specify)_____

UTILITY
1 = Water
2 = Electricity

WHO TRANSPORTED WATER
1 = Household head
2 = Female child
3 = Male child
4 = Other adult female
5 = Other adult male
6 = Neighbor
7 = Employed laborer
8 = Other (specify)_____
9 = Casual laborer

Water collected from off-farm

Day/Date	Source of water	Unit of Water	Total units collected	Total Cost (Ksh)	Units given to the dairy cattle	Units given to other livestock	Time taken to fetch water or to water livestock (hrs: min)	Distance to the source of water	Who fetched water/took livestock to water?

Payment for public water and electricity

Day/date	Utility	Amount (Ksh/Month)	Estimated % For dairy cattle

FOOD CROPS

01 = Dry maize grain
02 = Green maize
03 = Sorghum/millet
04 = Beans
05 = Irish potatoes
06 = Sweet potatoes
07 = Cabbage, cauliflower
08 = Kale
09 = Kale seedlings
10 = Spinach
11 = Tomatoes
12 = Onions
13 = French beans

14 = Carrots
15 = Bananas
16 = Arrow roots
17 = Other vegetables
for market
18 = Sugarcane

CASH CROPS

19 = Coffee
20 = Tea
21 = Cut flowers
22 = Wheat
23 = Fruit/tree crops
24 = Pyrethrum
25 = Gum tree

HOME PRODUCT TYPE

1 = Fermented beverages
2 = Sewn/Knitted articles
3 = Wooden articles/furniture
4 = Charcoal
5 = Other (specify)_____

QUANTITY UNIT

0 = Count (Item)
1 = Kg
2 = Bunch
3 = Tray (eggs)
4 = Standard sack
5 = Wheelbarrow load
6 = Donkey cart load
7 = Hand cart load
8 = Pick-up load
9 = Kimbo or Kasuku tins (2 kg)
10 = Standard kiondo
11 = Bucket (debe)
12 = Other (specify)_____

FORAGES

26 = Napier grass
27 = Desmodium
28 = Lucerne
29 = Oats
30 = Fodder beet
31 = Vetch
32 = Other forages (specify)

_____

FODDER TREES

33 = Leucaena
34 = Sesbania
35 = Grevillea
36 = Calliandra
37 = Other (specify)_____

POULTRY

38 = Commercial poultry
39 = Local poultry
40 = Eggs

SALE LOCATION

1 = Own farm gate
2 = Local market centre
3 = Coop collection point
4 = Nearby town
5 = Nairobi

BUYER

1 = Individual
2 = Local trader
3 = Co-operative
4 = Other_____

FORM 2A - HARVEST AND SALES

Daily Food & Cash Crop, Poultry Harvest, and Sale since Last Visit

Day/Date	Crop Type	Plot No.	Patch No.	Quantity Unit	Units Harvested	Units Sold	Price Received Per Unit	Sales Location	Buyer	Remarks

Sales of home production

Day/Date	Product Type	Quantity Unit	Units Sold	Price Received Per Unit	Sale Location	Buyer	Remarks

FOOD CROPS

01 = Dry Maize Grain
02 = Green Maize
03 = Sorghum/Millet
04 = Beans
05 = Irish Potatoes
06 = Sweet Potatoes
07 = Cabbage, Cauliflower
08 = Kale
09 = Kale Seedlings
10 = Spinach

11 = Tomatoes
12 = Onions
13 = French Beans
14 = Carrots
15 = Bananas

16 = Arrow Roots
17 = Other market Vegetables
18 = Sugarcane

CASH CROPS

19 = Coffee
20 = Tea
21 = Cut Flowers
22 = Wheat
23 = Fruit/Tree Crops

24 = Pyrethrum
25 = Gum Tree

FORAGE

26 = Napier Grass
27 = Desmodium
28 = Lucerne
29 = Oats
30 = Fodder Beet
31 = Vetch
32 = Other Forages (Specify)_____
41 = Fodder Maize
42 = Green Maize Stover at harvest
43 = Green Maize Thinning

44 = Maize Stripping
45 = Dry Maize Stover
46 = Fodder Sorghum
47 = Sorghum Straw
48 = Wheat Straw

49 = Sweet Potato Vines
50 = Potato peelings
51 = Cabbage Residue
52 = Kale Residue
53 = Banana Pseudo Stem
54 = Banana Leaves
55 = Weeds
56 = ordinary Mixed Grass
57 = Rhodes Grass
58 = Sudan Grass

59 = Kikuyu Grass
60 = Barley
61 = Root Abaga
62 = Mangold

63 = Rape Seed

FODDER TREES

33 = Leucaena
34 = Sesbania
35 = Grevillea
36 = Calliandra
37 = Others (specify)_____

POULTRY

38 = Commercial Poultry
39 = Local Poultry
40 = Eggs
64 = Poultry Litter

QUANTITY UNIT

0 = Count (Item)
1 = Kg
2 = Bunch
3 = Standard sack
4 = Wheelbarrow load
5 = Donkey cart load
6 = Hand cart load
7 = Pick-up load (1.2 tons)
8 = Pick-up load (1.5 tons)
9 = Woman load
10 = Man load
11 = Standard kiondo
12 = Bucket (debe)

SOURCE

1 = On-farm
2 = Purchased Standing fodder (Off-farm)
3 = Roadside
4 = Common areas (Other than Roadside)
5 = Other private Areas Off-Farm_____
6 = Other (specify) _____

If source = 1 then enter plot
and patch otherwise no plot
and patch

FORM 2B – FODDER HARVEST

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Daily Fodder Harvests since Last Visit (Including Purchased Standing Fodder)

Day/Date	Fodder Type	Source	Plot No.	Patch No.	Quantity Unit	Units Harvested	Remarks

FOOD CROPS

01 = Dry Maize Grain
02 = Green Maize
03 = Sorghum/Millet
04 = Beans
05 = Irish Potatoes
06 = Sweet Potatoes
07 = Cabbage, Cauliflower
08 = Kale
09 = Kale Seedlings
10 = Spinach
11 = Tomatoes
12 = Onions
13 = French Beans
14 = Carrots
15 = Bananas

16 = Arrow Roots
17 = Other market Vegetables
18 = Sugarcane

CASH CROPS

19 = Coffee
20 = Tea
21 = Cut Flowers
22 = Wheat
23 = Fruit/Tree Crops
24 = Pyrethrum
25 = Gum Tree

QUANTITY UNIT

0 = Count (Item)
1 = Kg
2 = Bunch
3 = Standard sack
4 = Wheelbarrow load
5 = Donkey cart load
6 = Hand cart load
7 = Pick-up load (1.2 tons)
8 = Pick-up load (1.5 tons)
9 = Woman load
10 = Man load
11 = Standard kiondo
11 = Bucket (debe)

FORAGES

26 = Napier Grass
27 = Desmodium
28 = Lucerne
29 = Oats
30 = Fodder Beet
31 = Vetch
32 = Other Forages (Specify)_____
41 = Fodder Maize
42 = Green Maize Stover at harvest
43 = Green Maize Thinning
44 = Maize Stripping
45 = Dry Maize Stover
46 = Fodder Sorghum
47 = Sorghum Straw
48 = Wheat Straw

49 = Sweet Potato Vines
50 = Potato peelings
51 = Cabbage Residue
52 = Kale Residue
53 = Banana Pseudo Stem
54 = Banana Leaves
55 = Weeds
56 = Ordinary Mixed Grass
57 = Rhodes Grass
58 = Sudan Grass
59 = Kikuyu Grass
60 = Barley
61 = Root Abaga
62 = Mangold

