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**DETERMINANTS OF COORDINATION AND  
SUPPLY CHAIN PERFORMANCE**

***The Case of Fresh Milk Supply Chains in  
Kenya***

Department of Agricultural Economics  
of the University of Kiel, Germany

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Dissertation  
zur Erlangung des Doktorgrades  
der Agrar- und Ernährungswissenschaftlichen Fakultät  
der Christian-Albrechts-Universität zu Kiel

vorgelegt von

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# Contents

<b>ACKNOWLEDGEMENT</b> .....	IV
<b>TABLES</b> .....	VIII
<b>FIGURES</b> .....	IX
<b>MAPS</b> .....	IX
<b>SUMMARY</b> .....	X
<b>KURZFASSUNG</b> .....	XII
<b>CHAPTER 1 INTRODUCTION</b> .....	<b>1</b>
1.1 PROBLEM SETTING .....	1
1.2 OBJECTIVES .....	3
1.3 HYPOTHESES .....	4
1.4 JUSTIFICATION .....	4
1.5 SCOPE AND LIMITATIONS OF THE STUDY .....	5
1.6 DEFINITION OF TERMS .....	6
1.7 ORGANIZATION OF THE RESEARCH .....	8
<b>CHAPTER 2 INSTITUTIONAL CHANGE AND LIBERALIZATION IN THE KENYAN AGRICULTURE AND DAIRY INDUSTRY</b> .....	<b>9</b>
2.1 ROLE AND CONTRIBUTION OF AGRICULTURE TO THE KENYAN ECONOMY .....	9
2.2 AGRICULTURAL LIBERALIZATION IN KENYA .....	10
2.3 LIBERALIZATION AND INSTITUTIONAL CHANGE IN THE DAIRY INDUSTRY .....	13
2.3.1 <i>The livestock sub-sector</i> .....	13
2.3.2 <i>A historical perspective of the dairy industry: pre-liberalization period</i> .....	14
2.3.3 <i>Post-liberalization scenario</i> .....	17
2.4 THE KENYAN MILK SUPPLY CHAIN .....	17
2.4.1 <i>The chain configuration</i> .....	17
2.4.2 <i>Milk production system and consumption</i> .....	19
2.4.3 <i>Consumption patterns in the country</i> .....	20
2.4.4 <i>Informal milk supply chain</i> .....	21
2.4.5 <i>Milk collection, processing and marketing in the formal supply chain</i> .....	23
<b>CHAPTER 3 TRANSACTION COST THEORY AND COORDINATION MECHANISMS</b> .....	<b>27</b>
3.1 CLASSICAL AND NEOCLASSICAL ECONOMIC THEORIES .....	27
3.1.1 <i>The classical economic theory</i> .....	27
3.1.2 <i>Neoclassical (new classical) economics</i> .....	28
3.2 BASIS AND FOUNDATIONS OF NEW INSTITUTIONAL ECONOMICS .....	31
3.3 TRANSACTION COST ECONOMICS: DEFINITION AND APPROACHES .....	34
3.4 INFORMATION ECONOMICS AND TRANSACTION COSTS .....	37
3.5 BEHAVIORAL ASSUMPTIONS RESPONSIBLE FOR TRANSACTION COSTS .....	40
3.6 DIMENSIONS OF TRANSACTION COSTS AND COORDINATION CONTINUUM .....	42
3.7 INSTITUTIONS, TRANSACTION COSTS AND COORDINATION PERFORMANCE IN DEVELOPING MARKETS .....	49
<b>CHAPTER 4 EMPIRICAL STUDIES ON TRANSACTION COSTS, COORDINATION MECHANISMS AND SUPPLY CHAIN PERFORMANCE</b> .....	<b>61</b>
<b>CHAPTER 5 THEORETICAL AND EMPIRICAL MODEL</b> .....	<b>71</b>
5.1 THEORETICAL FOUNDATIONS FOR SMALLHOLDER MARKET PARTICIPATION .....	71
5.2 MARKET SITUATION FACING SMALLHOLDER MARKET PARTICIPANTS .....	73
5.2.1 <i>Market situation under assumption of no transaction costs</i> .....	73
5.2.2 <i>The market situation in the presence of transaction costs</i> .....	76
5.3 A THEORETICAL MODEL FOR DETERMINANTS OF COORDINATION MECHANISMS .....	80
5.4 SPECIFICATION OF THE ECONOMETRIC MODEL .....	83
5.4.1 <i>The multinomial logit model</i> .....	84
5.4.2 <i>Model justification</i> .....	85
5.5 EMPIRICAL SPECIFICATION OF DETERMINANTS OF COORDINATION MECHANISMS .....	86
5.5.1 <i>Household and individual characteristics</i> .....	87
5.5.2 <i>Firm specific characteristics</i> .....	88
5.5.3 <i>Transaction cost specific characteristics</i> .....	89

5.6	DETERMINANTS OF SUPPLY CHAIN PERFORMANCE.....	94
5.6.1	<i>Supply chain performance measurement</i> .....	94
5.6.2	<i>A theoretical model for determinants of supply chain performance</i> .....	97
<b>CHAPTER 6</b>	<b>DATA DESCRIPTION.....</b>	<b>101</b>
6.1	SURVEY STRATEGY .....	101
6.1.1	<i>Characteristics of the study area</i> .....	101
6.1.2	<i>Sampling techniques</i> .....	103
6.1.3	<i>Data gathering methods</i> .....	103
6.1.4	<i>Data and variable definitions</i> .....	104
6.2	SAMPLE CHARACTERISTICS AND DESCRIPTIVE ANALYSIS OF THE RESPONSES: DISTRIBUTION OF THE TRANSACTIONS .....	108
6.3	SAMPLE CHARACTERISTICS OF THE COORDINATION MECHANISMS .....	110
6.4	CHARACTERISTICS OF THE FACTORS INFLUENCING COORDINATION MECHANISMS BETWEEN MILK PRODUCERS AND THEIR BUYERS.....	111
6.5	CHARACTERISTICS OF RETAILER-SUPPLIER TRANSACTIONS .....	116
6.6	CHARACTERISTICS OF RETAILER-BUYER TRANSACTIONS .....	120
6.7	CHARACTERISTICS OF THE DEPENDENT VARIABLE: SUPPLY CHAIN PERFORMANCE .....	123
<b>CHAPTER 7</b>	<b>DETERMINANTS OF COORDINATION AND SUPPLY CHAIN PERFORMANCE</b>	<b>125</b>
7.1	MODEL RESULTS AND DISCUSSIONS: DETERMINANTS OF COORDINATION MECHANISMS IN PRODUCER-BUYER TRANSACTIONS .....	125
7.2	DETERMINANTS OF COORDINATION IN RETAILER –SUPPLIER TRANSACTIONS.....	131
7.3	COORDINATION IN RETAILER-BUYER TRANSACTIONS .....	136
7.4	DETERMINANTS OF SUPPLY CHAIN PERFORMANCE IN PRODUCER-BUYER MILK TRANSACTIONS .....	139
7.5	PERFORMANCE IN RETAILER-SUPPLIER MILK TRANSACTIONS.....	140
7.6	PERFORMANCE IN RETAILER-BUYER MILK TRANSACTIONS .....	143
<b>CHAPTER 8</b>	<b>SUMMARY AND IMPLICATIONS FOR POLICY .....</b>	<b>145</b>
8.1	SUMMARY.....	145
8.2	IMPLICATIONS OF THE STUDY FOR POLICY .....	149
8.3	DIRECTIONS FOR FURTHER RESEARCH.....	155
<b>REFERENCES</b>	<b>.....</b>	<b>157</b>
<b>APPENDICES</b>	<b>.....</b>	<b>171</b>
	<b>APPENDIX 1: QUESTIONNAIRES FOR MILK PRODUCERS</b> .....	171
	<b>APPENDIX 2: QUESTIONNAIRE FOR MILK RETAIL OUTLETS</b> .....	182
	CURRICULUM VITAE .....	197

## Tables

Table 2.1 Key cattle performance indicators in Kenya .....	13
Table 2.2 Milk production (grazing) systems in Kenya .....	19
Table 2.3 Cost and price per liter of milk.....	19
Table 2.4 Comparison of costs and revenues for three districts.....	20
Table 2.5 Registered participants in the milk chain .....	23
Table 2.6 Concentration in the Kenyan dairy industry.....	24
Table 2.7: Components of consumer price.....	26
Table 6.1: Summary of constructs for determinants of coordination mechanisms .....	106
Table 6.2: Summary of constructs for determinants of supply chain performance.....	107
Table 6.3: Sample distribution for milk producer transactions by district and division.....	108
Table 6.4: Producer-buyer chains in the milk industry .....	109
Table 6.5: Retailer-supplier milk supply chains.....	109
Table 6.6: Retailer-buyer milk supply chains .....	110
Table 6.7: Coordination mechanisms and their distributions in producer transactions.....	110
Table 6.8: Distribution of coordination mechanisms .....	111
Table 6.9: Distribution of coordination mechanisms in retailer-buyer transactions.....	111
Table 6.10: Distribution of production units by district and gender .....	112
Table 6.11: Classification of respondents by educational class .....	112
Table 6.12: Descriptive statistics for producer-buyer transactions .....	113
Table 6.13: Importance of legal contracts in producer-buyer transactions .....	114
Table 6.14: Seriousness of problem of lack of buyers .....	114
Table 6.15: Extent of price knowledge in producer transactions .....	115
Table 6.16: Length of credit period.....	115
Table 6.17: Distribution of retailer-supplier transactions by gender.....	116
Table 6.18: Distribution of retailer-supplier transactions by type of retail outlet .....	116
Table 6.19: Retailer-supplier transactions, summary descriptive statistics .....	117
Table 6.20: Extent of partner reliability .....	118
Table 6.21: Extent of difficult of finding alternative milk suppliers.....	118
Table 6.22: Usefulness of trader information sources to retailers .....	118
Table 6.23: Usefulness of government market information to retailers .....	119
Table 6.24: Personal relations in retailer transactions .....	119
Table 6.25: Length of credit period in retailer-supplier transactions .....	120
Table 6.26: Distribution of transactions by gender .....	120
Table 6.27: Distribution of retailer-buyer transactions by type of retail outlet .....	121
Table 6.28: Summary descriptive statistics for retailer-buyer transactions.....	122
Table 6.29: Distribution of retailer transactions by length of credit period .....	123
Table 6.30: Performance in producer-buyer transactions.....	123
Table 6.31: Performance in retailer- supplier transactions.....	124
Table 6.32: Performance in retailer- supplier transactions.....	124
Table 7.1 Multinomial Logit Model estimates for determinants of producer-buyer coordination .....	126
Table 7.2 Marginal effects of explanatory variables on the probability of coordination choice .....	128
Table 7.3 Multinomial Logit Model estimates for determinants of retailer-supplier coordination .....	132
Table 7.4 Marginal Effects of explanatory variables on the probability of coordination choice: retailer-supplier .....	134
Table 7.5 Multinomial Logit Model estimates for determinants of retailer-buyer coordination.....	136
Table 7.6 Marginal effects of explanatory variables on the probability of coordination choice retailer-buyer coordination .....	137
Table 7.7: Ordered Probit parameter estimates for determinants of producer-buyer transaction performance...	140
Table 7.8 Ordered Probit parameter estimates for determinants of retailer-supplier transaction performance ...	142
Table 7.9: Probit parameter estimates for determinants of retailer-buyer transaction performance.....	144
Table 8.1 Determinants of coordination mechanisms in the milk supply chains .....	148



**Figures**

Figure 2.1 Diagrammatic representation of the typical milk chains in Kenya ..... 18  
Figure 3.1 Transaction costs as a function of asset specificity..... 43  
Figure 3.2: Governance structure shift due to uncertainty ..... 45  
Figure 3.3: The continuum of governance structures..... 46  
Figure 3.4: Simple contracting schema ..... 47  
Figure 3.5: High and low level equilibriums with coordination and opportunism risk..... 53  
Figure 3.6: Links between governance, institutional environment and the individual ..... 55  
Figure 3.7: Dominance of hierarchical organization and adaptation during transition ..... 57  
Figure 5.1: Relationship between transaction costs and household sales and purchases ..... 72  
Figure 5.2: The conceptual model..... 94

**Maps**

Map 1 Map of Kenya showing the research area ..... 196

## **Summary**

Typical problems impacting the Kenyan agricultural sector range from unfavorable weather conditions, technical production skills, capital insufficiency, and inadequate markets and have been well documented. Changes in the general macroeconomic environment such as opening up of the markets (liberalization and privatization) have also brought about newer challenges for the participants in the agricultural sector. The changes have impacted differently on the prices and quantities of various products for both producers and consumers. Whereas many production and or marketing based studies have been useful in identifying key solution areas, institutional and management aspects in the agricultural sector have not been adequately addressed.

Based on the New Institutional Economics framework (specifically Transaction Cost Economics Theory) and Supply Chain Management frameworks, the study investigates two main issues among the market participating agents in the Kenyan milk supply chain. Firstly, it identifies and evaluates determinants of coordination mechanisms used in the Kenyan fresh milk supply chain. Secondly, it identifies and evaluates determinants of supply chain performance in the fresh milk supply chain. The two issues are investigated for transactions between milk producers and their buyers, between milk retail outlets and their milk suppliers, and between the retail outlets and their buyers. Coordination is defined by the kind of contracts used in transactions between the sellers and the buyers of milk. On the other hand, supply chain performance is defined by the extent to which the supply chain partners are satisfied with key aspects of their transactions with partners and is measured on likert type scales.

Primary data using personally administered questionnaires was collected on commercial dairy activities from two districts in Kenya: Nakuru and Nyandarua districts, between May 2005 and September 2005. The data collected comprised of the agents' socioeconomic characteristics, farm/firm specific factors, transaction cost characteristics and performance related aspects such as prices, milk quantities, milk quality, information flows and communications, and transaction partner reputations and trustworthiness. Two econometric models were applied to analyze the collected data. The first is a multinomial logit model that was applied to analyze data on determinants of coordination mechanisms. The second model is an ordered probit model that was applied to analyze data on determinants of supply chain performance. Both models were run in LIMDEP™ econometric software.

The results of the study provide a framework for characterizing coordination mechanisms, and factors influencing coordination modes or arrangements in the Kenyan fresh milk supply

chains. Three main coordination mechanisms were identified in the milk supply chains: spot market contracts, verbal contracts, and written contracts. The study demonstrates that the different kinds of coordination mechanisms have several advantages and disadvantages. The results also show that the coordination modes are used generally across milk transactions in the country. Furthermore, it shows that each coordination mechanism is associated with certain transaction costs, firm specific, as well as socioeconomic characteristics of the agents. With regard to supply chain performance, the study shows that, socioeconomic, firm specific and transaction cost factors as well as the type of coordination mechanisms used are important determinants of performance in milk supply chains. Specifically, the study shows that milk producers are constrained more by lack of information on markets and prices and inability to effect any meaningful impact in the market for their milk. On the other hand, retail outlets are shown to be constrained by high transaction costs arising out of having to deal with numerous small sized milk producers in the upstream market and inability to influence prices in the consumer market. Furthermore, milk prices, availability of buyers and market information asymmetries are found to be important determinants of supply chain performance in the milk transactions.

The study shows that certain state interventions may be necessary for the commercial development of the dairy industry especially with regard to reduction of key transaction costs, among them road transport infrastructure, farmer cooperative organizations, information and market search and contractual support institutions. The study is an important contribution to the operations of the dairy industry and in particular the fresh milk supply chain and provides a detailed insight into the mechanisms of coordination and supply chain performance in the dairy industry. It provides information on the institutional arrangements in the industry that is necessary for the understanding and development of the dairy industry in the country by private agents and policy makers. The information can assist in achieving better transaction partner selection when designing their milk supply chains. Most significant is in pointing out what kinds of transaction costs are important or likely to be faced by opting for certain transactions, transaction partners, and coordination modes. In the overall, the determinants of the contractual modes also show the sources of these transaction costs which can be addressed by the chain partners (or policy makers) or if they prove insurmountable, they can be avoided all together.

Key words: New Institutional Economics, Transaction Costs, Coordination Mechanisms, Supply Chain Management, Supply Chain Performance, Milk Supply Chain, Household Model, Multinomial Logistic Regression, Ordered Logistic Regression, Kenya.

## ***Kurzfassung***

Die typischen Probleme, die den kenianischen Agrar-Sektor beeinflussen, reichen von ungünstigen Wetterbedingungen, technischen Produktionsfähigkeiten, und Kapitalunzulänglichkeit bis zu unzulänglichen Märkten, und sind gut dokumentiert worden. Änderungen im allgemeinen makroökonomischen Klima wie Erschließung der Märkte (Liberalisierung und Privatisierung) gehen mit neuen Herausforderungen für die Marktteilnehmer in verschiedenen Sektoren der Wirtschaft einher. Die Änderungen haben sich auf Preise und Mengen der verschiedenen Produkte sowohl für Produzenten als auch Verbraucher ausgewirkt. Während viele produktions- und oder marketingbezogene Studien Lösungen für zentrale Probleme in diesen Bereichen bieten, sind Institutions- und Managementaspekte im landwirtschaftlichen Sektor bisher nicht ausreichend untersucht worden.

Basierend auf der neuen Institutionenökonomie (beziehungsweise Transaktionskosten Theorie) und dem Konzept des Supply Chain Managements, untersucht die Studie zwei Hauptthemen der Marktteilnehmer kenianischen Milchindustrie. Es werden zum einen Determinanten der Koordinationsmechanismen, die in der kenianischen Milchliefkette angewandt werden, und zum anderen Determinanten der Leistungsfähigkeit der Lieferkette bei Frischmilch identifiziert und analysiert. Beides wird für Verhandlungen zwischen Milchproduzenten und ihren Kunden, zwischen Einzelhändler und Milchlieferanten, sowie zwischen Einzelhändlern und ihren Kunden untersucht. Koordination wird durch die Art der Verträge definiert, die in den Verhandlungen zwischen Anbietern und Nachfragern von Milch zur Anwendung kommen. Demgegenüber wird die Leistungsfähigkeit der Lieferkette durch den Umfang definiert, in dem die Partner dieser Kette mit Schlüsselaspekten ihrer Transaktionen mit Vertragspartnern zufrieden sind, der auf Likertskalen gemessen wird.

Die Primärdaten, wurden im Milchsektor in zwei Bezirken Kenia, Nakuru und Nyandarua, zwischen Mai und September 2005 mittels persönlicher Befragung erhoben. Diese Daten umfassen sozioökonomische Eigenschaften der Marktteilnehmer, betriebs- und transaktionskostenbezogene Eigenschaften, sowie leistungsbezogene Aspekte der Lieferketten wie Preise, Milchmenge, Milchqualität, Informationsflüsse und Kommunikation, sowie Renommee und Vertrauenswürdigkeit der Verhandlungspartner. Zur Analyse der erhobenen Daten werden zwei ökonometrische Modelle angewendet. Zunächst wird ein multinomiales Logit Modell angewendet, um die Daten hinsichtlich der Bestimmungsfaktoren der Koordinationsmechanismen zu analysieren. Zusätzlich werden die Bestimmungsfaktoren der

Leistungsfähigkeit der Milchliefkette mit einem Ordered Probit Modell untersucht. Beide Modelle werden mit der ökonometrischen Software LIMDEP<sup>TM</sup> geschätzt.

Die Ergebnisse der Studie bieten eine Grundlage zur Charakterisierung der Koordinationsmechanismen der kenianischen Frischmilchliefkette und der Faktoren, die diese Koordinationsmechanismen beeinflussen. Drei Hauptkoordinationsmechanismen werden identifiziert: Spotmarktverträge, mündliche Verträge, und schriftliche Verträge. Die Untersuchung zeigt, dass die verschiedenen Arten der Koordinationsmechanismen verschiedene Vor- und Nachteile haben. Generell kommen unterschiedliche Arten der Koordinationsmechanismen bei Milchtransaktionen zur Anwendung. Es wird weiterhin gezeigt, dass jeder Koordinationsmechanismus mit bestimmten Verhandlungskosten und unternehmensbezogenen sowie sozioökonomische Eigenschaften der Teilnehmer verbunden ist. Im Hinblick auf die Leistungsfähigkeit der Lieferkette zeigt die Studie, dass sozioökonomische, betriebsbezogene und Transaktionskostenbezogene Faktoren so wie die Art des benutzten Koordinationsmechanismus wichtige Determinanten sind. Insbesondere werden Milchproduzenten dieser Milch mehr durch Informationsmangel über Märkte und Preise sowie mangelnde Einflussmöglichkeiten auf den Milchmarkt eingeschränkt. Andererseits werden die Einzelhandelsgeschäfte auch durch die hohen Transaktionskosten aufgrund der Vielzahl kleinerer Produzenten mit denen sie im vorgelagerten Bereich in Beziehung stehen sowie mangelnder Einflussmöglichkeiten auf die Preise im Absatzmarkt für Konsumgüter belastet. Außerdem werden Milchpreise, Verfügbarkeit der Kunden und Marktinformationsasymmetrien als Determinanten der Leistungsfähigkeit der Milchliefkette identifiziert.

Die Studie zeigt weiterhin, dass bestimmte staatliche Interventionen für die kommerzielle Entwicklung der Milchindustrie besonders hinsichtlich der Reduzierung zentraler Transaktionskosten, wie beispielsweise Verbesserung der Transportinfrastruktur, Gründung landwirtschaftlicher Genossenschaften, Reduzierung von Informations- und Suchkosten sowie institutionelle Unterstützung von Verträgen notwendig sind. Diese Studie ist ein wichtiger Beitrag für die Betriebe der Milchindustrie und insbesondere der Frischmilchliefkette und bietet einen ausführlichen Einblick in die Mechanismen der Koordination und Leistungsfähigkeit der Milchliefketten. Sie stellt Informationen über institutionelle Vereinbarungen zur Verfügung, die für das Verständnis und die Entwicklung der Milchindustrie im Land durch private Teilnehmer und Politiker notwendig sind. Diese Informationen können bei der besseren Auswahl von Verhandlungspartner beim Aufbau von Milchliefketten unterstützen. Als bedeutendster Aspekt wird dargestellt, welche Arten von

Verhandlungskosten wichtig oder wahrscheinlich sind, wenn eine Entscheidung für bestimmte Verhandlungspartner und Koordinationsmechanismen getroffen. Insgesamt zeigen die Determinanten der Vertragsarten auch die Quellen der Transaktionskosten an, welche von den Partnern in der Lieferkette (oder von Politikern) beeinflusst werden können oder wenn sie sich als unüberwindbar erweisen, vermieden werden können.

Schlüsselwörter: Neue Institutionenökonomie, Transaktionskosten, Koordinationsmechanismen, Supply Chain Management, Milchlieferketten , Supply Chain Performance, Haushaltsmodell, Multinomiale Logit Regression, Ordered Probit Regression, Kenia.

## **Abbreviations**

CBS	Central Bureau of Statistics
CME	Coordinated market economies
COMESA	Common Market for Eastern and Southern Africa
EAC	East African Community
FAO	Food and Agriculture Organization
GoK	Government of Kenya
KCC	The Kenya Cooperative Creameries
KDB	The Kenya Dairy Board
Kshs	Kenya Shillings
LME	Liberal market economies
MNL	Multinomial logit
NIE	New Institutional Economics
OECD	Organization for Economic Co-operation and Development
SCM	Supply Chain Management
SCOR	Supply Chain Operations Reference (Model)
TCE	Transaction Cost Theory
UNSD	United Nations Statistical Database
WTO	World Trade Organization

## CHAPTER 1 INTRODUCTION

### ***1.1 Problem setting***

A supply chain is a set of three or more entities (organizations or individuals) directly involved in the upstream and downstream flows of products, services, and/or information from a source to a customer (Mentzer et al, 2001). The entities in the supply chain include producers, intermediaries, processors, retailers and product users among others. Coordination on the other hand is the extent to which the work activities of the parties are logically consistent and coherent so they are directed toward a common objective in such a way that they supplement and complement one another (Milgrom and Roberts, 1992). Coordination is necessary to ensure smooth flow of resources from one technological level to another, such as from a producer to a processor or processor to retailer, that is, within a supply chain. This is especially so when the technologies are owned or controlled by different independent economic entities. Williamson (1985) has shown that there is a close relationship between coordination modes and transaction costs, a point further developed by Hobbs (1996) who develops an insightful framework for analyzing supply chain relations based on transaction cost economics. This study investigates coordination and performance relationships in the Kenyan fresh milk supply chain in the frameworks of supply chain management and transaction cost economics.

The Kenyan milk industry has undergone major changes following market reforms in the last two decades. The period can be characterized as a transition period from state controlled agricultural sector to a market driven sector. Both the institutional environment (at the macro level) and the institutional arrangements (at the micro level) have been undergoing changes, which have had important implications for the management of the various agricultural supply chains in the country. Specifically, the implications are couched in terms of coordination modes and performance levels attained by agents in the supply chains. The thesis of this work is that determinants of coordination and performance in the supply chains have changed during the transition period and require an analysis to understand them and their implications for the performance of the agricultural sector. With regard to the dairy industry, these changes are illustrated in the following paragraphs.

Agricultural market reforms in Kenya began in 1987 and brought about many changes in all major sub-sectors of agriculture. Most of the sectors were opened up to private participation and or the state led organizations were required to operate on commercial basis alongside private enterprises. In the dairy industry, the changes were characterized by an increase in the



number of milk processing firms from a single firm supported by the government to more than 40 firms within a span of five years. Before liberalization, the single processing firm was supported by an extensive network of cooperatives responsible for collection, bulking and onward distribution of the produce. Cooperatives therefore played a significant role in coordinating the flows of materials, information and funds in the dairy industry. However, after the market reforms, many primary cooperatives were adversely affected as they were unprepared and consequently failed due in part to their reliance on the milk processing firm. The failure of most cooperatives coupled with the withdrawal of state marketing bodies presented new challenges for the small-scale producers as they heavily relied on them to market their products. Producers were henceforth expected to coordinate both production and market side activities by themselves. Furthermore, the failure of farmer cooperative organizations and most of the milk processing factories meant that producers were no longer guaranteed a market for their products, product prices became subject to supply and demand forces and for the milk processors the problem of capacity utilization and cost control became critical to their survival as they were no longer guaranteed milk supplies. The upshot is that the nature of transaction costs faced in the milk supply chain has changed drastically and the costs are reflected in the type of coordination mechanisms used and the performance levels the supply chain participants are able to achieve in their transactions.

Additional challenges have been provided by an increase in the number and types of intermediaries in the milk supply chain. New types of intermediaries in the milk supply chain include itinerant milk traders, brokers and agents and retail outlets for milk (such as milk bars and kiosks) in urban and rural areas. Thus the number and types of transactions in the supply chain have also tremendously increased for all participants in the supply chain with varying consequences on the transaction relations, transaction costs and performance levels in the supply chains.

Furthermore, downstream in the supply chain, the consumer faces high prices for the processed products. Unlike producer prices that often vary with supply conditions, consumer prices for processed products are often either non-responsive or change only in one direction, upwards. The consumer pays for the coordination problems in the supply chain and the benefits of a liberalized business environment in the milk industry have been slow in reaching the consumer especially for the processed milk products. The growing importance of unprocessed milk transactions bought directly from producers or through intermediaries attests to the magnitude of the pricing problem.

The developments above have brought about new coordination problems in the Kenyan dairy industry that call for a new look at the management of the milk supply chains so as to keep the costs of transacting among the participants within manageable levels. The need to generate a fair return on investments by the producers, processors and other chain participants requires approaching the problems in the dairy industry from a holistic perspective. In an attempt to mitigate some of these problems, it is necessary to come up with institutional arrangements that can lower coordination costs for the benefit of all the participants.

Whereas government efforts target sector-wide improvements, participants in the milk supply chain can shape the costs of transactions through choice of appropriate governance structures. Coupled with the choice of coordination mechanisms is the question of the extent to which coordination can be improved or optimized. It has been generally recognized that transaction costs are important in determining the kind of coordination modes employed by agents. Other factors besides transaction costs such as socioeconomic characteristics of the agents and firm/farm specific factors may have some role to play. However, it is not clear which among these characteristics and factors are major determinants for the type of coordination mechanism used in the Kenyan milk supply chain given the diverse nature of transaction costs, socioeconomic and firm specific factors. There is also recognition that the influence of these factors is not homogenous across the various stages of the supply chain.

In addition to the above, it is understood that performance in the supply chains has to be enhanced for the benefit and sustainability of the dairy operations. This calls for an investigation into the main determinants of the level of supply chain performance attained by the supply chain participants. Establishing the link between coordination mechanisms and transaction costs, socioeconomic and firm specific factors and supply chain performance in the milk supply chain is necessary to provide possible future directions for coordination and performance improvement in the dairy industry. The study therefore addresses these issues.

## **1.2 Objectives**

This study identifies and evaluates the determinants of coordination mechanisms and supply chain performance in the Kenyan milk supply chain.

The specific objectives of the study are:

- To characterize the coordination mechanisms used in transactions at the producer and trader stages of the fresh milk supply chain.

- To identify and evaluate the determinants of coordination mechanisms in transactions at the producer and trader stages of the fresh milk supply chain.
- To identify and evaluate the determinants of supply chain performance in transactions at the producer and trader stages of the fresh milk supply chain.

### **1.3 Hypotheses**

The following hypotheses are advanced and investigated in the study

- The predominance of the coordination mechanisms depends on the stage in the milk supply chain. As such, spot market contracts dominate transactions with direct consumers and verbal and written contracts dominate in transactions with other types of transaction partners.
- Socioeconomic and firm related factors influence the type of coordination mechanisms employed. The strength and nature of influence differs according to the coordination mechanisms employed and also according to the stage in the supply chain.
- Market search cost, negotiation cost and monitoring cost components of transaction costs influence the kind of coordination mechanisms employed. The strength of the association between the transaction cost components also differs with the type of coordination mechanism used and the stage in the supply chain.
- Socioeconomic characteristics, firm related factors and transaction cost characteristics as well as the kind of coordination mechanism used influence the level of supply chain performance attained in the milk transactions. The impact of the factors on supply chain performance differs according to the stage in the supply chain.

A detailed discussion of the specific factors and their theoretical relationships is found in sections 5.5 and 5.6.

### **1.4 Justification**

The dairy industry contributes up to 3.5% of Kenya's Gross National Product (GNP) and up to 14% of the agricultural GDP. It is a source of livelihood for over 660,000 rural households, 365,000 direct farm wage jobs and 40,000 jobs in the processing activities. Most of the producers and other participants are small scale in nature and face costly market transactions. Coordination has consequences for the performance of the industry as it determines whether value is added in the milk supply chains or not. With the adoption of the common markets

such as East African Community (EAC), the Common Market for Eastern and Southern Africa (COMESA), and the requirements of the World Trade Organization (WTO), the need to achieve competitiveness and survival for the local milk supply chains is now more critical. This study therefore targets parties involved in the production, processing and distribution activities of the milk supply chain with the aim of contributing to their improvement and enhancement of their value creation processes for the benefit of the consumer.

The study also aims at providing information and an understanding of the milk supply chain operations so as to help in creating a conducive environment (institutional) for the growth of the dairy industry, given the role the dairy industry plays in national development.

The current knowledge base on the management of supply chains in Kenya is thin. While recognizing efforts in production activities, the probability of success is higher when a holistic approach to the chain is undertaken. Both the downstream and upstream chain activities and the management of the flows of information, materials, and funds are necessary for the successful functioning of agricultural supply chains. This work makes a contribution in this area of research.

Finally the study makes a valuable contribution to the on-going academic development and research in the fields of New Institutional Economics (NIE) and chain management in agriculture, as well as agro-industrial and agribusiness areas.

### ***1.5 Scope and limitations of the study***

The study focuses on the basic milk supply chain involving production and retailing chain levels. The processing stage of the supply chain, input supplies and consumers are not investigated. However, this does not mean that their role in the dairy industry is in any way less significant. Resources available are limited and therefore milk producers and traders are selected as starting points for chain wide investigations in the operations of the Kenyan milk supply chain.

Two districts from two provinces in Kenya have been selected for inclusion in the study: Nakuru district from Rift Valley province and Nyandarua District from Central province. The study does not therefore necessarily cover the entire country but uses the two districts due to the scope of dairy activities and the importance of the districts in the national dairy milk production and marketing. The two districts offer a fair view of the nature of transaction costs, coordination and supply chain performance of the other regions of the country, albeit with minor adaptations.

The emphasis of the study is on transaction costs, coordination and supply chain performance. These are not the only determinants of the operations of the enterprises in the dairy industry as there are other constraints such as production costs and other expenses to countenance with. The issues addressed here should be looked at together with other costs and constraints impinging on the operations of the agents in the milk supply chain.

Furthermore, market participating agents are not the only groups operating in the Kenyan dairy industry. There are other dairy farmers or milk producers whose product does not reach the market. Insights from this study can be looked at as a glimpse in to the constraints facing non market participating agents as the constraints are the same but only worse in their case. Attempts to address problems facing non market participating agents have been addressed in studies elsewhere (for example Omamo, 1998; Key et al 2000; and Goetz, 1992 among others).

### **1.6 Definition of terms**

- A supply chain is a set of three or more entities (organizations or individuals) directly involved in the upstream and downstream flows of products, services, and/or information from a source to a customer (Mentzer et al, 2001; Daganzo, 2003).
- A basic supply chain: Consists of a firm, an immediate supplier and an immediate customer directly linked by one or more of the upstream and downstream flows of products, services, finances and information.
- An ultimate supply chain includes all firms involved in all the upstream and downstream flows of products, services, finances and information.
- A supply chain orientation is the recognition by a firm of the systemic, strategic implications of the activities, and processes involved in managing the various flows in a supply chain.
- Supply chain management is the implementation of a supply chain orientation across customers and suppliers. It is the systemic, strategic coordination of the traditional business functions within a particular firm and across businesses within the supply chain, for the purposes of improving the long-term performance of the individual firms and the supply chain as a whole.

- Supply chain performance: A consideration of the chain wide performance as opposed to single firm performance measures.
- Governance structures/coordination mechanisms/modes/contracts: These are used to capture the types of linkages used and the types of relations that subsist among the transacting partners. These terms are used interchangeably in this study to mean the same thing.
- Coordination: Coordination is the extent to which the work activities of the parties are logically consistent and coherent, so that they are directed toward a common objective in such a way that they supplement and complement one another.
- Spot market contract: A contract for the immediate exchange of goods or services at current prices. The identity of the party is irrelevant.
- The relational bilateral governance (also implicit contract): A non-written (non-legally enforceable) contract that specifies only the general terms and objectives of the relationship. The governance introduces the idea of repeated relations with the same agents and is equivalent to verbal contracts.
- The relational bilateral governance with 'qualified partners'. This structure is close to the previous one. However, agents are not free to choose their partners, but have to select a 'qualified' transactor (accredited for instance by a collective organization)
- The formal (written) bilateral contract: A legally enforceable set of promises that defines all or part of each party's obligations.
- Financial participation in the ownership of the partner(s): In this case, the buyer (respectively seller) is a stockholder of the other but stays legally independent from the seller (respectively buyer). Joint venture is a canonical example of this type of governance structure.
- Vertical integration: Refers to bringing of two or more successive stages of the supply chain under common ownership and management (Milgrom and Roberts, 1992).
- Transect sampling: A special random sampling technique used in ecological survey where sampling frames are unavailable. Straight lines are mapped out and objects randomly selected for inclusion in the study.

### ***1.7 Organization of the research***

The study is organized as follows. Chapter two discusses institutional changes in the Kenyan agricultural sector with special emphasis on liberalization and its effects on the Kenyan dairy industry. Chapter three presents the theoretical underpinnings of the study, that is, the New Institutional Economics and in particular Transaction Cost Economics theory with reference to developing markets. Chapter four discusses empirical works on transaction costs, coordination mechanisms and supply chain performance, with special reference to agricultural and smallholder enterprises in developing countries. Chapter five discusses the economic problem facing market participating agents, presents theoretical and empirical models for the study and finally discusses the empirical specification of the relations under study. A descriptive overview of the data and variables of interest are discussed in chapter six. Model results and discussions on the determinants of coordination mechanisms and supply chain performance are presented and discussed in chapter seven. Finally, chapter eight summarizes, discusses policy implications and suggests further research directions in light of the findings in this study.

## CHAPTER 2

### INSTITUTIONAL CHANGE AND LIBERALIZATION IN THE KENYAN AGRICULTURE AND DAIRY INDUSTRY

The chapter reviews major institutional changes that have occurred in the Kenyan agricultural sector and their impact on key agricultural commodity supply chains. It evaluates the effects of liberalization policies with special emphasis on the dairy industry. The chapter is organized as follows: Section 2.1 reviews the role of agriculture in both the national and individual welfare of the Kenyan people. Section 2.2 reviews the main institutional changes using examples from key agricultural sectors and industries in Kenya. Section 2.3 analyses the institutional changes in the dairy industry following liberalization policies while section 2.4 provides a discussion of the current milk supply chain and possible coordination mechanisms used. Two types of supply chains and three types of coordination mechanisms are discussed.

#### ***2.1 Role and contribution of agriculture to the Kenyan economy***

Kenya has a total area of 582,646 square kilometers, of which 11,230 km<sup>2</sup> is under water (CBS 2006), and an estimated human population of 33.6 million as of the year 2005 (UNSD, 2006). An estimated 65-75% of the population lives in rural areas with the rest residing in urban areas and towns. This means that agriculture will continue playing a significant role in the livelihoods of the people. It further means that Kenya's economy will continue relying on agriculture to contribute significantly to the creation of the nation's wealth or gross domestic product (GDP). Currently, agriculture contributes up to 25% of the country's GDP. The multiplier effect of agriculture on the performance of the rest of the economy cannot be gainsaid. Besides its general contribution to wealth creation, agriculture is vital for the following reasons:

- It provides 70% of the raw materials required by all industries
- Over 80% of the country's population relies on agriculture for employment and general livelihood
- Agriculture is a major source of foreign exchange, major items being tea, coffee, horticultural produce among others
- It is also a source of employment and incomes, as it contributes up to 19% of waged employment in the country and employs over 59% of the country's labor force (Ngigi, 2005).



The challenge facing the country is harnessing the limited agricultural resources to achieve the country's needs in food security and incomes for the people. The constraints facing the country stem from the increasing population leading to reductions in arable land areas. It is imperative that agriculture produces not only enough to meet the food needs of those residing in the rural areas but also adequate surpluses to feed the rest of the population. Agricultural producers should be assisted to overcome their subsistence nature of production in order to increase their participation in the market. Thus commercialization of agriculture through strengthening of agricultural supply chains is necessary to help in achieving these objectives. The next section reviews major institutional changes that have characterized key agricultural sectors in Kenya in the last two decades.

## ***2.2 Agricultural liberalization in Kenya***

Before liberalization, Kenyan agricultural sector had been dominated by government parastatals set up to assist producers in processing and marketing agricultural commodities. The parastatals were set up for major commodities such as tea, coffee, sugar, rice, pyrethrum, maize, milk and beef among others. Others were set up to assist in financing and insurance of agricultural activities by guaranteeing minimum returns to farmers. For some time after Kenya's political independence, the institutions were being run well and the government continued supporting them. The government also took over control of cooperatives through which it used to channel credit and extension services to farmers.

Agricultural liberalization has been taking place in Kenya for the last two decades since mid 1980's. It had become evident that the parastatals were not performing well anymore due to poor management (Nyoro, 2002). The parastatals required government subsidies which was a drain on the economy. The Sessional Paper on Growth and Economic Management of 1986 (Sessional Paper 1 of 1986) initiated the liberalization process in the agricultural sector. The aim was to remove the monopolistic trends and allow the private sector to participate and take up the functions of the parastatal bodies. A review of liberalization in the key crop and livestock sectors show that it has been driven by forces consisting of the donor community and institutions like the World Bank and the International Monetary Fund (IMF). The concerns underlying the liberalization have been the need for efficiency and private participation in the economy in sectors formally controlled by the government through parastatals. The key agricultural areas that have been affected include coffee, tea, grains (maize, wheat, and rice), sugar, and dairy industries.

The objectives of the reforms included the following:

- to enhance productivity
- to raise the level of production of basic food commodities to their potential
- to improve quality and standards of products and diversify exports and hence high economic growth.

A common feature of the liberalization process has been the withdrawal of the then existing institutions from the market and the coming up of new institutions to try and replace them. The institutional vacuum following the liberalization policies has been difficult to fill in certain industries. In certain cases, poor planning has been a major problem for less than successful performance of the newly liberalized industries, other reasons being government reversals or half hearted liberalization and lack of capacity to implement the reforms or lack of supporting institutions to enforce the new trading arrangements. These have had negative consequences for certain sectors while other sectors have successfully been liberalized. Examples of sub-sectors and industries that are being liberalized are briefly discussed below.

### **Fertilizer**

Fertilizer trade was liberalized in 1990 (Omamo and Mose, 1999). Before then, international and domestic trade in fertilizer was being undertaken by the Kenya Grain Growers Cooperative Union (KGGCU), a parastatal body that was responsible for handling input and commodity trading in the country. However, due to inefficiencies in its operations, there was a need to liberalize trade in fertilizer. In 1990, the government liberalized international and domestic trade in fertilizer by abolishing quotas and licenses and decontrolling prices. As a result, many private traders entered the business, especially in major urban areas and rural trading centers. The results of the liberalization are so far mixed; in the high potential areas, fertilizer availability has improved but in low potential areas, the benefits have been minimal. The high competition in the trade means that revenues are depressed, yet economies of scale in the fertilizer trade are important. The institutions in the fertilizer trade are still evolving.

### **Cereals**

Maize market reforms began in 1987/88 with the Cereal Sector Reform Program as part of the structural adjustment policies (Nyoro et al, 1999). The reform process intensified in the early 1990s under pressure from international lenders culminating in the full liberalization of the maize industry in 1994. The government eliminated movement and price controls on maize trading, deregulated maize and maize meal prices and eliminated direct subsidies on maize

sold to registered millers. Maize and maize meal prices were previously set at pan seasonal and pan territorial levels. Private traders were allowed to transport maize across districts without any hindrance. The government still participates in maize markets but on a limited scale through the National Cereals and Produce Board (NCPB) which functions as a price stabilization and strategic reserves agency. The expected result was to reduce maize marketing costs by encouraging more market participation by private parties. However, the objective has not been achieved as the policy environment has not been helpful, tariffs and trade bans intended to protect consumers and producers are still exercised as the government tries to ensure that consumers have access to food and that producers are not negatively affected by predatory pricing practices of traders. A consequence of this is that more than 15 years later, the maize supply chain is still not yet fully functioning. Market failures still persist, the private sector response has been low and is thought to be collusive and exploitative. Furthermore, government interference still persists. The same scenario applies to wheat marketing that was also liberalized in 1993.

### **Coffee and tea**

The process of liberalization in the coffee sub-sector began in 1992 in line with the structural adjustment policies at the time (Karanja and Nyoro, 2002). At this time, the Nairobi Coffee Auction was required to conduct its trade in US dollars. Farmers were also allowed to be paid in dollars, and to retain part of the dollars for their own use. For the farmers, direct payment gradually replaced the pooling payment system. The pooling system is slow unlike the direct payment system that is faster and payments are based on quality. However, smallholder marketing that works through cooperatives continues to use the pooling system. In 1993, the coffee milling monopoly of the Kenya Planters Cooperative Union (KPCU) ended and other millers were allowed to enter into coffee milling, increasing the milling capacity from 140,000 to 230,000. The result is that there is overcapacity of about 60% in coffee milling.

Full liberalization of the coffee sector took place in April 2002. Before then, coffee marketing was solely being undertaken by the Coffee Board of Kenya (CBK). Other agents have since then been licensed while the CBK has been left to regulate the industry. The rest of the structure (and participants) comprising of cooperative societies, milling factories and others remained as before as they were already being privately handled. The gradual liberalization process in the coffee (and in the tea) sectors were designed to avoid disruptions in coffee production, processing and marketing. Broad consultations have always been carried out unlike other sectors that were earlier liberalized. New institutional arrangements in the coffee

supply chain and their effects are still evolving. The need to protect the smallholder farmer can also be discerned in the coffee liberalization process.

The tea industry was liberalized in the year 2000 and has been relatively successfully. Liberalization in the sugar industry is still going with some sugar processing firms having been partially liberalized while others are being prepared for liberalization. The pyrethrum industry is yet to be opened up.

The next section discusses liberalization and institutional developments in the dairy industry.

## **2.3 Liberalization and institutional change in the dairy industry**

### **2.3.1 The livestock sub-sector**

Livestock contributes about 47% of the agricultural GDP and about 12% to the national GDP (FAO, 2005). The varied climatic conditions in Kenya underlie the diverse livestock activities being undertaken in the country. The livestock activities range from cattle, goat, sheep, donkey, camel rearing and poultry keeping. In the semi arid areas are camels, donkeys and goats, conditions in these regions being unsuitable for cattle rearing especially for the grade and improved breeds. Among the livestock, cattle (beef and dairy) play the most significant role in both national and individual economic welfare. They are kept on both large and small scales for both commercial and subsistence purposes.

Table 2.1 below shows that the total number of cattle in Kenya is estimated to be 11.5 million heads (FAO, 2005). A census has not been carried out for the last 40 years to ascertain the correct number and distribution of the animals hence the figures are at best estimates. However, the figures show that the number of cattle has been declining for the last decade. The table also shows that the quantity of milk produced and consumed has remained stable since the year 2000.

Table 2.1 Key cattle performance indicators in Kenya

Aspect of cattle	Year				Annual growth rate	
	1980	1990	2000	2002	1980-1990	1990-2000
Cattle '000	10,000	13,793	11,706	11,500	3.3	-1.6
Milk production '000 metric tons	1,033.8	2,480	2,884	2,841	9.2	1.4
Milk consumption '000 tons	968.6	2,235	2,645	2,640	8.7	1.7

Source: FAO, 2005

Dairy is the second largest contributor to livestock GDP after beef. It provides income to more than 660,000 rural households, most of who have per capita income of less than US\$ 2 per day. The industry is characterized by smallholder producers, who produce over 70% of the total milk marketed in the country (Staal 2004a).

There is an estimated 3.2 million dairy cattle in the country (Onyango et al, 2003). Cattle of milk producing ability constitute grade and cross breeds. About 80% of the dairy cattle are kept by the small scale farmers. Whereas dairy cattle contribute 60% of the total milk in the country, indigenous animals contribute up to 40% of total national milk production. However, most of the milk produced by indigenous cattle is not marketed as it is consumed by the households. The main dairy breeds kept in Kenya are the Friesians, Ayshire, Guernsey, Jerseys and the cross-breeds.

Most of the high milk producing areas are found in Central Province, Rift Valley and parts of Eastern Province (slopes of mount Kenya). The two leading milk producing districts in the country are Kericho (Rift Valley) and Nyandarua (Central). Other districts are Uasin Gishu, Trans Nzoia, Nakuru in Rift Valley Province and Kiambu in Central province. The areas have the necessary conditions (temperatures and rainfall) favorable for dairy production.

### **2.3.2 A historical perspective of the dairy industry: pre-liberalization period**

The history of Kenya's dairy industry is almost synonymous with the history of Kenya Cooperative Creameries (KCC), a firm formed in 1931 following merging of three milk cooperatives that were then operating in Naivasha, Nyahururu and Kipkelion areas (Lumbwa). The need for the merging arose from fierce competition in a market characterized by thin local markets among the three dairy cooperatives and also from the need to increase the bargaining power of the farmers (Ngigi, 2005). KCC continued expanding its processing capacity in the 1950s to cater for the colonial farmers' interests in the pre-independence period, to the exclusion of the indigenous people who were not allowed to produce and deliver their milk to KCC. The firm entered into contracts with the farmers as a means of reducing uncertainty in the utilization of its investment in processing capacities. Thus in this period, the dairy industry was dominated by large scale milk producers with smallholder producers playing a minimal or peripheral role.

KCC remained the sole milk processor and its influence in the industry increased in 1958 with the formation of the regulatory arm of the government, the Kenya Dairy Board (KDB), through the Dairy Industry Act Chapter 336 Laws of Kenya. KCC was given powers to act as

## INSTITUTIONAL CHANGE AND LIBERALIZATION IN THE KENYAN AGRICULTURE AND DAIRY INDUSTRY

a government agent in the processing, packaging and selling of milk in urban areas. It was to ensure that no raw milk is sold in the urban areas. However, raw milk could be sold in the rural areas.

The role of the Kenya Dairy Board was generally to promote milk production and marketing. Specifically, it was mandated to

- Organize, regulate and develop efficient production, marketing, distribution, and supply of dairy produce required by different classes of consumers
- promote quality assurance to attain high quality products with emphasis on hygiene of milk production
- encourage proper use of milk containers for transportation and storage facilities for milk and milk products
- regulate the sales of raw milk and importation of dairy products
- promote consumption of quality milk and milk products
- develop, promote, and advise on proper packaging equipment and materials
- license milk producers and processors to permit the greatest possible degree of private enterprise in production and processing of dairy products
- enforce the Dairy Industry Act through anti-hawking operations and prosecutions
- train farmers on clean milk production and modern techniques of animal management through short courses and seminars.

However the Board was never fully empowered to regulate and oversee the development of the dairy industry. Besides lacking in adequate financing, most of the important functions had been transferred to KCC (nutrition function) and the Ministry of Agriculture (dairy development). Thus KCC, which was essentially a private firm but with heavy government influence and interventions, acquired regulatory powers. This situation continued even after independence giving rise to the monopolistic status of KCC in the dairy industry.

In the last few years before and after independence, the share of the smallholder agriculture in national production and marketed surplus increased tremendously. This was largely due to the use of high yielding cattle breeds, supporting institutional and organizational frameworks for milk marketing and improved services for tick control, disease control, extension and artificial insemination services. It should be noted that the period before 1969 was characterized by

open markets with independent dairies processing their milk. However, after 1969, the situation started changing, especially between 1969 and 1992. Rationalization of the dairy industry by the government ultimately created a monopolistic market situation.

One of the major developments in the period before liberalization involved initiation of milk price controls by the government in 1971 based on the uniform pricing system and abolishing the quota system. The result was that KCC received virtual monopoly rights in the industry. It was also required to buy all quality milk delivered at its gate without turning away the farmers subject to minimum quality requirements. This meant KCC became a buyer of last resort for the milk delivered by the farmers. It also acted as a strategic reserve provider of milk for the government through powdered milk. This also meant that the firm could even out deficit periods by reconstituting the powdered milk into liquid milk as need arose. It also acted as the government's agent in the school milk feeding program (Ngigi, 2005).

Consequently because of these expanded roles, KCC increased its capacity countrywide to include 11 cooling plants and 11 processing plants spread over the country and processed a variety of products. It provided a reliable outlet for all dairy farmers, which was favorable to the smallholders. Other private firms were restricted to niche or specialty products like cheese, yoghurt and ice cream.

Despite KCC's monopoly, Ngigi (2005) observes that the firm was only able to utilize 77% of its installed capacity that stood at 1.2 million liters per day as of 1991. This was due to the seasonality of the milk production eventually leading to cost control problems. The firm had also employed too much permanent labor and coupled with lower margins, heavy inventories, high transportation costs and wastes in the rainy season, its performance and efficiency declined. Delayed payments to farmers also set in leading to the insolvency of cooperatives which were in charge of the collection and the transportation of milk to KCC and transmitting payments to farmers. KCC was being served by about 700 cooperatives that were handling 80% of the milk being delivered to the firm. In the 1980s two small cooperatives were set up on a pilot basis to process milk. These were Kitinda in Western Kenya and Meru Dairy in Eastern province. However, the two firms controlled only 2% of all milk marketed through the formal channel. Hence KCC's monopoly went on unchallenged.

In summary, the pre-liberalization period was characterized by increased participation of smallholder producers due to reduced costs of marketing and improved services. It was also characterized by heavy government controls and protectionism for the industry. A single processor (KCC) was sanctioned by the government thereby becoming quasi parastatal, which

was however not able to efficiently utilize its capacity, control costs and effectively market its products on behalf of farmers. Social functions were emphasized at the expense of commercial or sound economic decisions. Furthermore the regulatory mechanism through the Kenya Dairy Board (KDB) was found to be inadequate.

### **2.3.3 Post-liberalization scenario**

Reforms in the dairy industry began in 1987 when the government began divesting away from breeding services through cost recovery measures. The breeding service (Artificial Insemination) costs had earlier in 1966 been lowered to make them affordable to farmers. In 1988, the government divested away from clinical services which were from then expected to be undertaken by the private sector. In 1989, the manufacture and sale of feeds was liberalized. In 1991, the process to transfer management of cattle dips to local communities was started and completed in 1992. And in 1992, the marketing of milk was liberalized following elimination of price controls.

One feature arising out of the liberalization of the industry is the increase in the number of private firms and individuals operating in the industry besides KCC. The number of processors shot to 42 in 1999 from three in 1991. In the pre-liberalization period, KCC's peak production per day was 0.97 million liters. Later in 2000, this daily intake reached a low of about 20,000 liters per day. The decline in KCC's intake has had serious implications for the dairy industry. The next section analyses the milk supply chain in the post liberalization period in Kenya.

## **2.4 *The Kenyan milk supply chain***

### **2.4.1 The chain configuration**

The milk supply chain involves activities and processes from production, processing, trading and consumption of milk. The Kenyan milk supply chain can be categorized into two: the cold chain and the warm chain. Milk delivered to the main processing firms constitutes the 'cold chain' or the pasteurized milk system while milk sold and used in an unprocessed form constitutes the 'warm chain'. Each of these chains has an important role to play. The supply chains differ in terms of sizes, geographical distribution, degree of licensing, relative rewards, quality perceptions and long term prospects for the development of the dairy industry. There are continuing developments and tradeoffs in the industry meaning that the various



institutions and supply chains are still evolving. Figure 2.1 shows the typical milk supply chains in Kenya.

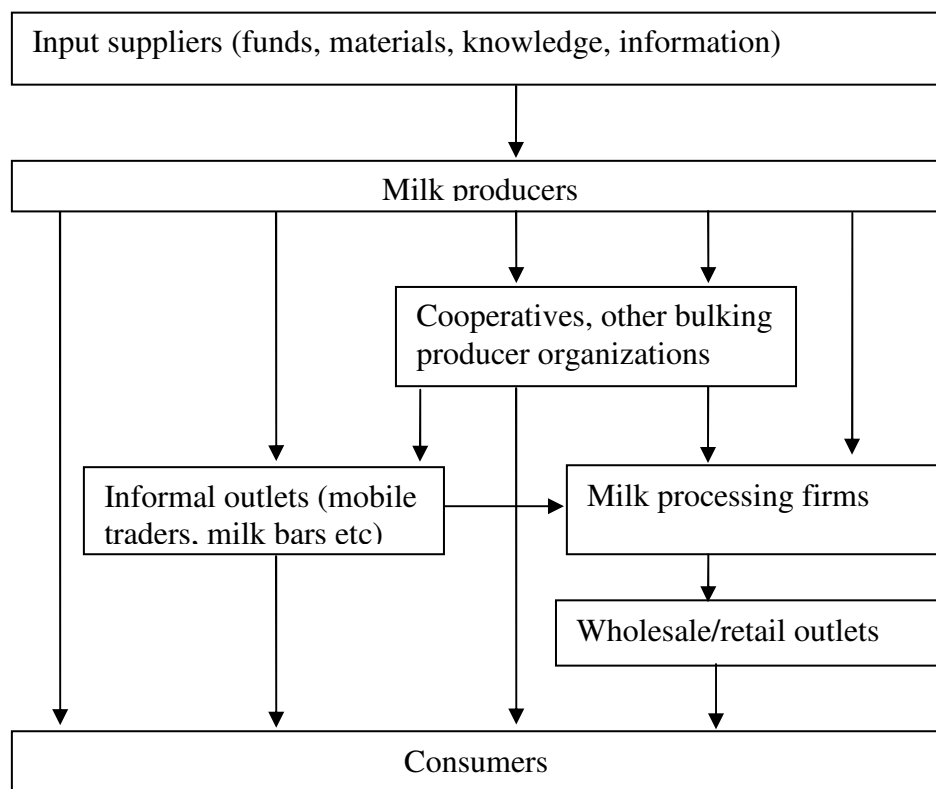


Figure 2.1 Diagrammatic representation of the typical milk chains in Kenya

An alternative classification to cold and warm chains above is formal and informal milk supply chains. Supply chains handling non processed milk products are categorized as informal supply chains (Ngigi, 2005; Onyango et al, 2003). They include mobile (itinerant) traders, milk bars and kiosks, brokers, and self help groups. The formal chain participants are the milk processors, cooperatives, supermarkets and retail shops and kiosks, milk bars and others that handle processed milk products.

An overview of the supply chains shows that 42% of the milk is often sold directly to customers by the milk farmers. On the other hand 32% of the milk is sold to informal market participants who also buy 6% from cooperatives to bring the total milk handled by them to 38%. About 24% of the milk is sold through cooperatives and of this amount, 12% is delivered to processors and 6% sold directly to consumers. Only 14% of the farmers' milk is handled by the processing firms (Staal 2004b). However, evidence also shows that some of the informal participants deliver some of their milk to processing firms.

## 2.4.2 Milk production system and consumption

The type of milk production system depends on the technology used and the number of animals kept. The production systems are classified as small, medium and large scale productions according to the number of animals kept. The cost structures and margins (including milk prices) vary according to the production systems as well as from region to region (Ngigi, 2005; Staal, 2004a) (Table 2.2 below shows some of their characteristics).

Table 2.2 Milk production (grazing) systems in Kenya

	<b>Small-scale Zero</b>	<b>Medium-scale open</b>	<b>Large-scale open</b>
Cows (average)	3	12	146
Milking cows	2	4	33
Acres	1	4	160
Marketed milk (liters)	2,014	3,180	73,700
Other: Home use calf feeding and unsold	1,210	4,339	29,377
Total (liters)	3,224	7,519	103,077
<b>% marketed</b>	<b>62</b>	<b>42</b>	<b>72</b>

Source: Adapted from Karanja (2003:8)

However, the classification of milk producers by number of cows kept or size of land may not give a true picture of what is meant by smallholder producer. Other sources have classified smallholders as productions less than five liters of milk per day. This captures intensive producers who may have less than 3 cows and less than one acre of land but efficient enough to produce more than 5 liters of milk per day. The quantity of milk produced and marketed is a better criterion for classifying the milk producers. This study involves only small and medium scale milk producers with daily milk productions less than 100 liters.

Table 2.3 Cost and price per liter of milk

	<b>Zero-grazing system</b>	<b>small-scale open grazing</b>	<b>large-scale open grazing</b>
Variable costs	8.60	6.20	8.50
Labor costs	4.90	3.10	2.70
Fixed costs	1.45	1.20	1.30
<b>Total costs</b>	<b>14.95</b>	<b>10.50</b>	<b>12.50</b>
<b>Producer price</b>	<b>15.00</b>	<b>12.00</b>	<b>14.00</b>

Source: Adapted from Karanja (2003:11)

Figures available from Karanja (2003) indicate that zero grazing systems face higher milk production costs compared to small scale open grazing or large scale open grazing systems. However, the systems also face different prices depending on their locations, sales outlets and buyer arrangements (table 2.3 above).

Table 2.3 above indicates that margins are narrower for zero grazing farmers. Their cost structure is higher as they use relatively more purchased inputs (feed) and fixed assets compared to other grazing systems. Per unit production costs also depend on the average yields per cow which vary according to production systems and regions. For example, in a study by Ngigi (2005), she finds that milk yields per cow were 2214.97 liters in Kiambu under zero grazing system and 1633.46 liters per year in Nyandarua and Nakuru under open grazing systems. Therefore the costs and production levels vary according to the production system employed and location of the farming units. Table 2.4 below further illustrates these observations.

Staal, (2004a) estimates the average costs and revenue for three districts of Kiambu, Nakuru and Nyandarua and shows that milk producers are able to make some positive returns from their enterprises. Kiambu has the highest cost structure but also fetches a higher price by virtue of its proximity to the capital city, Nairobi. The other districts fetch lower prices but also are also low cost producers. In an efficiently working market however, Kiambu producers are likely to be disadvantaged.

Table 2.4 Comparison of costs and revenues for three districts

	Kiambu (1998)	Nakuru (2000)	Nyandarua (2000)
Cost per liter (Kshs)	17.20	13.28	11.93
Price per liter (minimum)	17.63	15.19	14.30
Revenue per liter	21.29	16.88	16.68
Profit per liter	4.09	3.60	4.75

Source: Adapted from Staal (2004a:3)

### 2.4.3 Consumption patterns in the country

Of the total milk produced in the year 2000, 63% was marketed, about 30% was consumed at home, and 7% fed to calves. The marketed milk is usually a surplus after home consumption and feeding of calves have been taken care of.

Though national milk production is currently higher than demand, the increasing population coupled with an improvement in the economic condition may put pressure on the milk supplies in a few years' time. The balance between demand and production will depend on the state of the economy (Omoro et al, 1999). In a depressed economy, the surplus situation in the market may persist for some time.

About 80% of processed milk products are sold in Nairobi and Mombasa. Per capita consumption is estimated at 82 liters on average, but this ranges from less than 64 liters in the rural areas to 125 liters in the urban areas. Milk shows high income elasticity, which provides potential for the growth of the industry especially when economic conditions and incomes improve (Karanja, 2003; Onyango et al, 2003).

Most of the marketed milk, whether raw or processed, is consumed in the urban areas. The informal milk outlets account for up to 80% of the outlets while formal or processed milk account for the remaining portion in the urban areas. However, in Nairobi, most of the milk consumed is processed milk (Staal, 20004b).

#### **2.4.4 Informal milk supply chain**

One feature characterizing the current milk supply chain is the emergence of informal milk outlets in the country. Informal milk sales account for up to 80% of the milk supplied and consumed in urban and peri-urban areas. Informal milk supply chains therefore cannot be ignored anymore because of the role they currently play in the milk industry. Sale of unprocessed milk in urban areas is illegal, however, it is legally allowed in the rural areas. However, Ngigi (2005) notes that unprocessed milk has always been sold in urban areas even before liberalization. This implies that it is the scale and openness of the operations that have brought the illegality of the practice into the open. The regulations regarding informal milk sales were not changed, therefore informal distribution of milk in urban areas remains an illegal activity. However the sale of unprocessed milk in urban areas has continued to flourish due to the lucrativeness of the market and inability of the Kenya Dairy Board to effectively regulate and ensure compliance.

Informal milk distribution takes the form of direct sales to consumers by farmers, milk vending (mobile or itinerant traders), operating milk bars and other retail outlets that generally handle unprocessed milk. In urban areas, the diminishing purchasing power of consumers has made informal milk distribution an attractive source of milk for the people compared to the high prices offered for processed milk products. Consumer prices are sometimes up to 30-

50% cheaper for unprocessed milk compared to prices for processed milk products. Consumers in the country also perceive whole milk as being superior (quality and taste) to skimmed pasteurized milk, based on the butter fat content. Furthermore for producers, milk prices have been found to be 10-20% higher than what processing firms pay the producers. Payment for the milk is also timely, so the farmer does not have to wait for long periods before receiving a payment.

However, informal milk distribution faces problems such as perceived unhygienic conditions under which the informal milk dealers operate which are likely to pose health hazards to users. Many of the operators have no training or facilities to handle milk safely and hygienically. Some of the operators are not licensed to operate the milk outlets. Besides risks in handling of milk, there have been fears that use of raw milk may bring about zoonotic diseases (TB, Brucellosis, and Pneumonia) which can be transmitted to man. This is particularly so if the milk is not properly boiled before use, however it is common for milk to be boiled by households before use.

There have been reported cases of adulteration of milk through addition of water, or additives and preservatives to enhance shelf life, which are harmful to consumers. This is a classic case of moral hazard and hidden action. Sometimes milk coagulates while being moved over long distances before they are sold. This causes losses to the vendor and or to the farmer.

With most milk being consumed in raw form, form and time utility, which are created through processing, are lost. There are also possibilities of shortages (due to droughts) arising out of lack of reserves or storable products to even out the cycles. This is likely to create price instabilities in the market, which are not conducive for the development of the industry. Shortages are often reported in the coastal areas by as much as 70% and by 30 to 40% in the west of the country. However, most of the shortages are as a result of preference for raw milk rather than availability of milk in general. It is also a result of the inability of consumers to afford the high prices charged for processed milk.

Sometimes producers have not been paid for their milk by the vendors or the vendors have disappeared with the proceeds from the milk. This means that whereas informal channels pay on time and a higher price, they cannot guarantee farmers a reliable market for their milk. As farmers increase their production levels, the informal distributors can absorb only limited quantities. Farmers have to look elsewhere for a market beyond the informal buyers, that is, in the formal market. Thus for the long term development of the dairy industry, the formal market has an important role to play (Staal 2004b; Launonen et al, 1985).

## 2.4.5 Milk collection, processing and marketing in the formal supply chain

### Collection of milk

When brokers are used to collect milk from farmers, they are paid a margin or per unit (liter) commission. Brokers ensure that the milk collected from producers is of the right quality. Brokers are informal agents. Cooperatives and self-help groups also play a vital role in the bulking of milk for onward transmission to processing firms or direct resale to consumers and other traders. Some 332 dairy cooperatives are registered in Kenya and handle up to 24% of the total milk marketed by smallholder farmers (Staal 2004a). Most of them channel their milk to processors. To transport the milk, most transporters charge producers an average of Kshs 2 per liter of the collected milk (Karanja, 2003).

The types and numbers of licensed milk traders in Kenya as of 1999 are shown in table 2.5 below. Most producers and informal outlets are not registered hence are not reflected in the table. This is in addition to the supermarkets and other general grocery shops, whose role in marketing of processed milk is increasingly becoming significant.

Table 2.5 Registered participants in the milk chain

Producers	Processors	Milk bars	Mini dairies	Cottage	Total
1043	42	393	23	51	1552

Source: Adapted from Karanja (2003:23).

### Milk processing and the problem of prices and capacity utilization

Though the number of processors licensed stood at 45 in 1999, only 34 firms were operational at the time. Of the 3 billion liters of milk produced in 1999, only 200 million liters of milk were processed. The rest was used unprocessed, consumed at home or fed to calves or wasted. By the end of 2001 only 22 processing firms were operational and by 2004, the number of the firms is reported to have fallen to 17. There are realignments in the industry and efficient processors are expected to survive. The large number of processing firms implies more competition for the consumer's attention. Ultimately the number of processors will decline thus increasing concentration in the industry. The concentration levels in the industry are shown in table 2.6 below.

Table 2.6 Concentration in the Kenyan dairy industry

	Top 2 firms, %	Top 4 firms, %	Bottom 10 firms, %
1999	42	65.5	1.9
2001	64.5	79.5	2

Source: Karanja (2003:30)

In 1999, the top 4 firms were Brookside, Premiere, Spin Knit, and Meru Central. In 2001, the firms remained the same but with Meru Central overtaking Premiere. The concentration ratio is expected to be even higher in 2005 as the larger firms (including New KCC) improve their milk intake and efficiency. Concentration levels affect economies of scale, transaction costs and other economies and this should benefit consumers in terms of lower prices (Girgzdiene, 1999). Capacity utilization determines the firms' ability to spread the costs of processing milk through economies of scale. The rate of capacity utilization is expected to change from time to time, especially with the on going realignments. Only 26% of installed processing capacity in the industry was being used as of 1999. This idle capacity was contributed to a very large extent by KCC. Of the total estimated 2 million liter processing capacity in the industry, KCC has 1.2 million liters or 60%. As of 1999, KCC was using only 10% of its capacity. The rest are shared by the other firms in varying capacities. However, the New KCC has currently improved its milk intake to about 300,000 liters per day since being reorganized by the government. Low utilizations of available capacity ultimately translate into high prices for consumers and low prices for producers. The inability to utilize capacity is an indicator of lack of sales growth, which indicates low performance.

### **Pricing structure, competitiveness and performance of processors**

A feature closely linked to and impacting on the actual and potential performance of the milk processing firms is price of processed milk. On freeing up the milk market, the expectations were that competition would bring in favorable prices for both the producer and the consumer, but this has not been realized. Producer prices have remained relatively low as a proportion of consumer prices for the processed milk products. For example, the current prices paid by the processors to the farmers have ranged between Kshs 13 to 19. During periods of gluts (long rain season) the price paid to producers sometimes falls as low as Kshs 10.

On the other hand consumers pay a price ranging from Kshs 42 to 60 for a liter of fresh pasteurized or whole milk. The gap between the consumer prices and the producer prices thus

comes to about three times the prices producers receive. With most people in Kenya living on less than 2 dollars per day, processed milk gets out of reach for most of them. But milk is essential for the health and nutrition of the people and since access to milk through the formal outlets is beyond most of the people's reach, informal milk supply chains naturally fill this gap.

When the consumer price is used as a measure of performance, there seems to be high levels of inefficiencies at the processing stage of the supply chain (Karanja, 2003). The trend in prices shows that consumer prices have increased for the last 15 years. On the other hand, producer prices decreased (in real terms) over the same period. This implies the welfare of producers has decreased. The proportion of consumer price paid to producers has declined from 60% between 1985-1990, to 28% in 2001. The processing stage is therefore a costly link in the supply chain.

The fact that upcountry prices for processed milk are lower by as much as 20% than in major cities can be attributed to the marketing strategy differentials of the milk processing firms (Karanja 2003). Since the milk is supplied by the same processors, this cannot be attributed to the production cost structure alone. It may be a price skimming strategy by processors in the major urban areas. The margins on the milk in supermarkets are also thin. Karanja computes the processing margin to be 57% of retail consumer price for one liter of milk. Thus most of the margin between the producer and consumer prices can be attributed to the processing stage of the chain.

The cost of packaging material constitutes the largest portion of the cost of milk, amounting to 26% of the consumer price. Packaging is monopolized by one firm. Cheaper packaging materials and technologies are necessary to reduce the costs of packaging and consequently, the consumer prices (table 2.7 below). The total cost of pasteurizing, cooling and packaging was estimated at 40% of the consumer price. The profit margin for the milk processing firms of 16% of consumer price is also very high. Raw milk cost accounts for only 26% of the consumer milk price. Transportation costs on the other hand have been found to be quite minimal relative to the consumer prices. Both informal and formal milk supply chain charge the same transport cost per liter. Therefore the contribution to these high consumer prices cannot be directly linked to transportation costs. The scenario shows the magnitude of the challenges facing the formal milk supply chain in the country.



Table 2.7: Components of consumer price

Cost component	Contribution to consumer price (%)
Cost of raw milk	26
Transport costs	6
Processing	57
Retail margin	8
Distribution	3

Source: Adapted from Karanja, (2003:35)

### **Coordination in the milk industry**

Three types of coordination mechanisms are commonly used in the milk transactions: Spot market contracts, verbal contracts and, written contracts. Spot market contracts are characterized by one off transactions between agents with no prior arrangements and no guarantee for repeat transactions in future. The transactions usually take place at market centers but buyers looking for milk can also search for sellers to buy the milk. Most of the transactions involve spot cash payments and prices may be negotiated during the transaction. Furthermore, sellers use spot market contracts mostly when they have surplus milk that has not been committed for delivery to other buyers. On the hand, verbal contracts involve prior agreements to supply milk at certain prices (mostly negotiated in advance) and involve repeat transactions. The collection of milk is agreed upon in advance, which could be as follows: buyer collects from seller, seller delivers to buyer or another location for delivery is agreed upon in advance. Payments for the milk may be on the spot or deferred in case of credit transactions. Reputations play an important role in ensuring that the parties meet their part of the contracts. Finally, written contracts are very much similar to verbal contracts except that they are formal agreements, being backed by law. Written contracts are signed by the parties concerned for delivery of quality milk at specified prices and locations. Volumes may not necessarily be specified in the contracts.

The chapter has reviewed the Kenyan milk supply chain in light of the institutional changes that have been occurring in the industry in the last two decades. It has shown that the nature of production and marketing activities leaves the milk supply chain prone to coordination problems arising out of transaction costs and that there are disparities in the performance of the milk supply chains. It has also reviewed the coordination modes in the milk supply chains. The next chapter discusses the theoretical framework that can be used to analyze transaction relations and performance of the fresh milk supply chains in the country.

## CHAPTER 3

### TRANSACTION COST THEORY AND COORDINATION MECHANISMS

The chapter discusses the theories underlying institutional arrangements, that is, coordination mechanisms, and performance in supply chains. It reviews the challenges facing product supply chains in light of transaction costs they face. According to Hobbs (1996), the appropriate framework for analyzing supply chain management relations is the Transaction Cost Economics theory, which is a branch of the New Institutional Economics (NIE). In the supply chains, transactions are determined not only by prices involved. The behavior of transacting parties is critical in determining whether the transaction takes place or not. Performance in supply chain depends on how chain relations are managed, that is, how agents go about managing costs of their transactions.

The chapter begins by tracing developments in the economic theories underlying transactions between agents, from the classical economic theory through neoclassical economic theories in section 3.1. Section 3.2 introduces the New Institutional Economic Theory while section 3.3 introduces the Transaction Cost Theory and various definitions for transaction costs. Section 3.4 relates Information Economics to Transaction Cost Theory and section 3.5 relates elements of Behavioral Economics to transaction costs and coordination mechanisms. Section 3.6 addresses the dimensions of transaction costs and their relationship to coordination mechanisms. Finally, section 3.7 reviews the role of institutions, transaction costs and coordination mechanisms in developing markets.

#### **3.1 Classical and neoclassical economic theories**

##### **3.1.1 The classical economic theory**

The Classical School of Economic Theory began with the publication in 1776 of Adam Smith's monumental work, 'The Wealth of Nations'. Adams Smith cited in Barney and Hesterly (1996) was among the first people to explain the role of decentralized system of prices as a coordination mechanism in the market through the operation of 'the invisible hand' in The Classical Theory of Economics. Much of this work was in developing theories about the way markets and market economies work. The working of the 'invisible hand' was such that it leads all individuals in the market, in pursuit of their own self-interests, to produce the greatest benefit for the society as a whole. The approach known as a '*laissez-faire*' approach places total reliance on markets, and anything that prevents markets from clearing properly should be done away with. The government was not supposed to intervene in markets but was

to play its role by encouraging free trade and free markets. Any imperfections in the market that prevented this process should be dealt with by the government to ensure that optimum equilibriums in the economies or markets were attained. The government was supposed to achieve optimum equilibrium through the use of 'supply-side policies' (to reduce market imperfections) and to ensure a balanced budget based on three theories: free market theory, Says law and quantity theory of money. Much of Adam Smith's work laid the foundation of modern economics. Much of this work has subsequently been updated by modern economists who generally are referred to as Neo-Classical Economists, the word neo meaning 'new'.

Among the opponents of classical economic theory were the Keynesian economists arising from the works of John Maynard Keynes from the 1930s. Keynesians argued that markets would not automatically lead to *full-employment equilibrium*, but in fact the economy could settle in equilibrium at any level of unemployment. This meant that classical policies of non-intervention would not work. The economy would need prodding if it was to head in the right direction, and this meant active intervention by the government to manage the level of demand, unlike classical theories that sought to have no government involvement in markets.

Another critic of the Classical theory was John Stuart Mill who differed with the earlier classical economists on the inevitability of the distribution of income produced by the market system. Mill pointed to a distinct difference between the market's two roles: allocation of resources and distribution of income. The market might be efficient in allocating resources but not in distributing income, he wrote, making it necessary for society to intervene. Thus the issue of functioning and malfunctioning (failures) of markets had begun that necessitated a review of the economic thinking underlying the working of the markets.

### **3.1.2 Neoclassical (new classical) economics**

Under classical economics the value of a product was thought to depend on the costs involved in producing that product. Goods were distributed in an economy, it was assumed, in the same way that costs were distributed -- thus a landlord would receive more goods than a tenant farmer because the landlord bore most of the cost. The problem with this approach was that prices for a product did not always reflect the expected value as indicated by the costs of a product. Clearly, something was wrong with the perspective that the cost of a product was expressed in its price, a phenomenon that is explained by differences in "utility." Economists began to explore the way that elements such as supply and demand effected price, and Neo-Classical Economics gradually came into being.

New Classical Economics (NCE) emerged as a school in macroeconomics during the 1970s based on neoclassical economic framework. It emphasizes the importance of rigorous micro foundations, in which the macroeconomic model is built up from the actions of individual agents, whose behavior is modeled by microeconomics. Neoclassical economics refers to a general approach to economics based on supply and demand which depends on individuals (or any economic agent) operating rationally, each seeking to maximize their individual utility or profit by making choices based on available information.

Neoclassical Economics is based on three main assumptions: rationality and self interest, utility and profit maximization, and full and relevant information. The assumptions are briefly discussed below.

### **Rationality and self interest**

People have rational preferences among outcomes that can be identified and associated with a value. All agents also possess rational expectations. Rationality implies that preferences are rational if they are complete and transitive. That is, that the decision maker is able to compare all of the alternatives, and that these comparisons are consistent. The decision makers then choose or predict the best alternative. Rational expectations refer to the use of the available information to make the best possible predictions about the future.

Neoclassical economists usually assume, in other words, that human beings make the choices that give them the best possible advantage, given the circumstances they face. Circumstances include the prices of resources, goods and services, limited income, limited technology for transforming resources into goods and services, and taxes, regulations, and similar objective limitations on the choices they may make.

Strictly speaking, neoclassical economics does not assume that real, concrete human beings are rational and self-interested. Rather, most economists assume that economic systems work *as if* they consisted of rational, self-interested persons. The rationality and self interest here refers to the average person, where it is assumed that deviations from rational self-interest are random and will cancel out and so the system will act as if everyone were rational and self-interested. Accordingly, neoclassical economics studies an economic system consisting of rational, self-interested persons.

There are two very different issues here. The first issue is that people are sometimes altruistic. People often do act on non-self-interested values -- but when they do so they act on their own values, not those of the government, some philosopher, or (most important) the observing

economist. A broader neoclassical economics assumes that people choose in the way that best advances their own values, altruistic or self-interested as those values may be.

### **Utility and profit maximization**

Individuals maximize utility and firms maximize profits. Utility maximization implies that rational economic agents make decisions that maximize their satisfaction in consumption. Under profit maximization, the agents determine price and output levels that return the highest profits possible.

### **Full and relevant information**

The assumption implies that people act independently on the basis of full and relevant information. Information relevant for decision making is available to decision makers who make full use of it. There is perfect information such that no economic agent will be left worse off or better off for lack of relevant information for decision making.

From the three assumptions above, neoclassical economists have built a structure to understand the allocation of scarce resources among alternative ends. From the basic assumptions of neoclassical economics comes a wide range of theories about various areas of economic activity. For example, profit maximization lies behind the neoclassical theory of the firm, while the derivation of demand curves leads to an understanding of consumer goods, and the supply curve allows an analysis of the factors of production. Utility maximization is the source for the neoclassical theory of consumption, the derivation of demand curves for consumer goods, and the derivation of factor supply curves.

The role of demand and supply was emphasized by Marshall in his book (Principles of Economics, 1890) where he explained that prices resulted from the intersection of demand and supply curves and introduced the concept of market periods, from the very short run to the long run.

Neoclassical economists believe that free markets usually bring about an efficient allocation of resources. Consequently, efficient allocation is the important thing about free markets. In those more or less rare cases when markets "fail" to bring about an efficient allocation of resources, it is appropriate for the government to intervene to correct the situation, if it can.

The framework of neoclassical economics is summarized as follows. Buyers attempt to maximize their gains from getting goods, and they do this by increasing their purchases of a

good until what they gain from an extra unit is just balanced by what they have to give up to obtain it. In this way they maximize "utility"—the satisfaction associated with the consumption of goods and services. Likewise, individuals provide labor to firms that wish to employ them by balancing the gains from offering the marginal unit of their services (the wage they would receive) with the disutility of labor itself—the loss of leisure. Individuals therefore make choices at the margin. This results in a theory of demand for goods, and supply of productive factors (Wikipedia, 2006).

Similarly, producers attempt to produce units of a good so that the cost of producing the incremental or marginal unit is just balanced by the revenue it generates. In this way they maximize profits. Firms also hire employees up to the point that the cost of the additional hire is just balanced by the value of output that the additional employee would produce.

The neoclassical vision thus involves economic "agents," be they households or firms, optimizing (doing as well as they can), subject to all relevant constraints. Value is linked to unlimited desires and wants colliding with constraints, or scarcity. The tensions, the decision problems, are worked out in markets. Prices are the signals that tell households and firms whether their conflicting desires can be reconciled.

Neoclassical economics conceptualized the agents, households and firms as rational actors. Agents were modeled as optimizers who were led to "better" outcomes. The resulting equilibrium was "best" in the sense that any other allocation of goods and services would leave someone worse off. Thus, the social system in the neoclassical vision was free of irresolvable conflict. The next section relaxes some of these assumptions.

### **3.2 *Basis and foundations of New Institutional Economics***

A realization that perfect market competition was not always appropriate led to other models being introduced such as imperfect competition market model forms and industrial organization.

Institutional economics regards individual economic behavior as part of a larger social pattern influenced by current ways of living and modes of thought. It rejects the narrow classical view that people are primarily motivated by economic self-interest. Opposing the laissez-faire attitude towards government's role in the economy, the Institutionalists called for government controls and social reform to bring about a more equal distribution of income. Institutional economics therefore developed as an alternative to the neoclassical economic theory

formulated by among others, Alfred Marshall in the 19th century. The most prominent of the so-called old Institutionalists were Thorstein Veblen and John R. Commons.

Major contributions to New Institutional Economics, to which transaction cost economics belong, have been made by Oliver Williamson, Douglas North among others over the last three decades. Williamson used the term New Institutional Economics to distinguish it from the 'old institutional school' pioneered by Commons and Veblen (Paarlberg, 1993). According to the old institutional school, institutions were a key factor in explaining and influencing economic behavior, but there was little analytical rigor and theory in this school of thought. It operated outside the neoclassical economics, and there was no quantitative theory from which reliable generalizations could be derived or from which sound policy choices could be made. Neoclassical economics on the other hand ignored the role of institutions and economic agents that were assumed to operate in almost a vacuum (Makhura, 2001).

According to the neoclassical theory, markets function according to the Walrasian model in which homogenous products are traded, perfect information is guaranteed for both sellers and buyers and friction in time or space does not occur (Kreps, 1994 in Boger, 2001a). However, the frictionless trading and business environment have been shown to fall short of characterizing the operation of market economies.

In his path breaking article, 'The nature of the firm', Coase (1937), showed that despite the price system, firms continued to exist because sometimes the cost of transactions in the market were higher than if transactions are internalized, that is, carried out wholly within the organization. He stated that the cost of using the market involves the cost of establishing the price, the cost of negotiations, the cost of specification of the contract and, the cost of monitoring compliance. In the presence of high costs of using the market, firms provide an alternative to the market system. Specifically the coordination alternative used depends on the associated costs of transactions, that is, which coordination is more efficient (FitzRoy et al, 1998). Neoclassical economic assumptions of no transaction costs, perfect information and, full rationality, are relaxed under New Institutional Economics, which helps cope with real world economic problems (Boger, 2001a; North, 2005). But the assumption of self-seeking individuals attempting to maximize their utility or profit subject to certain constraints still holds. The NIE encompasses both paradigms and acknowledges the importance of institutions within the framework of neoclassical economics.

New institutional economics explains the operation and evolution of institutions over time and evaluates their impact on economic performance, efficiency, and distribution (Boger, 2001a; North, 2005). There is a sort of two way causality between institutions and economic growth. On the one hand, institutions have a profound influence on economic growth, and on the other hand, economic growth and development often result in a change in institutions. However, not all institutional changes are beneficial. By influencing transaction costs and coordination possibilities, institutions can either facilitate or retard economic growth. This may be explained by the availability of different institutions in different countries and different economic development paths.

The NIE represents an expanded economics that focuses on choices people make, while at the same time it allows for factors such as pervasiveness of information, evolution and evolution of norms, and willingness of people to form bonds of trust (Boger, 2001a; Clauge 1997; Williamson, 2005). The goal of new institutional economics is therefore to explain what institutions are, how they arise, what purpose they serve, how they change and how, if at all, they should be reformed (Klein, 1999).