63 = Rape Seed

FODDER TREES

33 = Leucaena
34 = Sesbania
35 = Grevillea
36 = Calliandra
37 = Other (specify)_____

POULTRY

38 = Commercial Poultry
39 = Local Poultry
40 = Eggs
64 = Poultry Litter

SOURCE

1 = On-farm
2 = Purchased Standing fodder (Off-farm)
3 = Roadside
4 = Common areas (Other than Roadside)
5 = Other private Areas Off-Farm_____
6 = Other (specify) _____

If source = 1 then enter plot
and patch otherwise no plot
and patch

FORM 2C – FEEDING OF FODDER TO ANIMALS

Quantity of fodder fed to the animals since last visit

Day/Date	Fodder Type	Quantity Unit	Units Fed to Dairy Animals	Units Fed to Other Animals	Remarks

FOOD CROPS

1 = Maize
2 = Sorghum / millet
3 = Dried beans
4 = Irish potatoes
5 = Sweet potatoes
6 = Cabbage, cauliflower
7 = Kale
8 = Spinach
9 = Tomatoes

10 = Onions
11 = French beans
12 = Carrots
13 = Bananas
14 = Arrow roots
15 = Other vegetables for market
16 = Other food crop_____

FUEL /OTHER GOODS

36 = Charcoal
37 = Firewood
38 = Kerosene
39 = Gas
40 = Soap and detergents
41 = Others (specify) _____

PURCHASE UNIT

0 = Count (No.) of items)
1 = Kg
2 = Gram
3 = Litre
4 = Packet
5 = Kimbo or Kasuku tin (2 Kg)
6 = Bundle
7 = Tray (eggs)
8 = Sack
9 = Bucket (debe)
10 = Others (specify)_____

LIVESTOCK PRODUCTS

17 = Milk
18 = Beef
19 = Eggs
20 = Poultry meat
21 = Goat meat
22 = Mutton
23 = Pork
24 = Butter
25 = Cheese

OTHER FOOD STUFFS

26 = Sugar
27 = Tea
28 = Maize meal
29 = Wheat flour
30 = Loaf of bread
31 = Rice
32 = Cooking fat
33 = Vegetable oil
34 = Salt/spices
35 = Other (specify)_____

SOURCE

1 = Individual/neighbour
2 = Local trader
3 = Shop
4 = Co-operative
5 = Local market
6 = Butchery
7 = Other (specify)

TOOLS/EQUIPMENT/MATERIAL

1 = Farm implements (hoe, panga, etc.)
2 = Milk cans
3 = Other dairy equipment
4 = Construction materials
5 = Other_____

FORMS 3 - FOOD PURCHASES

Daily Household Expenditure on Food

Day/Date	Food Item/Fuel	Purchase unit	Units purchased	Price per Unit (Ksh.)	Source	Remarks

Household Expenditure on Tools/Equipment/Material

Day/Date	Item	Quantity Purchased	Unit	Price per Unit (Ksh.)	Source	Remarks

SERVICE OR TREATMENT
1 = Artificial insemination
2 = Bull service
3 = Anthelmintic treatment
4 = Acaricide treatment
5 = Vaccination (specify
Vaccine)_____
6 = Castration
7 = Foot trimming
8 = Dehorning
9 = Mastitis treatment
10 = Other (specify)_____

SERVICE PROVIDER TYPE
1 = Veterinarian
2 = Animal Health Assistant (AHA)
3 = Local traditional herbalists
4 = Local informal service provider
5 = Neighbour
6 = Self
7 = Other (specify) _____

NATURE OF PAYMENT
1 = Cash sale – Single sale
2 = Cash sale – informal contract
3 = On credit sale – Single sale
4 = On credit sale – informal contract
5 = On credit sale – formal contract
6 = Other _____

DRUG UNIT
0 = Count (No.)
1 = Kg
2 = Litre
3 = Milliliters (Miles)
4 = Bottle
5 = Other (specify)_____

SOURCE OF LIVESTOCK SERVICE

1 = Government vet dept (on Official duty
2 = Government vet dept (on Private duty)
3 = Private vet practice
4 = Local traditional herbalists
5 = Co-operative
6 = Agrovet shop
7 = Chemist
8 = General shop
9 = Other (specify)_____

DRUG/MEDICAL TYPE

1 = Anthelmintic
2 = Acaricide
3 = Vaccine
4 = Milking salve/Jelly
5 = Teat dip
6 = Antibiotics (specify)
7 = Antifungal (specify)
8 = ECF drugs (specify)
9 = Trypanocidal drugs (specify)_____
10 = Mineral/ vitamin supplement
11 = Herbs
12 = Other (specify)_____

FORM 4 - LIVESTOCK SERVICES

Animal treatment and USE of Livestock Services including Bull Service, AI, and Vet Service

Livestock Services Only									
Day/Date	Service / treatment type	Name of Service /treatment Provider	Service/ treatment Provider Type	Source of Service/ Treatment	Total Cost of Service/ Treatment	Cost of Drugs/ Medication (if separate)	Where was animal treated? (Km from farm)	Nature of payment/ contract	Date/time Technician was called	Date/time technician arrived

Household Purchase of Vet Drugs/Medication (Record above treatment if drugs were used)

Veterinary Drugs Only								
Day/Date	Drug Type	Drug Unit	Drug Quantity Purchased	Price per Unit (Ksh.)	Drug Name	Source of Drug	Distance to Source (Km)	Nature of Payment/ Contract

ANIMAL TYPE	BREED	SOURCE OF MONEY	LOCATION OF SELLER/BUYER	TYPE OF SELLER/ BUYER
1 = Cow	1 = Holstein Friesian	1 = Own savings	1 = In the district	1 = Another small dairy farmer
2 = Heifer	2 = Ayrshire	2 = Informal credit from self-	2 = Outside the district	2 = Private large dairy farmer
3 = Female calf	3 = Sahiwal	Help groups		3 = NGO project
4 = Male calf	4 = Jersey	3 = Formal credit from		4 = Government project
5 = Immature male	5 = Guernsey	Bank/co-operative		5 = Other (specify)_____
6 = Castrated adult male/steer	6 = Other (specify)_____	4 = Donations		
7 = Bulls		5 = Dowry		
8 = Sheep		6 = Other (specify)_____		
9 = Goats				
10 = Donkeys				

END USE OF ANIMAL PURCHASED/SOLD	REASONS FOR SALE	SOURCE OF INSEMINATION
1 = Slaughtered for sale in butchery	1 = Culling of old / sick animals	1 = AI with local semen
2 = Slaughtered for home consumption	2 = Shortage of feed/fodder	2 = AI with imported semen
3 = Kept for reproduction	3 = Shortage of farm labour	3 = Bull
4 = Kept for dairy production	4 = To raise money to pay school fees	
5 = Draught	5 = To raise money to buy food	
6 = Other (specify)_____	6 = Other (specify)_____	

REASON OF DEATH	
1 = Died due to disease (specify disease)_____	7 = Slaughtered due to injury.
2 = Died due to injury, accidents sustained	Accidents sustained
3 = Died due to poisoning (acaricide, snake bites, bracken fern etc.)	8 = Other (specify)_____
4 = Bloat	
5 = Slaughtered for meat	
6 = Slaughtered due to disease (specify disease)	