Institutions have been defined as rules of conduct (norms, traditions, value systems, religions, sociological trends) that facilitate coordination or govern relationships between individuals or groups. Institutions provide for more certainty in human interaction (North, 1990). Institutions therefore have influence on behavior and therefore on outcomes such as economic performance, efficiency, economic growth and development.

### **Approaches to New Institutional Economics (NIE)**

NIE operates at two levels: macro and micro levels (Williamson, 2000). The macro level deals with institutional environment or rules of the game, which affect the behavior and performance of economic actors and in which organizational forms and transactions are embedded. Williamson further describes it as the set of fundamental political, social, and legal ground rules that establish the basis for production, exchange and distribution. The other level is the micro level which is also referred to as institutional arrangements, and deals with the institutions of governance. Institutions of governance refer to modes of managing transactions and include market, quasi-market, and hierarchical modes of contracting. The focus here is on the individual transaction and the question regarding organizational forms. It is these institutional arrangements that govern the way in which its members cooperate and or compete. Institutions in this case do not refer to organizations.



Among the branches of the New Institutional Economics is New Economic History by North among others, Public Choice and Political Economy by Buchanan and Tullock among others, New Social Economics by Becker, Theory of Collective Action by Ostrom, Olson and Hardin, Law Economics by Posner and Transaction Cost Economics by Coase, Williamson and Furubotn. Transaction Cost Economics branch is also closely associated with social capital by Putnan and Coleman, property rights literature by Alchain and Demsetz and Economics of Information by Akerlof, Stigler and Stiglitz (Furubotn, 2005).

Among these branches of NIE, North's New Economic History and Williamson's Transaction Cost Economics have received major prominence and the differences in the approaches of the two are briefly discussed here briefly. North takes a macro level view of institutions and looks at the role of institutional change in fostering overall economic growth and explaining the divergence in the development of various countries, which tries to explain how economies evolve over time. According to North, institutions that evolve to lower transaction costs are the key to the performance of economies (North, 1990). He equates institutions in this case to institutional environment, which Williamson distinguishes from Institutional arrangements. North further posits that inefficient institutions can persist over time and this hinders economic growth. The main catalysts for institutional change are changes in relative prices caused by population changes and technological innovations. Both relative price changes and technological changes will lead to changes in the rules of the game thereby introducing new institutional arrangements in their transactions.

On the other hand, Williamson's approach takes a different view of institutions and transaction costs from a micro perspective. This study adopts Williamson's definition and approach to institutions and transaction costs by virtue of being micro rather than macro in nature but operating within the institutional environment. However, the two approaches (micro and macro approaches) to institutions are complementary.

### ***3.3 Transaction Cost Economics: definition and approaches***

Transaction cost economics is based on the hypothesis that institutions are transaction cost minimizing arrangements, which may change and evolve with changes in the nature and sources of transaction costs. Building on Coase (1937), Williamson (1975, 1985) uses the Transaction Cost Economic Theory to explain the role of hierarchies as alternative governance structures to the price system. He explains that while the market governance relies on prices, competition and contracts to ensure that all parties to an exchange observe their rights and responsibilities, hierarchical forms depend on a third party who may be called "the

boss” to achieve the same intention. This approach is commonly referred to as Williamsonian Transaction Cost Economics (TCE). The transaction is the unit of analysis. Transaction costs cannot be directly measured but instead are estimated through proxies to bring out any significant relationship between the proxy and the governance of interest. The prevalence of coordination alternatives explain why firms exist in general and their behavior in the market and the problems necessitating their use in transactions. Williamson (2005) further points out that transaction cost economics is concerned with complex markets where there are small numbers of parties on each side of the transaction, which goes beyond the simple market exchanges. He refers to transaction cost economics as the science of contract and to neoclassical economics as the science of choice.

Thus according to Williamson, a trade off exists between costs of coordination and hierarchies within an organization and the costs of using contracts in the markets (Drugger, 1983; Makhura, 2001). This trade off depends on the magnitude of the transaction costs.

### **Transaction costs defined**

Transaction costs are costs that arise when a good or service is transferred across a technologically separable interface (Williamson, 1985). Transaction costs arise because of the frictions involved in the exchange process. The exchange process involves transfer and enforcement of property rights. Eggertson (1999) defines transaction costs as ‘the costs that arise when individuals exchange ownership rights for economic assets and enforce their exclusive rights’. Transaction cost theory identifies the causes of transaction costs as market search and information costs, negotiating or bargaining costs (when prices are not exogenously determined) and monitoring and enforcement costs (Coase, 1937; Williamson, 1975, 1981, 1985). Basically the costs arise because the parties must find each other, communicate and exchange information, the goods and services must be described, inspected, weighed and measured. Contracts must also be drawn up, title transferred and records kept. These contracts may have to be enforced in cases of violation, which involve costs.

Information costs arise because the markets are not perfect as information is not freely available. Information is costly as it requires time, efforts and money to acquire. Lack of information increases search costs for the transacting partners (Williamson, 1975, 1989; Hobbs, 1997; Douma and Schroeder, 1991). Resources are spent to acquire information on potential contracting partners, the price and quality of the resources in which they have property rights (Eggertson, 1999) which may be in terms of personal time, travel expenses and communication costs.

Monitoring of contractual partners is designed to make sure that they abide by the terms of the contracts. Monitoring costs are related to the level of trust between the transacting partners. Trust can be build over time or broken between transacting partners. When trust is adjudged to be low, there will be a corresponding increase in monitoring costs. The higher the level of monitoring required of partners, the higher the expected costs and consequently, the more costly it is to transact among the partners (Barney and Hesterly, 1996).

Two further dimensions of transaction costs in the context of marketing agricultural produce are presented by Jaffee and Morton (1995) in Makhura (2001):

- screening costs, which refer to the uncertainty about the reliability of potential suppliers or buyers and the uncertainty about the actual quality of the goods
- transfer costs, which refer to the legal, extra legal or physical constraints on the movement and transfer of goods. The dimension commonly includes handling costs, storage costs, and transport costs among others.

Other approaches to defining transaction costs include Drabenstott (1995), who refer to transaction costs as perceived risk, transportation, and administrative costs. Staal et al (1997), and Delgado (1995) in Makhura (2001) classify transaction costs into observable and unobservable or inhibitive transaction costs. The observable transaction costs include marketing costs such as transport, handling, packaging, storage, spoilage among others and are observable when a transaction takes place. Unobservable transaction costs include costs of information search, bargaining, screening, monitoring, coordination, enforcement (Bardham, 1994 in Makhura, 2001), and product differentiation (Benham et al, 1998). Delgado (1997) in Makura et al (2001) identifies these costs as costs of participating in the market process, whether the market exists or not.

According to Hobbs (1997), transaction costs can be divided into information, negotiation and monitoring costs. Information costs arise ex ante of an exchange and include the costs of obtaining price and product information and the cost of identifying suitable transaction partners. Negotiation costs are costs of physically carrying out the transaction. She presents examples of negotiation costs to include costs such as are commission costs, costs of physically negotiating the terms of exchange, and costs of drawing up formal contracts. Monitoring or enforcement costs occur ex post of a transaction and are the costs of ensuring that the terms of the transaction (quality standards and payment arrangements) are adhered to by other transaction partners. Haddad and Zeller (1997) cited in Makhura (2001) equate transaction costs with administrative costs of screening, delivery and monitoring of

implementation of the program, which closely mirror Hobbs. Cuevas and Graham (1986) also cited in Makhura (2001) classify them as explicit costs for the observable costs and implicit costs for the unobservable costs.

Frank and Henderson (1992) identify transaction cost factors related to uncertainty, input supplier concentration, asset specificity and internalization costs. For Zaibet and Dunn (1998), transaction costs include high transport costs due to distances from market, poor or non existent infrastructure, high marketing margins due to monopoly power and high costs of searching for markets and monitoring contracts.

Other transaction costs in agricultural markets include bureaucratic costs and distortions in managing, and coordinating integrated production, processing and marketing, the value of time used to communicate with participating farms and to coordinate them, costs of incentives employed to convince farmers to voluntarily participate in integrated production, costs involved in establishing and monitoring long term contracts and the economies of scale forgone when batch production replaces commodity production (Hayes et al in Makhura, 2001).

Information inefficiencies and institutional problems like absence of formal markets give rise to transaction costs. The presence of transaction costs is often reflected by the difference, or discrepancy, between perceived buying and selling prices (de Janvry et al, 1991). In such a case, sellers experience low selling prices and will be discouraged to sell while buyers experience high buying prices and will be discouraged from buying. This creates disutility in the market and leads to market failures (Fafchamps and Minten, 2001).

A further delineation of transaction costs is by Key et al (2000) who distinguish transaction costs into fixed and proportional transactional costs. Fixed transaction costs do not vary with the amount of product sold but proportional transaction costs vary with quantity of product bought or sold. In this study, transaction costs are defined and classified into three classes of information and market search costs, monitoring, negotiation and, monitoring costs according to Hobbs (1997) and North (1990).

### **3.4 Information economics and transaction costs**

According to information economics, individuals act in an environment characterized with incomplete information. Incomplete information can also arise because of the inability to process all the information pertaining to a decision to be made due to bounded rationality. Seminal works on information economics have found relevance in transaction cost

economics. Stigler (1961) shows that searching for market information is not costless and that may explain why there is sometimes divergence of prices between efficient markets and why capital markets are imperfect. Akerlof's (1970) work on the market for lemons explains how quality guarantees, reputation, and trust are useful tools that ensure production of quality goods and provision of information about the goods. Other important works have been undertaken by Stiglitz (1998) on the role of imperfect information, adverse selection, and moral hazard, on the performance of credit and labor markets, and the behavior of firms.

Information requirements determine the mix of coordination (between markets and organizations) that can be used in transactions (Douma and Schreuder, 2002). Under perfect competition, each individual is a price taker; they will have no influence individually on the market price. The price conveys all the necessary information to market participants. The only decisions that decision makers make is how much to sell given the prevailing prices. The product is also assumed to be homogenous in nature. Thus in this case the price mechanism will be adequate in coordinating the market.

When the price does not provide all the required information about a product (such as quality), uncertainty sets in. In this situation, contingent contracts may be necessary to ensure that the prices and quality of the products delivered are acceptable to both parties. However, it would be impossible to cover all possible uncertainties occurring in future periods as there are limits on how much the human mind is able to accommodate at any one time. It would also be very expensive to arrive at such contracts as well as enforcing them. Alternative coordination modes are therefore necessary in such cases.

### **Information asymmetry**

Symmetrical information occurs when the distribution of information across all agents before a transaction takes place is the same. In such a case the information will have zero economic value. Sometimes information may be available but is unevenly distributed. This results in information asymmetry. The value of information can only be revealed to another party by disclosing that information, while such disclosure destroys its value. This is the information paradox (Douma and Schreuder, 2002). The paradox makes it difficult for those who have information to make it available to others before getting something in return. Parties that need the information are unwilling to pay for it before knowing the contents of what they are buying. Information asymmetries may give rise to opportunistic behavior (strategic behavior). All coordination modes require information, but the type of information requirements differ.

Markets and prices are able to transmit certain types of information, but not all types of information.

### **Hidden information**

Hidden information (Douma and Schreuder, 1991, 2002; FitzRoy et al, 1998) leads to *adverse selection*. In a transaction, one may end up with a set of business partners or clients in which the high-risk part of the population is over-represented (lemons) (Akerlof, 1970). One partner to a potential transaction is better informed about a relevant variable in the transaction, which the other party does not have. The high risks have self-selected themselves in response to the market offer. Ultimately, the costs of the offer will rise making it even more unattractive to potential lower risk parties. Adverse selection is an ex ante information problem as the parties concerned have no incentive to reveal this information truthfully as it will be harmful to them. At certain levels of information asymmetry, no transaction may take place and this may lead to complete market failures. The private information is unobservable to the other party to the transaction and consequently introduces risk for the other party (Douma and Schreuder, 2002).

Hidden information can manifest itself in all coordination types. When private information is present it can preclude transactions across markets as well as within organizations. Markets and organizations offer different solutions to the information problem.

### **Hidden action**

Moral hazard (or hidden action) is an information problem that can develop in both markets and organizations (Douma and Schreuder, 1991; and FitzRoy et al, 1998). It refers to actions (mostly, undesirable) which parties in a transaction take (or fail to take) after they have agreed to execute the transaction (Spencer and Zeckhauser, 1971). Thus moral hazard is an ex post phenomenon. One party to the transaction may have incentive to entertain actions that may be harmful to the other party's interest. Outputs or claims may be falsified, inputs and efforts may also be misrepresented among other actions that may not easily be observed by the other party to the transaction. The effect of hidden action is similar to private information above. When potential transacting partners anticipate that hidden action is possible, the transaction may not take place at all.

Information economics finds relevance in the agricultural field through the Imperfect Market Theory. The theory explains the emergence of key agrarian institutions which are seen as

substitutes for missing markets for credit or insurance in an environment of pervasive risk, information asymmetry and high transaction costs. Such institutions play an important role in the development of the agriculturally dependent economies. The kinds of governance structures crafted to address information problems have an important role to play here.

### **3.5 Behavioral assumptions responsible for transaction costs**

Two basic assumptions of bounded rationality and opportunism underlie the transaction cost theory. The concepts of bounded rationality and opportunistic behavior are used by Williamson to explain contractual choice and ownership structure of firms.

#### **Bounded rationality**

Bounded rationality means that those who engage in transactions are intently rational but limited by their cognitive abilities. The inability to evaluate all the alternative courses of action and to select the most optimal alternative as caused by bounded rationality means that the participants cannot specify all the contingencies to their contracts. Bounded rationality therefore refers to human behavior which is 'intendedly rational but limitedly so' (Simon, 1961 in Douma and Schreuder, 2002). The presence of complex and uncertain environments make bounded rationality a problem in transactions. For complex transactions and in uncertain environments, it becomes difficult or costly to write up a contract incorporating all contingencies to the transactions. A contingent contract encompassing all possible future scenarios would require enormous amounts of information that would be beyond an individual's processing ability. The result of incomplete contracts is uncertainty because the economic players cannot foresee all the possible outcomes or formulate other responses to the unforeseeable eventualities. Sufficient information reduces uncertainty (Williamson, 1975, 1981; Barney and Hesterly, 1996; Douma and Schreuder, 1991, 2002). These observations have also been made by Zuurbier & Bremmers (1997) and additionally, for frequency by Macbeth and Ferguson (1994), Douma and Schreuder (1991) and, Buvik and John (2000). Williamson (2005) further avers that all complex contracts are unavoidably incomplete because of bounded rationality.

#### **Opportunism**

Williamson observes that human beings are not only boundedly rational but they also display opportunistic behavior. Opportunism means that economic players 'display self-interest seeking with guile' and as making 'self disbelieved statements'. Opportunism arises when

there is incomplete or distorted disclosure of information, especially calculated to mislead, distort, disguise, obfuscate or otherwise confuse partners in an exchange. Some actors sometimes behave opportunistically and it is costly or impossible to distinguish between genuine and those likely to behave opportunistically before the transaction takes place (Douma and Schreuder, 2002). Williamson furthermore states that even those who behave opportunistically need not do so all the time. Opportunistic behavior can occur *ex ante* or *ex post*. *Ex ante* opportunistic behavior leads to adverse selection as in hidden action. *Ex ante* opportunistic behavior can occur only when there is asymmetric information: the seller has information that buyers do not have. Such opportunistic behavior may manifest itself as moral hazard, cheating, shirking, and other forms of strategic behavior. Shirking takes place if benefits exceed costs, that is, when the rewards or benefits are not perfectly correlated with productive efforts such that the incentive to produce or to apply more effort is diminished (Alchian and Demsetz, 1972). If shirking can be easily detected at zero costs, neither party to the transaction would shirk, since the other party would renegotiate the contracts and pass over the costs to the shirking party. However, if it is costly to monitor efforts of the transacting partners, the shirking party may not bear the full cost of their shirking behavior. In this case, the marginal cost of monitoring will be higher than the marginal gains from detecting shirking. This means that when monitoring the behavior of transacting partners is less than perfect, the incentives to shirk will remain. The costs of monitoring will increase with increase in the number of violations of the contractual terms.

Opportunism becomes a problem when there is small numbers exchange situation, that is, a situation where there is a small number of transaction partners. When there many sellers or buyers, opportunism is reduced due to the importance of reputations among the sellers or buyers. When there are very few sellers or buyers, the concern over reputations rises and this is likely to raise costs of verifying the reputations before transacting.

Transacting parties use governance structures that take into consideration bounded rationality, opportunism and costs involved in the exchange. The mode of governance of a transaction is determined by minimization of the sum of transaction and production costs. Douma and Schreuder (2002) in addition remark that the atmosphere of a transaction also determines the governance mode of a transaction besides the transaction costs. The atmosphere in this case refers to the value attached to one mode of coordination, which despite having higher transaction costs may still be the preferred mode of governance. In this case, the benefits derived from the particular governance mode translate into higher utility which goes beyond



monetary returns or costs. The atmosphere also captures other influences on coordination mechanisms besides transaction costs.

### **3.6 Dimensions of transaction costs and coordination continuum**

Asset specificity, frequency of transactions and, uncertainty and complexity of transactions have been hypothesized to influence the kind of governance structures adopted by transaction partners (Williamson 1985; Joskow, 1985, 1987). The relative influence of these factors differs according to the kinds and nature of products, sectors, or economies among others.

#### **Asset specificity**

Williamson (1985) defines asset specificity in relation to the ease with which it can be redeployed to alternative use without sacrificing productive value. The level of transaction specific investment determines the type of governance structure chosen. The investments may range from modification of the physical technology, operating policies and procedures or learning special language, styles and business practices of their partners to expedite the transaction and also the location of the enterprises. Despite the fact that investing in specialized production facilities has been known to increase productivity (Dyer, 1997; Douma and Schreuder, 1991), the investments have value in so far as they are applicable to only one partner or one transaction and not elsewhere. The bargaining positions of transacting partners, ex ante and ex post will be determined by the idiosyncratic investments made or likely to be made by each of them. The partner that has made specific investments in the transaction is vulnerable to ex post contractual opportunistic behavior by the other party in attempting to appropriate quasi rents of the specialized assets (Klein, Crawford and Alchian, 1978). This is a typical 'hold up' problem (Williamson, 1991). Thus it is important to determine the importance asset specificity has on the mode of governance that is employed by the transacting partners.

One remedy to the hold up problem is vertical integration by one of the parties that is most vulnerable. Other possible remedies include explicit agreements, or use of several governance structures. Transaction cost economics holds that parties tend to choose the governance structures that best control the underinvestment problem, given the particulars of the relationship (Klein, 1999).

Figure 3.1 below shows the trade-offs between asset specificity, transaction costs and coordination mechanisms.  $k_1$  and  $k_2$  are two levels of asset specific investments indicating low and high levels of asset specificities respectively. Below  $k_1$  parties to transactions have

invested lower amounts in transaction specific assets. The risk of their partners behaving opportunistically or holding them hostage in the transactions is low, consequently the perceived level of transaction costs faced by the parties are relatively low. Spot market (open markets) contracts are therefore adequate in coordinating transactions between the parties as the need to safeguard the assets is low. However, as the partners increase the amount of investments necessary for their transactions from  $k_1$  to  $k_2$  the need to protect the investments from being taken advantage of by the transaction partners rises. But since the level of asset specificity is moderate, the levels of perceived transaction costs are also relatively moderate and consequently simple contracts and informal agreements may be adequate to safeguard their investments. The range of possible safeguards between  $k_1$  and  $k_2$  is large and these are generally referred to as hybrid coordination modes and include verbal contracts, written contracts, partnerships, share exchange, strategic alliances among others. Beyond  $k_2$  the level of asset specificity rises tremendously and the perceived level of transaction costs escalate. Hybrid based coordination mechanisms are not adequate to safeguard the investments from opportunistic tendencies in the market. As a result, the parties concerned are likely to withdraw from the market and bring the transactions in-house by carrying out self production, acquiring the relevant partners or merging with them. This leads to formation of integrated, or diversified or conglomerate firms referred to as hierarchies in order to minimize exposure to high transaction costs in the market. In such cases, the costs of internal organization are perceived to be lower than the costs of market organization.

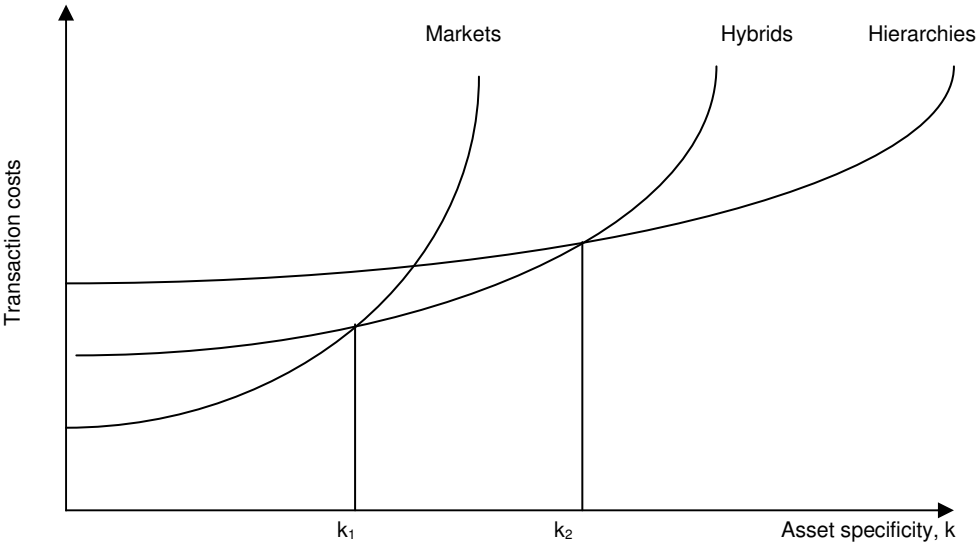


Figure 3.1 Transaction costs as a function of asset specificity

Source: Williamson (2005:49)

**Frequency and volume of transactions**

Another factor determining whether exchange relationships are carried out in-house or in the spot markets is the frequency with which transactions are carried out (Douma and Schreuder 1991; Macbeth and Ferguson, 1994). When the frequency of transactions is high it is expected that transaction will be carried out within organizations rather than across markets. To set up specialized governance structures involves certain fixed costs and the need for safeguards against post contractual opportunistic behavior will be influenced by the frequency of the transactions. Whether the volume of transactions conducted through such specialized governance structure utilizes it to capacity is the remaining issue. A higher probability of repeated exchanges lowers the expected transaction costs per unit of exchange (Dyer, 1997).

Without specific investments, spot market contracts will normally suffice, irrespective of frequency of transactions. At the other end, highly specific investments will require the use of hierarchies to govern the transactions, whether transactions are carried out frequently or not. For moderate levels of investments, hybrid governance mechanisms may be adopted such as contracting, whether formal or informal. Klein (1985) points to a self-enforcing contract encompassing an implicit enforcement mechanism that prevents strategic hold-ups. When transactions are carried out with a high frequency, contract performance can be implicitly enforced if the transacting party facing termination expects to earn a future 'quasi-rent stream' which is greater than the immediate short-term gain from breaching the contract.

**Uncertainty and complexity**

Douma and Schreuder (1991, 2002) indicate that uncertainty when combined with complexity of the transaction causes many exchange relationships to be brought in-house. For complex, high technology exchanges there will be more uncertainty surrounding it compared to uncertain but simple transactions.

Without uncertainty, transactions would be predictable and ex ante. Uncertainty comprises unforeseen, exogenous disturbances as well as behavioral uncertainty. The former refers to changing market conditions, while the latter arises either from lack of communication or from strategic opportunistic behavior (Williamson, 1985). Increases in uncertainty makes it impossible to write out full contingent contracts, therefore it is not possible to spell out the full rights and obligations of the transacting parties (Joskow, 1985, 1987).

Together with asset specificity, behavioral uncertainties affect the efficiency of governance structures. The most susceptible governance structures are the hybrid forms due to their typical contractual relationships (Williamson, 1996). Hybrids are more susceptible to

uncertainties because they do not normally contain adequate safeguards to withstand uncertain changes in the transaction environment even with moderate levels of asset specificity. In hybrids, the transacting parties remain independent and the cost of coordinating their activities including information flows, monitoring opportunistic tendencies (rent seeking) coupled with inability to enforce such contracts easily lead to a breakdown in the contractual arrangement. This leads to a shift in the transaction function of the hybrid mode as shown in figure 3.2 below. It becomes difficult to build new contractual arrangements. A consequence of the shift in transaction costs associated with the hybrid coordination modes is that more transactions will move to the open markets and or to hierarchies leading to reduced efficiencies in the market due to institutional breakdowns. Some transaction parties may not recover to effectively participate in the market. The effects of uncertainty, frequency and asset specificity on the coordination mechanisms have useful implications for the performance of the transactions and the economies concerned.

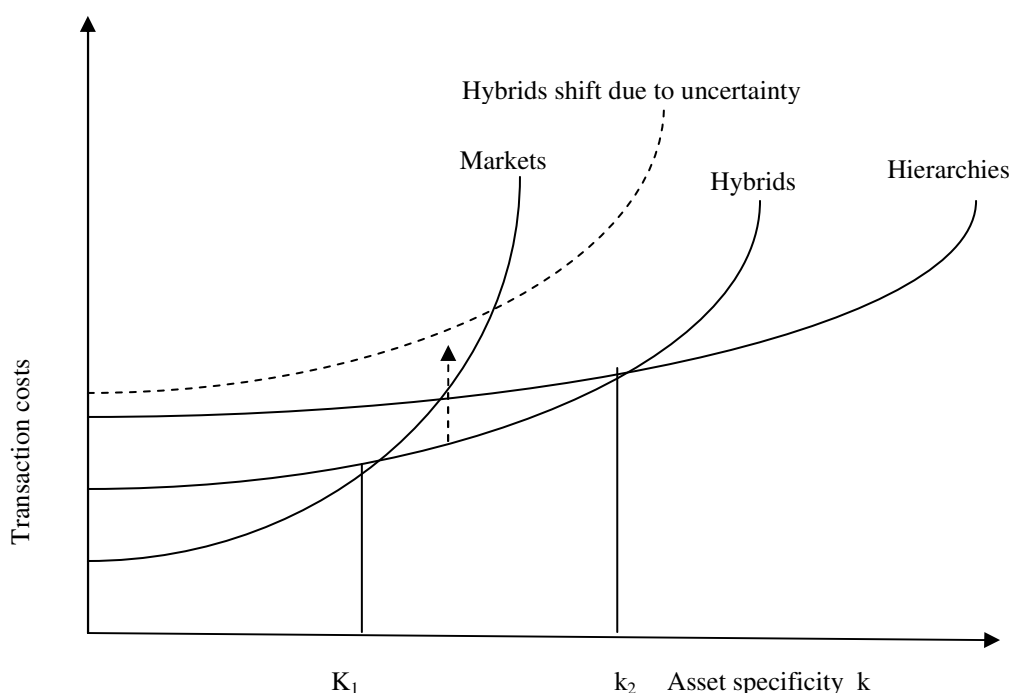


Figure 3.2: Governance structure shift due to uncertainty

Source: Williamson (1991:140)

### A continuum of coordination mechanisms

Inter-organizational coordination refers to how well the transacting members perform in accordance with their roles in the system (Cheung, 1983 cited in Hernandez-Espallardo and Arcas-Lario, 2003). It is the extent to which the work activities of the parties are logically

consistent and coherent, so that they are directed towards a common objective in such a way that they supplement and complement one another. Cyert and March (1958), Heide (1994), cited in Buvik and John (2000) provided the initial theoretical models of co-ordination.

Inter-organizational coordination is considered as a continuum of governance structures bounded by the spot market prices at one end and within-firm organization at the other end. In between these extremes are hybrid forms sharing features of the two extreme types and include joint ventures, alliances, shareholding and shared product life (Macbeth and Ferguson, 1994; Zuurbier, 1994, 1996). Figure 3.3 below shows the continuum of these governance structures.

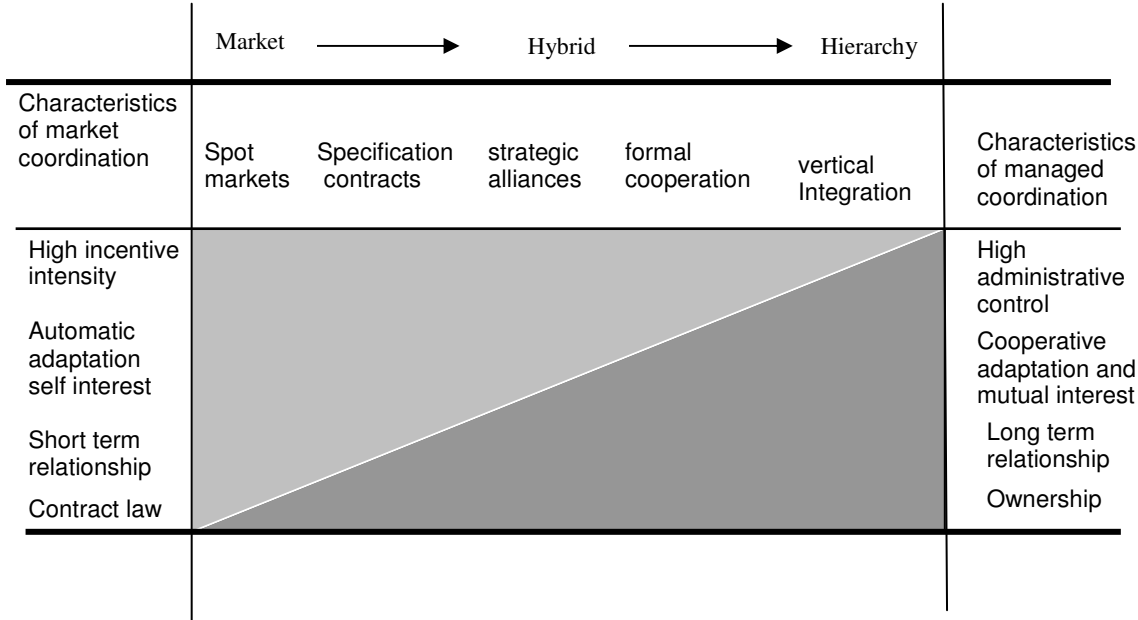


Figure 3.3: The continuum of governance structures  
 Source: Adapted from Peterson and Wysocki (1998) in Boger (2001a:10)

Williamson (2005) devises a schema for empirically testing and predicting contracting in the face of safeguards and asset specificity. This is shown in figure 3.4 below. Letting  $k$  be the measure of asset specificity and  $s$  the presence or absence of safeguards, organizations that use special purpose technology have their  $k > 0$ . In this case, there is incentive to safeguard their specific investments. Safeguards may include penalties, information disclosure and verification procedures, specialized dispute resolution and in the limit common ownership. When  $s = 0$ , no safeguards are provided. Node A corresponds to the neoclassical spot market situation based on prices. Courts are used as safeguards in case of contract violations. Node B poses unrelieved contractual hazards in that specialized investments are exposed ( $k > 0$ ) for which no safeguards ( $s = 0$ ) have been provided. Such hazards will be factored in the prices

offered to take care of the implied contractual breakdown. Nodes *C* and *D* have added contractual safeguards. Transactions will be transferred from *C* to *D* if there are continued contractual breakdowns. Prices bid at *C* are expected to be lower than at *B*, which includes the contractual hazard premium. But transactions need not necessarily end at node *D*. Other cost effective safeguards like reputation or credibility can be used to achieve the same end. Macbeth and Ferguson (1994) have also related the coordination mechanisms to transaction costs, indicating that transaction costs vary on the coordination continuum.

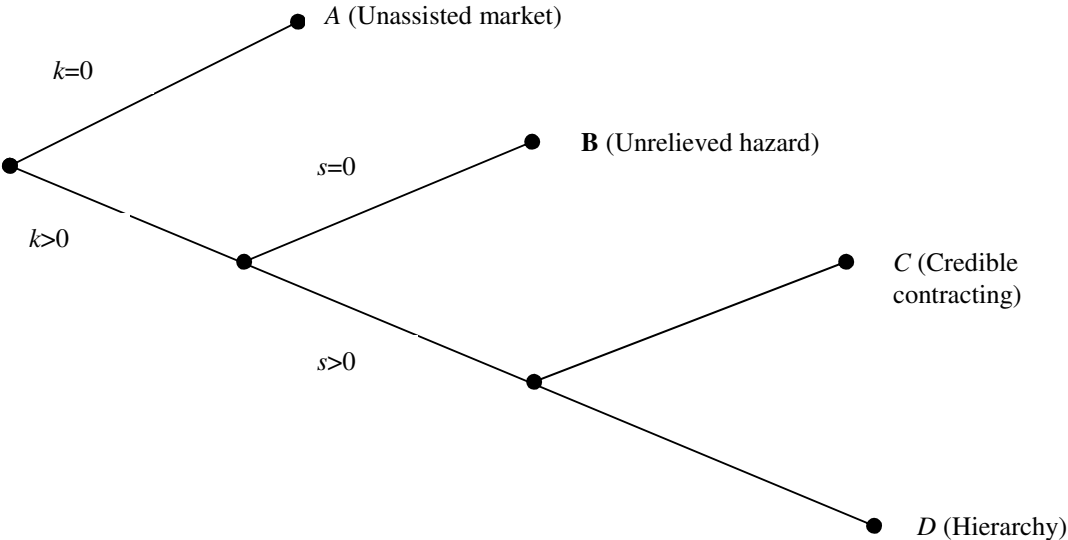


Figure 3.4: Simple contracting schema  
 Source: Williamson (2005:50)

Coordination has become critical because of the structural changes that emerge in the business environment from time to time such as low or no market growth, greater and more international competition, more choice and enhanced value, improved food safety and legislation and consumer concerns about various environmental issues. Collaborating (partnering) is a strategic option for achieving and meeting these requirements (Downy, 1996). Buvik and John (2000) note that greater vertical co-ordination of action between buyers and sellers will create additional economic value through interaction that takes into account the traditional partner’s requirements and circumstances. They also note that complete contracts are increasingly difficult to write and that such contracts lock the parties in positions that might otherwise be revised profitably. Incomplete contracts can only work

within supportive governance structures, such as vertical co-ordination, that have higher chances of reducing ex-post transaction costs (Douma and Schreuder, 1991).

One way of cooperating is through collusion where the parties agree in some way to cooperate in the market association as a group. The incentives to collude are mostly to gain economic profits by restricting outputs or by raising prices or both. The incentives to cheat by each member of the cartel are equally high. Bertrand (1833) and Cournot (1897) cited in Barney and Hesterly (1996) have illustrated examples of this cheating and the inherent opportunistic behavior. Given the strong incentive to cheat, effective collusion requires a very strong monitoring system. Monitoring however is difficult granted the dispersion of the members—the producers and customers (Stijnen et al, 1998).

However, cheating is not limited to cartels only. Explicit governance structures, which are used to manage cheating problems, also face more or less the same problems. Besides the explicit governance structures, trust between parties to a transaction can be used to manage cheating. According to Downy and Cannon cited in Masuku and Kirsten (2004), trust exists if one party believes the other party is honest or benevolent. Over time, the partners realize that they can be trusted not to behave opportunistically. Thus trust can be used as a low cost substitute for costly governance structures (Barney & Hesterly, 1996; Mentzer et al, 2001).

Beers et al (1996) recognize the importance of collaboration in agricultural product chains with regard to quality, delivery time, assortment and product life cycle of products. They further note that a basic aspect of collaboration between organizations is the exchange of information associated with receiving, processing and delivery of materials and products. Porter (1985) argues that the use of information technology may bestow competitive advantage to those companies involved with regard to new forms of relationships with customers, new product characteristics, quality and delivery time of the product and services. Specifically information tries to bridge the uncertainties in goods flow and quality of products in agriculture (Trienekens, 1993 cited in Beers et al 1996; Downy, 1996).

Frohlich and Westbrook (2001) in their study cited in de Treville and Hameri (2002) demonstrated that higher supply chain performance resulted when a firm combined with both an upstream and downstream partner, than either with an upstream or downstream partner. But one-sided integration was found to be better than none at all. Higher levels of integration brought about higher levels of performance (also observed by Gimenez and Ventura (2003)). The success of a supply chain management strategy is dependent on the relations among the supply chain partners, which further depends on the costs involved, real or perceived. The

relations between the supply chain partners are determined by the level of transaction costs between them.

### ***3.7 Institutions, transaction costs and coordination performance in developing markets***

Developing markets face many barriers in their attempts to commercialize their agricultural activities. They face informational barriers and may not easily venture into distant markets for fear of opportunistic tendencies from potential trading partners. Institutions that are supposed to support the markets are poorly developed, missing or ineffective. Thus market arrangements and market support institutions that are common in developed markets may not be available. But limited transactions still take place under these conditions in these economies.

Kydd and Doward (2003) show that disappointing performance of market liberalization policies in promoting agricultural performance in sub-Saharan Africa result from weaknesses in the neoclassical theory on which liberalization policies are based. After independence, most countries in Africa used state intervention to support agriculture at the expense of the private sector. State corporations were established to support the introduction and spread of more intensive production methods for the smallholder farmers and to develop rural areas. State intervention offered a means of providing a coordination mechanism across trading, infrastructural, research and extension investments and activities through financing, coordinating farmers, reducing systemic investment risks and investing in organizational and human resource development necessary to develop working systems.

The state parastatals were not successful and as a result the 1980s saw pressure from donor countries to reform them and involve the private sector in the economic system. The parastatals were not profit driven, were prone to political interferences, and were a discouragement to private participation in the economies. Thus liberalization efforts set in based on the neoclassical theory of competitive markets. The urge to open up the markets was given impetus by the World Bank and the International Monetary Fund (IMF) that based their mission on neoclassical competitive market solutions to the markets.

Actions to promote more efficient and less distorted operation of agricultural markets, with privatization of agricultural marketing organizations (de-linking credit, input and output markets), deregulation of these markets and elimination of credit, input and output subsidies



were undertaken. These changes are among what Williamson (1996) refers to as changes in the institutional environment.

Using figures from the World Bank and FAO, Kydd and Doward (2003) show that there has been low or negative per capita growth in agriculture in much of Sub Saharan Africa over the last 30 years which manifests itself in high incidences of rural poverty compared to other regions in the world. Arguments have been presented as to whether pre-liberalization situation should have been sustained despite not having delivered substantial improvements in agriculture as they were expected to, that is, to reduce rural poverty and increase food security.

Various reasons have been presented for the lack of success in liberalization, ranging from lack of sufficiently thorough liberalization (partial liberalization) to weak institutions – cultural, political, and legal factors, which undermine clear property rights consequently the investment incentives. A third explanation for liberalization's lack of success is the lack of a proper liberalization agenda. All these find relevance in developing agricultural markets in Africa.

Major problems facing rural areas have been indicated as poor roads and communication, lack of a well developed monetary system, business environment characterized by weak information, difficult and weak contract enforcement mechanisms, high risks and high transaction costs, which Kydd and Doward define as the costs of protecting oneself against risks of transaction failure by searching for and screening potential contracting parties and their goods and services, then negotiating and contracting with them, and monitoring their adherence to the contract.

Among the major risks facing agriculture in the rural areas is the transaction risk, which can be divided into two: coordination risks and risks of opportunism (Kydd and Doward, 2003). They define coordination as efforts or measures designed to make players within a system act in a common or complimentary way towards a common goal (Poultron, 2003 in Kydd and Doward, 2003). Economic coordination failure can thus be defined from two different but complementary perspectives: in terms of its direct effects on individual investors, it is the failure to make investment due to possible absence of complementary investments by other players at different stages in the supply chain. In terms of wider processes, and economic impacts, economic coordination failure occurs “where individuals’ failure to coordinate complementary changes in their actions leads to a state of affairs for everyone that is worse than some alternative state of affairs that is also an equilibrium” (Hoff, 2000 in Kydd and

Doward, 2003). Examples of failures to coordinate include having undue share of revenues in the supply chain, or delivering sub-standard products. Examples of opportunism include loan default by farmers, low product prices offered by traders at harvest time (when farmers are desperate for cash), or in remote areas (where farmers have no other sales outlets), sale of poor or adulterated products and, use of false weights. All these depress investments in the economic activity.

Low level equilibriums result from low or depressed investments, thin markets, coordination failure and weak institutions (for coordination and contract enforcement). This leads to low equilibrium traps or vicious cycles. Three different approaches are used to explain the problem of coordination failure or low equilibrium trap based on NIE.

According to North, institutional change is considered as an evolutionary process where powerful groups respond to changes in relative prices, technologies and transaction costs by modifying institutions in ways that they perceive to be in their interests. These changes may stimulate very different types of institutional changes promoting, in broad terms, pro development form (structuring transactions to create and promote trade and investments) or an 'anti-development' form (structuring transactions to create rents and, in the process, creating the possibility of a low level equilibrium trap). There is a strong dependence in these processes as initial conditions play an important role in determining the relative perceptions and power of different groups, and the institutional and technological options that they face.

Williamson on the other hand takes a micro-economic approach to analyze the way that agents, in the context of their institutional environment, structure their institutional arrangements, and this then influences the organization of the economy with regards to choices to use firms, markets and relational contracts or hierarchical, market and hybrid contractual forms for exchange and coordination. The key insights relevant here are the influences on contractual form and transaction failure of asset specificity, risk exposure, frequency of contracts, the nature of goods and services exchanged, the institutional environment, and human propensity for opportunism. This can be applied to rural markets following the realization that asset specificity is the result of thin markets in developing economies. Complementary investments are difficult to make except perhaps when a monopolist is involved such that the monopolist ends up capturing an unfair share of the revenues. Williamson calls for non standard contractual forms in cases of high asset specificity which is also applicable to developing poor rural markets such as share cropping, interlocked markets and local monopolies. These may be the most efficient contractual forms

given the circumstances prevailing at the time and can ensure that transaction costs and risks are minimized and that the supply chain does not fail completely.

The other institutional economics approach is found in Hall and Soskice (2001) cited in Kydd and Doward (2003) in their examination of 'varieties of capitalism' in Organization for Economic Co-operation and Development (OECD) economies. They propose two types of national economy, at poles of a spectrum. Liberal market economies or LMEs, where activities are coordinated via intra-firm hierarchies, competitive market arrangements and vertical hybrid arrangements between firms in a supply chain, and coordinated marketed economies or CMEs, where there is more use of 'non market relations to coordinate endeavors and to construct core competencies' with more extensive information within networks. CMEs draw on a further set of organizations and institutions, supporting more horizontal or networked strategic interaction, both across and within supply chains.

LMEs are associated with radical innovations while CMEs are linked to continuous technical innovations. The role of the state is higher in CMEs as they take deliberative and coordination processes that promote and enforce coordinated action and shared understandings of goals and distributive outcomes of such action. The CME approach may be more appropriate for poor countries facing serious weaknesses in the institutional environment that need continuous technical innovation and have serious coordination failures.

Kydd and Doward propose a formal model of low equilibrium traps and coordination failure that demonstrates a mechanism by which coordination failure may lead to under development traps and also highlights key variables determining the movement of an economy to low or high level equilibriums. This is shown in figure 3.5 below.

Figure 3.5 shows the relationship between the actors' costs and returns and the volume of investments in a supply chain. It is assumed that all actors face a two stage investment problem, in which they must make stage 1 investments in assets specific to a particular activity in the supply chain in order to reap net revenues in stage 2. Their revenues in stage 2 are however determined not only by the scale of their own stage 1 investments, but also by the scale of others' stage 1 investments. This relationship with others is thus a result of potential coordination failure (limited stage 1 investment by others may mean that there is not sufficient supply or demand of complementary products or services to support full utilization of the capacity generated by the actors' stage 1 investments) and of opportunism by other agents who, in a thin market, may be able to capture undue share of the surplus generated in the supply chain.

Figure 3.5 also shows that increasing total supply chain investments lead to increasing and then decreasing returns in net revenues assuming no loss of coordination failure or opportunism. However, there is a threshold level of total supply chain investment ( $I^*$ ) below which individual actors in that supply chain incur losses and above which they reap profits. Below the threshold, no actor has incentive to invest leading to a low level equilibrium trap. Above the threshold, we may expect the dynamics of competition and technical and institutional innovations to further lower costs with time with continuing increases in investment.

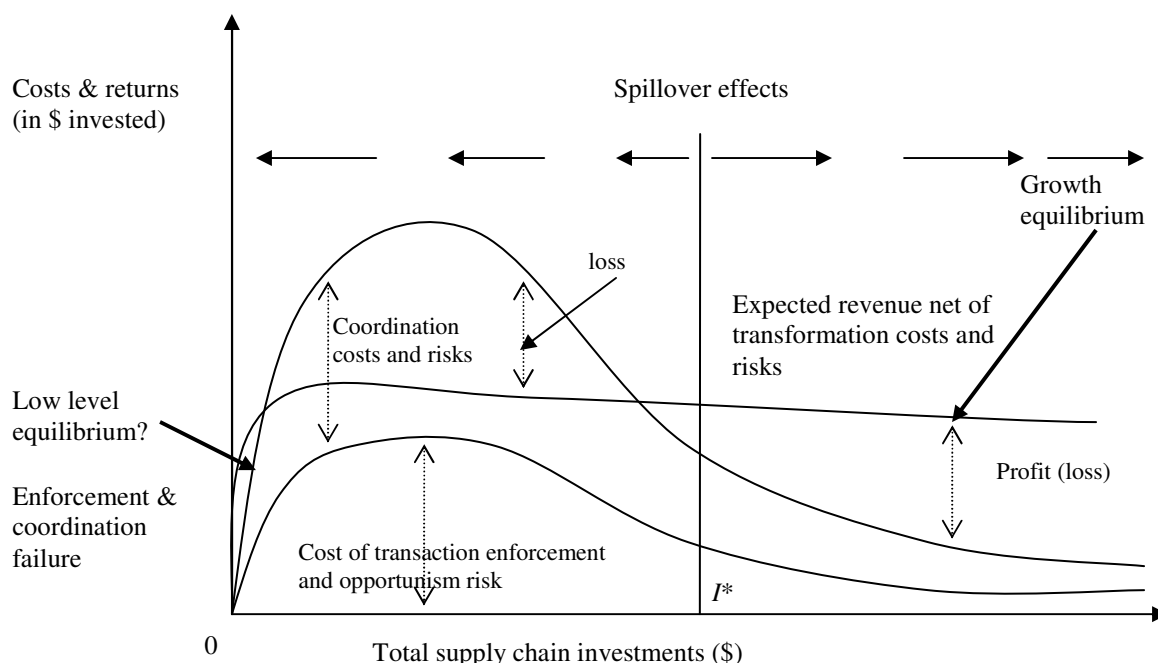


Figure 3.5: High and low level equilibriums with coordination and opportunism risk

Source. Kydd and Doward (2003:19)

Following the CME logic, coordination cannot be achieved by the market mechanism alone. Non market mechanisms referred to by Kydd and Doward (2003) as local and extensive coordinations are also necessary. Vertical integration (e.g. for large scale commercial farms) and local relations linking various local agents interested in investing in different activities in the supply chain through farmer groups or powerful traders can be employed. However, this coordination needs support probably from the state to keep it on the growth path so that it does not become too slow and fragile.

An alternative to local endogenous coordination is externally assisted 'soft' coordination processes (state or NGO assisted) or the more extensive 'hard' coordination where some strong central coordinating body with a mandate from the state ensures investments across the supply chain with highly credible coordinated commitments. However, the history of such bodies (e.g. parastatals) does not make this option appealing.

Total supply chain investments threshold can be lowered to make it attractive to potential participants by lowering coordination costs and risks, by lowering transaction enforcement costs and opportunism risks, and by raising expected returns net of transformation costs and risks. Most important is to lower stage 1 costs.

Williamson (1996) presents a framework for linking governance structures, individuals and the institutional environment (figure 3.6 below). In it, he identifies the institutional environment as the overreaching wider or general environment in which individuals and governance structures interact. According to Menard (1995), the institutional environment provides the rules of the game and includes contract laws, norms, customs and standards which are capable of inducing a shift in the relative costs of transaction costs in different governance structures, thereby leading to a change in the governance structures. The institutional environment is visualized to operate at higher levels than governance structures, for example at the national or macro level rather than at the enterprise or micro level.

Governance structures, though they may be changed by changes in the institutional environment, have a life of their own (arrowed circle) and this is determined by transaction costs (Williamson 1996; Boger, 2001a). The governance structures have a feedback to both the individuals and the institutional environment. An example of a feedback is change of contractual law in response to new product developments.

The individual in the diagram refers to the behavioral assumptions of bounded rationality and opportunism. The attributes of individuals influence the costs of transactions and the relative advantages of governance structures. Behavior is further influenced by the institutional environment: the rules and norms developed, for instance, determine the level of trust in a society (Boger, 2001a).

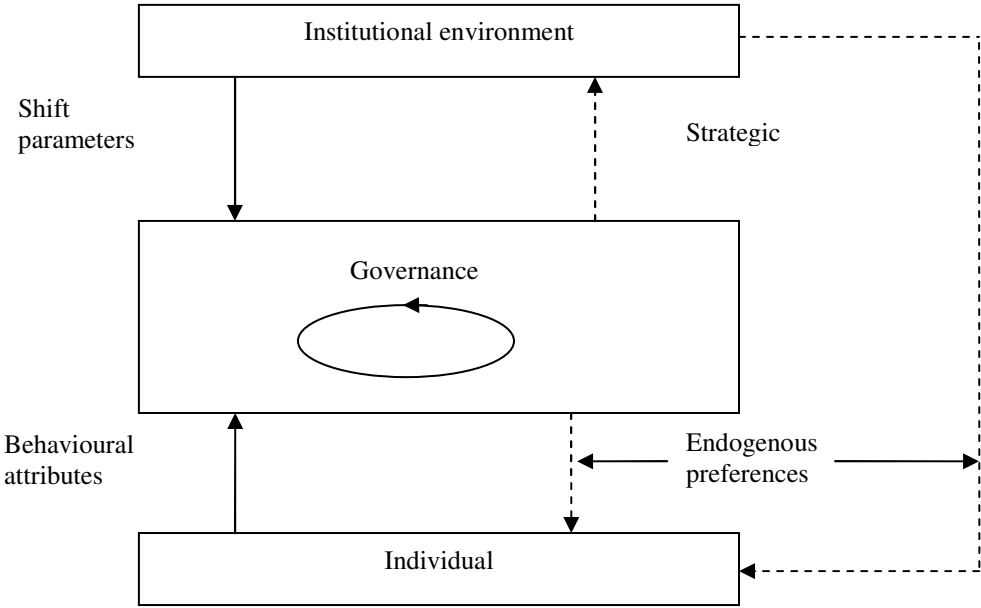


Figure 3.6: Links between governance, institutional environment and the individual

Source: Williamson (1996:223).

The links between institutions, governance and individual behavior illustrate the key interactions in economies and determine economic performance. Thus the difference between developed and developing markets rests in the effectiveness of property rights regime, information institutions, and market failure mitigating arrangements which allow the market forces to operate competitively and to move to whichever vertical coordination that is the least costly alternative given the available technology (Hobbs and Kerr, 1999). Institutions, in such an environment, are usually stable or change gradually and, for the most part, predictable for economic actors. The stability of institutions is a “necessary condition” for complex human interaction (North, 1990).

Various studies on Williamson’s three links have been undertaken for both transition and developing economies. Among transition economies, Brunetti, Kisunk and Weder (1998) in Boger (2001a) find that the impact of property rights, political stability, corruption and predictability of rules on the flow of foreign direct investments and economic growth are important preconditions for successfully transforming and improving the performance of these economies. Thus institutional changes are likely to affect governance and economic performance of the economies. Institutional change can be gradual or abrupt (shock therapy) and these two show trade-offs. Both kinds of institutional change have been captured in theoretical models by Dewatripont and Roland (1996), and Roland and Verdier (1997) also in Boger (2001a). Roland and Verdier develop a search model which explains why price

liberalization has been associated with an output fall in transition economies. The key factors leading to output decline in the model are search frictions in exchange and transaction specific investments. Asset specificity gains a new dimension in transition: due to substantial liberalization, disruption of previous production links and depreciation of the capital stock, searching for new business partners is usually laborious. New investments are made only after a new long term partner has been found.

The disorganization of production links after the breakdown of state managed institutions had severe impacts on output decline in such countries. Before liberalization, the state institutions provided instruments for avoiding adverse effects of specificity (hold ups). There arose a vacuum of formal institutions such that the lowered specificity in firms' relations opened room for bargaining due to asymmetric information and incomplete contracts. The consequent of the disorganization is that transaction costs increase as enterprises seek new customers and suppliers. The combination of the freedom to contract with imperfect information causes a breakdown of business relationships and a decline in production. Under such conditions, the question arises of how firms should reorganize (Boger, 2001a).

A theoretical framework for reorganizing of firms in less developed and transition economies has been provided by Beckmann (1999, 2000), cited in Boger (2001a). He uses the basic links between asset specificity and governance structures in TCE to model a socialist style of economy (figure 3.7 below). It is assumed that only hierarchical modes of organization exist (fat line in the figure). Such organizations suffering from bureaucratic burden and high transaction costs are economically justified only if asset specificity and or uncertainty are substantial. The fundamental institutional changes in transition remove the constraint of keeping transactions in hierarchical structures and bring the freedom to contract. With privatization and restructuring of state owned firms, one would expect a change in governance structure for transactions with a low and medium degree of asset specificity (vertical solid arrows). However, the assumption that transition leaves asset specificity untouched may not hold. Decapitalization or abrupt interruption in business links (Blanchard and Kremer 1997 cited in Boger, 2001a) can incur substantial sunk costs and reduce specificity (dejected arrow lines). Furthermore, specific relations in vertical coordination between firms will decline if liberalization leads to open markets and entry of new firms. Finally uncertainties due to major institutional changes negatively affect transaction costs of susceptible hybrid modes. The hybrid modes may either disappear or not evolve with the result that the spot market solution may dominate in early transition.

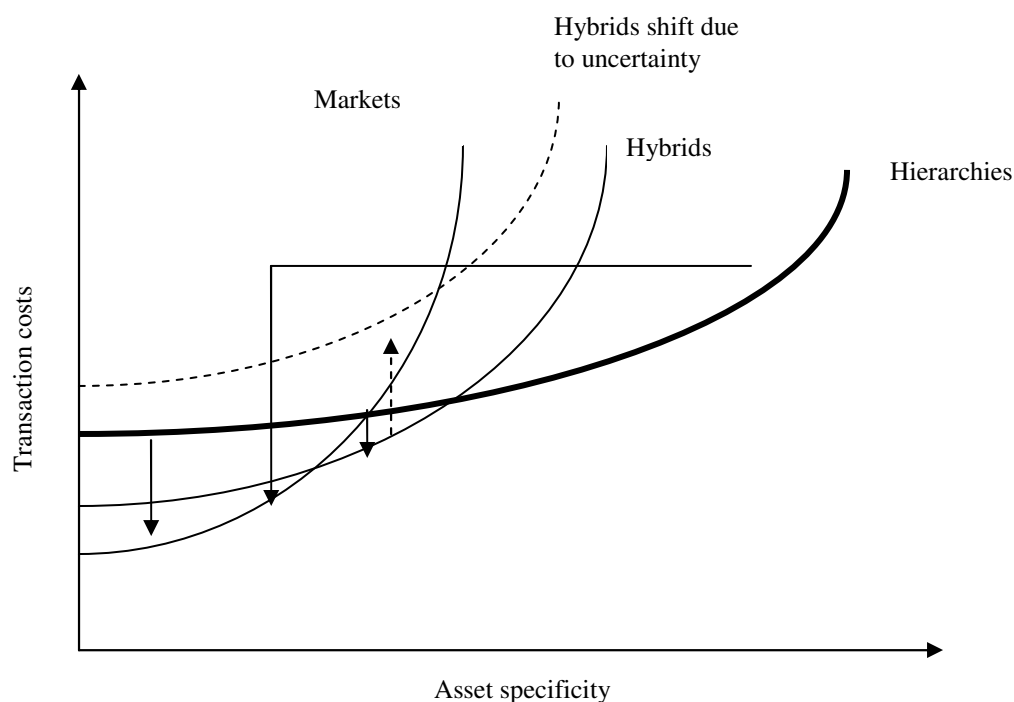


Figure 3.7: Dominance of hierarchical organization and adaptation during transition

Source: Boger (2001a:38)

The change in governance structures from hybrids to spot markets in early transition has feedback effects on the institutional environment. Recanatini and Ryterman (1999) further develop the model by Blanchard and Kremer by analyzing the institutional outcomes of disrupted business links. They argue that business networks emerge endogenously as a spontaneous response with a positive impact on firms' performance. These 'self organizing' networks are more likely to emerge in regions where institutional disorganization is great. Evidence from a survey of Russian firms indicates that the networks of firms are hybrid forms of governance embedded in informal institutions that create reputation, trust, interdependence and altruism (Macneil, 1985 in Boger, 2001a). It is only if these institutions become widely accepted as business rules that the establishment of informal networks induce institutional change in such economies.

The role of informal institutions and self organization on firms' performance has been studied by Koford and Miller (1999) in Bulgaria and Fafchamps (2004) for countries in Sub-Saharan Africa. When legal enforcement is limited, firms trade mainly within business groups via repeated spot market contracts that have many characteristics of relational contracts. Due to high uncertainty related to new, unknown business networks, firms try to solidify relationships within established informal business networks. Reputation serves as the enforcement mechanism of delivery and quality. They further show that if reputational effects



are limited to groups, it may have important implications on market entry and competition. Private ordering via informal institutions might mitigate opportunistic behavior within the business groups but it lowers competition and provides fertile ground for market power. Furthermore, poorly developed formal market institutions such as contract laws and courts force firms to engage in lengthy and costly trust building processes leading to high transaction costs compared to a situation in which enforcement institutions function well (Hobbs and Kerr, 1999).

Empirical evidence from private firms in Eastern Europe show that courts and relational contracts within a network are substitutes for enforcing contractual obligations (Johnson et al, 1999). Thus the impact of institutional development is two fold: first the role of courts will increase over time as legal systems become more workable and as decreasing costs of searching for alternative partners deteriorate stability in networks. Second, an increasing importance of courts will lead to improved efficiency since transaction costs can be lowered and entry barriers from more efficient firms reduced.

Market frictions go beyond the problems of contract enforcement and informational barriers associated with finding partners. Lack of quality and monitoring mechanisms create challenges in organizing business as well. Quality related problems affect buyers who may not be able to observe it before purchase.

In north's view (North, 2005), institutions evolve to reduce transaction costs and these institutions are important for the performance of economies. North sees the role of the government as being crucial in specifying property rights and enforcing contracts both of which promote specialization and reduce the costs of market exchange. The inability of societies to develop effective, low cost enforcement of contracts is an important source of stagnation and contemporary underdevelopment in developing countries (North, 2000, 2005).

There has been a recognition that transaction costs are relevant for agricultural market analysis in developing countries because many of their institutions (formal rules of behavior) that are taken for granted in developed countries which facilitate market exchange are absent in these low income countries. The occurrence of market failures and incomplete markets has been linked to higher transaction costs and to information asymmetries, which cannot be explained by neoclassical economics (Makhura, 2001; North, 2005; Kydd and Doward, 2003).

Earlier approaches at the recognition of transaction costs in agricultural markets have been explored by de Janvry et al (1991) for the case of missing markets in many African markets. They use the household as the decision making unit and show that in the absence of food

markets, households will normally strive to be self sufficient in their food requirements before they allocate their resources to cash crops. Another observation in the market is that there are wide variations between the selling prices (usually low) and the buying prices (usually high) (Sadoulet and de Janvry, 1995). The reasons for the missing markets have been attributed to transaction costs. Makhura (2001) provides examples of studies that indicate transaction costs to be a major reason for the observed missing markets such as for credit, labor markets, land markets as well as product markets. He further shows studies that indicate that these market failures result in alternative institutional arrangements, such as share cropping, interlinking and interlocking of markets among others.

Sadoulet and de Janvry (1995) study determinants of commercialization of small scale farmers and find that distance from markets, poor infrastructure, high marketing margins, imperfect information, supervision and incentive costs contribute a lot to whether a farming household participates in the market or not. Thus before a farmer participates in the market, he must overcome these transaction costs.

The importance of transaction costs have been identified by Coase (1937) and Hobbs (1997) as costs of searching for potential transacting partners, negotiating with them and ensuring that they meet their terms of transactions. Participation in the market will not be possible when these costs are very high (Staal et al., 1997; Coase, 1937). Campell (1978) in Makhura (2001) illustrate the problem of transaction costs by indicating that after one has decided on a price, one needs to find a buyer. The longer one looks for ideal buyers, the higher the search costs incurred. The transaction costs include advertising, telephone and transport costs, and also the actual time spent. These extra costs of search and information may rise so high that they exceed the gap between the price at which one would be willing to sell or buy and the price asked or offered by the end user.

Very high transaction costs limit the number of participants in the market. Unfortunately, the transaction costs associated with parties that are not able to participate in the market cannot be estimated or measured. But it is known that the transaction costs that the non market participants face may be too high to surmount in order to be able to participate in the market. High or prohibitive transaction costs may arise from prohibitive investment requirements (specifically asset specificity) (Frank and Henderson, 1992), too much uncertainty in transactions (natural and human), and high frequency/volume of transactions. Institutional arrangements are necessary to deal with problems such as hold up costs arising from differential investments in the transactions.

Staal et al (1997) shows that high transaction costs limit the amounts of products that can be available for transactions in the market, or the use of inputs (Strasberg et al 1999). Zaibet and Dunn (1998) show that household characteristics such as family size and dependency ratio may also limit market participation. Capital is not individual specific; it is shared among the family members (Goetz, 1992).

These few studies point to the significance of transaction costs and institutional arrangements in affecting market relations of individuals and firms in developing markets. The next chapter provides a detailed review of relevant works with regard to transaction costs and other determinants of coordination mechanisms and supply chain performance with special reference to agricultural markets in developing countries.

**CHAPTER 4**  
**EMPIRICAL STUDIES ON TRANSACTION COSTS, COORDINATION MECHANISMS AND SUPPLY CHAIN PERFORMANCE**

The difficult in the measurement and estimation of transaction costs empirically has been recognized by many researchers and scholars (Allen, 1999; Wallis and North, 1986; Davis 1986). However there have been continuing efforts in this direction over time.

An assumption in empirically testing transaction costs follows directly from the Coase theorem which states that under assumption of zero transaction costs, the type of organizational arrangement does not matter. The merits of alternative arrangements can be explained through a direct comparison of the costs of governing exchange under each alternative (Masten, 1996). Coase’s argument is that:

$$\begin{aligned}
 G^* &= G^1, \text{ if } C^1 > C^2 \\
 &= G^2, \text{ if } C^1 \geq C^2 \dots\dots\dots 1
 \end{aligned}$$

where  $G^1$  and  $G^2$  represent alternative governance structures,  $G^*$  is the chosen alternative and  $C^1$  and  $C^2$  are the costs related to the transaction under the corresponding organizational alternatives. Problems with transaction cost measurement usually hamper this form of analysis. A major problem facing transaction cost analysis is availability of data. The data required is usually not collected on regular basis, neither is it standardized nor publicly available. This problem has been recognized by among others, Menard (2000); Masten (1996); and Hobbs et al (1997). These limitations have however not stopped efforts in empirically studying transaction costs. Using the Coase theorem and insights from Williamson, Masten (1996) formalizes Coase’s argument as

$$C^1 = \beta_1 X + e_1 \dots\dots\dots 2$$

$$C^2 = \beta_2 X + e_2 \dots\dots\dots 3$$

where  $X$  displays a vector of observable attributes of both the organizational form and the transaction,  $\beta_1$  and  $\beta_2$  reflect parameter vectors, while  $e_1$  and  $e_2$  summarize unobserved factors such as errors and misperceptions of transaction costs. How the types of transaction costs affect the differential efficiency of organizational alternatives can thereby be analyzed, even though transaction costs themselves cannot be measured. The probability of observing the governance structure  $G_1$ , therefore becomes

$$\Pr(C^1 < C^2) = \Pr(e_1 - e_2 < (\beta_2 - \beta_1)X) \dots\dots\dots 4$$

The operationalization has been extensively used in recent empirical works.

Masten, Meehan and Synder (1991) provide a method of measuring the costs of organization, which are used to represent transaction costs. They note that while the proxies capture the hazards of the market, they ignore the internal costs of governance. Reduced form estimates are unable to distinguish between internal and external transaction costs. They use switching regression techniques and adopt censored regression models used in labor economics. Actual dollar estimates of organization costs are obtained as well as estimates of the magnitude of individual coefficients to capture their relative impact. They applied this methodology to naval shipyards and found the overall organizational costs to be 14% of the total costs and that with an incorrect contract agreement the costs would go up to 70%.

Other efforts at directly operationalizing transaction costs based on Masten's (1996) structural discrete alternatives have been undertaken by Fahlbeck (1996). Fahlbeck analyses the influence of physical asset specificity, site specificity and human asset-specificity on the choice of the marketing channel among Swedish farmers. The results indicated that farmers with a higher degree of sunk costs, that is, greater asset specificity, favor trade with cooperative societies. Sales to cooperatives incur lower transaction costs when asset specificity is high compared to investor owned firms. Allen and Luech (1992) show that measurement and enforcement costs dictate the choice between cash rent contracts and cropshare contracts in land leasing while risk-sharing considerations derived from neoclassical theory are irrelevant for contract choice. Cropshare contracts are directly linked to low measurement costs of output and a high chance of soil exploitation.

Vakis et al (2003) measured transaction costs based on observed behavior in the market among potato farmers in Peru. They estimated proportional and fixed transaction costs using reduced form and semi structural conditional logit approach to market choice. A result of their study was that the choice of a market is a function of effective farm level prices and of market information that account for fixed transaction costs. Information that farmers receive reduces fixed transaction costs by increasing the price received. They observed that the effect of information availability was two times that of transport cost reduction. The study shows that transaction costs are not synonymous with transport costs and that fixed transaction costs are critical if the market is to properly function. In the same vein, Renkow et al (2004) present a framework for quantifying fixed transaction costs facing semi-subsistence households in Kenya. Log likelihood regression was used on the demand and supply side equations.

Frank and Henderson (1992) studied transaction costs as determinants of vertical coordination in the US food industries. They measured vertical coordination by a vertical coordination index derived from the industry's upstream and downstream matrices of connections for a product as dependent variables using ordinary least squares regression. Explanatory variables used included farm output supply concentration, flow economies, capital intensity, demand and input supply uncertainty and concentration, and idiosyncratic investments and scale economies, all which were found to be significant. Non market exchanges were found to reduce transactional inefficiencies.

On the other hand, Buvik and Andersen (2002) have studied the impact of vertical coordination on ex post transaction costs comparing domestic and international buyer-seller relationships. Using ex post transaction costs as the dependent variable and vertical coordination and asset specificity as explanatory variables, they analyze relationships between manufacturing firms in Norway using ordinary least squares regression. Governance performance varied widely under international buyer-seller relationships compared with local relationships due the higher costs of performance monitoring in the international business relationships. The study involved unilateral rather than bilateral buyer seller relationships. In Buvik and John (2000), relationship development effectively reduces the threat of opportunism in long-term ties which in turn reduces ex post transaction costs. Thus performance should be higher in long term ties due to in part, lower inventory costs.

Perishability and the bulky nature of milk combined with tropical climates and poor market access means that milk lends itself to quality problems, and needs an appropriate location of processing plants and specialized transportation arrangements. Though asset specificity is observed, temporal specificity is the most relevant for milk as it determines the subsequent investments and activities (Masten, 2000). The temporal nature of milk therefore requires short and fast supply chains. Extensive negotiations in the market are not appropriate. Ngigi (2002) and Staal et al (1997) also note that the lengthy period to maturities or gestations in agriculture causes supply inflexibility in response to market changes in agriculture. Agriculture is also prone to transaction, environmental and behavioral uncertainties. Seasonal variability in output for non-storable commodities increases dependence on relational contracts between suppliers of raw materials and processors. Ngigi further notes that the milk industry is characterized by multiple sales outlets for the small-scale producers, sales on credit where lump-some payments are expected at the end of an agreed period, as well as spot cash sales due to different levels of transaction costs faced by the agents.

Aust (1997) examines vertical integration versus vertical coordination in the broiler industry in the USA and finds that the driving force behind contracting in the industry is asset specificity and uncertainty. She notes that vertical coordination is chosen over vertical integration because of its flexibility, which allows firms to obtain inputs with specific characteristics without getting into another business where large investments may be required. She uses Schmid's (1987) Situation-Structure and Performance framework to analyze the industry and categorizes transaction costs into asset specificity and information costs. She also notes that contracts do not eliminate risks fully as there are still risks of contract non renewal and the risk of contractor not keeping chicks in housing on regular basis. She thus provides a link between the transaction costs and their reduction through the coordination mechanisms.

Hobbs and Linda (1999) provide a theoretical framework for analyzing vertical linkages in agrifood supply chains. Based on Transaction Cost Economics, they show that vertical coordination is determined by transaction costs that arise from transaction characteristics, and that these characteristics are a result of product characteristics, which are further influenced by regulatory, technological and socio-economic factors. Using examples from the agricultural sector they show that vertical relations are widespread and that trust and strategic alliances play a vital role in the supply chains.

Von Bailey and Hunnicutt (2002) evaluate the role of transaction costs in market selection for commercial feeder cattle in the Utah State. They find that transportation, shrinkage and commissions alone are not enough to explain the selection of marketing alternatives (video, internet, direct sales and the traditional auction). They provided a detailed analysis of the components of transaction costs and their measures and the role trust plays in the reduction of these costs. Other significant factors are size of operation, and experience. Respondents were asked to indicate their perceptions of transaction costs under different pricing methods. The proportion of cattle sold through each market type was then regressed against the transaction cost factors using seemingly unrelated regression model. Transaction costs were found to be significant and present in the industry.

Hobbs (1997) measures transaction costs in the choice between direct sales and auction sales of cattle in the UK. The influence of transaction costs and farmer variables in the choice of coordination mode were tested. The dependent variable was the proportion of cattle sold through each coordination mode against the measures of information, negotiation and monitoring costs. The study approached the measuring of transaction cost by looking at the importance of individual transaction costs. A two limit maximum likelihood regression

estimation technique (Tobit) was used. Four types of transaction cost and three producer characteristics were shown to be significant in the study.

Mathye et al (2000) in Makhura (2001) also study the choice of marketing channels for smallholder banana and mango farmers in the Northern Province of South Africa. They find that not all farmers sell their produce and that those who sell tend to use different channels such as fresh produce market, 'achaar' (type of salad) market and direct sales to consumers. Problems of transport, searching for markets and education were identified as the major factors determining which channel was used by the farmers.

A study of the grain marketing in Ethiopia by Gabre-Madhini (2001) provides further insights into the measurement of transaction costs in the agricultural sector. The study covered the grain supply chain and detailed measures of transaction costs such as search time, search labor, working capital and social capital. These were estimated using revenue functions through instrumentations for each of the cost components. Two stage least-squares estimation was then applied to the revenue functions. She concludes that transaction costs (social capital) form a major component of the total costs in the Ethiopian grain transactions.

In a study by Fafchamps and Minten (2001), the role of social capital or networks in the resolution of disputes among traders is studied. They measured social capital in terms of the number of relatives in the trade, the number of traders known personally as well as the number of clients known personally. They find that incidences of contract breach are low and that traders preferred to depend on trust based relationships for contract enforcement rather than formal legal institutions such as courts and the police. The study closely mirrors Gabre-Madhini (2001) on the role of social capital in transactions.

The significance of trust among supply chain partners has been studied by among others Whan et al (2004). Trust is highly associated with both side's specific asset investments. Constructs were used to identify and measure the variables for trust and asset specificity. An ordinary regression analysis was then applied with trust as the dependent variable. The biggest challenge to implementing supply management relations was traced to the ability to cultivate trust among the partners. Trust takes a long time to build showing that it is dynamic in nature. In the study, trust is considered as a consequence of asset specificity; however trust could as well be an antecedent to asset specificity. This point is still unclear.

In studies on the predictions made by transaction cost theory regarding the relationship between governance structures and the characteristics of transactions using 'survivor analysis', Pint and Baldwin (1997) find that inefficient governance structures are weeded out



by competitive pressures. Also vertical integration will be more efficient when asset specificity, uncertainty and thin markets are present. It is also possible to tailor contracts to fit characteristics of transactions. They stress importance of reputation in reducing opportunism.

Key et al (2000) have used proportional and fixed transaction costs in Mexico to study why some maize producers may have different relationships to the market. They use estimates of supply elasticity and measures of the relative importance of factors that determine both proportional and fixed transaction costs for households. The reduced form model of the market participation equation and the supply functions under the log likelihood were then applied to the data. Transportation and improvement of market institutions were found to be critical in improving production and increasing market participation by the producers. Improvement of market institutions is expected to reduce transaction costs. This was shown by the result that selling to official sources tended to significantly increase the production and selling threshold for the sellers. Ownership of assets (pick-up truck) also increased the tendency to participate in the market.

In their study on alternative techniques for influencing market participation among peri-urban milk producers in the Ethiopian highlands, Holloway et al (2000) find that institutional innovations to promote entry into the market should be accompanied by a mix of other factors such as infrastructure, knowledge, and asset accumulation in the household. The location of the producer together with distance also influenced the level of participation in the market. Furthermore, in Staal et al (1997), transaction costs are presented as the cause for lack of participation in dairy markets in East Africa. In this case contracts and cooperatives are essential in reducing transaction costs. Larger producers face less transaction costs than smaller ones and this is reflected in the market outlets they choose, costs of inputs and the prices they receive. Transaction costs are also likely to rise with distance from captive markets. Long distances increase costs of information search, wastage and spoilage when the roads are bad and the buyers are not found on time.

Staal et al (2000, 2002) further study the effect of location on the uptake of technologies by smallholder dairy farmers in Kenya. They use elements of market access such as distance to destination, quality of road, utility derived by the producer and transaction costs. Transaction costs are captured by the individual capacity and resources of agents at the point of observation. Transaction costs faced by the agents are found to be a function of their individual characteristics and their ability to use market information and conduct exchanges.

The effect of transport costs on the household's decision to devote resources to low yielding crops rather than to cash crops has been studied by Omamo (1998) in Siaya district of Kenya. The results indicate that transport costs were important in explaining the cropping decision of the households. More resources and land are devoted to cash crops when the distances to markets are shorter or when the households are located closer to roads. Similar results were realized in Fafchamps (1992) study where the relationship between food price volatility and market integration were investigated. He found that better roads and transportation tended to equalize price movements across a larger or international market, but also that the food prices were highly dissociated from local supply and demand conditions. Furthermore, Minot (1999) also find that transaction costs (particularly transportation costs) do not only decrease market surplus but that they can substantially reduce the elasticity of supply and demand.

De Janvry et al (1991) use household characteristics to measure unobservable transaction costs. The rationale is that market failures are household specific. Grosh (1994) and Key et al (2000) add that market failures are also commodity specific. However, there is possibility that transaction costs are transaction specific as the same commodity being sold by the same buyer using different coordination mechanisms may attract different levels of transaction costs.

Goetz (1992) studies the effect of transaction cost factors on market participation of coarse grain farmers. He used proxy variables such as ownership of a cart for transportation of grain to the market, physical distance to market and regional dummy for location of market. The results indicate that there was a significant relationship between the grain price and the probability of buying, and the quantities bought and sold. Other factors that influenced market participation were better information and access to grain processing technology.

Strasberg et al (1999) and Zaibet and Dunn (1998) study the effect of land size, location, number of plots and existence of annual crops (as proxies for transaction costs) on market participation. They test the proposition that larger family ownership systems, as opposed to restricted family ownership systems and farm size are sources of increased risk aversion and transaction costs in market participation. They find that nuclear family ownership system had a significant and positive correlation with fertilizer purchasing. In the case of mechanization and labor hiring, the estimate was positive but not significantly different from zero for nuclear family. For a large family, farm size was significant and positively correlated to mechanization and labor use. Strasberg et al (1999) show that the use of fertilizer depended mainly on the distance to a motorable road, assets such as the value of agricultural equipment

owned, value of the livestock owned, and human resource factors. This shows that transaction costs are also available in the input markets just as in the output markets.

The cost of market information has also been recognized as a major component of transaction costs. Market information costs are defined as the costs associated with lack of or access to sources of information. Abdulai and Delgado (1999) find that the decline in the cost of information and transport flows as a result of good infrastructure reduces transaction costs. In Strasberg et al 1999, increased human capital has a significant positive effect on the effective use of inputs since the chances are that better management skills, and thus a greater propensity to seek information on operations of the market are available.

Makhura (1994) in Makhura (2001) defines access to information amongst others as having the opportunity of listening to radio for agricultural communications. He finds that farmers having access to the use of such information sold more agricultural produce while those having no access sold less. He and Yang (1999) find that farmers in some regions of China used neighbors, TV and newspapers or magazines and carried out investigations on markets to access market information. Transaction costs were thus lowered in all the cases. High transaction costs faced by the farmers really originated from small transaction scale, outdated information and disorderly marketing system.

Randolph and Ndung'u (2000) measure the importance of attributes of different health services for the decision of the smallholder dairy farmers in Kenya to choose an animal health service using conjoint analysis. The results indicate that promptness and professionalism of the service determine the farmer's decisions whereas the price is the least important reason for choosing a health service. Thus the risk of delays in the health services outweighs the price considerations showing the significance of transaction costs.

Leathers and Kähkönen (1998) focus on market participation in post liberalization agricultural markets in Tanzania and Zambia. They define transaction costs to include information, negotiation, enforcement costs and transfer costs (costs of handling, transport, storage, processing, wholesaling and retailing). They use a descriptive survey to show that transaction costs for many farmers are too high for them to participate in the market despite a growing private sector after liberalization and privatization. The results show that the high transaction costs emanated from poor institutional environment and infrastructure.

Makhura (2001) studies the role of transaction costs on market participation of smallholder commercial farmers in the Northern Province of South Africa using Heckman's two stage estimation approach. Transaction costs were divided into fixed and proportional transaction

costs. The results show that information, asset endowments and market access significantly influence the decision to participate in the market by households.

Boger (2001a, 2001b) studies the effect of transaction costs on the governance structures in the Polish Hog sector. Using multivariate and multinomial logit models and variables such as asset specificity, quality systems, grading, bargaining power, market structure/site specificity for market channels and contract types, she finds that farmers that did not invest significantly traded on spot markets and received relatively low prices. Those who invested significantly secured their investments through neoclassical or relational contracts and received higher prices. However, there were some transactions that had high investments but were taking place on the spot markets and thus lacked any safeguards for their investments.

Low economic performance stems from high incidence of cheating, whether real or perceived. Potential customers can keep away from new products when they suspect there may be a hidden flaw (Casson, 1991). Insisting on pre-payment of sales and post payment of purchases eliminates all exposure to risk for some chain members. Transaction costs are expected to be lower in smaller stable compact groups and information flows among them will be better. Parties found cheating risk losing reputation and are punished as it is easier to monitor the activities of each other leading to better performance than large amorphous groups (Casson, 1991). Chains that have lower information costs are expected to perform better than those that do not. Information costs can be captured by various kinds of uncertainty that impact on performance through the chosen coordination mechanisms.

Supply chain performance measurement is difficult because it involves different groups or firms. However, Beamon (1999) provides a framework for the selection of a performance measurement system. The main measures for performance identified are resources, output and flexibility. The measures contain quantitative and qualitative measures unlike simple numerical measures that limit the scope of performance measurement. The measures are also more complete, accurate and therefore more effective.

The importance of measuring the impact of supply chain performance is underlined by Bolstorf (2003). Using the Supply Chain Council's SCOR model (Supply Chain Operations Reference-model), performance is evaluated through measures such as delivery performance (time, order fulfillment, lead time and supply response time) and total supply chain management cost (within firm) and also cash-to-cash cycle time. Most of the information that is critical may be not be open to the public but may be confined within the firms.

Chen and Paulraj (2004) carry out an extensive survey of research done in the field of supply chain management consisting of its critical elements, its performance measurement and the theoretical framework. They assert that Supply chain performance should go beyond financial performance and operational performance measures to include system wide measures such as extent of mutual trust, changes in inventory held and turnover at the various stages of the chain and adaptability of the supply chain as a whole to meet customer needs.

Performance in SCM has been measured by Kaplan and Norton (1996) and also emphasized by Brewer and Speh (2000) using the Balanced scorecard approach. The scorecard provides a multidimensional scorecard and balances financial and non financial measures. It measures performance across four balanced perspectives of: financial perspective – return on investment, economic value added; customer perspective – customer satisfaction, customer retention, market share, customer acquisition; learning and growth perspective and – employee satisfaction, information technology (IT) system availability and; internal business processes – costs and quality, response time, new product introductions. Similar approaches on supply chain performance have been used by Bullinger et al (2002) cited in Hieber (2002).

Performance has also been measured by the prices paid and or received by members of the supply chain. Keidailene and Hockman (2002) in a study in Lithuania, measures performance by the prices that cooperatives were paying relative to private firms. The prices were found to be about 10% higher for raw milk delivered to cooperatives societies compared to deliveries to dairy processing firms, implying that better performance for the producers concerned and the entire chain was achieved by selling through cooperative societies.

Performance measures vary from absolute measures to relative measures, both of which are relevant in the evaluation of performance in supply chains. Performance measures can also be grouped as financial and non financial performance measures. Both types are also necessary for a proper evaluation of the supply chain activities. However due to lack of standard performance measures and especially at the chain level, multiple constructs consisting of financial and non financial indicators can be used. Standardized measures of performance are still evolving. However, subjective measures of performance have been widely used to measure performance. A composite measure of performance incorporates the measures subjectively derived from the respondents, as well as financial measures where available. Likert-like scales are used for the subjective measures. Subjective measures have been used widely by Venkatraman and Ramanujan (1987), among others. They find that subjective measures give results similar to their quantitative counterparts.

## CHAPTER 5

### THEORETICAL AND EMPIRICAL MODEL

The chapter begins by introducing the theoretical foundations of smallholder market participation in the face of transaction costs as a prelude to modeling determinants of coordination mechanisms and supply chain performance in the Kenyan dairy industry in sections 5.1 and 5.2. Section 5.1 introduces the economic problem facing smallholder market participation in the presence of transaction costs. Section 5.2 builds on this framework to compare farmers' and traders' decision making under two conditions: with and without transaction costs. These foundations are necessary to understand the kind of challenges that farm households and agricultural commodity traders face in their attempts to commercialize their farming activities or to participate in product markets as sellers.

The economic model for the study is discussed in section 5.3 for market participating farmers and traders. The model does not take into consideration non market participating agents but the understanding is that the constraints facing agents participating in the market are worse for those agents not able to participate causing them to be shut out of the market. In section 5.4 the econometric model for the determinants of coordination mechanisms in the supply chains is discussed. Empirical specification of the determinants of coordination mechanisms are discussed in section 5.5. Finally, section 5.6 discusses a theoretical and econometric model for the determinants of supply chain performance in the Kenyan fresh milk supply chains.

#### ***5.1 Theoretical foundations for smallholder market participation***

Most of the markets in developing countries are dominated by small scale operators, generally referred to as smallholders. This is both at the production and marketing/trading levels of the respective primary product supply chains. The number of producers is usually large. The number of traders can also be large in number or dominated by few large buyers (monopsonists) depending on the commodity and location of interest.

Based on the competitive market situation, smallholder market participation has been modeled to account for the fact that production and marketing decisions of the decision makers are usually not separable. The decisions are rather looked at as a continuum, on one end is autarky (self production), both production and buying in the middle (net buyers), and at the other end full market participation as net sellers (Key et al, 2000; Bellemare and Barrett, 2006). The location of the agents on the continuum is a function of transaction costs they face. It therefore means that the amount of a product sold or the degree of participation in the

market is a function of the transaction costs so faced by the decision makers. A threshold must be attained before the individuals decide to participate in the market whether as sellers or traders. Figure 5.1 below illustrates these relationships.