FORM 5 - PURCHASES AND SALES OF ANIMALS

Purchases of animals

Day/date	Animal type	Breed	Age (Yrs: Months)	Price (Ksh)	Source of cash for purchase of ani-mal	Cost of transport/ Brokering (Ksh)	Location of Seller	Type of seller	End use of animal purchased

Sales of animals

Day/date	Animal type	Breed	Age (Yrs: Months)	Price (Ksh)	Reason for sale	Location Of buyer	Type of buyer	End use of animal sold

Births

Day/date	Animal type 3 = Female calf 4 = Male calf	Id of dam (no.)	Source of insemination	Other remarks

Deaths

Day/date	Animal type	Reason(s) of death	Id of dam (no.)	Source of insemination	Other remarks

FEED TYPE

0 = Napier	10 = Desmodium	20 = Cotton seed cake
1 = Maize stover green	11 = Leucaena	21 = Sunflower seed cake
2 = Maize stover dry	12 = Gliricidia	22 = Other Oilseed by-products
3 = Banana pseudostems	13 = Calliandra	23 = Poultry waste
4 = Fresh ordinary grass	14 = Horticultural by-products	24 = Pyrethrum marc
5 = Wheat straw	15 = Dairy meal	25 = Brewer's waste
6 = Barley straw	16 = Maize bran	26 = Bone meal
7 = Mixed grass/weeds	17 = Maize germ	27 = Fish meal
8 = Lucerne hay	18 = Wheat bran	28 = Mollasses
9 = Ordinary grass hay	19 = Pollard	29 = Others (specify)_____

FEED PURCHASE SOURCE

1 = Individual farmer
2 = Local trader
3 = Shop
4 = Co-operative
5 = Other_____

FEED PURCHASE UNIT

1 = Kg
2 = Standard 70 kg bag
3 = 50 kg bag
4 = 20 kg bag
5 = Hand cart load
6 = Donkey cart load
7 = Pick-up load
8 = Lorry load
9= Single line planted 50m length
10 Area in acres
11= Other (specify)_____

FEED TRRASPORT

1 = On foot
2 = Bicycle
3 = Hand cart/wheelbarrow
4 = Donkey cart
5 = Pick-up
6 = Lorry
7 = Other (specify)_____

NATURE OF PAYMENT/CONTRACT

1 = Cash sale - Single sale
2 = Cash sale - informal contract
3 = On credit sale - Single sale
4 = On credit sale - informal contract
5 = On credit sale - formal contract
6 = Other (specify)_____

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FORM 6 – PURCHASES OF FEED/FODDER

Day/date	Feed Type	Feed Brand (if any)	Unit	Quantity Bought	Unit Price	Total Cost	Source (Seller)	Distance to source (Km)	Transported by: 1 = buyer 2 = seller	Time spent buying and transporting (hrs: min)	Cost of transport (Ksh)	Nature of Pay-ment/ Contract

FEED TYPE

0 = Napier
1 = Maize stover green
2 = Maize stover dry
3 = Banana pseudostems
4 = Fresh ordinary grass
5 = Wheat straw
6 = Barley straw
7 = Mixed grass/weeds
8 = Lucerne hay
9 = Ordinary grass hay

10 = Desmodium
11 = Leucaena
12 = Gliricidia
13 = Calliandra
14 = Horticultural by-products
15 = Dairy meal
16 = Maize bran
17 = Maize germ
18 = Wheat bran
19 = Pollard

20 = Cotton seed cake
21 = Sunflower seed cake
22 = Other Oilseed by-products
23 = Poultry waste
24 = Pyrethrum marc
25 = Brewer's waste
26 = Bone meal
27 = Fish meal
28 = Mollasses
29 = Others (specify)_____

FEED BUYER

1 = Individual farmer
2 = Local trader
3 = Shop
4 = Co-operative
5 = Other_____

FEED PURCHASE UNIT

1 = Kg
2 = Standard 70 kg bag
3 = 20 kg bag
4 = Hand cart load
5 = Donkey cart load
6 = Pick-up load
7 = Lorry load
8 = Single line planted 50m length
9 = Area in acres
10 = Other (specify)_____

FEED TRANSPORT

1 = On foot
2 = Bicycle
3 = Hand cart/wheelbarrow
4 = Donkey cart
5 = Pick-up
6 = Lorry
7 = Other (specify)_____

NATURE OF PAYMENT/CONTRACT

1 = Cash sale - Single sale
2 = Cash sale - informal contract
3 = On credit sale - Single sale
4 = On credit sale - informal contract
5 = On credit sale - formal contract
6 = Other _____

FORM 6 (CONTINUED)-SALES OF FEED AND FODDER

Day/date	Feed Type	Feed Brand (if any)	Unit	Quantity Sold	Unit price	Total cost	Buyer	Distance to buyer (Km)	Transported by: 1 = buyer 2 = seller	Time spent selling and transporting (hrs: min)	Cost of transport (Ksh)	Nature of payment/ contract

MILK UNIT

1 = Litre
2 = Kg
3 = Grams
4 = Treetop bottle (750 ml)
5 = Large cup (500 ml)
6 = Small cup (350 ml)
7 = Other (specify)_____

BUYER TYPE

1 = Dairy society/coop
2 = Trader/hawker
3 = Farmer group (non-coop)
4 = Local bar/hotel/restaurant
5 = Local household
6 = KCC plant
7 = Private processors
8 = General shop
9 = Other (specify)_____

WHO TRANSPORTED MILK

1 = Household head
2 = Female child
3 = Male child
4 = Other adult female
5 = Other adult male
6 = Neighbor
7 = Employed laborer
8 = Other (specify) _____
9 = Collected by buyer
10 = Hired transporter

AM OR PM MILK
1 = AM milk
2 = PM milk
3 = AM and PM milk
4 = Other _____

FORM 7 - MILK CONSUMPTION AND SALES

Daily Household Milk Consumption and Sales

	Milk consumed					Milk sold						
	Quantity consumed by the house-hold	Quantity given to permanent farm la-borer(s)	Quantity given to rela-tives and friends	Quantity fed to calf	Unit	Buyer type	AM, PM, milk or both (code)	Amount sold	Quantity Unit	Price/ Unit	Who trans-ported milk from farm to first bulking point or buyer?	Distance to first bulking point or buyer (Km)
MON__/__						a.						
						b.						
						c.						
TUE__/__						a.						
						b.						
						c.						
WED__/__						a.						
						b.						
						c.						
THU__/__						a.						
						b.						
						c.						
FRI__/__						a.						
						b.						
						c.						
SAT__/__						a.						
						b.						
						c.						
SUN__/__						a.						
						b.						
						c.						

MEANS OF TRANSPORT	BUYER TYPE	LOCATION OF BUYER	WHO TRANSPORTED MILK
1 = On foot	1 = Dairy society/coop	1 = Farm	1 = Household head
2 = Donkey	2 = Trader/hawker	2 = Neighbor	2 = Female child
3 = Bicycle	3 = Farmer group (non-coop)	3 = Market center	3 = Male child
4 = Vehicle	4 = Local bar/hotel/restaurant	4 = Nearby town	4 = Other adult female
5 = Collected by buyer	5 = Local household	5 = Nairobi	5 = Other adult male
6 = Other (specify)_____	6 = KCC plant	6 = Other (specify) _____	6 = Neighbor
	7 = Private processors	7 = Nearby main road	7 = Employed laborer
	8 = General shop	8 = Village shop	8 = Other (specify)_____
	9 = Other (specify)_____		9 = Collected by buyer
			10 = Hired transporter

WHAT ARE THE TERMS OF PAYMENT FOR THE SALES?	NATURE OF SALES AGREEMENT	MILK QUALITY CHECK
1 = Immediate cash	1 = Cash sale – single	1 = Not checked
2 = Payment every week	2 = Cash sale – informal contract	2 = Lactometer (fluid milk only)
3 = Payment every two weeks	3 = On credit sale – Single sale	3 = Smear test
4 = Payment every month	4 = On credit sale – informal contract	4 = Smell test
5 = Others (specify) _____	5 = On credit sale – formal contract	5 = Colour check
6 = Exchange milk with goods	6 = Other (specify)_____	6 = Match check
		7 = Alcohol gun test
		8 = Thermometer test
		9 = Other (specify)

Day/Date	Buyer type	Means of transport to first bulk-ing point or buyer	Time spent on milk sale/delivery (hrs: min)	Transport costs to first bulking point or buyer	Who trans-ported milk from first bulk-ing point to the buyer?	Means of transport from first bulking point to buyer	Transport cost from first bulking point to buyer	Location of buyer (Code)	Terms of payment?	What was nature of sales agree-ment? (Code)
MON --/--	a.									
	b.									
	c.									
TUE --/--	a.									
	b.									
	c.									
WED --/--	a.									
	b.									
	c.									
THUR --/--	a.									
	b.									
	c.									
FRI --/--	a.									
	b.									
	c.									
SAT --/--	a.									
	b.									
	c.									
SUN --/--	a.									
	b.									
	c.									

FORM 7 MILK SALES – (Continued – same rows as above)

Day/Date	How did the buyer check milk quality?	Quantity of milk rejected
MON --/--		
TUE --/--		
WED --/--		
THUR --/--		
FRI --/--		
SAT --/--		
SUN --/--		

PRODUCT/FEED TYPE

0=Milk
1 = Napier
2 = Maize stover green
3 = Maize stover dry
4 = Banana pseudostems
5 = Fresh ordinary grass
6 = Wheat straw
7 = Barley straw
8 = Mixed grass/weeds
9 = Lucerne hay
10 = Ordinary grass hay

11=Desmodium
12 = Leucaena
13 = Gliricidia
14 = Calliandra
15 = Horticultural by-products
16 = Dairy meal
17 = Maize bran
18 = Maize germ
19 = Wheat bran
20 = Pollard
21 = Cotton seed cake

22=Sunflower seed cake
23 = Other Oilseed by-products
24 = Poultry waste
25 = Pyrethrum marc
26 = Brewer's waste
27 = Bone meal
28 = Fish meal
29 = Mollasses
30 = Others (specify)_____

COSTS OF SEARCHING FOR OR BARGAINING

1 = Transport cost
2 = Broker – Intermediary cost
3 = Other cost (specify)_____

PRINCIPAL REASON FOR SEARCHING FOR OR BARGAINING

1 = Find a better price
2 = Find a single buyer or seller of more quantity
3 = Want more buyers or seller
4 = Find a 'regular' buyer or seller
5 = Other (specify)

BUYER /SELLER CONTACTED

1 = Dairy society/coop
2 = Trader/hawker
3 = Farmer group (non-coop)
4 = Local bar/hotel/restaurant
5 = Local household
6 = KCC plant
7 = Private processors
8 = General shop
9 = Other (specify)_____

FORM 8 - SEARCHING AND BARGAINING

Milk and Feed Sales or Purchases

Day/ Date	Market objective 1 = selling 2 = buying	Product 0 = milk see codes for feeds	Time spent searching for or bargaining with buyers of milk? (hrs: min)	Money spent while searching for buyers or sellers? (Ksh)	Reason Money was spent during searching for or bargaining? (see code)	Main reason for searching for or bargaining with buyers or sellers? (see code)	Was the search or bargain successful? 1 = yes 2 = no	If yes, who was buyer or seller contacted? (see code)

Market Failure

Transaction Type 1 = milk sales 2 = feed sales 3 = feed purchase	IF FEED, what type? (use product code)	How many times since last visit was a BUYER or SELLER wanted but NOT FOUND for this item	How many times since last visit would the SELLER NOT HAVE ALL of the quantity DESIRED?	How many times since last visit would the BUYER NOT BUY ALL of the quantity OFFERED?

NON-CROP ACTIVITY

A = Dairy cattle
B = Dairy goats
C = Local goats/sheep
D = Poultry
E = Donkeys
F = Home production for sale
G = Other (specify)_____

TYPE OF OPERATION

01 = Preparing Fields for Planting
02 = Planting
03 = Weeding
04 = Manuring
05 = Fertilizing (inorganic)
06 = Collecting "Cut and carry" fodder/grass/stover
07 = Harvesting + transporting/ heaping
08 = Milking
09 = Processing Milk
10 = Animal feeding

11 = Herding / Grazing
12 = Barn cleaning
13 = Spraying/Dipping
14 = Purchase of animals
15 = Purchase of agricultural inputs
16 = Selling/Transporting Milk/Dairy Products
17 = Sale of manure
18 = Purchase of feed
19 = Drawing/collecting water
20 = Other (specify)_____

FORM 9 - HOUSEHOLD LABOR ALLOCATION

Daily Household Labour Allocation for Livestock, Crops, and Farm Activities.

Day	Date (dd/mm)	Type of Op-eration	Non-crop activity	Plot No.	Patch No.	No. of HH Females	No. of HH Males	No. of HH Children < 16 Yrs	No. of Casual Laborers	No. of Long-term laborers	Time spent (hrs: min)	Remarks
MON	_ / _											
TUE	_ / _											

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NON-CROP ACTIVITY

A = Dairy cattle
B = Dairy goats
C = Local goats/sheep
D = Poultry
E = Donkeys
F = Home production for sale
G = Other (specify)_____

TYPE OF OPERATION

01 = Preparing Fields for Planting
02 = Planting
03 = Weeding
04 = Manuring
05 = Fertilizing (inorganic)
06 = Collecting "Cut and carry" fodder/grass/stover
07 = Harvesting + transporting/ heaping
08 = Milking
09 = Processing Milk
10 = Animal feeding

11 = Herding / Grazing
12 = Barn cleaning
13 = Spraying/Dipping
14 = Purchase of animals
15 = Purchase of agricultural inputs
16 = Selling/Transporting Milk/Dairy Products
17 = Sale of manure
18 = Purchase of feed
19 = Drawing/collecting water
20 = Other (specify)_____

Daily Household Labour Allocation for Livestock, Crops, and Farm Activities

Day	Date (dd/mm)	Type of Op-eration	Non-crop activity	Plot No.	Patch No.	No. of HH Females	No. of HH Males	No. of HH Children < 16 Yrs	No. of Casual Laborers	No. of Long-term laborers	Time spent (hrs: min)	Remarks
WED __/__												
THU __/__												

NON-CROP ACTIVITY

A = Dairy cattle
B = Dairy goats
C = Local goats/sheep
D = Poultry
E = Donkeys
F = Home production for sale
G = Other (specify)_____

TYPE OF OPERATION

01 = Preparing Fields for Planting
02 = Planting
03 = Weeding
04 = Manuring
05 = Fertilizing (inorganic)
06 = Collecting "Cut and carry" fodder/grass/stover
07 = Harvesting + transporting/ heaping
08 = Milking
09 = Processing Milk
10 = Animal feeding