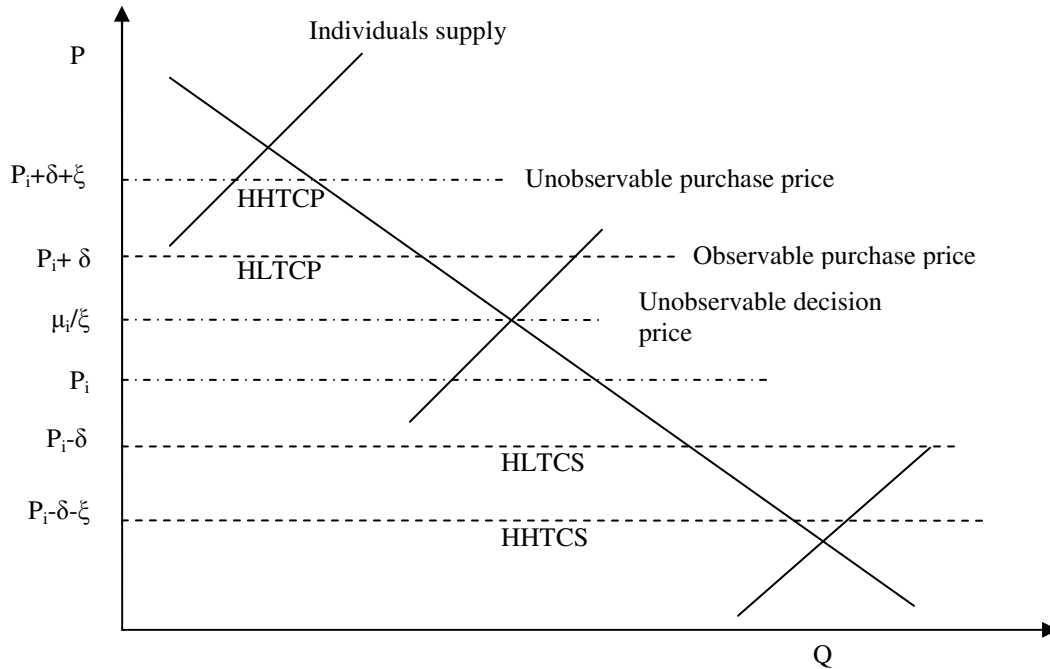


Figure 5.1: Relationship between transaction costs and household sales and purchases

Source: Adapted from Makhura (2001:36).

- HHTCS = sales by household facing high transaction costs
- HLTCS = sales by household facing lower transaction costs
- HHTCP= purchases by household facing high transaction costs
- HLTCP= purchases by household facing lower transaction costs

Net selling individuals and household will receive an observed sales price of  $P_i - \delta$ , where  $\delta$  represents the marketing costs. At this price, sales will be reflected by HLTCS, i.e sales of a low transaction cost household. When the household faces more transaction costs,  $\xi$ , the unobserved decision price is  $P_i - \delta - \xi$  and will correspond to sales of HHTCS, i.e sales of a household facing high transaction costs, which is less than sales of HLTCS. Thus at high transaction costs, less quantities will be sold, implying that transaction costs are negatively related to market participation (Makhura, 2001).

On the other hand, deficit households which purchase food will face the observed price of  $P_i + \delta$  where  $\delta$  are the observable costs. At this price the household equilibrium conditions will be at HLTCP, that is, purchases by households facing low transaction costs. But if the

household faces unobservable transaction costs,  $\xi$ , the decision price will be  $P_i + \delta + \xi$ , thus purchasing at HHTCP or purchases of a household facing high transaction costs. The household tends to purchase less when faced with high transaction costs as compared to when it is facing low or no transaction costs (Makhura, 2001). Thus it can be similarly concluded that market participation is negatively related to transaction costs.

It has been noted by Ejupu et al (1999) that non surplus producers may also participate in the market as sellers. Makhura (2001) also shows that a production level is necessary but not sufficient condition for commercialization or market participation. Other household related characteristics also affect the decision to participate. He further indicates that a household model rather than a competitive market framework would be required in this case.

Commercially participating households and individuals require the separability of consumption and production/marketing decisions. The competitive market framework can be used taking cognizance of the household decision making process in the presence of transaction costs. The next section compares household and individual agent decisions in the presence and absence of transaction costs by expanding on the exposition above.

## ***5.2 Market situation facing smallholder market participants***

In order to conceptualize the market situation facing commercial agricultural producers and traders in agricultural supply chains, consider a household that produces an agricultural product, in this case milk. The household's decision can be divided mainly into production and marketing decisions. Firstly, the household chooses the optimal allocation of resources to determine the quantity to be produced. Following a typical household setting, this decision is based on the utility that can be derived from the production activity, monetary or otherwise, given the available resources such as labor, land, and other factors. Secondly, the household then makes decisions regarding the market where the volumes of the product to sell or buy are determined.

The exposition below draws from several sources including Key et al (2000), Vakis et al (2002, 2003), and Makhura (2001) to illustrate the economic problem facing smallholder farmers and traders participating in markets under two situations: when transaction costs are assumed to be absent and when transaction costs are present.

### **5.2.1 Market situation under assumption of no transaction costs**

Under the assumptions of no transaction costs, the household maximizes its utility ( $U$ ) by deciding on the consumption of  $k$  goods ( $(c_k)$ ), production of  $k$  goods ( $(q_k)$ ), and sales of  $k$



goods ( $s_k$ ). The inputs used to produce product  $i$  can be depicted as  $x_{ik}$ . The sales component enters into the utility function through the revenue generated from sales ( $p_k s_k$ ), the sum of which is used to purchase other goods represented by  $R_k$ , meaning the household will purchase an equivalent of  $R_k$  in other goods.

Thus the neoclassical subjective equilibrium for a commercializing or market participating household or individual is

$$\text{Max } U = u(c_k, R_k; H_u) \dots\dots\dots 1$$

that is, the households can consume what it produces ( $c$ ), or gain revenues to purchase other goods ( $R$ ), given household characteristics ( $H_u$ ). The household characteristics represent a set of factors that can shift the utility function.

The constraints imposed on this utility maximization are shown by

$$\sum_{k=1}^N [p_k c_k + R_k] \leq \sum_{k=1}^N [p_k (q_k - s_k) + T] \dots\dots\dots 2$$

which is the full income constraint, implying that expenditure on all purchase must not exceed revenues from all sales and transfers ( $T$ ),

$$p_k c_k + p_k s_k + p_i x_{ik} \leq p_k q_k + R_k + e_k \dots\dots\dots 3$$

or commodity resource balance, stating that for each of the  $N$  goods, the amount consumed, sold, and used as inputs is equal to what is produced and bought plus the endowment of good  $k$  ( $T_k$ ), represented by  $e_k$

$$G = g(q_k, x_{ik}; H_q) \dots\dots\dots 4$$

or production technology ( $G$ ) that relates inputs ( $X_{ik}$ ) to output ( $q_k$ ), given the set of household characteristics ( $H_q$ ) shifting the production function.

$$c_k, q_k, x_i, s_k, R_k \geq 0$$

where

$$R_k = p_k s_k, \text{ and}$$

$$s_k = f(c_k, q_k; H_q, H_u, T) \dots\dots\dots 5$$

$P_k$  ( $p_{ks}$  for selling price and  $p_{kc}$  for purchase price) and  $p_i$  are given market prices of good  $k$  and input  $i$  respectively.

Thus  $c$ ,  $R$ ,  $s$  and  $q$  are defined and decided over  $k$  goods, where the set  $k$  covers all goods entering into production, consumption and the market or commercial activity.

The household jointly makes its production, consumption and market participation decision subject to a number of constraints: the full income constraint (2), the resource equilibriums (3) and the technology (4) to produce the output.

The market situation without transaction costs can thus be captured by the Lagrangian demand and supply equations as below.

$$\begin{aligned} \text{Max } L = & \mu(c_k R_k; H_u) + \mu_k \left[ \sum_{k=1}^N p_k (q_k - s_k) - R_k - p_k c_k + T \right] \\ & + \lambda [p_k (q_k - s_k) - p_k c_k - p_i x_{ik} + R_k + T_k] + \Phi G(q_k, x_{ik}; H_q) \dots \dots \dots 6 \end{aligned}$$

where  $\mu$ ,  $\Phi$ , and  $\lambda$  are Lagrange multipliers associated with the full-income constraint, resource balance equilibriums, and technology constraint, respectively.

The optimal consumption, input use and market participation must, respectively, satisfy the following first order conditions, upon solving which the optimal supply and demand can be determined. These represent the shadow prices of the constraint resource.

For consumption the partial derivative of  $u$  (or  $L$ ) with respect to  $c_k$  is:

$$\frac{\partial u}{\partial c_k} = \mu p_k + \lambda p_k \dots \dots \dots 7$$

For other purchased goods, the partial derivative with respect to  $R_k$  is

$$\frac{\partial u}{\partial R_k} = \mu - \lambda \dots \dots \dots 8$$

For output, the partial derivative of  $G$  with respect to  $q_k$  is:

$$\Phi \frac{\partial G}{\partial q_k} = -\mu p_k - \lambda p_k \dots \dots \dots 9$$

For inputs, the partial derivative with respect to  $x_{ik}$  is

$$\Phi \frac{\partial G}{\partial x_{ik}} = -\lambda p_i \dots \dots \dots 10$$

For marketed goods, the partial derivative of  $G$  with respect to  $s_k$  is:

$$\Phi \frac{\partial G}{\partial s_k} = -\mu p_k - \lambda p_k \dots \dots \dots 11$$

Using equations (7) and (8) subject to the full income constraint (2), we can solve for a system of demand equations for consumption,  $c_k(p, I; H_u)$  and purchased goods  $R_k(p, I; H_u)$ .  $I$  is income redefined under full income constraint (Key et al, 2000).

Using equations (9) and (10) for profit maximization, subject to (4), we can solve for output supply equations,  $q_k(p; H_q)$  and input demand equations,  $xi(p; H_q)$ .

Using equations (11) and (8) subject to constraint (5) we can solve for a system of market participation equations  $s_k(p_k; H_q, H_u)$ . This implies that market participation will be endogenously affected by prices, as well as by exogenously determined household characteristics. This supposes that participation in the markets is just a response to an observable signal.

### 5.2.2 The market situation in the presence of transaction costs

The above derivation assumes a market without any frictions or transaction costs. Though transaction costs are largely unobservable, the presence or absence of certain factors can be used to provide an indication of the effect of the transaction costs. Transaction costs can be categorized as proportional transaction costs ( $t_{pc}$ ), varying with the amount of product exchanged and fixed transaction costs ( $t_{fc}$ ) that do not vary irrespective of the amount of product transacted (Key et al, 2000). Transaction costs have been shown to arise among smallholder farming enterprises and households. Different households face different levels of transaction costs and these arise due to information asymmetries and differential assets, including household and firm specific characteristics.

Transaction costs lower prices effectively received by the seller and also increase the price effectively paid by the buyer and this is likely to lead to lower market participation. The difference in the prices received and prices paid result in price bands such that if the decision price falls within the band, households will not participate or will withdraw from the market (Sadoulet et al, 1995; Minot, 2000; Key et al, 2000).

The objective function of the household under transaction costs becomes

$$Max U_t = u_t(c^t, R^t; H_u) \dots\dots\dots 12$$

Subject to:

Full income constraint under transaction costs

$$\sum_{k=1}^N \tau_k^s [p_k - t_{pc}(h_t)](q_k - s_k) - \tau_k^s R_k^t - \tau_k^c [p_k + t_{pc}(h_t)]c_k - \tau_k^s t_{fc}(h_t) - \tau_k^c t_{fc}(h_t) + T \geq 0 \dots\dots\dots 13$$

With the resource balance equilibriums affected by transaction costs in the similar way as under the assumption of no transaction costs, where  $\tau_k^s = 1$  if  $s_k > 0$  and  $\tau_k^s = 0$  if  $s_k = 0$ .  $R_k^t$  is the revenue gained under transaction costs and  $R_k^t = 0$ , when  $s_k = 0$  and  $R_k^t \leq R_k$ . The  $\tau_k^c = 1$  if  $c_k > 0$  and  $\tau_k^c = 0$  if  $c_k = 0$ .

These conditions imply that when the household is not participating in the market, variable or proportional transaction costs will not exist, and the fixed transaction costs ( $t_{fc}$ ) will determine whether the household participates or not. That is, the household's response to transaction costs is twofold. When transaction costs are perceived to be too high, the agents will not participate in the market and will switch to consumption of the products. On the other hand, when the agents are able to participate in the market, differential transaction costs they face will cause them to shift their transactions from one market to another so as to minimize the transaction costs.

Demand and supply equations can be derived conditional on market participation of households facing both fixed transaction costs ( $t_{fc}$ ) and proportional transaction costs ( $t_{pc}$ ). The lagrangian is defined as:

$$\begin{aligned} Max L_t = & u_t(c^t, R^t; H_u) + u \sum \tau_k^s [p_k - t_{pc}(h_t)](q_k - s_k) - \tau_k^s R_k^t - \\ & \tau_k^c [p_k + t_{pc}(h_t)]c_k - \tau_k^s t_{fc}(h_t) - \tau_k^c t_{fc}(h_t) + T + \\ & \lambda [\varphi_k(q_k - s_k) - \varphi_k c_k - \varphi_i x_{ik} + \varphi R_k + T_k] + \phi G(q_k, x_{ik}; H_q) \dots\dots\dots 14 \end{aligned}$$

The optimal solution here cannot be found by solving the first order condition since the presence of  $t_{fc}$  (fixed transaction costs) creates discontinuity in the Lagrange. This requires consideration of Kuhn-Tucker conditions. Key et al (2000) postulate a two step procedure in this case: solve for optimal condition subject to market participation, and then choose the participation level leading to highest level of utility. When transaction costs are specified as fixed transaction costs, per unit shadow prices through the Lagrange multiplier for that constraint can be computed.

The first order conditions (FOCs) for equation 14 above are:

For consumption of own production

$$\frac{\partial u^t}{\partial c^t} = \mu \tau^c(p_k + t_{pc}(h_t)) + \lambda \tau^c(p_k + t_{pc}(h_t)), \dots \dots \dots 15$$

For consumption of purchased goods,

$$\frac{\partial u}{\partial R_k} = \tau_k^c \mu(p_k + t_{pc}(h_t)) - \tau_k^c \lambda(p_k + t_{pc}(h_t)), \dots \dots \dots 16$$

For output

$$\phi \frac{\partial G}{\partial q_c} = -\mu \tau_k^s(p_k - t_{pc}(h_t)) - \lambda \tau_k^s(p_k - t_{pc}(h_t)), \dots \dots \dots 17$$

For inputs used in production

$$\phi \frac{\partial G}{\partial x_{ix}} = -\lambda \tau_k^s(p_{ck} - t_{pc}(h_t)), \dots \dots \dots 18$$

For marketed goods

$$\phi \frac{\partial G}{\partial s_k} = -\mu \tau_k^s(p_k - t_{pc}(h_t)) - \lambda \tau_k^s(p_k - t_{pc}(h_t)), \dots \dots \dots 19$$

The income constraint takes two forms: When the household participates in the market, the change in utility as a result of unit change in  $\mu$  will be equivalent to income constraint in (13) which has both fixed and proportional transaction costs. However, when the household is not yet participating

$$\frac{\partial L_t}{\partial u} = -\tau_k^s t_{fc}(h_t) - \tau_k^c t_{fc}(h_t) + T = 0. \dots \dots \dots 20$$

We can solve for systems of demand equations under transaction costs

$$c_k^t = c_k^t(p_t + t_{pc}; I, h_u) \dots \dots \dots 21.1$$

$$R_k^t = R_k^t(p_t - t_{pc}; I, h_u) \dots \dots \dots 21.2$$

The systems of output supply equations under transaction costs

$$q_k^t = q^t(p_t - t_{pc}; h_q) \dots \dots \dots 21.3$$

Input equations

$$x = x(p_i, h_q) \dots \dots \dots 21.4$$

and the system of market participation equations is given by

$$s_k^t = s^t(p - t_{fc}; h_q, h_u)$$

depending on whether  $\tau_k^s = 0$  or 1,

and

$$s_k^t = s^t(p - t_{fc}; h_q, h_u)$$

when

$$\tau_k^s = 1 \dots\dots\dots 21.5$$

From the foregoing, and according to Makhura (2001) and Key et al (2000), transaction costs affect all systems of equations. Utility maximization under transaction costs is different from one when transaction costs are assumed not to exist. Under transaction costs, more of the production will be consumed since producers will be valuing output consumed at  $p_k + t_{pc} \geq p_k$ , and they will be saving on a higher purchase price.

On the other hand, less of other goods  $R_k$  will be consumed since there is a low propensity to participate in the market. A twist in the indifference curve and an inward shift of the full income constraint will be observed.

The household's market supply without transaction costs is a function of prices and household characteristics, that is

$$s_k = s(p, h_u, h_q)$$

Equation (21.5) thus shows that households participating in the market face both fixed and proportional transaction costs. Fixed transaction costs will shift the supply curve with respect to both revenue ( $R$ ) and price, thus increasing the threshold at which market participation can take place, that is, when production under transaction costs (particularly fixed transaction costs) will lower the decision price considerably so much so that it might not be worthwhile to participate in the market. Furthermore, consumption is a residual of production and market participation;

$$q(p - t_{pc}, h_q) - s_k^t(p - t_{pc}, h_u, h_q) = c(p + t_{pc}, h_u)$$

This shows that market participation and consumption are inversely related. With this observation in mind, the equations can be modified to apply to traders participating in the market. In this case consumption is either zero or negligible and a solution for profit maximization can be carried out in the same way.

Equation 21.5 also indicates that when no sales take place, we can get the decision price,  $P_k^d$ , for selling by setting the amount sold to zero ( $s= 0$ ) and solve for  $P_k = P_k^d$ . The equation for shadow decision price will be given by

$$P_k^d = P_k^d (t_{fc}, p_k, h_q, h_u) \dots \dots \dots 22$$

Equation (21.5) shows that the decision to take part in the market depends only on fixed transaction costs, while the market supply (conditional on participation) will depend on both fixed and proportional transaction costs. When a certain threshold of fixed transaction costs has been attained positive values of supply (sales or market participation) will be observed for the commodity (Makhura, 2001a).

The rest of the exposition below focuses on agents (households and traders) that are net sellers (that is,  $s>0$ ) to model determinants of coordination mechanisms used in their transactions in the market. Section 5.3 to 5.5 model determinants of coordination mechanisms in the milk supply chain transactions while section 5.6 models determinants of supply chain performance in the transactions.

**5.3 A theoretical model for determinants of coordination mechanisms**

To model determinants of coordination mechanisms used by market participating agents (farmers and traders) in the Kenyan fresh milk supply chains, we assume that the agents make two types of decisions: production decisions and marketing decisions. The decisions are also assumed to be made in the presence of transaction costs. For the farmers, production decisions involve allocating resources to the various portfolios of crop and livestock activities, while marketing activities include finding markets and entering into transactions to sell their products under various coordination mechanisms in various supply chains. Both decisions are interrelated and should be simultaneously determined. However, this study models farmer marketing decisions assuming their production decisions are predetermined. The question of whether or not to participate in the market is therefore not addressed as all the agents are assumed to be already participating in the market, albeit at different levels. Milk retail operators also make marketing decisions by buying the farmers’ milk and selling it to consumers and or other buyers. The study concentrates on market participating agents, at both producer and trader stages of the milk supply chain.

We assume that milk producers and traders wish to maximize some utility function of net revenue over time and in so doing choose not only the profit maximizing production methods

but also appropriate contractual forms for the various transactions they engage in. We take note that to realize the net benefits, several costs will necessarily be incurred by the agents for each transaction. The costs are assumed to be specific to each coordination mechanism used.

The relative benefits of alternative coordination mechanisms to use in transactions with other parties have to be addressed by the market participant. The benefits or losses derived under each coordination mechanism are determined by quasi rents available in their transaction relationships. The transacting parties will continuously be evaluating the opportunity costs of their transaction arrangements. The quasi rents are a function of transaction costs (Klein, Crawford and Alchian, 1978). The problem of hold up is likely to arise in this case as the parties compare their switching costs from one transaction arrangement to another. Ultimately for each transaction, the chosen coordination mechanisms are expected to be the net revenue maximizing coordination arrangements.

The modeling draws from several sources including Doward (1999, 2001), Vakis (2003), and Hobbs (1997). Doward categorizes costs faced by agents into two groups. The first category is production or transformation costs necessary to physically produce the products in readiness for the market. These costs are likely to vary due to efficiencies and scale economies of each farm or firm. The other category of costs is referred to as transaction costs. These costs consist of pure transaction costs (information and search costs, negotiation costs and monitoring and enforcement costs) as well as the associated risk costs arising from the transactions. Vakis et al (2003) distinguish transaction costs as fixed transaction costs and variable or proportional transaction costs. Hobbs (1997) does not distinguish between fixed and proportional transaction costs but classifies the fixed and proportional transaction costs into three classes: market search and information costs, negotiation costs, and monitoring and enforcement costs. In this study, risk costs are not handled separately as these arise out of opportunistic tendencies among transacting partners because of information asymmetry problems and asset specificity. Risk costs are therefore assumed to be part of the pure transaction costs. The study therefore uses Doward's framework but defines transaction costs according to Hobbs and Vakis et al.

To generate revenues, a firm will need to select quantities of milk to sell under each of the coordination mechanisms. Let the total amount of milk sold be  $Q$ , such that the firm is able to select or allocate various quantities or volumes of milk to sell under each of the coordination mechanisms. A firm may sell all its milk under spot market contracts, under verbal contracts or under written agreements or allocate partial volumes under each of the coordination



arrangements. Let the volume of milk handled or sold under each of the coordination mechanism be  $Q_j$ . Furthermore, let the transformation costs be represented by  $C$ , proportional transaction costs by  $P_j$ , fixed transaction costs by  $F_j$  and finally  $TR$  as the total revenues received by the agent or firm. Assuming that all agents are rational, net revenue maximization ( $\Pi$ ) can be found by choosing the volume ( $Q_j$ ) to be obtained under each contractual form  $j$  to maximize

$$\Pi = f(TR, C, Q_j, F_j, P_j; z_j) \dots \dots \dots 23$$

such that

$$\sum_j Q_j = Q$$

and

$$Q_j \geq 0$$

where  $TR$  are the gross revenues derived under each coordination mechanism,  $C$  are the transformation costs,  $Q_j$  is the quantity sold under coordination  $j$ ,  $F_j$  are the fixed transaction costs under coordination  $j$ ,  $P_j$  are the proportional transaction costs under coordination  $j$  and  $z_j$  are the relevant individual socioeconomic and firm specific characteristics that also affect the net revenues derived under each coordination mechanism.

Fixed transaction costs relate to searching for the best market and buyer or obtaining information about prices. In addition, they are invariant to the specific quantity sold and may also be market or transaction specific. For example, knowledge of market specific attributes such as prices and relevant infrastructure (that could potentially affect the probability of finding a buyer) can influence the decision of a farm enterprise or trader as to where to sell and how to sell it. On the other hand, proportional transaction costs vary with the number or value of transactions undertaken. Such transaction costs include transport costs and time taken to reach markets or buyers.

Socioeconomic characteristics such as experience, education, gender and age could also enhance the ability to collect and analyze relevant information and thus can affect choice of coordination mechanisms. The type of supply chain partner (and their relations) and the location or region where the sellers and buyers are located may also affect what kinds of coordination mechanisms may be used in the transactions. The benefits derived from a particular coordination mechanism also depend on the quantity sold ( $q_j$ ) in addition to the above factors since the scale of operation influences bargaining related attributes.

Assuming that farmers and milk traders are risk neutral, they will undertake their market transactions under coordination mechanisms that yield the highest net revenues ( $\Pi_j$ ), subject to transaction costs they face, their socioeconomic characteristics and their firm specific characteristics. Thus the net revenues represent revenues net of fixed transaction costs which may not be quantifiable. Specifically a transaction will be carried out by farmers and traders using a coordination mechanism  $j$  which maximizes the following net revenue function:

$$\max_j \{ \Pi_j = TR_j - C - P_j - F_j(z_j) \} \dots\dots\dots 24$$

represented in proportional transaction costs are distance and time costs assumed vary with quantities bought or sold while fixed transaction costs include information and search cost components, negotiation cost components and, monitoring and enforcement cost components.

The coordination mechanisms used vary from  $j$  to  $k$ . The components entering the model are allowed to vary for each transaction relation between the producers and buyers, traders and suppliers and traders and buyers, that is, for each stage of the supply chain. The type and number of coordination mechanisms are also allowed to vary under each of the three stages in the supply chain. Since farmers and milk traders are assumed to be risk neutral and as such strive to maximize their net revenues subject to transaction costs and other resource constraints, observing transaction  $i$  under coordination mechanism  $j$  implies:

$$\Pi_{ij} > \Pi_{ik}, \forall j \neq k \dots\dots\dots 25$$

That is, coordination mechanism  $j$  is observed if and only if  $\Pi_j > \Pi_k$ . However, the net revenues associated with each coordination mechanism may not be directly observable but can be represented by their latent profits,  $\Pi_{ij}^*$ , such that the chosen coordination mechanism represent the maximum possible latent net revenues available to the transacting partners.

**5.4 Specification of the econometric model**

The econometric specification follows a multinomial logistic regression given the nature of the issues under consideration. The use of a particular coordination mechanism is choice based, in that agents can opt to use one coordination mechanism based on the perceived benefits that can be derived from using it. The values of interest are discrete in nature. Three coordination mechanisms are possible in the milk supply chain: spot market contracts, verbal contracts and written contracts. However, when only two choices are available, the multinomial logit model collapses to a binomial logit model.

**5.4.1 The multinomial logit model**

Essentially the multinomial logit model (MNL) only deals with individual specific data, which means that the values of the independent variables are assumed to be constant among all alternatives in the choice set (Maddala 1983, Wooldridge, 2002). A general formalization of the MNL according to Schmidt and Strauss (1975) is:

$$\Pr(Y = j) = \frac{e^{\beta_j w_i}}{1 + e^{\sum e^{\beta_k w_i}}}, j = 1, 2, \dots, J \dots\dots\dots 26$$

$$\Pr(Y = 0) = \frac{1}{1 + e^{\sum e^{\beta_k w_i}}} \dots\dots\dots 27$$

The estimated equations lead to a set of probabilities for  $J+1$  choices for a decision maker with the vector  $w_i$  describing each individual transaction characteristics and the vector of coefficients  $\beta_j$  associated with the  $j^{th}$  coordination category. Normalization is achieved by setting  $\beta_0 = 0$ . We thus obtain a vector  $\beta_j$  for each probability except for the first which is the normalized alternative. The estimated coefficients of the model can therefore be interpreted as the effect of the characteristics  $w_i$  on the probability of an alternative  $j$  relative to the chosen option (John and Weitz, 1988 in Boger, 2001a).

Thus the probability of choosing alternative  $j$ , if one were to define it, would either be one or zero depending on the relative profitability of alternative  $j$  (Train, 1993) subject to perceived opportunistic behavior of transacting partners captured in transaction cost related factors, firm specific factors and socioeconomic characteristics. Since the possible coordination mechanisms are more than two, the model can be estimated using multinomial logistic regression. The model parameters are estimated by the maximum likelihood estimation. The dependent variable need not be normally distributed under the maximum likelihood estimation since the estimates remain consistent.

The empirical model for the study can thus be summarized as follows.

$$\Pi_{ik}^* = X_i \beta_k + W_i \phi_k + \varepsilon_{ik} \dots\dots\dots 28$$

where  $\Pi_{ik}^*$  are the latent net revenues from transaction  $i$  under each coordination mechanism  $j$ ,  $X_i$  is a vector of transaction cost characteristics,  $W_i$  are socioeconomic and firm related attributes of the operators,  $\beta_k$  and  $\phi_k$  are parameters to be estimated, and  $\varepsilon_{ik}$  are *iid.* error terms.

The estimated coefficients give the role of transaction costs, farmer and trader socioeconomic characteristics and firm specific factors in selecting the coordination mechanism to guide transactions among buyers and sellers of milk.

For a better interpretation of the outcomes, marginal effects are computed by differentiating the coefficients at their mean. The marginal effects of the attributes on the probability of observing the coordination mechanisms are therefore represented as:

$$\delta_j = P_j [\beta_j - \sum P_l \beta_l] = P_j [\beta_j - \bar{\beta}] \dots \dots \dots 29$$

#### 5.4.2 Model justification

The model adopted for analyzing coordination mechanisms in the fresh milk supply chains is determined by theoretical and practical data constraints. The determinants of coordination mechanisms employed are largely individual specific, individual here referring to the unit of analysis, the transaction, based on transaction cost economics and supply chain management frameworks. The alternatives may also not be fully independent of each other under the independent of irrelevant alternatives (IIA) assumptions. This implies that there is a possibility of employing more than one coordination mechanism by the decision makers at the same time, however, this should present no problem as each transaction is analyzed independently. The focus is not the individual decision maker rather the transactions that the individual undertakes. It is possible that some choice specific attributes also influence the type of coordination mechanism employed, implying that a nested logit model would be more appropriate. In carrying out the transactions, three types of coordination mechanisms are possible, spot market contracts, verbal contracts and written contracts. However, a fourth mechanism comprising of hybrids between any two of the coordination mechanisms is possible in the transactions. But for the purpose of analysis, whenever more than two coordination mechanisms are observed, the transaction is classified according to which coordination had the larger amount of milk transacted under it. Sampling results showed that less than 1% of the transactions consisted of hybrid coordination mechanism, a negligible number of transactions. The inability to get information on the coordination mechanisms not observed or not employed rules out the use of nested logit models or conditional logit models. Such information on unobserved alternatives is normally difficult to get from the decision makers (Boger, 2001a; Benham and Benham, 2000). The nested model does not also allow for varying of individual choice sets as it assumes the dependence of alternatives. For these reasons, nested and conditional logit model are not employed in this study.

A natural alternative to the nested logit model is the multivariate probit model (Greene, 2003; McFadden, 1984). However, this model would require two simultaneous equations of binomial choices. Such a model can be achieved by a multinomial logit model. The multinomial logit model measures the probability with which the individual will choose one of the three coordination alternatives for a particular transaction given a set of socioeconomic, firm specific factors and transaction cost characteristics. The multinomial logit model provides estimated coefficients of the variables of each alternative so that distinctive criteria typifying the alternatives can be obtained for each contractual form. The large number of coefficients associated with the number of choices is a desirable advantage due to detailed information on the single alternatives (Boger, 2001a).

Since the MNL model assumes individual characteristics as independent variables and not choice specific attributes, this model specification is only feasible from the perspective of the transaction, not of the individual who carries out the transaction. In essence the interpretation of the results is not about the probability of an individual using a certain coordination mechanism, rather the probability of a transaction being carried out with one of the coordination mechanisms (Boger, 2001a). Three models are estimated for transactions between milk producers and their buyers, retail outlets and their milk suppliers and retail outlets and their milk buyers.

### ***5.5 Empirical specification of determinants of coordination mechanisms***

Three coordination types are identified, spot market contracts, verbal contracts and written contracts. The three coordination modes constitute a part of Milgrom and Roberts' (1992) six part coordination continuum. Milgrom and Roberts define spot market contracts as a contract for exchange of goods and services at current prices without bothering with the identity of the parties. Verbal contracts are termed as relational bilateral contracts or implicit contracts and are basically non written and legally non enforceable. They are characterized by repeated transactions with the same agents. Formal or written contracts on the other hand are enforceable by law being sets of promises that define each party's obligations. These three have been identified to be extensively used in milk supply chains in Kenya. It is hypothesized that the kind of coordination mechanism employed is determined by certain socioeconomic characteristics, certain firm or enterprise specific characteristics and various transaction cost components. Each mode of coordination is identified by the proportion of milk sold through it.

### **5.5.1 Household and individual characteristics**

According to Zaibet and Dunn (1998), certain household characteristics impinge on transaction costs. Zaibet and Dunn consider these household characteristics as endogenous or internal transaction costs. They indirectly impact on the level of transaction costs that a household faces. Family size is shown to have influence on the level of transaction costs, such that larger or extended families are likely to be associated with higher transaction costs. However, other household related factors independent of family size play an important role in moderating or influencing the transaction costs. Such characteristics may include education level of farm/firm operators, their experience and gender.

The gender of the operator affects the level of transaction costs. Females have been found to face more transaction costs compared to male operators or male headed households (Makhura et al, 2001; Udry, 1996; and Pingali et al, 2005). If we let the coordination mechanisms to vary on a continuum from less coordination (that is spot market contracts) on one end and more coordination (written contracts) on the other end with verbal contracts falling in between, it is hypothesized that female headed operations will employ more coordinated transactions compared to their male operated counterparts. Female operators are more likely to perceive higher transaction costs than male operators. Conversely, it is hypothesized that male headed operations are more likely to use spot market contracts than their female counterparts.

Age of the operators also influence the level of transaction costs. Age has been used as a measure of experience especially for operations that have been continuing over time. Higher experience makes certain information and search costs easier or cheaper (Pingali et al, 2005). This implies that older farm or enterprise operators face lower transaction costs than younger operators. Over time, operators set up business relations based on trust and or reputation which becomes a valuable asset (social capital) in their activities. Older operators are therefore likely to be more involved in relational based transactions than spot market contracts. Conversely it is hypothesized that younger operators will employ more spot market contracts due to their low relational asset specificities or social capital. Lack of stable transacting partners implies that younger operators face more transaction costs in the market and this will be associated with the use of spot market contracts.

There are, however, exceptions to using age as a measure of experience. A case in point is liberalization efforts in many developing countries in the last two decades that led to a breakdown of existing relations and institutions and setting up of new institutions and new agents entering the industry. In this case the link between age and experience may not be

obvious. For example at the retail and processing levels of the Kenyan milk supply chain, many traders and processing firms have come up after liberalization meaning that most of the participants are new in their enterprises. In this case experience measured by the number of years since the enterprise begun would be more appropriate to use. At the production level, the changes were not very drastic in terms of new entrants, except in the number and types of milk buyers. In general however, the higher the experience of the operator, the more likely it is that the operator will use relational based contracts rather than spot market contracts. Lower enterprise experience is likely to be associated with spot market contracts and to some extent written contracts.

Another socioeconomic characteristic is the educational level of the operator (Boger, 2001a). Education increases the efficiency of searching for and processing information. Thus information costs are likely to be lower for more educated operators (Pingali, 2005; Makhura et al, 2001). The ability to evaluate more information about a transaction means that the problem of bounded rationality is lower for more educated operators. More educated operators are likely to be less averse to explicit contracts such as written contracts due to higher information access in the market. It is therefore hypothesized that higher education levels increase the likelihood that the transaction will be carried out using written contracts. Higher education level is also likely to lead to more usage of spot market contracts due to better information search, and processing ability and, communication. Educational level and experience are inversely related in that more educated operators are likely to have operated their enterprises for shorter periods than less educated operators of the same age.

### **5.5.2 Firm specific characteristics**

Besides socioeconomic characteristics, other important variables likely to be associated with the governance structures are firm specific factors. Such characteristics include firm sizes in terms of level of quantity of product handled or produced, type of enterprise, stage in the supply chain and location of enterprise. The quantity of milk handled by a firm can be used as an indicator of its size. Firm size has been measured in terms of land size for arable crops (Makhura et al, 2001; Boger, 2001a). Larger firms are expected to employ more relational coordination mechanisms rather than spot market contracts. The reason could be the larger quantity of product handled requires more certainty in the market. Fresh milk shows high temporal asset specificity and transaction costs can easily rise when the operator is exposed to the spot markets. To avoid possible losses, operators opt for coordination mechanisms that ensure that their milk is sold as fast as possible. The likelihood of the price being bargained

down or the failure to secure a market for the milk rises when the quantity available for sell is large. Larger milk producers and traders are easily left exposed to opportunistic tendencies from other traders or buyers, especially from partners that have not made complementary investments. Large firms are as a consequence likely to adopt either written contracts to safeguard their investments or use spot market contracts to ensure fast sales in the absence of safeguards.

Pingali et al (2005) point out that location specific factors are also associated with differential transaction costs. This means that firms located in one region are likely face higher or lower transaction costs than other firms located in a different region. The reason for this may be infrastructural or simply historical in nature. In this study, two regions were investigated: Nakuru district and Nyandarua districts. Nyandarua district suffers from poor road and communication infrastructure relative to Nakuru district despite being a high potential district. Historically, Nyandarua was formerly served by a good network of cooperatives and good processing facilities from the only milk processing firm in the country at the time (Kenya Cooperative Creameries) before liberalization of the industry most of which later collapsed and left the dairy industry disorganized as a consequent of liberalization. In this transition period, households and individuals in Nyandarua district face more transaction costs as they try to realign their transactions and institutions. Lack of suitable institutions in Nyandarua implies that spot market contracts are likely to persist relative to Nakuru district.

The length of the supply chain can be captured by the number of distinct stages the milk goes through before it finally reaches the consumer. Farmers can sell milk directly to consumers, to traders, to farmer cooperative organizations or directly to the processing firms. Direct sales to consumers constitute short supply chains (part of the warm chain) while sales to processing firms constitute long supply chains (cold chain). Iyengar (2005) finds that the length of the supply chain is inversely related to the level of transaction costs faced. Thus short supply chains are a reflection of the prevalence of high levels of transaction costs and the converse is true for long supply chains. Short supply chains are expected to use spot market contracts and verbal contracts, while long supply chains are expected to use both spot market contracts and written contracts. However, exceptions are likely to arise in the presence of social capital among the transacting partners.

### **5.5.3 Transaction cost specific characteristics**

Besides the above socioeconomic and firm specific factors, transaction cost characteristics are also hypothesized to affect the type of coordination mechanisms employed by agents in the



milk supply chains. Based on Hobbs' (1997) classification of transaction costs into information and search costs, negotiation and monitoring costs, the hypothesized relationships are discussed below. The classification can also be seen in the light of ex-ante and ex-post transaction costs. Ex- ante transaction costs are those that are observed or determined before a transaction takes place and are generally represented by information and market search costs. On the other hand, ex post transaction costs are those that are observed after a particular transaction has been carried out and are represented by monitoring costs. Negotiation costs occur when the transaction is actually being carried out. Transaction cost characteristics constitute one category of the independent variables in the study. The three components of transaction costs are further discussed below.

### *Information and market search costs*

One of the factors influencing transaction costs is uncertainty in the markets. High levels of uncertainties are likely to lead to high transaction costs. Uncertainties arise from imperfect market information on prices of outputs and inputs. Information costs include the time spent discovering information on price, potential partners and the resources used to acquire this information (Coase, 1937; Williamson, 1985; Gabre-madhini, 2001). Being located in remote areas or far away from markets will require more efforts at discovering market prices and customers. More resources in terms of money and time are required to search for such information and markets in distant markets compared to nearby markets. Transaction costs are therefore likely to increase with the remoteness of an operator from markets. It may also be difficult to establish closer relations among the transacting parties due to low knowledge about potential transacting partners. Consequently it is hypothesized that explicit contracts will prevail with longer distances between the sellers and the buyers. It is also hypothesized that the transactions are also likely to remain at arms length (spot market contracts) for those not able to initiate explicit contracts.

Related to distance, is the average time required to travel between the seller and the buyer (Vakis et al, 2003; Winter-Nelson and Temu, 2005). Travel time is determined by the condition (quality) of the available road infrastructure besides plain distances between sellers and buyers. It also depends on the means of transport used for traveling and transporting the milk products, which is a function of the parties' asset endowments and scale of operation. When the road infrastructure is good for all transacting parties, the effect of distance is likely to be minimal. On the other hand, shorter distances with poor road infrastructure may have bigger influence on marketing decisions of the agents concerned. In such a case, the time

required to travel between the sellers and the buyers is a better measure of the difficulty of accessing the market compared to plain distance measures. It is therefore expected that the time required to reach buyers or sellers will be directly associated with transaction costs. Consequently spot market contracts and written contracts are likely to prevail with increases in the time needed to reach the markets. Shorter travel times to market favor use of verbal contracts.

In addition to the above items, transport costs (Hobbs 1997; Omamo, 1998) are used to capture some of the bargaining costs in the market. Transport costs depend on the distance and on the means of transport. The means of transport commonly used by the parties to transport milk products are on foot, by animal drawn carts, by bicycle or motor vehicle. The costs of transporting milk on foot, bicycle, or on carts are difficult to discern or quantify and may not be proportional to distances between the sellers and buyers. Milk transactions are also not wholly carried out at one market point or outlet. Estimates of transport costs to such market points are likely to be very unreliable, especially when in combination with the diverse means of transportation used. Difficulties in transportation are therefore better described by distances between the partners and time taken to reach the partners.

Market search costs are also measured by the time taken to sell the milk products in possession of the agents concerned. Vakis et al (2003) and Hobbs (1997) have used various measures to capture the time required to sell agricultural products in the market. For the case of milk, this refers to how long it takes the seller on average to sell the milk products before they expire or get spoiled. In the presence of difficulties to sell the milk, sellers will spend more effort, time and money searching for alternative buyers which increases transaction costs. Relational coordination mechanisms are more likely to be used to reduce this problem. Higher costs will be incurred when it takes longer to close the sales. Longer times to sell milk will be associated with spot market contracts and to some extent written contracts. Low times to sell the milk will be associated with verbal contracts. The type of coordination mechanism used will be however moderated by the distances between the transacting agents and social capital considerations.

The ease with which a buyer can be found and a price agreed on in advance has also been used to estimate information and search costs in the market (Vakis et al, 2003; Hobbs, 1997). Knowledge of prices in advance of a transaction reduces search costs. Uncertainties in prices cause sellers and buyers to exert more efforts and time to get the price information. This may discourage some parties from the market. Ability to determine price information in advance of

the transactions increases the likelihood of using verbal and written contracts in the transactions. Inability to determine market prices in advance is likely to be associated with usage of spot market contracts.

Related to information search is the importance of various sources of market information to the transaction parties. The source of price information provides an indicator on the ease of information flow and exchange between the transacting parties. Price information sources could be public such as by state organs, mass media or private such as from other transacting parties (traders or producers). Public information sources are likely to favor use of spot market contracts. On the other hand private sources of price information are likely to favor use of relational based coordination mechanisms. This is because public price information improves the market for all participants and reduces opportunistic tendencies and the problem of private information.