11 = Herding / Grazing
12 = Barn cleaning
13 = Spraying/Dipping
14 = Purchase of animals
15 = Purchase of agricultural inputs
16 = Selling/Transporting Milk/Dairy Products
17 = Sale of manure
18 = Purchase of feed
19 = Drawing/collecting water
20 = Other (specify)_____

Daily Household Labour Allocation for Livestock, Crops, and Farm Activities

Day	Date (dd/mm)	Type of Operation	Non-crop activity	Plot No.	Patch No.	No. of HH Females	No. of HH Males	No. of HH Children < 16 Yrs	No. of Casual Laborers	No. of Long-term laborers	Time spent (hrs: min)	Remarks
FRI _/_												
SAT _/_												
SUN _/_												

LABORER TYPE

1 = Male casual labour
2 = Female casual labour
3 = Child casual labour
4 = Male long-term labour
5 = Female long-term labour
6 = Child long-term labour
7 = Other (specify)_____

HOUSEHOLD MEMBER

1 = Household head
2 = Other adult female
3 = Other adult male
4 = Female child <16
5 = Male child <16
6 = Other (specify)_____

UNIT OF TIME

1 = Hour
2 = Half day (8-1 p.m.)
3 = Daily
4 = Weekly
5 = Monthly
6 = Work lot
7 = others (specify) _____

TYPE OF OPERATION

01 = Preparing Fields for Planting
02 = Planting
03 = Weeding
04 = Manuring
05 = Fertilizing (inorganic)
06 = Collecting "cut and carry"
Fodder/grass/stover
07 = Harvesting + transporting/ heaping
08 = Milking
09 = Processing Milk
10 = Animal feeding

BUYER TYPE

1 = Dairy society/cooperative
2 = Trader/hawker
3 = Farmer group (non-cooperative)
4 = Local bar/hotel/restaurant
5 = Local household
6 = KCC plant
7 = Private processors
8 = General shop
9 = Other (specify)_____

NON-CROP ACTIVITY
A = Dairy cattle
B = Dairy goats
C = Local goats/sheep
D = Poultry
E = Donkeys
F = Home production for sale
G = Other (specify)_____

OFF-FARM INCOME TYPE
1 = Casual labour
2 = Professional services
3 = Livestock services
4 = Retail trade
5 = Remittances (gifts)
6 = Loan
7 = Other (specify)_____

11 = Herding / Grazing
12 = Barn cleaning
13 = Spraying/Dipping
14 = Purchase of animals
15 = Purchase of agricultural inputs
16 = Selling/ Transporting milk/dairy products
17 = Sale of manure
18 = Purchase of feed
19 = Drawing and collecting water
20 = Other (specify)_____

FORM 10 - HOUSEHOLD LABOR EXPENDITURE AND INCOME

Daily Household Expenditure on Hired Labour

Day/Date	Laborer Type	Unit of Time	Quantity done	Wage per Time Unit (Ksh.)	Non-crop activity	Plot No.	Patch No.	Operation Type(s)

Daily Household Income from Off-Farm Labour, Services, or Remittances, and home-produced goods

Day/Date	Off-farm income type	Earned by which Household member	Amount (Ksh.)	Remark

Payment from milk sales

Day/Date	Total amount Received (Ksh)	Buyer type	Was payment delayed? (Y/N)	Day/date payment was due	Amount still Delayed (Ksh)	Remarks

Smallholder Dairy (R&D) Project

Assessment of Informal Milk Market Performance and Associated Public Health Risks in Kenya

QUESTIONNAIRE FOR THE SURVEY IN KIAMBU AND NAIROBI[1]

---

[1] NB. Look for and fill in CODES if a box [_____] is provided.

NAME OF ENUMERATOR _____

Date: (dd/mm/yy)   [__ / __ / __]

Time started _____   Time ended _____

SECTION A: BACKGROUND INFORMATION

1. Respondent's Name_____ 2. Business Name (Where applicable) _____

3. Background

District	Division	Sub-location
[__]	[__]	[____]

CODES

DISTRICT	DIVISIONS	SUB – LOCATIONS				
		Kikuyu	*Limuru*	*Kiambaa*	*Githunguri*	*Lari*
1 = KIAMBU	1 = GITHUNGURI	1202 = LUSIGETI	1224 = THIGIO	1239 = KARURI	1252 = GATHANGARI	1308 = KAMAE
	2 = KIAMBAA	1208 = GITARU	1227 = NDIONI	1241 = GATHANGA	1257 = RIUKI	1324 = KAMBURU
	3 = KIKUYU	1211 = KERWA	1232 = NGECHA		1258 = GIATHIEKO	1326 = KAMUCHEGE
	4 = LARI	1218 = KIBICHIKU			1259 = KANJAI	1327 = NYANDUMA
	5 = LIMURU	1221 = UTHIRU			1260 = KIMATHI	1328 = GACHOIRE
		1222 = CHURA			1263 = NYAGA	
		1223 = RUKU			1267 = GATHUGU	
		Kasarani		*Kibera*		
2 = NAIROBI	1 = KASARANI	1112 = ROYSAMBU	1116 = KASARANI	1089= NAIROBI WEST	1093=WOODLEY	1088=MUGUMOINI
	2 = KIBERA	1115 = RUARAKA	1118=KAHAWA NORTH	1092=KIBERA	1091=GOLF COURSE	

3. Background cont'd

Sex of respondent	Age of respondent (yy)	Trade/business type	Position in business	Milk sales area	Distance from sales area to Nairobi (km)	Period in business (yy: mm)	Source of initial financing	Other occupations	Prevailing weather conditions	Ambient Temp (°C)
[__]	_____ Yrs	[__]	[__]	_____	[__]	[__ . __]	[__]	[__]	[__]	[__]

CODES

Type of Trade/Business	Position in Business	Sex of Respondent	Source of initial financing	Other occupation	Weather condition
1= Co-operative 2= Self help group 3= Milk bar 4= Milk shop/kiosk 5= milk bar/snack bar 6= Small mobile trader (Hawker) 7= Raw milk 'processor' 8= Other (Specify) _____	1= Proprietor 2= Employee 3= Others (Specify) _____	1= Male 2= Female	1 = Savings 2 = Credit (specify creditor)_____ 3 = (Others specify) _____	1= None 2= farming 3= Salaried employment 4= Retired with pension 5= Retired without pension 6= Businessman/woman 7= Others (specify) _____	1 = Hot 2 = Cold 3 = Dry 4 = Wet

4. Milk procurement

Source area		Source type	Organization of collection	Time of purchase/collection (HH)		Unit of measure	Purchase price per unit (Ksh)	Amount purchased		Mode of payment	Commodities bartered against milk (if payment is in kind)
District	Division			AM	PM			AM	PM		
____	____	a. [__]	[__]	____	____	[__]	____	____	____	[__]	____
____	____	b. [__]	[__]	____	____	[__]	____	____	____	[__]	____
____	____	c. [__]	[__]	____	____	[__]	____	____	____	[__]	____
____	____	d. __]	[__]	____	____	[__]	____	____	____	[__]	____
____	____	e. [__]	[__]	____	____	[__]	____	____	____	[__]	____

CODES

Source type	Organisation of collection	Unit of measure	Mode of payment
1 = Individual farmer (s) 2 = Dairy co-op. Society 3 = Private processor 4 = Self-help group 5 = Traders/hawkers 6 = Own farm 7 = Others (specify) _____	1=Farmer(s) deliver to a collection point 2=Trader(s) deliver to a collection point 3=Farmer(s) deliver to trading premises 4=Trader(s) deliver to trading premises 5=Buyer collects at co-op collection point 6=Buyer collects at farmstead 7=co-op delivers to trading premises 8=others (specify)_____	1= Litre 2= Kg 3= Treetop bottle 750 ml) 4= Soda bottle (300 ml) 5= Small cup (350 ml) 6= Large cup (500 ml) or ½ litre 7= Others (Specify) _____	1= Cash; now 2= Cash; next day 3= Credit; monthly 4= Credit; fortnightly 5= Credit; weekly 6= Others (specify) _____

4. Milk Procurement (Cont'd)

Source type (cont'd as in previous Table)	Quality control measures before receiving milk	Penalty for delivering unwholesome-some milk	Type of handling vessels	Size of handling cans (litres)	Maximum number bulked from each source	Method of supplier identification where milk not bulked	Contractual arrangements with suppliers		Type of road milk is transported on
							Nature	Specification	
a. [____]	[__][__][__]	a. [____]	[____]	_____	_____	[____]	[____]	[__][__][__]	[____]
b. [____]	[__][__][__]	b. [____]	[____]	_____	_____	[____]	[____]	[__][__][__]	[____]
c. [____]	[__][__][__]	c. [____]	[____]	_____	_____	[____]	[____]	[__][__][__]	[____]
d. [____]	[__][__][__]	d. [____]	[____]	_____	_____	[____]	[____]	[__][__][__]	[____]
e. [____]	[__][__][__]	e. [____]	[____]	_____	_____	[____]	[____]	[__][__][__]	[____]

CODES

Source type	Quality control measures before receiving milk	Penalty for delivering unwholesome milk	Method of supplier identification	Nature of Contract	Type of road
1 = Individual farmer (s)	1= None	1= None	1 = Can labelling	0= None	1 = Tarmac
2 = Dairy co-op. Society	2= Lactometer	2= Shared costs	2 = Colour of cans	1= Informal	2 = Murram
3 = Private processor	3= Odour test	3= Buyer bears full cost	**Type of handling cans**	2= Formal (Lawyer assisted)	3 = Earth
4 = Self-help group	4= Visual check	4= Seller bears full cost	1=Plastic	**Specification of contract agreement**	4 = Narrow path
5 = Traders/hawkers	5= Match check	5= Other (Specify)_____	2=Metal	1= None	5 = Other (Specify)
6 = Own farm	6= Alcohol test	**Type of handling cans**	3=Glass	2= Quantities of daily supply	_____
7 = Others (specify)_____	7= Thermometer test	Plastic	4=Plastic and Metal	3= Mode of payment	
	8= Boiling	Metal	5=Plastic, Metal and	4= Date of payment	
	9= Others (Specify)_____	Glass	6=Glass	5= Time of supply	
		Plastic and Metal	7=Other (Specify)	6= Purchase of all milk supplied	
		Plastic, Metal and Glass		7 = Other (Specify)_____	
		Other (Specify)____			

4. Milk procurement (Cont'd)

Source type (continued as in previous table)	Distance to resale point (km)	Who transported milk from collection point	Mode of Transport from collection point	Time taken to resale point from supplier (HH: MM)	Input services /goods provided to suppliers in the last ONE MONTH	Values of input services/goods provided (Ksh)	Agreed mode of repayment for services/ goods provided
a. [__]	[__]	[__]	[__]	_____	[__] [__] [__]	_____	[__]
b. [__]	[__]	[__]	[__]	_____	[__] [__] [__]	_____	[__]
c. [__]	[__]	[__]	[__]	_____	[__] [__] [__]	_____	[__]
d. [__]	[__]	[__]	[__]	_____	[__] [__] [__]	_____	[__]
e. [__]	[__]	[__]	[__]	_____	[__] [__] [__]	_____	[__]

If milk is transported on **public transport**, give transport costs: **Personal** fare (Ksh) _____ Milk **load** fare (Ksh) _____

CODES

Whether input services are provided	Who transported from collection point	Mode of transport from collection point	Input Services provided	Agreed mode of repayment for services provided
1= No	1= Self transport	1= on foot	1= None	1 = Deducted from proceeds of milk supplied
2= Yes	2= Supplier transports	2= draught animals/cart	2= Vet clinical services	2 = cash repayment
	3= Transporter	3= bicycle	3= Veterinary drugs	3 = Others (Specify)
	4= Others (Specify)___	4= open public vehicles	4= A. I services	_____
		5= closed public vehicles	5= Transport services	
		6= open private vehicle	6= Financial advances	
		7= closed private vehicle	7= Financial credit	
		8= others specify)_____	8= Others _____	
		9= Hired Transport		

SECTION C: MILK HANDLING PRIOR TO SALE

5. Milk Handling (Same for every source type)

Is milk still kept separate after receiving	Longest period milk stays before sale (Hrs)	Do you process milk? [a]	Major sales products	Quality control measures prior to sale	Method of preservation-ion	Type of milk scoop	Distance to nearest water point (Km) **(enter 0 if in premises & blank for hawkers)**
[_]	_____	[_]	[_] [_]	[_] [_]	[_] [_]	[_]	_____

[a] Processing implies boiling/heating, pasteurization or making dairy products such as mala, yoghurt, ice cream etc

CODES

Is milk still kept separate after receiving	Major product types	Quality control measures prior to sale	Method of milk preservation	Type of milk scoop
1= No 2= Yes **Process milk** 1= No 2= Yes	1 = Raw fresh milk 2 = Mala/Lala 3 = Yoghurt; own processed 4 = Yoghurt; not own processed 5 = Milk shake 6 = Cream 7 = Ice cream 8 = Tea 9 = Others (specify)_____	1= None 2= Lactometer 3= Odour test 4= Visual check 5= Match check 6= Alcohol test 7= Thermometer test 8= Boiling 9= Others (Specify)____	1= Not treated 2= Boiling 3= Refrigerating/chilling 4= Cold water bath 5= Antibiotics added 6= Hydrogen peroxide 7= Lactoperoxidase added 8= Other additives (Specify)_____ = Others preservation method (specify) _____	Plastic Metal Glass Plastic and Metal Glass, Metal and Plastic Other (Specify)_____

5 Cont'd

Is water available at time of visit?	Water source	Mode of cleaning containers/ milk scoop	Storage place of containers/ milk scoop	Amount left over yesterday		
				Unit	Amount	Fate
[__]	[__]	[__]	[__]	[__]	____	[__]

CODES

Water source	Mode of cleaning milk containers	Storage place of containers/scoops	Fate of left over milk
1=Piped/tap 2=River/Stream 3=Community ground pump 4=Roof catchment (Rain water) 5=Private ground pump/well 6. Other (Specify) _____	1 = With cold water alone 2 = With hot water alone 3 = With cold water and soap 4 = With hot water and soap 5 = With detergent and water 6 = Others (Specify) _____	1= Refrigerator 2= On the counter 3= Dipped in water 4= Dipped in can of milk 5= Polythene bags 6= Others (Specify) _____ **Is water available at time of visit?** 1= No 2= Yes	1= Thrown away 2= Used by family when raw 3= Unboiled, naturally fermented and sold 4= Unboiled, naturally fermented and used by family 5= Boiled, naturally fermented and sold 6= Given to animals 7= Processed into *Mala* (cultured) 8= Refrigerated and sold 9= Others (specify)_____