*Measures of bargaining/negotiation costs*

These are costs that arise while transactions are actually taking place. The costs depend on the ease and time taken to reach an agreement between and among those engaged in the negotiating activity. Boger (2001a) uses price to distinguish between contractual arrangements. The average price received or paid is expected to be inversely proportional to the transaction costs involved. For sellers, transaction costs will be reflected in lower prices which they receive due to high transaction costs (Key et al, 2000). For buyers, it will be reflected in the higher prices which they pay for the products. Thus the effect of transaction costs is to squeeze margins for all transacting parties. Higher bargaining costs will lead to lower prices received. For the sellers, high prices are likely to be associated with spot or verbal contracts while lower prices are likely to be associated with written contracts reflecting the presence or absence of transaction safeguards. For the buyers, high prices are associated with verbal and written contracts and lower prices will be associated with spot market contracts.

Related to prices received or paid is the coefficient of variation of prices (Vakis et al, 2003). Price variation captures the difference between the highest and lowest prices for the product over the latest year or the ending 12 month period. Higher variations in the prices are therefore a reflection of the seasonal nature of production as well as transaction costs inherent in the transactions. It is hypothesized that higher price variations are associated with the use of spot market contracts. Low variations in milk prices on the other hand are be associated with verbal and written contracts. However, this variable was not used in this study.

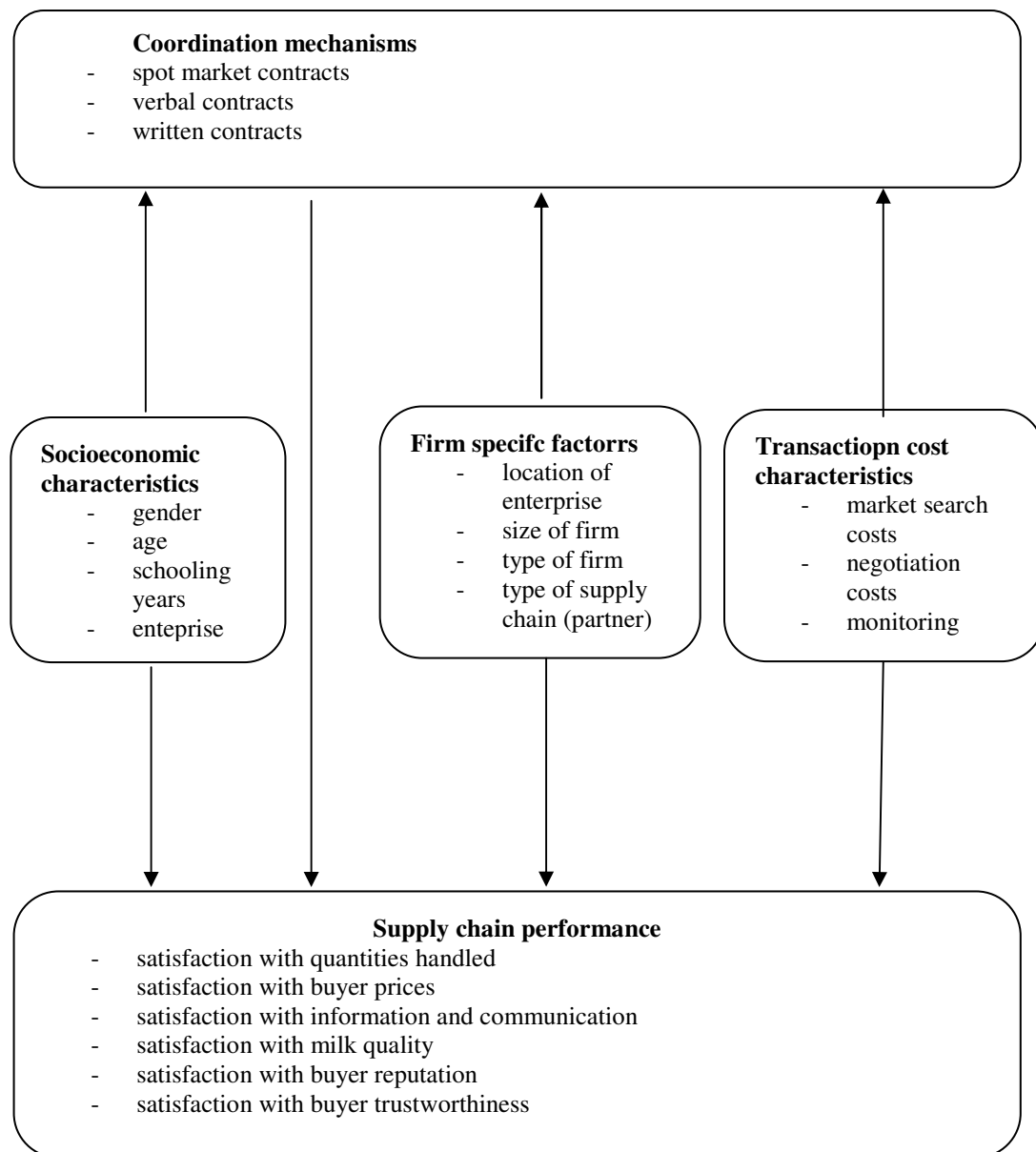
The number of buyers in the market provides an indication of market access and consequently the ease of getting buyers for the milk products. The presence of a large number of buyers reduces the costs of negotiating in the market. Producers are usually large in number while buyers (not consumers) are usually fewer and larger. The probability of conducting transactions using spot market contracts increases with increases in the number of buyers. Higher buyer availability will therefore be associated with verbal and written contracts with difficulties in finding buyers being associated with spot market contracts.

### *Monitoring and enforcement costs (ex post costs)*

Monitoring may be necessary once the transaction or contract has been entered into to ensure compliance by all or both parties to the transaction. Monitoring costs arise because of problems of information asymmetry that result in moral hazards and opportunistic tendencies among transacting parties. The efforts put in to ensure compliance with the terms of the transaction depend on the perception of the likelihood of opportunistic tendencies. Various measures have been used to represent monitoring costs. Hobbs (1997) uses quality uncertainty and shrinkage losses to represent monitoring costs. Vakis et al (2003) use trust levels in the buyers, time to get paid and extent of the importance of signed agreements among the transacting parties.

The time taken to get paid is reflected in the credit transactions. For cash sales, monitoring costs will be negligible. For credit sales however, associated default risks emerge leading to monitoring efforts designed to check likely defaults in payments. The duration of credit period can vary from zero (for spot cash payments) to over 30 days. It is thus hypothesized that since longer credit periods require more monitoring to ensure compliance, relational based coordination mechanisms are necessary to provide the required safeguards. These are governance structures that are likely to minimize the possible monitoring costs that may arise from the credit transactions.

The presence or absence of signed agreements (legal contracts) also indicates the extent to which monitoring costs influence the transacting parties. Higher importance is likely to be attached to signed agreements when transactions are carried out under relational based coordination mechanism as opposed to spot market contracts. Furthermore, higher levels of trust, reputation or reliability among transacting partners are likely to be associated with relational based coordination mechanism rather than spot market contracts. The relations above are summarized in the diagram 5.2 below.



Direction of causation  $\longrightarrow$

Figure 5.2: The conceptual model

Source: Own conceptualization, 2006

## 5.6 Determinants of supply chain performance

### 5.6.1 Supply chain performance measurement

The next issue the study addresses is the relationship between socioeconomic characteristics, firm specific factors, transaction cost factors, coordination mechanisms, and performance in the Kenyan fresh milk supply chains. Most studies on performance have focused on single firms/households emphasizing internal efficiency over external effectiveness. There is a

limited availability of multi firm performance measures and in addition performance has not been linked directly to transaction costs in the studies undertaken. Industry structure has been the main focus in performance related studies; however the changes that have been taking place in the economies call for a review of the structural paradigm, especially in developing countries. Competition is changing from single firm competition to chain competition. This study therefore takes a holistic approach to the supply chain by investigating the determinants of supply chain performance in Kenya.

Performance in agricultural markets has frequently been evaluated based on the industrial organization model, the S-C-P model (Scherer, 1970; Shepherd, 1979; and Debrah and Anteneh, 1991). The model examines the causal relationships between market structure, conduct and performance, and is usually referred to as the S-C-P (structure, conduct, performance) model. However, empirical applications of the model in the presence of imperfect markets show some deficiencies, especially for developing markets whose markets are far from imperfect or are missing. Kriesberg (1986) in Jabbar et al (1997) proposes a more appropriate model for the less developed countries as an alternative to the S-C-P model. Kriesberg's model differentiates between marketing efficiency and marketing effectiveness as performance measures. Marketing efficiency is related to the amount or cost of inputs required to obtain a given level of output, and is measured by input to output or, cost to benefit ratios. For instance, a change which reduces input costs without reducing consumer services or satisfaction would be considered as raising efficiency. Marketing effectiveness is viewed in terms of the objectives set for the marketing system (for example, higher net prices to producers or movements of larger quantities of goods at reasonable cost to urban producers). It is thus measured in terms of objectives and depends on comparisons between alternative supply chains or channels, enterprises, or even countries with similar developmental conditions. Marketing efficiency and effectiveness have essentially the same meaning if the objectives sought are the same. Market performance is then evaluated by how well the process of marketing is carried out and how successfully its aims are accomplished (Jabbar et al, 1997).

Further attempts at evaluating performance while recognizing the importance of transaction relationships (both vertical and horizontal market relations) among categories of firms within the marketing system have been made by French (1977) cited in Jabbar et al, 1997) and, Scarborough and Kydd, (1992). This extended approach is known as the 'food or commodity system framework' (Schaffer, 1973 and 1980 in Jabbar et al, 1997) and is similar to French's concept of "filière", which means a commodity production and marketing chain. Furthermore,

this approach recognizes the importance of joint products and services, and the existence of marketing firms and channels that handle a number of commodities or services using the same facilities.

An alternative theory to the above is based on market organization incorporating transaction cost and information theories. In these theories, markets, firms, relational contracts, vertical integration, groups and associations are regarded as different forms of organization ruling transactions implying that market is just one form of organization in the process of transaction. Non-price relationships in transactions are given particular importance in these theories. There are few empirical applications of these theories in the less developed countries, particularly in the area of food marketing. Moustier (1996) in Jabbar et al (1997) gives a good review of the conceptual differences among the strands of organization theory, and applies the theory to a study of vegetable market organization in Brazzaville.

Theoretical developments in transaction cost economics are based on the premise that many factors that affect the operations of the agents in the market are hardly completely measurable but are important enough to determine whether a transaction succeeds in the market or not in the market. Therefore other criteria apart from quantitative measures have to be included in the assessment of the performance of transactions in the market.

The primary interest in evaluating performance in agricultural markets is to assess the impacts of marketing inefficiencies on consumer and producer prices, on levels of production and consumption by all agents in the supply chain. Thus evaluating performance in supply chains goes beyond the price effects to address the relationships among the transacting agents (Whan and Suh, 2004; Mentzer et al, 2001; Hobbs, 1996). The concept of supply chain management and the role of transaction costs in determining performance in the supply chains are yet to be well addressed for developing markets. Furthermore an appreciation of the fact that performance of individual agents is tied to the performance of the entire system of agents in the supply chain has yet to be fully evaluated for agricultural supply chains in these countries. Another challenge is provided by the available measures of performance which show that there is a limited availability of multi firm performance measures and, in addition performance has not been linked directly to transaction costs in many of the works. This study attempts to fill this gap for developing markets.

The study adopts various measures of supply chain performance that have been used in previous studies and computes a score on the measures to represent the level of performance attained in the supply chain transactions. Venkatraman and Ramanujan (1987) make use of

subjective performance measures as proxies for measuring performance in supply chains and notes that the subjective measures give results similar to their quantitative counterparts. Their findings are particularly useful since standardized performance measures and especially at the chain level are not yet available. In this case, composite measures of performance incorporating measures subjectively derived from the respondents as well as financial measures where available are used. Supply chain performance in this study was measured by the extent to which the agents were satisfied with various aspects of their transactions with their partners. Performance was therefore represented by five key measures of performance that included satisfaction with prices offered, quantities of milk handled, information and communications, quality of milk, and the agents' reputation and trustworthiness.

The study hypothesizes that performance in the supply chains is influenced by transaction cost characteristics, coordination mechanisms, the socioeconomic characteristics and firm specific factors. Thus in addition to the factors influencing coordination mechanisms discussed in section 5.5 above, the level of performance attained in the supply chains is also influenced by the type of coordination mechanisms employed. The type of coordination mechanisms used provides an indicator of whether the relationship between the transacting parties is close or at arms length. Verbal and to some extent written contracts represent closer transaction relations than spot market contracts. Verbal and written contracts are therefore an attempt at relationship building in the supply chains. Relationships in the supply chain are manifested through long term ties and size and number of transacting partners. Low levels of transaction costs are expected in relational based coordination mechanisms, which are consequently expected to show higher performance levels compared to spot market contracts.

### **5.6.2 A theoretical model for determinants of supply chain performance**

This section focuses on developing a theoretical model for the determinants of supply chain performance in the fresh milk supply chains. Performance relations are investigated in transactions between milk producers and their buyers and milk traders and their customers. Trader transactions constitute upstream transaction activities with their milk suppliers and downstream transactions with their milk buyers. The two types of upstream and downstream trader transactions are analyzed separately.

In carrying out their transactions, market participating milk producers and traders make decisions regarding who to sell their milk to and what volumes of milk to sell to them. The decision regarding the transaction partners and quantities of milk to transact with them depends on the satisfaction or performance they expect to derive from the transactions, which



is equivalent to maximization of their expected utility. The agents therefore strive to maximize an objective function, in this case, maximization of expected utility. The agents are assumed to be risk neutral and therefore prefer higher performance levels to lower performance levels. The expected utility can be expressed in form of net revenues derived from the transactions by allocating quantities of milk to the available transaction partners. High satisfaction results when the objective function is realized or closely mirrors the actual results. On the other hand, low satisfaction results when the objective function is not achieved. The attainment of the objective function can be calibrated on a continuous scale that captures the extent to which the agents have been able to achieve their objectives.

The net revenues attained by the agents is however constrained by various factors that include socioeconomic characteristics, firm specific factors, transaction costs faced as well as coordination mechanisms used. The agents also face certain production constraints in transforming their products in readiness for the market, which can be represented by the inputs they use for farmers and purchase of milk for resale in the case of traders. Assuming the traders and milk producers are risk neutral and therefore maximize expected profits, the objective function in light of the constraints can be expressed as:

$$Max_t = E[PQ(Z, C) - I'C] \dots\dots\dots 30$$

where  $E$  is the expectation operator given the constraints facing the milk producers and traders in the market,  $P$  is the output price,  $Q$  is the output expected to be transacted in the market,  $C$  is a column of vector production inputs,  $I$  is a column vector of input prices (cost of purchased milk), and  $Z$  is a vector of the agents' socioeconomic characteristics, location, firm specific attributes, coordination mechanisms, and transaction cost characteristics. The net revenues  $\pi$  attained by the agents can be expressed as a function of the constraints facing the agents as follows:

$$\pi = \pi(P, Z, I, \dots) \dots\dots\dots 31$$

implying that the net revenues attained are a function of the output and input prices as well as socioeconomic characteristics, firm specific factors, transaction cost characteristics and coordination mechanisms used. The relationship between the net returns and the constraining factors can be expressed in stacked form as:

$$y = X\beta + e, \dots\dots\dots 32$$

with  $y$  representing the objective function (net revenue),  $X$  representing the constraining

factors,  $\beta$  representing the coefficients for the determinants of performance and  $e$  expressing the effect of unobservable factors.

However, since the net profits attained cannot be observed, they can be considered as a latent function of the explanatory factors. What is observed is an ordinal measure of the level of performance attained by the agents, which is assumed to be a continuous function of the factors determining it. Let the observed performance level be represented by  $y^*$ .  $y^*$  is an ordinal measure of the satisfaction level derived from the transaction. Let the  $y^*$  indicate the disposition to the state of affairs of the agent’s transaction with his partners such that the higher the value of  $y^*$ , the more favorably disposed the agent is to the transaction.

We assume that  $y^*$  is fully known to the parties transacting themselves and independent among the transactions entered into and that  $y^*$  is a linear combination of the observed and unobserved characteristics determining it, so that

$$y^* = X\beta + e, \dots\dots\dots 33$$

where  $y^*$  is an ordinal measure depicting the level of performance in the transaction,  $X$  is the vector of the observed factors influencing the level of performance (socioeconomic, firm specific, transaction cost and coordination mechanism used), and  $e$  reflects the net influence of unobserved factors on  $y^*$ , and  $\beta$  is the vector of the coefficients.

**5.6.3 An Ordered Probit model for determinants of supply chain performance**

Unlike coordination mechanisms that are considered to be discrete in nature, evaluating performance involves ordered responses. The study seeks to evaluate the determinants of supply chain performance and the extent to which these determinants impact of the performance level achieved by the parties in the milk supply chain transactions. To capture the ordinal nature of the responses, an ordered probit model is used to analyze the data for the transactions between milk producers and their buyers, between traders and their suppliers and between the traders and their downstream customers. Probit models use the inverse of the standard normal cumulative distribution function and assume the categorical dependent reflects an underlying quantitative variable. Unlike the multinomial logit models which ignore ordering of the responses, ordered probit models make use of the extra information contained in the ordering of the responses. The ordered probit model can be derived as follows:

Let  $y$  be the ordered response taking the values 0,1,2. The ordered probit is derived from a latent variable,  $y^*$ , such that

$$y^* = X\beta + e, \quad e|X \sim Normal(0,1) \dots\dots\dots 34$$

Let  $\alpha$  be the unknown cut off points such that  $\alpha_1 < \alpha_2$ , and define

$$y_T = \begin{cases} 0 & \text{if } y^* \leq \alpha_1 \\ 1 & \text{if } \alpha_1 < y^* \leq \alpha_2 \dots\dots\dots 35 \\ 2 & \text{if } y^* > \alpha_2 \end{cases}$$

The response variables vary as follows: 0 for low performance, 1 for moderate performance and, to 2 for high performance. The error term is assumed to be normally distributed, therefore the probability of observing a performance level for a transaction given X is represented as follows:

$$\begin{aligned} \Pr(y = 0|X) &= \Pr(y^* \leq \alpha_1|X) = \Pr(x\beta + e \leq \alpha_1|X) = \Phi(\alpha_1 - X\beta) \\ \Pr(y = 1|X) &= \Pr(\alpha_1 < y^* \leq \alpha_2|X) = \Phi(\alpha_2 - X\beta) - \Phi(\alpha_1 - X\beta) \\ \Pr(y = 2|X) &= (\Pr(y^* > \alpha_2|X) = 1 - \Phi(\alpha_2 - X\beta)) \dots\dots\dots 36 \end{aligned}$$

where  $\Phi (\cdot)$  is the cumulative standard normal distribution function and  $X\beta$  is the probit score or index.

Thus the distribution gives the probability that in transaction n the performance or likelihood of being satisfied with the transaction is high or low.

The model collapses to a binary probit model when J =1 such that

$$\Pr(y = 1|X) = 1 - \Pr(y = 0|X) = 1 - \Phi(\alpha_1 - X\beta) = \Phi(X\beta - \alpha_1) \dots\dots\dots 37$$

The parameters of the probit model can be estimated by the maximum likelihood methods.

The log likelihood function for the model becomes

$$\begin{aligned} \ell_t(\alpha, \beta) &= 1[y_t = 0] \log[\Phi(\alpha_1 - X_t\beta)] + 1[y_t = 1] \log[\Phi(\alpha_2 - X_t\beta) - \Phi(\alpha_1 - X_t\beta)] + \\ &1[y_t = 2] \log[1 - \Phi(\alpha_2 - X_t\beta)] \dots\dots\dots 38 \end{aligned}$$

The probit model can thus be expressed in brief as

$$\Pr(y=1|x) = \Phi(xb) \dots\dots\dots 39$$

The model is amenable to analysis with LIMDEP™ statistical software.

## **CHAPTER 6**

### **DATA DESCRIPTION**

The chapter discusses the operationalization of the determinants of coordination mechanisms and supply chain performance in the fresh milk supply chains in Kenya and their sampling results. The chapter draws on empirical studies on Transaction Cost Economics and Supply Chain Management theories to operationalize the relationships among transaction costs, operator socioeconomic characteristics, firm specific factors, and coordination mechanisms and supply chain performance. The study focuses on the fresh milk supply chain transactions in Kenya. The unit of analysis is the transaction between milk sellers and buyers. The supply chain is analyzed at three levels: transactions between milk producers and their buyers, transactions between milk retailers and their milk suppliers, and transactions between milk retailers and their downstream customers. At the producer stage of the supply chain, milk buyers include direct consumers, traders and processing firms. Sources of milk supplies for the retail outlets include direct farm supplies and supplies from other milk traders. On the other hand, customers of the retailers include direct consumers or users and milk processing firms. In all these transactions, the modes of coordination were spot market contracts, verbal contracts and written contracts.

The chapter is organized as follows. Section 6.1 presents the survey strategy that involves a characterization of the survey area, sampling and data collection techniques and data definitions. Section 6.2 presents a characterization of the types of transactions in the milk supply chains. Section 6.3 presents a characterization of the coordination mechanisms used in the milk transactions. Sections 6.4 to 6.6 presents a description of the factors influencing both coordination mechanisms and performance in the milk supply chains. Finally section 6.7 presents sample results for the dependent variable in supply chain performance.

#### **6.1 Survey strategy**

##### **6.1.1 Characteristics of the study area**

The study covered Nyandarua and Nakuru districts of Kenya. Nyandarua district is in Central Province while Nakuru district is in the Rift Valley Province but the two districts share common borders with each other. There are differences in the two districts: Nakuru district has population of about 1.5 million while Nyandarua district has about 0.5 million people. Nakuru district has several urban areas and towns, which serve as captive markets for the milk produced, but the biggest captive market is Nakuru town with about 300,000 people. Nakuru

## DATA DESCRIPTION

town also receives milk from the northern parts of Nyandarua district. Nyandarua district is mainly a rural district with very few urban areas and situated about 75 kilometers from Nairobi city. Nairobi city with a population of about 3 million is a major market for the milk produced in the two districts especially for processed milk.

Nyandarua is the leading milk producing district in the country, while Nakuru is considered the third largest milk producer in the country. The two districts are characterized by some of the highest concentration of dairying activities in the country ranging from production to processing and to consumption. The dairying (feeding) system in Nakuru district is characterized as semi intensive while that of Nyandarua district is characterized as extensive system. The two districts thus constitute a fair representation of the dairy industry in the country.

For sampling purposes, the districts were further divided according to administrative divisions. Nakuru district has a total of 13 divisions while Nyandarua has six divisions. Four divisions were selected from Nakuru district and two from Nyandarua district for inclusion in the study. The divisions were selected based on their unique characteristics, which included their geographical location, milk production levels and diversity of dairy activities. The divisions selected were Nakuru Municipality, Bahati, Rongai and Molo divisions from Nakuru district and North Kinangop and South Kinangop from Nyandarua district.

Nakuru Municipality was selected for its location that includes Nakuru town (population of about 300,000 people) and has diverse dairying activities ranging from production, trading, processing to consumption. Bahati division on the other hand is the leading milk producing division in Nakuru district and has mostly small scale level milk enterprises and serves Nakuru town and its environs. Rongai division is characterized by a mixture of large scale and small scale milk production activities and also serves Nakuru town and a number of processing firms elsewhere in the country. Molo division is situated farthest away from Nakuru town and mostly comprises of Molo Township. Molo is generally a small scale production area. It also receives milk from neighboring catchment divisions of Kamara, Kuresoi and Elburgon.

Parts of Nyandarua district, especially the northern divisions have similar characteristics to those of Bahati division of Nakuru district and were therefore not included in the study. South Kinangop serves Nairobi city and other milk processors in the central Kenya region, and is characterized by small scale milk production. North Kinangop on the other hand is situated

more than 100 km from Nairobi and is characterized as a large scale milk production area. The two divisions are major producers of milk in Nyandarua district.

### **6.1.2 Sampling techniques**

The population of interest constitutes commercial (market participating) dairy farmers and intermediaries in the fresh milk supply chain in Nakuru district in Rift Valley Province and Nyandarua district in Central Province of Kenya. The intermediaries include fresh milk retail outlets (shops, milk bars, kiosks, mobile/itinerant traders, brokers and, mini dairies) and farmer cooperative organizations (cooperative societies and farmer groups). Cross sectional data was collected on the participants' transactions at each of the supply chain levels (production and retailing).

A listing of retail outlets was compiled from the local authority list of licensed retail outlets and supplemented by on site visits at the market centers and along the major roads where they were located. On site visits were necessary as some of the retail outlets were no longer in operation. A listing of the dairy producers was not in existence therefore transects were utilized to access and sample the milk producers.

After selecting the divisions of interest, smaller administrative units (sub-locations) were randomly selected for inclusion in the study. At the producer level, a random sample of the milk producers was achieved by means of transects sampling. Transects sampling was the most optimal way of selecting milk producers as no sampling frame for milk producers was in existence at the time of the study for both districts. The sampling was based on certain landmarks or geographical features in the areas of interest. The starting point on the transect line was randomly selected to reduce bias in sampling. All cooperative societies and farmer groups were included in the study as their number was not large. However, stratified sampling was used to select the traders for inclusion in the study. Traders and other intermediaries were normally located in urban areas or market centers or at major road intersections. For the mobile traders, simple random sampling was applied as the traders operated and traveled in groups.

### **6.1.3 Data gathering methods**

Data gathering was carried out by means of personally administered questionnaires. The surveys were designed to collect data from the three different transaction types in the fresh milk supply chain: transactions between milk producers and their buyers, transactions

between the milk traders and their suppliers, and transactions between the traders and their buyers. The questionnaire was prepared using information derived from measurements previously used by other researchers, the respondents' recollection and their perceptions of their transaction relationships. The main source of data was primary surveys where data was collected on the coordination mechanisms employed, transaction costs characteristics, socioeconomic characteristics of the operators and firm specific factors in the chains and, extent of satisfaction with partner transactions. Constructs used to measure perceptions and attitudes employed likert type scales. The surveys were supplemented by general background information on the structure and operations of the dairy industry. The questions were adjusted to reflect each stage of the supply chain. Before collecting data, a pre-test was carried out to assess the appropriateness of the data collection instruments in order to increase the reliability and validity of the instruments. A pilot study was further carried out using the refined instruments on actual respondents leading to further refinement of the instrument and constructs. Both pre test and pilot surveys were intended to pinpoint any feasibility problems and, the suitability and relevancy of the instrument for the study's objective. Necessary adjustments were thereafter made on the instrument which was subsequently applied to the commercial milk producers and milk traders.

### **6.1.4 Data and variable definitions**

The definition of key variables is based on transaction cost economics predictions and supply chain management theory. Use is made of proxy measures that represent the theoretical measures. Several indicators of the theoretical measures have been used to capture the different aspects of a theoretical measure. This is intended to minimize measurement errors.

#### **The depended variables**

The first dependent variable was coordination mechanisms used in the milk transactions. The coordination mechanisms were measured by the proportion of milk transacted under each coordination mode. Three coordination mechanisms were identified and included spot market contracts, verbal contracts and the written contracts. The dependent variable for the second model was supply chain performance and was measured by the extent to which the transaction partners were satisfied with key aspects of their transactions. The key aspects included satisfaction with quantities of milk handled, prices of milk, information flows and communications, quality of milk, and reputation and trustworthiness of the partners. The measures were represented by 3 point likert scales measuring the extent to which partners

were satisfied with each others' transactions across key supply chain performance aspects. A score was then computed to represent the overall performance levels in the transactions.

### **Explanatory variables**

Explanatory variables consisted of information on the following aspects: data on socioeconomic characteristics of the farm and retail outlet operators such as gender, education level, experience and age of the operators. Data was also collected on enterprise specific factors such as firm size (in terms of quantity of milk produced), type of customers, and location of enterprise (in Nakuru or Nyandarua district including the divisions), type of retail outlets, and type of grazing systems for the milk producers. A third aspect on which data was collected was transaction cost characteristics, represented by information and market search costs, negotiation costs, and monitoring and enforcement costs. Finally information was collected on performance evaluations of the supply chain partners. The questionnaire was not structured along these aspects of information but according to the natural flow and ease of answering the questions by the respondents.

Table 6.1 below summarizes the constructs and their expected influences for determinants of coordination mechanisms. A positive sign indicates a high probability for the particular coordination mechanism when a high value of the independent variable is given. A negative sign indicates a high probability for the use of the given alternative coordination mechanism is expected for a low value of the independent variable. Question marks indicate weak or unclear impacts of the independent variable on the possibility of the alternatives arising in the two dependent variables. A multinomial logit model (MNL) was used to estimate the parameters and their effects on coordination mechanism.

Table 6.2 below summarizes the constructs for the determinants of supply chain performance for the Kenyan fresh milk supply chains. A positive sign indicates a high probability of higher performance for a high value of the independent variable. An ordered probit model was applied to analyze the supply chain performance relationships. Both models were amenable to analysis by LIMDEP™ econometric software. However, descriptive analyses were carried out in SPSS™ statistical software.



DATA DESCRIPTION

Table 6.1: Summary of constructs for determinants of coordination mechanisms

	<b>Construct</b>	<b>Construct description</b>	<b>*spot</b>	<b>*verb</b>	<b>*writ</b>
1	Gender	Sex of operator (1- male, 2-female)	-	+	+
2	Education	Number of schooling years	+	-	+
3	Experience	Enterprise experience in years	-	+	+
<b>Firm specific characteristics</b>					
4	Firm/farm size	Size of operation in liters of milk handled per day	+	-	+
5	Enterprise type	Type of operation or form of business (traders)	?	?	?
6	Location	Location of the enterprise (1- Nakuru district, 2- Nyandarua district)	+	-	-
7	Chain	Type/length of supply chain (direct or indirect 1/2)	+-	-	+
<b>Transaction cost characteristics</b>					
<b>Measures of information and search costs</b>					
8	Distance	Distance between milk seller and buyer or nearest outlet/collection points in km	+-	-	+
9	Time	Time to travel between milk seller and buyer or nearest outlets/collection points in hours	+	-	+
10	Sell time	Average time required to sell the milk in hours	-	+	+
11	Relations	Importance of personal relations in transactions (1-3)	-	+	+
12	Price knowledge	Extent of knowledge of milk price in advance (1-3)	-	+	+
13	Price information from traders	Importance of price information from partners (1-3)	-	+	+
14	Price information from government	Importance of price information from government or state (1-3)	+	-	-
<b>Measures of negotiation costs</b>					
15	Current Prices	Amount received or paid for a liter of milk in Kshs**	+-	+-	+-
16	Lack of buyers	Extent of problem of lack of buyers (1-3)	-	+	+
<b>Measures of monitoring costs</b>					
17	Credit time	Length of credit period, in days	-	+	+
18	Legal contracts	Extent of importance of legal contracts in transactions ( 1-3)	-	+	+
<b>The coordination mechanisms</b>					
*18	Coordination	Type of coordination mechanism employed ( 0-Spot, 1-verbal and, 2- written)			

\*\*Kshs = Kenya shillings. 1 Kshs = 100 cents

## DATA DESCRIPTION

Table 6.2: Summary of constructs for determinants of supply chain performance

	<b>Construct</b>	<b>Construct description</b>	<b>Effect</b>
1	Gender	Male or female head (household or firm) (1- male, 2-female)	?
2	Education	Number of schooling years	+
3	Age	Age of operator in years	+
4	Experience	Enterprise experience in years	+
<b>Firm specific characteristics</b>			
5	Firm/farm size	Size of operation in liters of milk handled per day	+
6	Location	Location of the enterprise (1-Nakuru, 2- Nyandarua)	?
7	Chain	Type/length of supply chain (direct/indirect 1-2)	?
<b>Transaction cost characteristics</b>			
<b>Measures of information and search costs</b>			
8	Distance	Distance between milk seller and buyer or nearest outlets in km	+
9	Sell time	Average time required to sell the milk in hours	-
10	Trader info	Importance of price information from partners (1-3)	+
11	Neighbor info	Importance of (public) price information from government or state (1-3)	+
<b>Measures of negotiation costs</b>			
12	Prices offered	Amount received or paid for a liter of milk in Kshs**	+
13	Lack of buyers	Extent of problem of lack of buyers/suppliers (1-3)	-
14	Reliable partners	Extent of partner reliability (1-3)	-
<b>Measures of monitoring costs</b>			
15	Credit time	Length of credit period, in days	+
16	Pay delay	Extent to which lack of payments is problem (1- 3)	-
17	Milk adulteration	Extent to which adulteration of milk is problem (1- 3)	-
<b>Type of Coordination employed</b>			
18	Coordination	Type of coordination mechanism ( 0-Spot, 1-verbal and, 2- written)	+
<b>Dependent variable: Measures for supply chain performance</b>			
Y1	Supplies	Extent of satisfaction with quantities of milk (1- 3)	
Y2	Prices	Extent of satisfaction with prices offered (1- 3)	
Y3	Quality	Extent of satisfaction with quality of milk (1- 3)	
Y4	Information	Extent of satisfaction with information flows and communications (1- 3)	
Y5	Reputation/trust	Extent of satisfaction with partner reputation and trust (1- 3)	

\*\*Kshs = Kenya shillings. 1 Kshs = 100 cents

## 6.2 Sample characteristics and descriptive analysis of the responses: distribution of the transactions

The unit of analysis in the study is the transaction. The transactions were between the milk producers and their respective customers/buyers and between the milk retail outlets and their respective milk suppliers and buyers.

### Producer-buyer transactions

In total, 340 usable milk producer transactions were realized from the survey. About 70.59% of the milk transactions were from Nakuru district while 29.41% were from Nyandarua district. There were also 256 retailer-supplier transactions and 278 retailer-buyer transactions. Table 6.3 below summarizes the distribution of the transactions by district and division.

Table 6.3: Sample distribution for milk producer transactions by district and division

		Producers-Buyer* transactions		Retailer-Supplier** transactions		Retailer-Buyer*** transactions	
		Number of Cases	Percent (%)	Number of cases	Percent %	No of cases	Percent %
<b>Nakuru District</b>	Nakuru Municipality	56	16.47	40	15.63	51	18.35
	Bahati	73	21.47	66	25.78	61	21.94
	Rongai	67	19.71	33	12.89	37	13.31
	Molo	44	12.94	36	14.06	40	14.39
	<b>Sub-total</b>	<b>240</b>	<b>70.59</b>	<b>175</b>	<b>68.36</b>	<b>189</b>	<b>67.99</b>
<b>Nyandarua District</b>	South Kinangop	57	16.76	55	21.48	61	21.94
	North Kinangop	43	12.65	26	10.16	28	10.07
	<b>Sub-total</b>	<b>100</b>	<b>29.41</b>	<b>81</b>	<b>31.64</b>	<b>89</b>	<b>32.01</b>
<b>Total</b>		<b>340</b>	<b>100</b>	<b>256</b>	<b>100</b>	<b>278</b>	<b>100</b>

Source: Field Survey Data, 2006

\*includes direct consumers, traders, farmer cooperative organizations and processing firms

\*\* includes direct farm suppliers and milk supplies from other traders

\*\*\* includes direct consumers and sales to processing firms

Table 6.4 below shows that about 32% of the transactions were carried out with direct consumers. Milk bars, hotels and restaurants constituted about 17.4% of producer transactions. The next supply chain constituted sales of milk directly to milk processing firms, or to cooperative organizations and brokers who further transferred the milk to processing

## DATA DESCRIPTION

firms and constituted 30% of the producer transactions. The final supply chain consisted of mobile traders who took up 20.3% of the producer's transactions. Mobile traders resell the milk to various users like consumers and milk bars and kiosks and trade on their own account.

Table 6.4: Producer-buyer chains in the milk industry

Supply chain component	Frequency	Percent	Cumulative Percent
Producer - direct consumer chain	110	32.4	32.4
Producer- milk bar/hotel chain	59	17.3	49.7
producer –processor chain	102	30.0	79.7
Producer - mobile traders chain	69	20.3	100.0
<b>Total</b>	<b>340</b>	<b>100</b>	

Source: Field Survey Data, 2006

### Retailer-supplier transactions

Retail outlets got their milk from two main sources: direct farm suppliers and from other traders. Direct farm supplies constituted about 82% of supplier transactions while supplies from other traders constituted about 18% of the transactions. Table 6.5 below shows the distribution of the retailer-supplier transactions.

Table 6.5: Retailer-supplier milk supply chains

Retailer supplier chain	Frequency	Percent	Cumulative Percent
Retailer-Direct Farm supplies	211	82.42	82.42
Retailer-other milk suppliers (traders)	45	17.58	100.00
<b>Total</b>	<b>256</b>	<b>100</b>	

Source: Field Survey Data, 2006

### Retailer-buyer transactions

Most of the transactions between the retailers and buyers were with direct consumers and constituted about 65% of the retailer-buyer transactions. About 20% of the transactions were conducted with hotels and restaurants. Finally, about 15% of the transactions were carried out with milk processing firms. The results are summarized in table 6.6 below.

Table 6.6: Retailer-buyer milk supply chains

<b>Retailer-buyer chain</b>			
	<b>Frequency</b>	<b>Percent</b>	<b>Cumulative Percent</b>
Retailer-Consumer chain	180	64.75	64.75
Retailer-Hotels/Restaurants chain	56	20.14	84.89
Retailer-Processor chain	42	15.11	100.00
<b>Total</b>	<b>278</b>	<b>100</b>	

Source: Field Survey Data, 2006

### **6.3 Sample characteristics of the coordination mechanisms**

#### **Producer-buyer coordination**

The dependent variable was coordination mechanisms, defined by the kind of contractual arrangement used in carrying out milk transactions with milk buyers. Three main coordination mechanisms were identified as spot market contracts, verbal contracts and written contracts. The distribution of the contractual arrangements for transactions between milk producers and buyers is shown in table 6.7 below. The results show that spot market contracts constituted 44.12% of all transactions between the milk producers and their buyers while verbal agreements took up 43.94% of the transactions. Written contracts comprised of 12.94% of the producer transactions.

Table 6.7: Coordination mechanisms and their distributions in producer transactions

<b>Nature of coordination</b>	<b>Frequency</b>	<b>Percent</b>	<b>Cumulative Percent</b>
Spot market contracts	150	44.12	44.12
Verbal Agreements	146	43.94	88.06
Written agreements	44	12.94	100
<b>Total</b>	<b>340</b>	<b>100</b>	

Source: Field Survey Data, 2006

#### **Retailer-supplier coordination**

The distribution of the coordination mechanisms in transactions between milk retailers and their suppliers is shown in table 6.8 below. About 63% of the retailer supplier transactions were based on spot market contracts while 32% of the transactions were based on verbal contracts. Written contracts constituted about 5% of the retailer-supplier transactions.

Table 6.8: Distribution of coordination mechanisms

<b>Nature of contract</b>	<b>Frequency</b>	<b>Percent</b>	<b>Cumulative Percent</b>
Spot market contracts	161	62.89	62.89
Verbal contracts	83	32.42	95.31
Written contracts	12	4.69	100.00
<b>Total</b>	<b>256</b>	<b>100</b>	

Source: Field Survey Data, 2006

### **Retailer-buyer transactions**

The distribution of coordination mechanisms in the retailer-buyer transactions is shown in table 6.9 below. Spot market contracts constituted 71% of transactions between the retail outlets and their milk buyers. Verbal contracts constituted 23% of the transactions while less than 6% of the transactions consisted of written contracts.

Table 6.9: Distribution of coordination mechanisms in retailer-buyer transactions

<b>Type of contract</b>	<b>Frequency</b>	<b>Percent</b>	<b>Cumulative Percent</b>
Spot market contracts	198	71.22	71.22
Verbal contracts	64	23.02	94.24
Written contracts	16	5.76	100
<b>Total</b>	<b>278</b>	<b>100</b>	

Source: Field Survey Data, 2006

## **6.4 Characteristics of the factors influencing coordination mechanisms between milk producers and their buyers**

A description of the factors influencing coordination mechanisms and supply chain performance is discussed in this section below.

### **Gender of operators**

In the producer-buyer transactions surveyed, about 46% of the transactions were carried out by women farm operators and 54% by men in both districts. Nakuru district had a significant number of female respondents (49%) compared to 33% for Nyandarua district (table 6.10 below).

## DATA DESCRIPTION

Table 6.10: Distribution of production units by district and gender

Gender	District		Total
	Nakuru	Nyandarua	
Male	50.7%	67.0%	55.8%
Female	49.3%	33.0%	44.2%
<b>Total%</b>	<b>100%</b>	<b>100%</b>	<b>100.0%</b>

Source: Field Survey Data, 2006

### Educational level of respondents

About 10% of the respondents reported having attended either adult education classes or no education at all. About 9% had between one and four years of primary school education. A further analysis showed that 28% of the respondents had between 5 and 8 years of primary school (primary school graduates) but the majority of the respondents (about 33%) reported having received between 10 and 12 years of education (at least secondary school education). More than 13 years of schooling was reported in 20% of the farm operators which comprises of advanced secondary school education, tertiary college training or university education (table 6.11 below).

Table 6.11: Classification of respondents by educational class

Educational class	Proportion of respondents
No formal education at all	10%
1 to 4 years of formal education	9%
5 to 8 years	28%
10 to 12 years	33%
13 to 16 years	20%

Source: Field Survey Data, 2006

The overall mean number of schooling years was about 9 years (table 6.12 below) while the modal number of schooling years was about 12 years. The results show a relatively high level of education indicating that most of the milk producers are relatively well informed about their dairy activities. This also explains the commercial nature of the milk producers. Further analyses showed that there were no significant differences in the mean education levels among the milk producers.

### Enterprise experience and age

Table 6.12 below also shows the distribution of enterprise experience and age of the milk producers. Experience of the operator was measured by the number of years since the

## DATA DESCRIPTION

enterprise began. The overall mean number of years since the enterprise began was about 15.6 years. However the largest proportion of producers had operated their farms for about 10 years with the longest time in operation being 50 years and the shortest time being less than one year. The distribution of the producers based on experience was relatively well balanced in the study regions and between the genders. The age of the dairy operators ranged from 18 years to 85 years. The overall mean age of the milk producers was about 45.744 years with the modal age being about 35 years old. The sample results show that older dairy operators were also the more experienced ones.