6. Training in Hygienic Milk Handling and Quality Control (use different line for different courses)

Duration of Training	Where was training received	Qualification
[__]	_____	_____
[__]	_____	_____
[__]	_____	_____
[__]	_____	_____

CODES

Training in milk quality control
1 = No training
2 = Up to one month of training
3 = Between 1 month and 6 months of training
4 = More than 6 months of training

SECTION D: MILK SALES

7. For the dairy products SOLD YESTERDAY, record the major customer types, amount sold to each customer type, price per unit and the contractual arrangements

Customer type	Buyer location	Approx. Number of buyers	Organization of delivery	Mode of delivery	Amount sold yesterday		Price per unit (Ksh)	Mode of payment	Contractual arrangements with buyers		
					Unit of measure	Quantity			Nature		Specification
a. [___]	_____	_____	[___]	[_]	[_]		___	___	[_] [_]	[_] [_]	[_] [_] [_]
b. [___]	_____	_____	[___]	[_]	[_]		___	___	[_] [_]	[_] [_]	[_] [_] [_]
c. [___]	_____	_____	[___]	[_]	[_]		___	___	[_] [_]	[_] [_]	[_] [_] [_]
d. [___]	_____	_____	[___]	[_]	[_]		___	___	[_] [_]	[_] [_]	[_] [_] [_]
e. [___]	_____	_____	[___]	[_]	[_]		___	___	[_] [_]	[_] [_]	[_] [_] [_]

CODES

Customer type
1= Own processing
2= Own snack bar
3= Household consumers
4= Private milk traders (hawkers)
5= Private dairy processors
6= Kiosks/retail shops
7= Supermarkets
8= Pupils/students
9= Hotels/restaurants
10= Institutions (schools, hospitals)
11= Individual buyers in offices
12= Others (specify) _____

Mode of Payment
1= Cash on delivery
2= Credit, monthly
3= Credit, fortnightly
4= Credit, weekly
5= In-kind payment
6= Other specify _____

Mode of delivery
1= On foot
2= Draught animal/carts
4= Bicycle
5= Public vehicle (*matatu*, or bus)
7= Own transport
6= Hired transport

Specification of contract agreement
1= None
2= Quantities of daily supply
3= Mode of payment
4= Date of payment
5= Time of supply
6 = Other (Specify) _____
Organisation of delivery
1= Buyer collects
2= Seller delivers

Unit of measure
1= Litre
2= Kg
3= Treetop bottle (750 ml)
4= Soda bottle (300 ml)
5= Small cup (350 ml)
6= Large cup (500 ml)
7= Others (Specify)
Nature of Contract
0= None
1= Informal
2= Formal (Lawyer assisted)

SECTION D: Continuation of milk sales

7. (cont'd). For the dairy products SOLD YESTERDAY, record the major customer types, amount sold to each customer type, price per unit and the contractual arrangements (cont'd from previous page)

Customer type (continue as in previous table)	Packaging	Type of packaging material	Compensation for spoilt milk	Peak sale time (HH: MM)	For **household consumers** indicate Measure in highest demand
a. _____	[__][__]	[__]	[__]	_____	[__]
b. _____	[__][__]	[__]	[__]	_____	[__]
c. _____	[__][__]	[__]	[__]	_____	[__]
d. _____	[__][__]	[__]	[__]	_____	[__]
e. _____	[__][__]	[__]	[__]	_____	[__]

7b. For milk bars/kiosks selling other **non-dairy products** (snacks, fruit etc.) ask for **estimate of share of milk sales** over total turnover (%) [__]

CODES

Customer type		Type of packaging material	Compensation for spoilt milk
1= Own processing	7= Supermarkets	1= Glass	1= None
2= Own snack bar	8= Pupils/students	2= Plastic	2= Shared costs
3= Household consumers	9= Hotels/restaurants	3= Metal	3= Seller bears full cost
4= Private milk traders (hawkers)	10= Institutions (schools, hospitals)	4= Polythene	4= Other (Specify)
5= Private dairy processors	11= Individual buyers in offices	5= Others (Specify)___	**Measure in highest demand**
6= Kiosks/retail shops	12= Others (specify)	**Packaging**	1= tree-top bottle (750 ml)
		1= Consumer's container	2= litre
		2= Seller's container	3= large cup (500 ml)
			4= small cup (350 ml)
			5= others (specify)_____

SECTION E: CAPITAL STOCK
8. Handling cans and quality check equipment.

Type	Number	Initial Cost (Ksh)	Salvage value (Ksh)	Is item used for any other work? 1=No, 2=Yes	Share of daily use (%)	Expected useful life (yrs)	Estimated re-placement cost (Ksh)
Aluminium cans	_____	_____	_____	_____	[_____]	_____	_____
Jerricans (specify capacity)							
1_____	_____	_____	_____	_____	[_____]	_____	_____
2_____	_____	_____	_____	_____	[_____]	_____	_____
3_____	_____	_____	_____	_____	[_____]	_____	_____
					[_____]		
Crates	_____	_____				_____	_____
Printing plates	_____	_____				_____	_____
Sealers	_____	_____				_____	_____
Others (Specify)	_____	_____				_____	_____
_____							
Quality test equipment	Number						
Lactometer	_____	_____				_____	_____
Alcohol gun	_____	_____				_____	_____
Thermometer	_____	_____				_____	_____
Others (specify)	_____	_____				_____	_____
_____							

Nb. **Salvage value** = scrap value; **Replacement cost** = current market price of a new item

9. Transportation/distribution vehicles

Item	Initial Cost (Ksh)	Salvage value	Is item used for other work? 1= No 2= Yes	Share of daily use where applicable (%)	Expected useful life (Yrs)	Estimated replacement cost (Ksh)
Bicycles						
1 _____	_____	_____	[___]	_____	_____	_____
2. _____	_____	_____	[___]	_____	_____	_____
3. _____	_____	_____	[___]	_____	_____	_____
4. _____	_____	_____	[___]	_____	_____	_____
Carts and draught animals						
1. _____	_____	_____	[___]	_____	_____	_____
2. _____	_____	_____	[___]	_____	_____	_____
3. _____	_____	_____	[___]	_____	_____	_____
4. _____	_____	_____	[___]	_____	_____	_____
Pick-up, Van, Truck						
1. _____	_____	_____	[___]	_____	_____	_____
2. _____	_____	_____	[___]	_____	_____	_____
3. _____	_____	_____	[___]	_____	_____	_____
4. _____	_____	_____	[___]	_____	_____	_____

Nb. Salvage value - scrap value;   Replacement cost = current market price of a new item

10. Heating and cooling equipment

Item	Number	Initial Cost (Ksh)	Salvage value (Ksh)	Is item used for other work? 1= No 2 = Yes	Share of daily use (%)	Expected useful life (yrs)	Estimated replacement cost (Ksh)
Sufurias	_____	_____	_____	[_____]	_____	_____	_____
Jikos	_____	_____	_____	[_____]	_____	_____	_____
Plunger/Stirrer	_____	_____	_____	[_____]	_____	_____	_____
Freezers							
1. _____	_____	_____	_____	[_____]	_____	_____	_____
2. _____	_____	_____	_____	[_____]	_____	_____	_____
Cooling drums							
1. _____	_____	_____	_____	[_____]	_____	_____	_____
2. _____	_____	_____	_____	[_____]	_____	_____	_____
3. _____	_____	_____	_____	[_____]	_____	_____	_____
Water-reserving drums							
1. _____	_____	_____	_____	[_____]	_____	_____	_____
2. _____	_____	_____	_____	[_____]	_____	_____	_____
3. _____	_____	_____	_____	[_____]	_____	_____	_____
Scoops _____	_____	_____		[_____]		_____	_____
Funnels _____	_____	_____		[_____]			_____

11. Furnishings (furniture, curtains etc)

Item	Initial Cost (Ksh)	Expected useful life (yrs)	Estimated replacement cost (Ksh)
1.			
2.			
3.			
4.			