Table 6.12: Descriptive statistics for producer-buyer transactions

	Minimum	Maximum	Mean
Average schooling years	0	16.000	9.076
Age of respondent in years	18	85.000	45.744
Experience of operator in years	0	50.000	15.438
Quantity bought by buyer in liters per day	1	70.000	9.694
Distance of buyer from seller to buyer in km	0	35.000	1.460
Time required to sell milk stocks in hours	0	17.000	5.676
Price per liter of fresh milk in Kshs*	11	30.000	17.099

N = 340

Source: Field Survey Results, 2005

\* Kshs = Kenya shillings, one shilling = 100 cents.

### **Farm size, distances traveled, mean time to sell and milk selling prices**

Table 6.12 above shows that the mean quantity of milk sold by the farmers was 9.694 liters per transaction per day. But this quantity varied between 1 liter and 70 liters showing skewness towards lower quantities. The mean distance required to travel between the milk producers and the milk buyers was about 1.5 km. The distance however varied from 0 km to 35 kilometers, with a general skewness towards shorter distance between producers and buyers. The overall mean duration taken by the farmers to sell the milk after milking was 5.676 hours with a range of 0 hours (immediate sales after milking) to 17 hours after milking. Furthermore, the mean price of milk per liter was about 17 Kenya shillings (Kshs). The lowest price fetched for the milk per liter was kshs 11 while the highest price fetched by the producers was Kshs 30. The data show a wide variation in the milk selling prices among the producers.



### Importance of legal contracts in transactions

Frequency distributions for the importance of legal contracts shows that in most of the transactions, legal contracts were not used or were not considered important to producers in 83.8% of the transactions with buyers. About 8% of transactions indicated that legal contracts were a significant part of their transactions while another 8% indicated that legal contracts contributed only partly to transactions with their buyers. The results therefore show that there were very few written contracts in transactions between the producers and the buyers. This result attests to the dominance of informal transaction relations between the producers and or use of spot market contracts. A summary of the observations are presented in table 6.13 below.

Table 6.13: Importance of legal contracts in producer-buyer transactions

Presence of contract with buyer	Frequency	Percent	Cumulative Percent
not true	285	83.82	83.82
partly true	28	8.24	92.06
true	27	7.94	100.00
<b>Total</b>	<b>340</b>	<b>100</b>	

Source: Field Survey Data, 2006

### Extent of lack of buyers in producer transactions

Buyer availability was represented by the extent to which lack of buyers was perceived to be a problem in producers' transactions with their buyers. This is shown in table 6.14 below. Lack of buyers was reported as a serious problem in about 12% of the producers' transactions with buyers, while in 24% of the transactions, lack of buyers was reported as being a small problem. Lack of buyers was not a problem in about 64% of the transactions.

Table 6.14: Seriousness of problem of lack of buyers

Lack of buyers	Frequency	Percent	Cumulative Percent
serious	41	12.06	12.06
a small problem	82	24.12	36.18
no problem	217	63.82	100.00
<b>Total</b>	<b>340</b>	<b>100</b>	

Source: Field Survey Data, 2006

### Advance milk price information in the supply chains

Milk producers were further asked to indicate the extent to which they were always able to determine prices for their milk in advance of selling milk (table 6.15 below). In about 20.3% of the transactions, it was very difficult for producers to know milk prices in advance of the transactions. In 26.76% of the transactions, producers were sometimes able to know milk prices before selling while in about 53%, the producers were always able to know the milk prices before selling their milk.

Table 6.15: Extent of price knowledge in producer transactions

<b>Knowledge about buyer price offers</b>			
	<b>Frequency</b>	<b>Percent</b>	<b>Cumulative Percent</b>
very difficult to know their prices	69	20.30	20.29
sometimes able to know	91	26.76	47.06
full knowledge	180	52.94	100.00
<b>Total</b>	<b>340</b>	<b>100</b>	

Source: Field Survey Data, 2006

### Length of credit period in transactions

Milk could be sold for spot cash payments or on credit. Most of the milk transactions were carried out on credit. Spot cash transactions constituted about 31% of all transactions. Among the credit transactions, 25% consisted of credit periods of up to 2 weeks, and 43.5% consisted of credit periods of at least one month. Thus in general there were more credit transactions than spot cash payments in the producers' transactions with buyers (table 6.16 below).

Table 6.16: Length of credit period

<b>length of credit period</b>			
	<b>Frequency</b>	<b>Percent</b>	<b>Cumulative Percent</b>
Spot cash sales	106	31.18	31.18
1 to 2 weeks credit sales	86	25.29	56.47
One month or more credit sales	148	43.53	100.00
<b>Total</b>	<b>340</b>	<b>100</b>	

Source: Field Survey Data, 2006

## 6.5 Characteristics of retailer-supplier transactions

### Gender of retail operator

Female retail operators constituted about 43% of the retailer-supplier transactions and male operators about 57% of the transactions (table 6.17 below). The distribution of retailer-supplier transactions by gender was similar to producer-buyer transactions.

Table 6.17: Distribution of retailer-supplier transactions by gender

Gender	Frequency	Percent	Cumulative Percent
Male	145	56.64	56.64
Female	111	43.36	100.00
<b>Total</b>	<b>256</b>	<b>100</b>	

Source: Field Survey Data, 2006

### Type of retail operation

The transactions were also broken down according to the type of enterprise as shown in table 6.18 below. Grocery shops and kiosks constituted about 34% of the retailer-supplier transactions. Milk bars accounted for about 39.5% of the transactions while mobile traders and farmer cooperative societies accounted for about 20% and about 6% of the retailer-supplier transactions respectively.

Table 6.18: Distribution of retailer-supplier transactions by type of retail outlet

	Frequency	Percent	Cumulative Percent
Grocery/kiosk	87	33.98	33.98
Dairy/milk bar	101	39.45	73.44
Mobile traders	52	20.31	93.75
Cooperative societies	16	6.25	100.00
<b>Total</b>	<b>256</b>	<b>100</b>	

Source: Field Survey Data, 2006

### Age, experience and educational level

Table 6.19 below shows summary statistics for key socioeconomic, firm specific and transaction cost variables in retailer-supplier transactions. The age of the retail operators ranged between 15 and 70 years with a mean of about 33 years. It implies that most of the

## DATA DESCRIPTION

retail operators were relatively young. Some of the retail outlets were hardly more than a year in operation having been newly set up. However, some outlets, especially the cooperative societies, had been in operation for longer periods. The mean enterprise experience indicates that most of the retail operations were new having been set up within the last decade, which coincides with when liberalization policies were initiated in the industry. Regarding the educational levels of the retail operators, the mean number years of schooling was 10 years with a range of zero to 16 years. Educational levels were higher in cooperative societies and milk bar operators, which also operated at higher levels than other business types such as kiosks or mobile traders.

Table 6.19: Retailer-supplier transactions, summary descriptive statistics

	<b>Minimum</b>	<b>Maximum</b>	<b>Mean</b>
Respondent's Age in years	15.00	70.000	33.340
Enterprise experience in years	0.00	41.000	3.945
Educational level of respondent in years	0.00	16.000	10.387
Quantity of milk supplied by supplier in liters per day	1.00	17,000.000	298.980
Time to transport from supplier in hours	0.05	9.000	1.109
N = 256			

Source: Field Survey Data, 2006

### **Travel times, prices and quantities of milk handled**

Table 6.19 above also shows that the quantity of milk handled in the retailer-supplier transactions varied from 1 liter to 17,000 liters with a mean quantity of about 300 liters per transaction. Lower quantities of milk were handled by the smaller operators especially the kiosks and the mobile traders while larger quantities were handled by the milk bars and cooperative societies. To transport milk from the suppliers to the retail outlets required between 0.05 hours to about 9 hours. However, the mean time required to transport the milk was about 1.1 hours, indicating skewness towards shorter delivery times. Larger operators tended to take longer procuring their milk supplies compared to smaller retail operators.

### **Supplier reliability**

The reliability of the milk supplier was considered an important factor in about 80% of the retailer-supplier transactions. In the remaining 20% of the transactions, reliability of the milk supplier was not considered an important factor in the transactions. The results are summarized in table 6.20 below.

Table 6.20: Extent of partner reliability

<b>Partner is reliable</b>			
	<b>Frequency</b>	<b>Percent</b>	<b>Cumulative Percent</b>
Not true	51	19.92	19.92
True	205	80.08	100.00
<b>Total</b>	<b>256</b>	<b>100</b>	

Source: Field Survey Data, 2006

### Alternative supplier search costs

In about 64% of the transactions between retail outlets and milk suppliers, finding alternative milk suppliers was not considered difficult. In about 22% of the transactions, there were some difficulties in finding alternative milk suppliers. On the other hand, difficulties in finding alternative milk suppliers were reported in 14% of the transactions (table 6.21 below).

Table 6.21: Extent of difficult of finding alternative milk suppliers

<b>It is difficult to find other suppliers</b>			
	<b>Frequency</b>	<b>Percent</b>	<b>Cumulative Percent</b>
Not true	164	64.063	64.063
Partly true	56	21.875	85.938
True	36	14.063	100.00
<b>Total</b>	<b>256</b>	<b>100</b>	

Source: Field Survey Data, 2006

### Trader information sources

In 90% of the retailer-supplier transactions, traders were considered to be very useful sources of market information. In about 10% of the retail transactions, trader information sources were not considered to be useful in the transactions. Thus a high significance was attached to market information exchanges by the retail operators in their transactions (table 6.22 below).

Table 6.22: Usefulness of trader information sources to retailers

<b>Trade information sources</b>			
	<b>Frequency</b>	<b>Percent</b>	<b>Cumulative Percent</b>
not very useful	26	10.16	10.16
Useful or very useful	230	89.84	100.00
<b>Total</b>	<b>256</b>	<b>100.00</b>	

Source: Field Survey Data, 2006

### Government market information sources

In about 89.5% of retailer-supplier transactions, government sources of market and price information were not considered to be useful in the transactions (figure 6.23 below). In the remaining 10.5% government information sources were indicted to be useful in retailer-supplier transactions. The results of evaluation of government information sources by retailers are likely to be a pointer to non availability rather than usefulness of the information. Market information from the government is rarely available to many dairy operators on time when they require it.

Table 6.23: Usefulness of government market information to retailers

<b>Government information sources</b>			
	<b>Frequency</b>	<b>Percent</b>	<b>Cumulative Percent</b>
not very useful	229	89.45	89.45
very useful	27	10.55	100.00
<b>Total</b>	<b>256</b>	<b>100</b>	

Source: Field Survey Data, 2006

### Personal relations in transactions

Personal relations between the retail outlets and milk suppliers were not considered important in about 31% of the transactions. In 37.5% of the transactions, personal relations were considered to be partially important in the transactions with milk suppliers. About 31.6% of the retail-supplier transactions considered the presence of personal relations to be an important factor in their transactions with milk suppliers. The results are summarized in table 6.24 below.

Table 6.24: Personal relations in retailer transactions

<b>Have relations with supplier</b>			
	<b>Frequency</b>	<b>Percent</b>	<b>Cumulative Percent</b>
not true	79	30.86	30.86
partly true	96	37.50	68.36
true	81	31.64	100.00
<b>Total</b>	<b>256</b>	<b>100</b>	

Source: Field Survey Data, 2006

### Length of credit period

Spot cash payments (no credit) accounted for about 57.4% of the transactions with milk suppliers (table 6.25 below). Weekly credit periods accounted for 24.6% of the transactions while monthly credit periods accounted for about 18% of the transactions with milk suppliers. This is unlike milk producers most of whose transactions were mostly carried out on credit basis.

Table 6.25: Length of credit period in retailer-supplier transactions

<b>Length of credit period</b>			
	<b>Frequency</b>	<b>Percent</b>	<b>Cumulative percent</b>
Spot cash payments	147	57.42	57.42
Weekly	63	24.61	82.03
Monthly	46	17.97	100.00
<b>Total</b>	<b>256</b>	<b>100</b>	

Source: Field Survey Data, 2006

## 6.6 Characteristics of retailer-buyer transactions

### Gender

About 57% of the transactions between retail operators and buyers were carried out by male operators. Female retail operators were responsible for about 43% of the transactions. The distribution of the retailer-buyer transactions by gender are shown in table 6.26 below.

Table 6.26: Distribution of transactions by gender

<b>Gender</b>	<b>Cumulative</b>		
	<b>Frequency</b>	<b>Percent</b>	<b>Percent</b>
male	159	57.19	57.19
female	119	42.81	100
<b>Total</b>	<b>278</b>	<b>100</b>	

Source: Field Survey Data, 2006

### Type of retail outlet

An analysis of the retail transactions by type of retail outlet indicated that 32% of the milk transactions were carried out by grocery shops. Milk bars handled 41.7% of the transactions while mobile traders and cooperative societies handled 20.5% and 5.75% of the transactions respectively. Unlike grocery shops, milk bars, mobile traders and cooperatives usually exclusively handle milk and milk related products. The results are shown in table 6.27 below.

Table 6.27: Distribution of retailer-buyer transactions by type of retail outlet

Type of retail outlet	Cumulative		
	Frequency	Percent	Percent
Grocery/kiosks	89	32.01	32.02
Dairy/milk bars	116	41.73	73.74
Mobile traders	57	20.50	94.24
Cooperative societies	16	5.76	100
<b>Total</b>	<b>278</b>	<b>100</b>	

Source: Field Survey Data, 2006

### **Educational level, enterprise experience and age**

The education level of the retail operators was captured by the number of years they attended school. The overall mean number of schooling years was about 10.6 years (table 6.28 below) and ranged from none at all to 16 years. The mean number of years of enterprise experience was about 4 years. The mean age of the retail operators was about 33 years but ranged from a minimum of 15 years and a maximum of 70 years. The mean quantity of milk sold by the retailers per transaction was about 266 liters per day indicating that on average the retail outlets were larger compared to the milk producers.

### **Distance, travel time, and milk prices**

Table 6.28 below shows that the mean distance between the retail outlets and the buyers was about 10 kilometers. The mean distance is highly influenced by buyers situated in distant locations such as processing firms and buyers in major towns. For transactions between retailers and direct consumers, distances were less than one kilometer.

The mean time required to travel between the milk buyers and the retail outlets was 0.80 hours (about 48 minutes) but varied between 0 and 7 hours. The variation in the times also reflected the differences between sales to direct consumers and sales to processing firms. The time required to reach the buyers is however affected by the means of transport used and the condition of the road. The main means of transport used either to deliver or collect milk were on foot, by bicycle or, by vehicle. Thus the time required to reach buyers may not necessarily be an indicator of distance from buyers but a function of the difficulties faced in attempts to reach the transacting parties.



## DATA DESCRIPTION

Table 6.28: Summary descriptive statistics for retailer-buyer transactions

	Minimum	Maximum	Mean
Educational level of retail operators in years	0	16.000	10.576
Enterprise experience in years	0	41.000	4.047
Age	15	70	33
Quantity bought by buyer in liters per day	2	17000.000	265.775
Distance to buyer in km	0	220.000	10.275
Time to get to buyer in hours	0,01	7.000	0.799
Current price for buyers per liter	14	30.000	21.367
Number of buyers	1	400	38
Time to clear fresh milk stocks in hours	0.40	48.000	12.404
N=278			

Source: Field Survey Data, 2006

The mean selling price of milk was about Kshs 21.40 per liter. The selling price ranged between Kshs 14.00 and Kshs 30.00, indicating wide variations in the prices received by retailers in their transactions. And finally, the mean number of milk buyers was 38 buyers. However, the number of buyers ranged from one to 400 buyers.

Furthermore, the time required to sell milk ranged from slightly under half an hour to about 48 hours. Operators with cooling facilities (milk bars and some cooperatives) could afford longer stocking times than others (e.g. mobile traders).

### Length of credit period

About 74% of the retailer-buyer transactions were based on spot cash payment basis without any credit being offered to buyers. In about 7.6% of the transactions, a credit period of one week was allowed by the retail outlet operators. Monthly credit periods constituted 18.7% of the retail transactions (table 6.29 below).

Table 6.29: Distribution of retailer transactions by length of credit period

Length of credit period	Cumulative		
	Frequency	Percent	Percent
Spot cash transactions	205	73.74	73.74
Weekly	21	7.55	81.29
Monthly	52	18.71	100
<b>Total</b>	<b>278</b>	<b>100</b>	

Source: Field Survey Data, 2006

### 6.7 Characteristics of the dependent variable: supply chain performance

The distribution of the dependent variable in the transactions between the milk producers and buyers is shown in table 6.30 below. In about 9% of the transactions, producers reported being dissatisfied in their transactions with the buyers. In more than 51% of the transactions, producers were neither satisfied nor dissatisfied in their transactions. On the other hand, satisfaction was reported in 39% of the producer-buyer transactions. The figures show that the performance of milk producers was quite modest as a majority of them indicated that they were not satisfied in transactions with their partners (about 60%).

Table 6.30: Performance in producer-buyer transactions

	Frequency	Percent	Cumulative percent
Dissatisfied	30	8.82	8.82
Neither satisfied nor dissatisfied	175	51.47	60.29
satisfied	135	39.71	100.00
<b>Total</b>	<b>340</b>	<b>100.00</b>	

Source: Field Survey Data, 2006

Table 6.31 below presents summary descriptive results for performance in retailer-supplier transactions. Dissatisfaction was reported in about 10% of the transactions with milk suppliers. In a further 54%, retailers indicated that they were neither satisfied nor dissatisfied in their transactions with milk suppliers. Finally, retailers reported being satisfied in 36% of the transactions with their partners.

## DATA DESCRIPTION

Table 6.31: Performance in retailer- supplier transactions

	<b>Frequency</b>	<b>Percent</b>	<b>Cumulative percent</b>
Dissatisfied	27	10.55	10.55
Neither satisfied nor dissatisfied	138	53.91	64.46
satisfied	91	35.54	100.00
<b>Total</b>	<b>256</b>	<b>100.00</b>	

Source: Field Survey Data, 2006

Responses on retailer-buyer transactions were grouped into two categories: very satisfied and not very satisfied (table 6.32 below). High satisfaction levels were reported in a majority of the retailer-buyer transactions at 62%. Transactions in which the retailers were not satisfied with their buyers' transactions constituted the remaining 38%. Thus on average, retailers performed better in transactions with their buyers compared to transactions with their suppliers. Low average satisfaction levels were also observed in transactions between the producers and their buyers.

Table 6.32: Performance in retailer- supplier transactions

	<b>Frequency</b>	<b>Percent</b>
Not very satisfied	105	37.77
Very satisfied	173	62.23
<b>Total</b>	<b>278</b>	<b>100.00</b>

Source: Field Survey Data, 2006

## CHAPTER 7

### DETERMINANTS OF COORDINATION AND SUPPLY CHAIN PERFORMANCE

The chapter is divided into two major parts. Part one consists of sections 7.1 through 7.3 and discusses multinomial logit model results for the determinants of coordination mechanisms in the fresh milk supply chains in Kenya. Section 7.1 discusses coordination in transactions between milk producers and buyers. Section 7.2 discusses coordination in transactions between retailers and milk suppliers while section 7.3 deals with coordination in transactions between retailers and milk buyers.

Part two consists of sections 7.4 to 7.6 and discusses ordered probit results for the determinants of supply chain performance in the fresh milk supply chain. Section 7.4 discusses determinants of supply chain performance in producer-buyer transactions. Section 7.5 discusses determinants of supply chain performance in retailer-supplier transactions while section 7.6 deals with the determinants of supply chain performance in retailer-buyer transactions.

#### ***7.1 Model results and discussions: determinants of coordination mechanisms in producer-buyer transactions***

Table 7.1 below shows the multinomial logit results for the relationship between coordination mechanisms and the explanatory factors. Most of the explanatory factors were significant at the 5% and 10% levels. In the producer-buyer transactions a number of variables were significant in determining the kind of coordination mechanism used in the transactions. The log likelihood chi-square value of 146.09 was significant at the 1% level (p-value = 0.00000). The pseudo R square was 0.217 and a moderate prediction of 67.94% for the coordination mechanisms was achieved. The parameter estimates for the producer-buyer transactions and the corresponding t-values (in brackets) are shown in table 7.1 below. Further discussions of the model results by means of marginal effects follow below.

Table 7.1 Multinomial Logit Model estimates for determinants of producer-buyer coordination

Variable description		Prob(Y=1) -	Prob[Y = 2]-written
		verbal	
Constant		-2.824** (-2.453)	-2.128 (-1.225)
DISTRICT	Location of farm (Nakuru/Nyandarua district)	-1.220*** (-3.420)	-1.540*** (-2.807)
EXPERIENCE	Experience of farm operator in years	0.018 (1.380)	-0.022 (-1.020)
QUANTITY	Quantity of milk sold in liters per day	-0.015 (-1.017)	0.019 (0.995)
SALETIME	Average time required to sell milk in hours	0.148*** (5.414)	0.084** (2.106)
DISTANCE	Distance in kilometers between farm and buyers	-0.049 (-0.730)	0.113** (2.199)
SELLPRICE	Milk selling price per liter	-0.054 (-1.193)	-0.158** (-2.208)
CREDIT	Length of credit period (none, 2 weeks, monthly)	0.584*** (5.241)	0.596*** (3.569)
PRICEKNOW	Extent of price knowledge before milk sales (1-3)	0.512*** (2.645)	0.471* (1.630)
NOBUYERS	Extent of problem of buyer availability in (1-3)	0.391** (2.261)	0.407 (1.484)
LEGALCON	Importance attached to legal contracts in (1-3)	0.799*** (2.732)	1.225*** (3.735)

N=340, Pseudo R-squared =0.217, percentage correctly predicted =67.94, chi-square = 146.089\*\*\*; \*\*\* significant at 1%, \*\* 5% and \*10%. t-values in brackets.

Source: Survey Results, 2006.

Table 7.2 below presents the marginal effects for transactions between milk producers and milk buyers for the three coordination mechanisms of spot market contracts, verbal contracts and written contracts. The results for the transactions show that the location of the producer was significant in distinguishing between the coordination mechanisms. Being located in Nyandarua district increased the probability of using spot market contracts with a marginal effect of 0.315. On the other hand, being located in Nakuru district increased the probability of using verbal and written contracts. The marginal effects of location for verbal and written contracts were -0.224 and -0.090 respectively indicating that being located in Nakuru district significantly increased the probability of using verbal and written contracts respectively. The results therefore imply that repeat transactions with partners were more likely to be undertaken in Nakuru district than in Nyandarua district. Such repeat transactions are likely to lead to lower information and market search costs. The use of the safeguards (relational contracting) is likely to result in lower transaction costs in Nakuru district compared to Nyandarua district.

The differences in the two districts can be accounted for by historical and geographical considerations. Nyandarua district being a rural district implies that the market for milk may not be readily available in producers' neighborhoods. There are also very few major urban areas that could act as captive markets for the milk produced in Nyandarua district compared to Nakuru district. Therefore most of the milk producers in the district are likely to sell their milk in distant markets and for this reason it becomes difficult to enter into relational based transactions which normally require more information and knowledge about the buyers. The cost of acquiring such information is likely to be very high and therefore spot market contracts rather than relational based transactions (verbal and written contracts) are more than likely to predominate. This observation is further strengthened by the influence of distance between the milk sellers and the buyers on the coordination mechanisms used as discussed below, where longer distances favor use of spot market contracts. A further explanation is based on the institutional changes that appear to have affected Nyandarua district more negatively than Nakuru district, restricting farmers in Nyandarua district to rely more on spot market contracts.

Experience of the farm operators had a significant and positive marginal effect on the use of verbal contracts. Longer experience in the dairy operations increased the probability of using verbal contracts. The marginal effect of enterprise experience for verbal contracts was 0.006. This implies that more experienced producers establish social networks (social capital) for milk sales and the networks are likely to persist for long periods. The marginal effects for both spot and written contracts were -0.003 indicating that having shorter enterprise experience increased the likelihood of using both spot market contracts and written contracts in transactions between milk producers and buyers but its effect was not statistically significant. However, experience did not have a significant influence on the use of spot market contracts and written contracts.

The results also show that verbal contracts were associated with lower quantities of milk handled (marginal effect of -0.005) but the effect was not significantly different from zero. On the other hand, positive marginal effects for quantity of milk sold imply that higher quantities of milk handled were positively associated with the use of spot market and written contracts in the transactions. The positive marginal effects for milk quantity signify that with increasing production levels, transactions are likely to be closed through spot market contracts and written contracts. However, the overall effect of quantity of milk sold was not significant in distinguishing between the coordination mechanisms.

Table 7.2 Marginal effects of explanatory variables on the probability of coordination choice

Variable	Variable description	Spot market	Verbal contracts	Written contracts
Constant		0.660** (2.444)	-0.592** (-2.233)	-0.067 (-0.420)
DISTRICT	Location of farm (Nakuru/ Nyandarua district 1-2)	0.315*** (3.774)	-0.224*** (-2.735)	-0.090* (-1.854)
EXPERIENCE	Experience of farm operator in years	-0.003 (-0.812)	0.006* (1.849)	-0.003 (-1.585)
QUANTITY	Quantity of milk sold in liters per day	0.002 (0.611)	-0.005 (-1.381)	0.003 (1.583)
SALETIME	Average time required to sell milk in hours	-0.033** (-5.190)	0.032*** (5.278)	0.001 (0.227)
DISTANCE	Distance in kilometers between farm and buyers	0.004 (0.285)	-0.018 (-1.172)	0.014*** (2.847)
SELLPRICE	Milk selling price per liter	0.018* (1.706)	-0.005 (-0.520)	-0.013** (-2.037)
CREDIT	Length of credit period (none, 2 weeks, monthly)	-0.144*** (-5.543)	0.115*** (4.519)	0.029** (1.971)
PRICEKNOW	Extent of price knowledge before milk sales (1-3)	-0.124*** (-2.744)	0.103** (2.308)	0.021 (0.774)
NOBUYERS	Extent of problem of buyer availability in the transactions (1-3)	-0.097** (-2.395)	0.076** (1.889)	0.020 (0.799)
LEGALCON	Importance attached to legal contracts in the transactions (1-3)	-0.217*** (-3.153)	0.136** (2.182)	0.081*** (3.094)

\*\*\* Significant at 1%, \*\* 5% and \*10%

Source: Survey Results, 2006.

The time required to sell milk was highly significant for spot market contracts and verbal contracts. Shorter times before selling milk significantly increased the likelihood of using spot market contracts (marginal effect of -0.033). On the other hand, longer times before selling milk increased the chances of using verbal contracts with a marginal effect of 0.032. Longer hours before selling were also positively associated with written contracts but were not statistically different from zero in their influence. Longer hours before selling milk are likely to increase uncertainty in transactions especially when there are no safeguards. Since milk is a highly perishable commodity, bargaining power will be low for milk producers especially when exposed to open markets. Milk producers therefore strive to close their sales as fast as possible using spot market contracts to reduce long exposures to uncertainties in the absence of safeguards that are usually provided by relational based contracts.

Longer distances between milk producers and buyers had a significant positive influence on the use of written contracts (marginal effect of 0.014). Milk producers selling to buyers located farther away were more likely to use written contracts. Long distances also favored the use of spot market contracts but the effect was not significant. Shorter distances increased the likelihood of using verbal contracts but the effect was also not significant.

Higher milk selling prices increased the likelihood of using spot market contracts by producers. The marginal effect of prices for spot market contracts was 0.018. Higher prices associated with spot market contracts reflect the lack of safeguards against transaction failure or opportunism. Lower milk selling prices were likely to favor the use of verbal contracts in the producer-buyer transactions but the effect was not significant. However, milk selling prices were significant in influencing the use of written contracts, albeit negatively. The marginal effect of milk selling prices on written contracts was -0.013 indicating that lower prices increased the probability that written contracts would be used in producer-buyer transactions. This result is theoretically supported in Transaction Cost Economics theory, where written contracts and other relational based contracts provide safeguards which can be represented by the difference between the spot market prices and the prices received or paid for under written contracts. The safeguards provide some insurance against market search costs, and bargaining costs which ensure that there is always a market for the highly perishable milk products, and in addition, contract enforcement is also made easier. Safeguards are also necessary when larger quantities of milk are sold or handled.

The length of credit period was highly significant in influencing the coordination mechanisms in various ways. Short credit periods (mostly 0 to 2 days) favored the use of spot market contracts (marginal effect of -0.144). Longer credit periods on the other hand favored the use of verbal and written contracts. For the verbal contracts, the effect of credit period was significant with a marginal effect of 0.115 while for written contracts the marginal effect was 0.029. Thus the effect of credit period was stronger for verbal contracts compared to written contracts. The length of credit period is often affected by the amount of trust subsisting between the transacting partners. Earlier results on the effect of enterprise experience indicated that more experienced operators tended to use verbal and written contracts, a result that could be explained by the trust and reputation developed over time as part of their social capital. Less experienced operators tended to use spot market contracts. Monitoring costs are likely to rise whenever milk is sold on credit due to perceived opportunism from transaction partners. Monitoring and enforcement costs can be reduced when there are effective legal enforcement mechanisms in the event of default. Reputation of the transacting partner may



also determine whether transactions are to be carried out on credit or not. Credit is usually extended to partners who are known to the sellers and or have good reputations (such as neighbors) or where legal redress can be easily sought (such as processing firms).

Some producers were able to determine milk prices in advance before the transactions took place. Others were not always able or were only able to determine the prices in advance. Low levels of price knowledge significantly favored the use of spot market contracts. Therefore difficulties in accessing price information by farmers increase the probability of using spot market contracts. The marginal effect of price knowledge of  $-0.124$  for spot market contracts was significant at the 1% level. On the other hand, advance price knowledge before transacting increased the likelihood that verbal contracts and written contracts would be used in the transactions. However, the influence of price knowledge on written contracts was not significant though it was positive. Information search costs are likely to be lower in the two relational coordination mechanisms compared to spot market contracts. The results indicate that adequate price knowledge is necessary for both verbal and written contracts.

Lack of price information leads producers to sell to buyers located near their farms to avoid uncertainties associated with insufficient market information. It would be difficult to use verbal contracts in such distant markets. The data also indicate that farmers using verbal contracts were also fairly more experienced than farmers using spot market contracts and written contracts, meaning that experienced farmers were more likely to have more price information relative to less experienced farmers. From the results, the positive relationship between high information availability and the relational contracts imply that the available information was most likely to have been gained from private sources, such as other farmers or milk buyers or traders. Farmers that did not have adequate information therefore opted to use spot market contracts in their transactions.

Difficulties in getting adequate numbers of milk buyers significantly favored the use of spot market contracts. On the other hand, high buyer availability significantly increased the likelihood of using verbal contracts with a significant marginal effect of 0.076. Higher buyer availability was also likely to increase the possibility of using written contracts but this was not statistically significant at the 10% level. The number of buyers in the market determines the relative bargaining powers and costs that farmers are likely to face in their transactions. Fewer buyers make it difficult to effectively bargain leading to high negotiation costs.

The importance of perceived enforceability of contracts, whether explicit or implicit, also influenced the type of coordination mechanisms used. Low importance attached to legal

contracts significantly increased the likelihood of using spot market contracts. The marginal effect of importance of legal contracts for spot market coordination mechanism was -0.217. But as the importance of contract enforcement increases, the probability of using the relational coordination mechanisms also increases. The marginal effects of legal contracts for verbal and written contracts were 0.136 and 0.081 respectively. Legal contracts are important for contract enforcement purposes. Availability of contract enforcement mechanisms reduces the costs of monitoring transaction partners. The presence or absence of contract support institutions affects the amount and extent of monitoring costs required in transactions between the producers and the buyers.

## ***7.2 Determinants of coordination in retailer –supplier transactions***

Regression results for determinants of coordination mechanisms in transactions between the milk retail outlets and milk suppliers show that the type of coordination mechanism employed was also influenced by socioeconomic factors, firm related factors and transaction costs characteristics. The regression results are presented in table 7.3 below. The model log-likelihood chi-square value was 126.877 with a p-value less than 0.00001. The pseudo R squared value was 0.31 and the model was able to predict the probability of using the coordination mechanisms up to 78% of the time. Further analyses and discussions of the results using marginal effect follow from table 7.4 below.

The results in table 7.4 show that being located in Nyandarua district significantly increased the probability of using spot market contracts with a marginal effect of 0.452. On the other hand, being located in Nakuru district significantly increased the probability of using verbal contracts (marginal effect of -0.410) in transactions between retailers and milk suppliers. Being located in Nakuru district also increased the likelihood that written contracts would be used in retailer-supplier transactions (marginal effect of 0.042). The results for the effect of location in retailer-supplier transactions closely mirror results in producers-buyer transactions. Being a male retail operator significantly increased the chance of using spot market contracts with a marginal effect of -0.185. On the other hand, being a female retail operator significantly increased the likelihood of using relational coordination mechanisms, that is, both verbal and written contracts. The marginal effects were 0.176 and 0.009 for verbal and written contracts respectively. Female operators are likely to perceive higher transaction costs and are more likely to adopt safeguards in their transactions than their male counterparts.

Table 7.3 Multinomial Logit Model estimates for determinants of retailer-supplier coordination

Description of the variables		Pr(Y=1)	Pr(Y=2)
Constant		-3.997** (-2.129)	-8.182* (-1.711)
DISTRICT	Location of the retail outlets (Nakuru, Nyandarua 1-2)	-2.301*** (-4.427)	-3.078*** (-2.895)
RESPSEX	Gender of operator (Male/female 1-2)	0.975*** (2.691)	0.802 (1.137)
QUANTITY	Quantity of milk sold in liters per day	0.000 (1.357)	0.000 (1.075)
TRADERIN	Importance of trader price/market information sources (1-3)	0.570** (2.435)	1.543** (2.299)
GOVTINFO	Importance of government price/market information sources (1-3)	-1.257*** (-3.338)	-0.712 (-1.275)
TIME_1	Time required to travel between milk retail outlet and milk supplier in hours	-0.370** (-2.096)	-1.077* (-1.731)
RELIABLE	Importance of supplier reliability in transaction (1-3)	0.793* (1.815)	1.447 (1.278)
RELATION	Importance of personal relations in transactions (1-3)	1.035*** (4.060)	0.582 (1.183)
COST_1	Ease of finding alternative milk suppliers (1-3)	0.290 (1.184)	-1.196* (-1.689)
SALETIME	Average time required to sell milk in hours	-0.056*** (-2.747)	-0.010 (-0.282)
CREDIT	Length of credit period (none, up to 2 weeks, monthly)	0.854*** (3.118)	1.357*** (2.718)

N=256; Chi squared =126.877\*\*\*; Pseudo R squared = 0.31; percentage correctly predicted = 78.13%.

\*\*\* Significant at 1%, \*\* 5% and \*10%

Source: Survey Results, 2006.

The size of the retail operation was measured in terms of the quantity of milk handled and did not have a significant influence on the use of the coordination mechanisms. However, the negative marginal effect of quantity of milk handled for spot market contracts indicates that low quantities of milk purchased increased the likelihood that retailers would use spot market contracts to purchase milk. On the other hand, positive marginal effects of quantity of milk for verbal and written contracts imply that larger quantities of milk were likely to be transacted using verbal and written contracts. Continuous supply is crucial for the retailers especially those that handle large quantities of milk and therefore verbal and written contracts provide the necessary safeguards against uncertainties in milk supplies.

Two sources of price information were evaluated for their significance in the retailer supplier transactions: trader price information sources and government price information sources. Both

had significant influence on the kind of coordination mechanisms employed. Low trader information availability increased the likelihood that spot market contracts would be used in the transactions (marginal effect of -0.122) while high trader information availability significantly increased the likelihood of using verbal contracts as well as written contracts with marginal effects of 0.098 and 0.023, respectively.

On the other hand, high availability of price information from the government significantly increased the likelihood of using spot market contracts (marginal effect of 0.235). Having low levels of government price information increased the probability that verbal and written contracts would be used in the transactions (with marginal effects of -0.228 and -0.007 respectively). Thus the influence of market information depends on the source of the information. Trader and government information sources represent private and public information sources respectively with different effects in the market. Private information is not usually available to the public and benefits only those parties that have access to it. This is a case of asymmetric information which is leveraged for private benefit or rent seeking. On the other hand, government information is normally considered open to the public as it can be available to all parties interested in using it. Such information sources are likely to reduce information asymmetries in the market and improve the workings of the whole market. Information and market search costs are likely to decline in the presence of more public information. Public information sources do not proffer any special competitive or business advantages to any particular individual or group but is likely to benefit all parties that have access to it.

The time required to travel between the retail outlets and the milk suppliers also significantly influenced the kind of coordination mechanisms used. Longer times required to reach milk suppliers increased the likelihood of using spot market contracts (marginal effect of 0.080) while shorter times to reach the milk suppliers increased the probability of using verbal and written contracts with marginal effects of -0.064 and -0.016 respectively. The results show that retail outlet operators that took shorter times to reach suppliers were likely to be those using relational based contracting while retail outlets that took longer times to access their milk sources were likely to be those using spot market contracts. Longer times to reach partners are pointers to difficulties in the transactions.

The time required to reach the milk suppliers is a function of several factors: the distance between the parties, the condition of the road and the means of transport used (asset endowments); all of which are likely to increase or decrease the time required to travel

between the transacting parties. Longer distances on good roads and good asset endowments (means of transport) reduce the times required to reach the transacting partners. On the other hand, shorter distances in the presence of poor road conditions and or lack of good means of transport will lead to longer times to reach the partners. In this regard, it is possible that retailers who use spot market contracts face certain difficulties that may include poor roads, poor means of transport or long distances traveled, and consequently face higher transaction costs. The result could also be explained by the possibility that such retailers transport their milk on foot due to smaller quantities involved.

Table 7.4 Marginal Effects of explanatory variables on the probability of coordination choice: retailer-supplier

Description of the variables		Spot market	Verbal contracts	Written contracts
Constant		0.821** (2.316)	-0.701** (-2.048)	-0.120 (-1.292)
DISTRICT	Location of the retail outlets (Nakuru, Nyandarua 1-2)	0.452*** (4.712)	-0.410*** (-4.416)	-0.042* (-1.702)
RESPSEX	Gender of operator (Male/female 1-2)	-0.185*** (-2.697)	0.176*** (2.653)	0.009 (0.765)
QUANTITY	Quantity of milk sold in liters per day	0.000 (-1.385)	0.000 (1.351)	0.000 (0.903)
TRADERIN	Importance of trader price/market information sources (1-3)	-0.122*** (-2.713)	0.098** (2.280)	0.023* (1.650)
GOVTINFO	Importance of government price/market information sources (1-3)	0.235*** (3.613)	-0.228*** (-3.535)	-0.007 (-0.693)
TIME_1	Time required to travel between milk retailer outlet and milk supplier in hours	0.080** (2.444)	-0.064** (-2.021)	-0.016* (-1.658)
RELIABLE	Importance of supplier reliability in transaction (1-3)	-0.161** (-1.949)	0.140* (1.762)	0.021 (1.049)
RELATION	Importance of personal relations in transactions (1-3)	-0.193*** (-4.119)	0.188*** (4.132)	0.005 (0.660)
COST_1	Ease of finding alternative milk suppliers (1-3)	-0.037 (-0.797)	0.058 (1.313)	-0.021 (-1.507)
SALETIME	Average time required to sell milk in hours	0.010*** (2.703)	-0.010*** (-2.814)	0.000 (0.122)
CREDIT	Length of credit period (none, up to 2 weeks, monthly)	-0.171*** (-3.263)	0.151*** (3.011)	0.019 (1.553)

\*\*\* Significant at 1%, \*\* 5% and \*10%

Source: Survey Results, 2006.

Reliability of milk suppliers was also significant in distinguishing between the coordination mechanisms. Transacting with unreliable milk suppliers increased the likelihood of using spot

market contracts. The marginal effect of reliability on spot market contracts was -0.161. On the other hand, high levels of supplier reliability increased the likelihood that verbal contracts would be used in transactions with milk suppliers with a marginal effect of 0.140. High supplier reliability was also likely to favor the use of written contracts but the influence was not significant enough, its marginal effect was only 0.021. Supplier reliability reduces the efforts required to search for milk suppliers each time a transaction takes place. Low reliability increases the likelihood of using spot market contracts when complementary investments in trust among trading partners is not possible.

The findings on the effect of partner reliability are similar to those on the effect of personal relations in the transactions. Absence of personal relations in transactions between retailers and milk suppliers increased the likelihood of using spot market contracts with a marginal effect of -0.193. On the other hand, the presence of personal relations increased the likelihood of using verbal and written contracts in the transactions. The marginal effect of personal relations on verbal contracts was 0.188 and on written contracts, the marginal effect was 0.005. Personal relations are a specific asset (relational asset or social capital) and reduce transaction costs in transactions.

Difficulties in finding alternative milk suppliers did not significantly influence the type of coordination mechanism used. But the negative marginal effect indicated that difficulties in searching and getting alternative milk suppliers were likely to increase the likelihood of using spot market contracts and written contracts. Higher buyer availability on the other hand were likely to increase the likelihood that verbal contracts would be used in the transactions.

The time required to sell milk had a significant influence on the probability of using spot market contracts and verbal contracts but did not influence the use of written contracts. Longer hours to sell milk increased the probability that the transaction would be carried out using spot market contracts with a marginal effect of 0.10. On the other hand, shorter milk sale times increased the likelihood that the transaction would be carried out using verbal contracts. The marginal effect was -0.01. Longer milk sale times were also likely to increase the probability of using written contracts but the effect was not significant.

Preference for shorter credit periods significantly increased the probability of using spot market contracts with a marginal effect of -0.171. On the other hand, longer credit periods increased the probability that verbal contracts and written contracts would be used with marginal effects of 0.151 and 0.019, respectively. However, for written contracts, the effect

was not significant. Both verbal and written contracts provide some level of safeguards against default on milk sold on credit.

### 7.3 Coordination in retailer-buyer transactions

The results in table 7.5 below show that various types of transaction cost and socioeconomic characteristics were significant in influencing the type of coordination mechanisms used. The chi-square value of 105.599 was significant indicating that the model was appropriate in addressing the determinants of coordination mechanisms in retailer-buyer transactions. The pseudo-R squared value of 0.254 shows a moderate fit but the prediction level was moderately good at 76%. Despite the low pseudo  $R^2$ , the high number of significant individual variables eliminates possibility of multicollinearity being present in the explanatory variables.