12. Other fixed annual costs (Ksh)

a. **Rent** of the premises per month (Ksh)_____ (if trader not paying rent, specify and enter the **market rent rate** of the premises)

b. **Trade licenses** and **annual fees (Ksh/Yr)**

KDB	Munici-pal/County council	Ministry of commerce	Service charge	Health inspection fees (premises in-spection)	Staff health inspection fees			TOTAL fees
					No. of staff	No. of inspections per year	Fee per person	

c. **Contingency protection fees** (from police, council *askaris*, KDB inspectors, harassment) _____ Ksh/month

d. **Actual** payments made **last month** (Ksh) _____

e. Others (specify) _____

13a. INTERMEDIATE INPUT AND COSTS: Vehicles

Item	Expenditure per year (Ksh)
Fuel	[ ]
Servicing, oil & filters	[ ]
Repairs and maintenance	[ ]
Tyres	[ ]
Tubes	[ ]
Annual inspection	[ ]
Insurance	[ ]
Road licence	[ ]
TLB (Transport &Licensing Board)	[ ]
Others specify	[ ]

Aids for filling (especially for formal milk market organisations e.g., coops):
Balance sheets
Calculation request forms (CRF)

13b. INTERMEDIATE INPUTS AND COSTS (cont'd): Processing and Sales

Item	Unit Codes: 0=Count; 1= kg; 3=packet; 4=sachet; 5=Ksh/month; 6=Ksh/yr	Price/Unit	Units pur- chased/year	Total expendi- ture (Ksh)
Packaging materials	[_____]	_____	_____	_____
Inoculants	[_____]	_____	_____	_____
Sugar	[_____]	_____	_____	_____
Food colouring	[_____]	_____	_____	_____
Flavouring	[_____]	_____	_____	_____
Fuel (lighting/heating only) charcoal, firewood, kerosene	[_____]	_____	_____	_____
Electricity	[_____]			_____
Water**	[_____]			_____
Sanitation Soaps & detergents Other	[_____] [_____]	_____ _____		_____ _____
Stationery	[_____]	_____	_____	_____
Repairs and maintenance (painting etc.)	[_____]	_____	_____	_____

** Where there is **no running water**, specify and record the cost of **buying water** and **carrying** the water to the premise

Average water usage			
Units of sale	Units used on average per day	Price per unit (Ksh)	Delivery charges
[_____]	[_____]	[_____]	[_____]

14. LABOUR FORCE

Category	Number	Sex	Age(s)	Monthly Cash wage (Ksh)	Other benefit (Value in Ksh)
Milk bar/snack bar/ snack shop attendants	_____	[___] [___] [___] [___]	[___] [___] [___] [___]	_____	_____
Dairy technologists	_____	[___] [___] [___] [___]	[___] [___] [___] [___]	_____	_____
Drivers	_____	[___] [___] [___] [___]	[___] [___] [___] [___]	_____	_____
Family labour	_____	[___] [___] [___] [___]	[___] [___] [___] [___]		
Casuals	_____	[___] [___] [___] [___]]	[___] [___] [___] [___]]	_____	_____
Others	_____	[___] [___] [___] [___]	[___] [___] [___] [___]	_____	_____

15. Give the **4 most important constraints** to the milk sales business

_____

_____

_____

_____

Rank them in order of **importance:** [_____] [_____] [_____] [_____]   (1=most important; 4=least important)

SECTION G: HYGIENE OF PREMISES AND MILK HANDLER (S)

16. Observe and record the PHYSICAL DESCRIPTION of the milk bar/processing premises

Item	Material
Walls	[___]
Roof	[___]
Floor	[___]
Sale counter/surface	[___]

CODES

Construction materials for walls, floor, roof, sales counter-surface (Section NOT to be answered by MILK HAWKERS)
1= Timber/Wooden
2= Earthen
3= Concrete
4= Metal sheets
5= Thatch
6= Plastic
7= Formica
8= Glass
9= Open
10= Others (specify)_____

17. Checklist on the Personal Hygiene and milk handling practices of the Milk Handler
(Circle right answer Y= Yes and N = No)

Is any protective clothing used?	Y	N	9. Any latrine facility available?	Y	N
If yes, is it clean?	Y	N	10. If yes, what is the type of latrine (tick)		
Is any head cover used?	Y	N	10.1 Pit latrine [____]		
Are there any visible cuts/wounds on:			10.2. Septic tank [____]		
4.1. Hands	Y	N	10.3. Sewerage type [____]		
4.2. Face	Y	N	11. Are flies visible within < than 3 Metres from the milk bar /kiosk?	Y	N
4.3. Legs	Y	N	12. Distance to nearest refuse disposal area (metres) [_____]		
5. Are there any septic wounds/spots on:			13. Are hands clean?	Y	N
5.1. Hands	Y	N	14. Are nails: clean?	Y	N
5.2. Face	Y	N	14.1. Short?	Y	N
5.3. Legs	Y	N	14.2. Polished.	Y	N
6. Are there any visible body discharges from:			15. Are any hand ornaments (not wedding ring) used?	Y	N
6.1. Nose	Y	N	16. Is he/she a smoker?	Y	N
6.2. Eyes	Y	N	17. Any coughing noticed.	Y	N
6.3. Throat	Y	N	18. If yes, does the person cover the mouth?	Y	N
6.4. Ears	Y	N	19. If yes, are the hands thoroughly washed after that?	Y	N
6.5. Sweat	Y	N	20. Are hands washed regularly before handling milk and the containers? (Not applicable to hawkers)	Y	N
7. Is milk bar/kiosk floor dry?	Y	N			
8 Is milk bar/kiosk floor clean?	Y	N			
8. Is the milk selling area dry?	Y	N			

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18. Give overall score of personal hygiene (milk handler) and cleanliness of premises (Tick overall score)

Personal Hygiene		Tick
Very good	(Very good standard of cleanliness: clean protective clothing, wearing hat/head dress, boots, good health)	1
Good	(Good standard of cleanliness: clean non-protective clothing, wearing hat/head dress, normal shoes, no signs of ill health)	2
Fair	(Fair standard of cleanliness: no hat, no shoes, not ill)	3
Poor	(Poor standard of cleanliness: Dirty, no hat, no boots, no shoes, signs of ill health)	4
Cleanliness of premises		
Very good	(Concrete floor, wall tiles/white wash walls, ceiling board, Formica counter, clean storage, running water)	1
Good	(Concrete floor, normal walls, no ceiling board, clean surfaces, ordinary wooden counter, clean storage, water available)	2
Fair	(Concrete floor, normal walls, no ceiling board, clean surfaces, ordinary wooden counter, clean storage, no water)	3
Poor	(Non-concrete floor, mud walls, no roof, dirty surfaces and equipment, no water)	4