Table 7.5 Multinomial Logit Model estimates for determinants of retailer-buyer coordination

	Description of variable	Pr(Y=1)	Pr(Y=2)
Constant		-1.838 (-1.132)	- (-3.129)
DISTRICT	Location of the retail outlets (1=Nakuru, 2= Nyandarua)	-1.532*** (-2.767)	-2.362** (-2.050)
RESPSEX	Gender of operator (Male/female)	0.624* (1.858)	1.935** (2.343)
RESPAGE2	Age of operator in years	-0.052*** (-2.717)	0.035 (1.108)
QTYBOT_1	Quantity of milk sold in liters per day	0.000 (-0.713)	0.001** (2.464)
DISTANCE	Distance between milk retail outlet and milk buyer	0.024*** (2.841)	0.017 (1.470)
CPRICE_1	Price of milk per liter in Kenya shillings	0.106** (2.100)	0.236** (1.892)
CREDITTI	Length of credit period (none, up to 2 weeks, monthly)	1.152*** (4.289)	2.246*** (4.494)
RETCRAIN	Type/length of supply chain ( direct consumers, processors)	0.248 (0.770)	1.331* (1.796)

N= 278; Chi-square = 105.599\*\*\*; Pseudo R squared = 25.4%; percentage correctly predicted =76%. \*\*\*

Significant at 1%, \*\* 5% and \*10%

Source: Survey Results, 2006.

Table 7.6 below presents the marginal effects of the determinants of coordination mechanisms in retailer-buyer transactions that are used for the interpretation of the model results. In the retailer-buyer transactions, the location of the retail outlet was significant in distinguishing between the use of spot market contracts and verbal contracts. Being located in Nyandarua district increased the likelihood of using spot market contracts. The marginal effect of Nyandarua district for spot market contracts was 0.260. Being located in Nakuru district on the other hand significantly increased the likelihood that verbal and written contracts would

be used in the retailers' transactions with buyers, with a marginal effect of -0.238. The marginal effect of Nakuru district for verbal contracts was significant with a marginal effect of -0.238. However, location had no effect on the use of written contracts. Thus for all transactions in the supply chain, operators in Nyandarua district were more likely to use spot market contracts while operators in Nakuru district were more likely to use relational based contracting.

Gender of the retail operator also had a significant influence on the kind of coordination mechanisms used except for written contracts where its influence was not significant. Being a male retail operator increased the probability that the transaction would be carried out under spot market contracts (marginal effect of -0.114). Being a female retail operator on the other hand increased the likelihood that the transactions would be carried out using verbal contracts with a marginal effect of 0.095. The effect of gender on the type of coordination mechanism used is similar previous findings in retailer-supplier transactions.

Table 7.6 Marginal effects of explanatory variables on the probability of coordination choice retailer-buyer coordination

Description of variable		Spot market	Verbal contracts	Written contracts
Constant		0.401 (1.499)	-0.264 (-1.019)	-0.137* (-1.760)
DISTRICT	Location of the retail outlets (1=Nakuru, 2=Nyandarua)	0.260*** (2.980)	-0.238*** (-2.794)	-0.021 (-1.375)
RESPSEX	Gender of operator (Male/female)	-0.114** (-2.074)	0.095* (1.774)	0.019 (1.556)
RESPAGE2	Age of operator in years	0.008*** (2.673)	-0.008*** (-2.885)	0.000 (1.137)
QTYBOT_1	Quantity of milk sold in liters	0.000 (0.663)	0.000 (-0.752)	0.000 (1.454)
DISTANCE	Distance between milk retail outlet and milk buyer	-0.004*** (-2.927)	0.004*** (2.892)	0.000 (0.930)
CPRICE_1	Price of milk per liter in Kenya shillings	-0.019** (-2.254)	0.016** (2.033)	0.002 (1.375)
CREDITTI	Length of credit period (none, up to 2 weeks, monthly)	-0.199*** (-4.460)	0.178*** (4.148)	0.021* (1.755)
RETCCHAIN	Type/length of supply chain ( direct consumers, processors)	-0.050 (-0.965)	0.037 (0.726)	0.013 (1.504)

\*\*\* Significant at 1%, \*\* 5% and \*10%

Source: Survey Results, 2006.



The age of the retail operator also played a significant role in influencing the use of spot market contracts as well as verbal contracts but not written contracts. Being a younger retail operator increased the probability that the transaction would be carried out using verbal contracts with a marginal effect of -0.008. The results also show that being an older retail operator increased the likelihood that the transaction would be carried out under spot market contracts with a marginal effect of 0.008. Age had no effect on the use of written contracts.

Shorter distances between retail operators and milk buyers significantly raised the probability of using spot market contracts (marginal effect of -0.004). On the other hand, longer distances significantly increased the probability of using verbal contracts in the transactions (marginal effect of 0.004). Therefore it appears that retail outlets that are likely to use spot market contracts are those that sell within their neighborhoods or vicinity. On the other hand, retail operators selling in distant markets are those that were likely to use verbal contracts to safeguard their business relations in the light of the distances involved.

Low milk prices increased the probability of using spot market contracts for the retail outlet operators (marginal effect of -0.019). The perishability of milk does allow for extensive negotiations to take place. This exerts pressure on prices received by the retail outlets. Higher milk selling prices significantly increased the probability of using verbal contracts (marginal effect of 0.016). In this case, buyers are willing to pay a higher price (over spot market prices) to safeguard continuous milk supplies.

The length of credit period was also significant in explaining the probability of using the coordination mechanisms. The marginal effect of the length of credit period for spot market contracts was -0.199 indicating that shorter credit periods increased the probability that spot market contracts would be used in the transactions. However, longer credit periods increased the probability that verbal and written contracts would be used in the transactions with marginal effects of 0.172 and 0.021, respectively. Similar results were observed for transactions between the retail outlets and their suppliers.

The type of retail chain was not significant in influencing any particular coordination mechanism. The coordination mechanisms were equally available to all retail supply chains whether to direct consumers or processing firms.

#### ***7.4 Determinants of supply chain performance in producer-buyer milk transactions***

Table 7.7 below presents ordered probit regression results for the determinants of supply chain performance in transactions between milk producers and buyers. The results show that the type of coordination mechanism used, experience of the operator, distance between the producers and the milk buyers, extent of the problem of lack of buyers and the length of credit period were not significant in influencing supply chain performance in transactions between milk producers and buyers. However, the positive coefficient for coordination mechanism implies that the possibility of higher performance was likely to be associated with verbal and written contracts than with spot market contracts. Similarly, the positive coefficient for experience shows that higher enterprise experience was most likely to be associated with better performance compared to lower experience. Furthermore, sales to distant buyers were more likely to be associated with higher levels of performance compared to nearer markets. On the other hand, the negative coefficients for buyer availability in the transactions indicates that lack of buyers increases the probability that performance in the supply chain would be lower and, for credit period, shorter credit periods (spot cash payments) were more likely to be associated with lower performance levels than transactions carried out under longer credit periods.

For the significant variables, longer times before selling milk negatively influenced the level of supply chain performance. Producers that were able to sell their milk in longer times were more likely to be dissatisfied in their transactions. Longer times before selling were also significantly associated with moderate levels of performance in producer transactions. On the other hand, shorter selling times were highly associated with high performance in the transactions. The result can be attributed to reduced transaction costs arising from buyer search uncertainties, reduced wastages and low bargaining costs in the market.

The milk selling price was significant and positively related to performance in producer-buyer transactions. Higher milk selling prices were likely to lead to higher supply chain performance. Lower selling prices were associated with low or moderate performance levels. This result is further corroborated by the results of other price related items such as presence or absence of pricing problems and price offers that were positively related to higher performance. Thus in general better or higher prices offers significantly increased the likelihood that milk producers would be satisfied in transactions with their partners and consequently the supply chain to which they belong were also likely to perform better.

Information flows and communications also played a vital role in influencing performance in producer-buyer transactions. Higher exchange of price and market information between milk producers and traders increased the likelihood that the milk producers would be satisfied in their transactions. This lack of information from traders was likely to lead to low or moderate performance compared to when adequate information is available. Information flows and communication on prices serves to assure producers that their milk is being sold under favorable terms. The result is also corroborated by the fact that higher information exchange takes place when relational based contracts rather than spot market based contracts are used.

In summary, results on determinants of supply chain performance indicate that the main factors contributing to higher performance in transactions between milk producers and buyers are better milk price offers, shorter milk selling times and, better information and communications with the buyers. Low values on these variables were likely to bring about low or moderate performance among farmers. Such low supply chain performance may consequently affect the entire supply chain to which the farmers belong.

Table 7.7: Ordered Probit parameter estimates for determinants of producer-buyer transaction performance

Variable	Parameter estimate	t-value
COORDINATION	.1801203786E-01	.165
EXPERIENCE	.7967351939E-02	1.211
MILK SALE TIME	-.4340082716E-01	-3.267***
DISTANCE	.4815763036E-02	.271
SELLING PRICE	.6087252426E-01	2.803***
(LOW PRICE PROBLEM 1-3)	.5858820749	7.481***
(BETTER PRICES OFFER 1-3)	.3765882850	3.999***
LACK OF BUYERS	-.4523021554E-01	-.725
CREDI PERIOD	-.1063985158	-1.264
TRADER INFO	.2473232485	3.623***
Threshold	.14850694**	14.864***

N=340;  $\chi^2=156.0962$ \*\*\*; cell counts y0 =30, y1= 174, y2=135; \*\*\* 1%, \*\* 5%, \* 10%  
Source: Survey Results, 2006.

### 7.5 Performance in retailer-supplier milk transactions

In transactions between milk retailers and their suppliers, the type of coordination mechanism used was significant in determining the level of performance achieved in transactions between

retailers and milk suppliers. The use of written contracts increased the possibility of attaining higher performance levels compared to the use of spot market contracts. Written contracts ensure steady supplies of milk products and reduce the uncertainties of having to search for suppliers each time they want to transact. Thus verbal and written contracts were positively associated with high satisfaction in transactions between the retail outlets and the milk suppliers. The results are presented in table 7.8 below.

The location of retail outlets also contributed to whether performance was likely to be high or low. Being located in Nakuru district was associated with higher satisfaction in supplier transactions compared to being located in Nyandarua district. Nakuru is associated with a better infrastructure, larger urban population relative to Nyandarua district and this could be a significant factor for the milk traders when sourcing for their milk. Relative to Nyandarua district, Nakuru faces lower transaction costs which are reflected in the performance levels attained by the agents.

Retailers that sourced their milk directly from other traders rather than directly from farmers were less likely to be satisfied in their transactions. Sourcing milk from the farms is difficult especially when producers are small in size and dispersed but is associated with lower farm gate prices and milk quality can be monitored compared to the case when traders are used as suppliers. However, direct milk supplies from farms is not able to guarantee high performance, a result that can be attributed to high transaction costs of trading with small and dispersed milk producers.

Results on the effect of milk purchase prices indicated that higher prices did not significantly influence high performance. However, low prices were significantly associated with low performance in transactions with milk suppliers. Since retailers thrive on margins between purchase and sales prices, this result seems to go against expectations. However, when looked at in conjunction with the previous result on sources of milk supplies, the result becomes clear. Accessing the lower farm gate milk prices for most retailers is associated with higher transaction costs as the traders would need to trade with a very large number of producers. Traders are therefore likely to forego the lower farm gate prices in favor transacting with other traders despite the higher milk purchase prices. It is also possible to establish long term trading relations with the few transaction partners which saves on transaction costs. Thus lower milk purchase prices do not necessarily lead to higher performance levels for the milk retailers.

Results on the effect of the importance of price offers in the transactions indicate that good milk price offers significantly increased the likelihood of the retailers being satisfied in their transactions with milk suppliers. The results imply that prices arrived at are likely to have been reached through negotiations with suppliers and thus are acceptable to them or in the case of transactions with the producers, the retailers are able to extract a favorable price from them due to their large sizes.

Table 7.8 Ordered Probit parameter estimates for determinants of retailer-supplier transaction performance

Variable	Parameter estimate	t-value
COORDINATION	.3324759033	2.264**
DISTRICT	-.5251692522	-2.691***
TYPE OF MILK SUPPLIER	-.6314276746	-2.888***
MILK PURCHASE PRICE	.5105358203E-01	1.649*
TRADER INFO	.2017831213	1.623*
NEIGHBORHOOD INFO	.1580122432	1.396
RELIABLE	.4642593592	2.279**
LATE PAYMENT PROBLEMS	.9428563372E-01	.998
BETTER PRICE OFFERS	.4597450687	3.546***
Threshold	1.935489705***	13.801***

N=256,  $\chi^2 = 74.70575$ \*\*\*, cell counts: y0 =27, y1= 138, y2=91 \*\*\* 1%, \*\* 5%, \* 10%

Source: Survey Results, 2006.

Information flows and communications were only marginally significant in influencing the level of satisfaction with retailer-supplier transactions. Higher information exchanges had the potential to lead to higher performance in transactions between the retailers and their milk suppliers. However, the effect of information from both traders and the neighborhoods were not statistically significant.

Supplier reliability also contributed to the observed level of performance in retailer-supplier transactions. Higher levels of reliability among milk suppliers increased the likelihood that performance would be higher. This result underscores the need to transact with a small set of partners who can be monitored or vetted for reliability compared to a large number of partners.

In summary the results show that the main factors that contribute to higher levels of satisfaction in retailer-supplier transactions are use of relational based coordination mechanisms (verbal to written contracts), better price offers, better market information flows and communications, and high supplier reliability. On the other hand, retailers were not satisfied with direct supplies of milk from the farms. Retailers in Nakuru were also not satisfied in their transactions with milk suppliers.

### **7.6 Performance in retailer-buyer milk transactions**

Table 7.9 below shows probit results for the determinants of performance in retailer-buyer transactions. Performance was measured on two-point scale; low performance and high performance, necessitating the use of a binary probit model according to whether the retailers were satisfied or not in transactions with their partners.

Reliability of buyers was important in influencing the level of satisfaction of milk retailers in their transactions with milk buyers. High buyer reliability therefore increased the possibility of higher satisfaction in retailer-buyer transactions. Reliability coupled with better or higher prices significantly increase the chances that the retailers would be satisfied in their transactions with milk buyers. Better information flows and communications with buyers were also positively associated with higher satisfaction in the retailer-buyer transactions. The presence of adequate numbers of buyers in the market also increased the chances of higher performance for the retailers.

The type of coordination mechanism did not significantly influence the level of performance but the positive coefficient implies that written contracts and verbal contracts were likely to be associated with high performance relative to spot market contracts. Similarly, absence of quality problems in the milk transactions increased the possibility of attaining higher performance levels in retailer-buyer transactions.

On the other hand, difficulties in finding alternative milk buyers were significantly associated with lower satisfaction in retailer-buyer transactions. This is a reflection of thin markets and high transaction costs that prevail in the market. Other factors that were not statistically significant but which had a negative effect on performance were transport problems and low educational levels, both of which were associated with low satisfaction levels in the retailer-buyer transactions.

Table 7.9: Probit parameter estimates for determinants of retailer-buyer transaction performance

Variable	Parameter estimate	t-value
COORDINATION	.2194394777	1.370
RELIABLE BUYER	.4337364493	1.985**
BETTER PRICE OFFERS	.5142616726	2.752***
EASE OF GETTING ALTERNATIVE BUYERS	-.3765049414	-1.646*
TRADER INFO	.2188633291	1.673*
TRANSPORT PROBLEMS	-.6350597871E-01	-.328
LACK OF BUYERS	.3415152379	1.676*
MILK QUALITY PROBLEMS	.2051858289	1.036
LOW PRICES	.8633960018	3.698***
DISTANCE	-.1779919575E-02	-.531
MILK SALE PRICE	.7931179265E-01	3.172***
EDUCATION LEVEL	-.6971414959E-02	-.210

N=278,  $\chi^2 = 76.67823$ \*\*\*, Hosmer-Lemeshow chi-squared = 6.62311, P-value = .57779, McFaden = .20803, cell counts: y0 = 105, y1 = 173, \*\*\* 1%, \*\* 5%, \* 10%  
Source: Survey Results, 2006.

## CHAPTER 8

### SUMMARY AND IMPLICATIONS FOR POLICY

The chapter is organized as follows. Section 8.1 presents a summary of the major findings in the study. Section 8.2 discusses the implications of the study for industry and policy in light of the findings and section 8.3 suggests areas for further research in light of the changes occurring in the dairy industry in Kenya.

#### **8.1 Summary**

The study has investigated two main issues among the market participating agents in the Kenyan milk supply chains. The first issue was to identify and evaluate the determinants of coordination mechanisms used in the Kenyan fresh milk supply chains. The second was to identify and evaluate the determinants of supply chain performance in the milk supply chains. The issues were investigated for transactions between milk producers and their buyers, between retail outlets and their suppliers, and between the retail outlets and their buyers. Coordination was defined by the kind of contracts used in transactions between the sellers and the buyers of milk. Three types of coordination mechanisms were identified in the milk supply chains; spot market based contracts, verbal contracts and written contracts. On the other hand, supply chain performance was defined by the extent to which the supply chain partners were satisfied with key aspects of their transactions with their partners and was measured on likert type scales.

To investigate the two issues, primary data was collected on commercial dairy activities from two districts in Kenya, Nakuru and Nyandarua districts. The data collected comprised of the agents' socioeconomic characteristics, farm/firm specific factors, transaction cost characteristics and performance related aspects such as prices, milk quantities, milk quality, information flows and communications, and transaction partner reputation and trustworthiness. The data was collected using questionnaires that were personally administered to milk producers and traders in the two districts between April and September 2005. Two econometric models were applied to analyze the collected data. A multinomial logit model was applied to analyze the determinants of coordination mechanisms while an ordered probit model was applied to analyze data for determinants of supply chain performance. Both models were run in LIMDEP™ econometric software. Additional descriptive analyses were carried in SPSS™ statistical software.



### **Determinants of coordination mechanisms**

The results of multinomial logit model showed that in all transactions between the milk sellers and buyers, agents in Nakuru district favored employing verbal and written contracts but their counterparts in Nyandarua district were more disposed to using spot market contracts. Socioeconomic characteristics however had no influence on the kind of governance mode used by the producers except for enterprise experience. Enterprise experience was significant in explaining the use of verbal contracts only in producer-buyer transactions. The role of gender was prominent in the traders' transactions with the milk suppliers and milk buyers. Male retail operators were likely to use spot market contracts while their female counterparts were disposed to using verbal and written contracts. The age of the operator also played a role in transactions between milk retailers and buyers such that older retail operators were inclined to use spot market contracts while younger retail operators were more likely to use verbal and written contracts.

The results also show that the three components of transaction costs (information and market search, negotiation and monitoring costs) were significant in explaining the kind of coordination mechanisms employed. In all the three transaction types, the length of credit period played a significant role in determining the kind of coordination mechanisms used. Short credit periods favored use of spot market contracts while long credit periods increased the likelihood that verbal and written contracts would be used, which shows the importance of monitoring and enforcement costs in the milk transactions. Monitoring costs were further underlined by the importance attached to legal contracts in producers' transactions with their buyers. Legal contracts were not significant in trader transactions.

Market and information search problems were exemplified in various ways in the milk transactions. In producer-buyer transactions, producers that did not have adequate market information had a high probability of using spot market contracts while those that had access to more information were more likely to use verbal and written contracts. On the other hand, the effect of information on the type of coordination mechanisms in retailer-supplier transactions depended on the type of information source. Two sources of price information were significant in the retailer-supplier transactions. Information from traders increased the likelihood of using relational based coordination mechanisms while government information sources increased the likelihood of using spot market contracts in the transactions. The effect of market information on retailer-buyer transactions was not significant.

Further indicators of market search costs were reflected in distances and times required to reach the buyers or sellers. Distance to market was significant in influencing the use of written contracts in transactions between the producers and the buyers. Longer distances increased the likelihood that written contracts would be used with similar results being reflected in retailer-buyer transactions. However, in retailer-supplier transactions, the most important component was the time required to reach the milk suppliers. Longer times to reach suppliers were associated with spot market contracts while shorter times were associated with verbal and written contracts.

The results also show that more negotiation costs were present in producer's transactions with the buyers. One measure of the negotiation costs was prices received or paid for the milk. In producer-buyer transactions, low prices were associated with verbal and written contracts while high prices were associated with spot market contracts. On the other hand, in transactions between retailers and buyers, low prices were associated with spot market contracts and high prices with verbal and written contracts. The lower spot market prices are a result of the competition in the retail markets where buyers have many outlets to choose from. In this case, retailers are price takers with little influence on the prices consumers pay. However, the retailers seem to be able to negotiate with processing firms and other buyers for favorable prices which may be attributed to the size of their operations.

Buyer/supplier availability was important in transactions between producers and their buyers and between retailers and their milk suppliers. In both cases, low buyer/supplier availability increased the likelihood that spot market contracts would be used while the presence of an adequate number of buyers or suppliers increased the probability that verbal and written contracts would be used in the transactions. The significance of buyer availability implies that producers are compelled to transact in open markets with the implication that the anxiety to sell their milk as fast as possible denies them bargaining strength in the market. Sales in the open markets therefore prevail in the absence of adequate numbers of buyers, and in retailer-supplier transactions, when low supplier unreliability and lack of personal relations among the transacting parties prevail in the transactions. Another important factor in producers' and retailers' transactions with their buyers and suppliers is the time needed to sell the milk which indicates that shorter times to sell milk were associated with spot market contracts while longer times to sell were associated with verbal and written contracts. This finding reinforces the results on lack of buyers and the urgency to sell milk that characterizes the use of spot market contracts and consequently contributes to the low bargaining power (especially) among the milk producers. A summary of these results is presented in table 8.1 below

Table 8.1 Determinants of coordination mechanisms in the milk supply chains

Factor	Spot market contracts	Verbal contracts	Written contracts
Location	Nyandarua	Nakuru	Nakuru
Gender	Males	Females	Females
Age	Older	Younger	Younger
Experience	Low	High	Not significant
Trader Information sources	Low	High	High
Government information sources	High	Low	Low
Distance to partners	Short	Long	Long
Time to reach market	Long	Short	Short
Time to sell milk	Long	Short	Not significant
Prices of milk	Lower for suppliers, high for producers	High	Lower for producers, high for retailers
Reliability/relations	Low	High	High
Buyer availability	Low	High	Not significant
Length of credit period	Low	High	High
Importance of legal contracts	Low	High	High

Source: Survey Results, 2006.

### Determinants of supply chain performance

The ordered probit model results show that socioeconomic characteristics did not significantly influence performance in the fresh milk supply chains at both producer and retailer stages of the milk supply chain. But one firm specific factor, location of firm, was significant in the traders' transactions with their milk suppliers. Traders in Nyandarua district appear to experience difficulties in getting milk supplies and are thus less satisfied in their transactions. The difficulties in milk supplies in Nyandarua district could be attributed to the prevalence of higher transaction costs arising from thin markets and infrastructural problems. Location did not have a significant influence on performance in producer-buyer and retailer-buyer transactions. Another significant firm specific factor in the retailer-supplier transactions was the type of milk supplier. Milk supplies from other traders rather than from farmers led to lower performance levels, a result attributed to high purchase prices and quality problems, however, farm supplies did not guarantee higher performance possibly due to the higher transaction costs associated with transacting with individual farmers.

The type of coordination mechanism used had a significant influence on the performance of retailer-supplier transactions but not between producers and their buyers or retailers and their buyers. However, in all cases, coordination mechanisms were positive in effect implying that there was possibility of higher performance with respect to verbal and written contracts. Use of spot market contracts was likely to lead to lower satisfaction levels than use of verbal and written contracts.

Transaction cost characteristics were significant at all stages of the fresh milk supply chain. The main transaction cost characteristics influencing the level of performance at the producer stage of the supply chain were mainly negotiation cost factors such as milk selling prices and the length of time taken to sell the milk and information and market search factors (information sources from traders). The results were also mirrored in retailer-supplier transactions and retailer-buyer transactions, where similar factors were significant determinants of supply chain performance in the milk transactions. Monitoring cost related factors did not play a significant role in the producer-buyer performance but the presence of partner reliability was an important safeguard in selecting the kind of transaction partners so as to minimize the possibility of opportunism.

## ***8.2 Implications of the study for policy***

### **Changing institutional set up and liberalization**

The changing institutional set up in the agricultural sectors in most developing countries does not call for widespread and direct state interventions in industries that have been recently liberalized. However, this does not imply that the government has no role to play in these industries. The challenge facing governments in developing countries is in ensuring that the benefits of institutional changes accrue to the largest portion of its populace, rather than to a few individuals. In the agricultural sector, consumers and producers are the two major groups of interest and the effects of the institutional changes should be seen in terms of how they affect the two groups. Furthermore, the sustainability of the industries depends on how satisfied the consumers and producers are with the changes. Consumers' interest lies in being able to access agricultural products at affordable prices, that is, getting value for their limited resources. For the producers, it is in being able to proportionally share in the benefits accruing from their activities rather than all the rents accruing to a few agents in the industry. This study has important implications for the two groups and on the sustainability of the benefits accruing from the liberalization of the dairy industry and in extension, the entire agricultural sector.

The implications of the institutional changes on coordination in the milk industry can be looked at from the benefit-cost point of view. In moving from the single processing firm in the pre-liberalization period, to the current regime where the number of participants in the milk supply chain has increased tremendously, several points arise. First and foremost, the large number of processing firms that came up after liberalization provided milk producers with a chance to exercise their choice over who to trade with in order to maximize their net

benefits. This benefit of choice however seems to be limited to a few regions while other regions are yet to experience the benefits (Nyandarua district is an example here). Despite the fact that Nyandarua district is one of the highest milk producing districts in the country, farmers have not benefited much from the changes due to lack of milk processing firms in the district. Empirical results have shown that when producers are faced with lack of adequate buyers, low market information, and the urgency to sell the milk, they resort to using spot market contracts. The results on performance also indicated that producers taking short times to sell are likely to perform better in the market. Since most of the producers who use spot market contracts come from Nyandarua district, it can be inferred that the performance of milk producers in the district is low and that the exposure to the open market transactions has not benefited them due to limited bargaining power. Therefore prevalence of spot market contracts in Nyandarua district is an indicator of institutional and organizational failure rather than market efficiency. These failures have been detrimental to both milk producers and consumers of processed milk.

### **Farmer cooperative organizations**

The nature of the production system that consists of many small producers means that transaction costs are relevant to them. Their small sizes cannot allow them individually and separately to reap economies of scale or impact favorably on the market. Their semi commercial nature further implies that productivity is low. It is costly for the producers to search for markets for their products. Transaction costs are therefore relevant to these producers. One way of addressing the problem of transaction costs is through farmer cooperative organizations.

Institutions in the dairy industry are undergoing changes. The dominant organizations before liberalization were farmer cooperative organizations. But a large number of the cooperatives have since failed and therefore deliberate steps are required to ensure that more cooperative organizations and institutions are set up in the agricultural supply chains. In some areas farmer groups are being formed as alternatives to cooperative societies. Brokers and agents are also emerging in the dairy industry, buying milk from producers and selling to processing firms and or other traders or consumers. Brokers and agents are trying to fill the gaps left by cooperative societies. Smaller traders (mobile traders) have also come up to deliver milk from the farms directly to the consumers, especially in the urban areas. The main difference between these upcoming modes of organizations and farmer cooperatives is that they are private enterprises. However, they play an important role in directing the farmers' milk to the

market. Until farmers themselves come up with their own organizations to use in organizing their production for the market, the benefits in the milk supply chain will continue accruing to the middlemen while farmers receive only marginal benefits for their milk. Empirical results indicated that it will be difficult for farmers to have an impact in the market or endear themselves to partners in the supply chains when acting singly. Middlemen and other retail outlet operators prefer to transact directly with farmers due to favorable farm gate prices and ability to monitor milk quality, however, direct farm supplies was not able to significantly lead to high performance levels.

Cooperatives are supposed to provide small producers with a means of reducing transaction costs they face through substituting individual information search, quality control, market search and monitoring for the group activity. Transport costs can be lower through collective action. The problem of small size productions is reduced by accumulating their quantities into one unit. Cooperatives can also guarantee a more or less continuous supply of products for other chain members. The failure of these member owned organizations further raises transaction and other costs that the participants (especially producers) face in the market. With the failure of cooperatives, horizontal co-ordination through collection and transportation is lost for the producers. The results have indicated that retail operators sourcing their milk directly from farmers were more likely to be satisfied or likely to perform better compared to those who got their milk from other traders. Transaction costs were higher for direct farm supplies since direct farm supplies involve searching for and transacting with very many small farmers individually but compensated with favorable farm gate prices. In such a case, the transaction costs faced by retailers outweigh the benefits arising from the lower farm gate prices. Cooperative organizations can therefore play a vital role in reducing the transaction costs (especially the bargaining costs) to ensure that they are not taken advantage of due to their small sizes.

The results have consequences for the policy makers in charge of the cooperative movement to assist in providing guidelines and education to farmers on the importance of cooperatives and their role in the milk supply chains and essentially in identifying the causes for the failure of farmer cooperative organizations. Cooperatives enable farmers to increase their role in the milk supply chain and share in the rents available in the market with their consumers through increased bargaining power in the market. Cooperatives increase the possibility of reducing transaction costs for the producers and thus making them attractive partners to transact with in the milk supply chain. Cooperative organizations should be strengthened to assist the small scale farmers to achieve their goals.

### **Importance of stable contractual arrangements**

The study also has implications for the sustainability of the dairy enterprises in the country especially the competitiveness of the milk supply chains. There is need to come up with successful milk supply chains that are able to compete against each other in the market. Farmers have to identify which supply chain partners they can link up with in order to deliver affordable and quality milk products to consumers. This is due to the realization that full commercialization of the dairy industry improves milk producers' production methods hence making them more efficient and competitive.

For sustainability and competitiveness to be achieved, the consumer has to be taken into consideration. Milk prices must be within what the consumer can afford otherwise farmers will not find it worthwhile to invest if they can not sell their milk. The implications are that supply chain members have to add value in the supply chains for the benefit of the consumers. Unnecessary costs must be eliminated in the supply chains. This requires foregoing short term gains to establish supply chains that can bring value to the consumers. Close working relations with supply chain partners is necessary to achieve competitiveness in the supply chains. In this regard, the use of explicit contracts and relational based contracting will be necessary coupled with information exchange. The results indicated that quantities of milk handled under written contracts were generally higher than under alternative coordination mechanisms. Performance results also showed that agents using relational based contracting were more likely to be satisfied in their transactions with their partners than those relying on the spot market contracts to transact their milk. Verbal contracts are an important component of the milk transactions, however, as the results demonstrate, verbal contracts are not adequate to guarantee the producers and traders full sale of their milk. They are also restricted within the locality of the agents. It therefore means that the highest potential for all participants lies in being able to find markets beyond their localities where verbal contracts may no longer be effective. Written contracts are therefore likely to play a crucial role to safeguard all the agents involved. Use of written contracts should make it easier for the farmers to increase their investments in their enterprises and consequently benefit from their commercial activities.

### **Processing firms and milk prices**

The importance of the processing firms in the milk supply chain is that they ensure that consumers are able to access milk when they need it, and that farmers are given chance to

expand their production due to the large quantities of milk the firms are able to buy. Though the number of processing firms was initially high, some are now inactive and concentration is going on in the industry. Some market power is thus exercised over the small producers in matters regarding quality and quantity of the milk. However, the large number of small producers may make it difficult to carry out monitoring activities due to the high transaction costs involved. Buying in bulk or in larger quantities and regularity and stability of delivery is of interest for the processors and other buyers. The prices paid for milk deliveries reflect the differences in transaction costs, and consequently their performance differentials.

The main challenges facing processing firms in the milk supply chain is utilization of their installed processing capacity. This problem is compounded by the fact that the prices of processed milk are usually beyond the reach of most consumers. Processing firms thus incur high fixed costs which are passed over to consumers further shrinking the consumer base for processed milk. It is necessary for the processing firms to increase efficiency in milk processing so as to keep the costs and prices to consumers low to stimulate more consumption of milk. This will further improve capacity utilization and lead to further price reductions. Uptake of milk from producers will also increase. Thus the findings have implications for the management of the private firms involved in the dairy industry to increase their efficiency as they are necessary for the sustainability and full commercialization of the dairy industry.

### **Information flows in the supply chains**

The study identifies two major sources of market information and their importance in affecting the amount of transaction costs in the milk supply chains: public and private information sources. The study shows that agents that did not have advance price information sold their milk using spot markets contracts while those who had the information entered into verbal and written contracts. For the farmers, the source of market information was not important rather the availability of the information. But for the traders, the effect of the information depended on the source of the information. The information needs of producers and traders are not exactly the same. Farmers prefer information that is generally available irrespective of the sources. For the traders, information exchange among them led to more use of verbal and written contracts while availability of public market information was likely to increase use of spot market contracts.

Despite the differences in the information sources, public information is necessary to make the market more transparent. The consequence is that public information sources improve the market condition for all participants while private information is used to benefit only a few



agents in the market. Furthermore, higher information availability was positively associated with satisfaction in transactions with their partners. The results also point to the necessity of setting up market information bureaus to assist market participants make informed decisions in their transactions. This recommendation can be supported by the result that price knowledge was more likely to lead to better contracts being crafted thus reducing opportunistic tendencies among the supply chain partners. In this case, the role of the Kenya Dairy Board should be re-evaluated to incorporate dairy information dissemination within the dairy industry.

### **Infrastructural facilities and other public goods**

The information problems facing the farmers and traders are also as a result of inability to access markets due to poor transport infrastructure. Poor infrastructure is represented by poor road conditions and lack of proper means of transport. This implies that distances may not necessarily be long but that it takes a long time to get to the market. As such, agents are not able to access the market on time. A remedy for this problem can be provided by the government undertaking policies aimed at improving access to milk producing areas. This will ensure faster access to the markets and consequently access the necessary information for their transactions. Information costs are a vital component of fixed transaction costs that can determine whether one participates in the market or not or whether a particular coordination mechanism is optimal or not. Thus improvement of transport infrastructure and provision of market information are vital interventions in reducing both the fixed transaction costs and the subsequent variable transaction costs.

The interventions are based on the observation that the nature of the transaction costs faced keep changing and can be affected by the supply chain partners or the government's policies regarding efforts to reduce the transaction costs. Such policies and efforts include infrastructural reforms (such as road construction, provision of market information), and mechanisms to improve legal redress that may arise from the contractual obligations of the partners. This is basically in the provision of public goods that benefit all the participants in the industry. Thus state can play an important role by providing or improving the institutional environment and physical infrastructural facilities, which are public goods. This should be able to address a number of transaction costs related to information and market search and monitoring and enforcement costs. The number and types of transaction costs are likely to be reduced for the benefit of the dairy industry and the agricultural sector as a whole.

### **Government participation in business**

There have been efforts by the government to participate in the dairy sector especially in the processing of milk. However, the participation has been in terms of being one of the processing firms on commercial basis and to act as a market leader to stabilize the industry. Such efforts have not hindered the private sectors' participation, as long as it is run purely on commercial basis. The reason for the re-entry into the market was that the market was facing problems following the failure of the sole milk processing firm after liberalization. Farmers had limited outlets for their milk and the need to correct this situation led to revamping of the Kenya Cooperative Creameries into a new firm New KCC Ltd, now a parastatal body. The government's investment in the firm should help stabilize the milk market and provide chance for the farmers to come up with appropriate organizational forms that they can use to negotiate with other supply chain members for their benefit. However, the government should, with time, reduce its ownership in the firm in favor of private ownership (e.g. issue shares to the public and farmers) to minimize political interference in its management and in its commercial orientation.

### **8.3 Directions for further research**

The role of information in both the kind of coordination mechanisms used and on the performance of the supply chains has been shown to be significant. However, information comes in different types. Private information supports formation of relational based contracting modes to the exclusion of the market. Government or public sources of information encourages not only the development of market based transactions but also provides a basis for coming up with better relational based contracts especially written contracts. There is need to design information systems that can serve the various parties in the supply chains. In this regard, there is need to evaluate the relative merits and feasibility of the various information sources and their implications for the participants in the milk supply chain. It is also important to design how this information can be disseminated in the industry and the costs that are likely to arise from the provision of the services and who is going to pay for it. This will also help place the Kenya Dairy Board's functions in perspective and the possibility of the organization playing the role of information dissemination in the industry.

An evaluation of transaction costs and coordination at the production and trader/retailer levels of the supply chain has been investigated. Furthermore, some downstream members in the milk supply chain have been included in the study. For a holistic approach to the supply

chain, other agents need to be incorporated in future studies. The agents include milk processing firms and input suppliers as they play an equally vital role in the industry. Specific interest is on the nature of transaction costs that the processing firms and input suppliers face and how the costs affect their performance in order to minimize or eliminate them to create value in the entire supply chain for the benefit of consumers. This will enable the alignment of the supply chains for maximum effect in serving the consumers and benefiting the agents as well.

Performance measurement has been arrived at based on subjective evaluations of the extent of satisfaction with key aspects of the supply chain transactions. A further step in this measurement process is to incorporate more quantitative supply chain performance measures in the analysis. Quantitative supply chain performance measures are still developing and it would be of interest to show how close or divergent the quantitative supply chain performance measures are from the qualitative supply chain performance measures in the milk supply chains.

The study has focused on small and medium scale milk producers as they constitute the majority of the milk producers. It would be of interest to compare the transaction costs faced by the small and medium scale producers on the one hand and the large scale milk producers on the other. This will permit a full appreciation of the differences or similarities in the milk production enterprises in the country that may be valuable for policy making purposes and improvement of the commercial orientation of the milk producers.

Cooperative societies and farmer groups have been recommended as some of the important institutions that can assist the milk producers in increasing their bargaining power in their supply chains and in the reduction of the myriad transaction costs facing the small and medium scale commercial milk producers. An evaluation of performance of farmer cooperative organizations vis-à-vis other private intermediaries (middlemen) may help identify areas of weaknesses for the farmer organizations and help them to improve their services.

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## References

## Appendices

### Appendix 1: Questionnaires for Milk Producers

Questionnaire Number

Enumerator \_\_\_\_\_

Sub-location \_\_\_\_\_

Division \_\_\_\_\_

District \_\_\_\_\_

Please answer the following questions to the best of your knowledge.

1. When did you begin keeping dairy animals and with how many cows? Please state the year and the number of cows.

Year  Number of cows

2. What kind of milk products do you currently handle? Please provide also information about the milk products as requested in the table.

Product	Average quantity per day	Units of measure	Do you sell product? Yes/No	How long it takes to sell product	Quantity able to sell before expiry or spoilage
Fresh milk					
Yoghurt					
Cheese					
Mala/fermented					
Other (specify)					

3. a) What type of milk cows do you keep? Please tick the appropriate ones and also indicate their numbers.

Type	Number
1) Indigenous cows	<input type="text"/>
2) Cross breeds	<input type="text"/>
3) Pure breeds (Grade)	<input type="text"/>

- b) Which one of the following grazing systems best describes your dairy operation? Please tick as appropriate?

1) Zero grazing system	<input type="checkbox"/>
2) Open grazing without supplements	<input type="checkbox"/>
3) Open grazing with supplements	<input type="checkbox"/>
4) Tethering	<input type="checkbox"/>
5) Other, specify	<input type="checkbox"/>

4. a. How much milk do you currently produce per day on average? Please state also the units of measure.

Highest amount  per day      Lowest amount produced

Appendices

- b) What quantity of the milk is consumed by your family per day on average? *Please fill in the box the amount and the units of measure used.*

Amount  units of measure

- b. Considering the amount of milk in the question above (question 4 above), how does this amount compare to what you produced in the previous year and what you expect in the coming year? *Please tick as applicable.*

Compared to this year,  
last year was ....

Next year is expected to be .....

More

More

The same

The same

Less

Less

5. a) What is the size of your dairy related workforce? *Please state their number.*

Permanent \_\_\_\_\_

Casual \_\_\_\_\_

Family labor \_\_\_\_\_

- b) What major costs do you usually incur in your milk operations? *Please provide also information about the costs by filling in and ticking as applicable.*

Cost component	Quantity/amount	Frequency	Trend over last five years		
			Increasing	Constant	Decreasing
Wages					
Power					
Fuel					
Water					
Forages and hay					
Veterinary and drugs					
Feed/concentrates					
Transport costs					
Others ( <i>specify</i> )					

(NB: frequency = daily, weekly, bi-weekly or monthly)

6. Who are the main buyers of your milk products? *Please provide also the following information about them in the table below.*

Type of buyer	Quantity bought	Units	Distance in km	Average time	Transport means	Transport costs	Who delivers/collects	Commissions
Neighbors								X
Hotels								
Milk bar/kiosk								
Cooperatives								
Farmer groups								
Processors								
Mobile traders								
Brokers								
Others( <i>specify</i> )								

Appendices

7. What reasons explain why you trade with your current buyers? *Please tick as applicable.*

**a) Neighbors**

Reasons	True	Partly true	Not true
Out of habit			
Reliability			
Better credit terms			
Better prices			
Cost of finding a new buyer is high			
Personal relations and contacts			
Presence of legal contracts			
Others ( <i>specify</i> )			

**b) Hotels**

Reasons	True	Partly true	Not true
Out of habit			
Reliability			
Better credit terms			
Better prices			
Cost of finding a new buyer is high			
Personal relations and contacts			
Presence of legal contracts			
Others ( <i>specify</i> )			

**c) Milk bars/kiosk**

Reasons	True	Partly true	Not true
Out of habit			
Reliability			
Better credit terms			
Better prices			
Cost of finding a new buyer is high			
Personal relations and contacts			
Presence of legal contracts			
Others ( <i>specify</i> )			

**c) Cooperatives**

Reasons	True	Partly true	Not true
Out of habit			
Reliability			
Better credit terms			
Better prices			
Cost of finding a new buyer is high			
Personal relations and contacts			
Presence of legal contracts			
Others ( <i>specify</i> )			

**d) Processors**

Reasons	True	Partly true	Not true
Out of habit			
Reliability			
Better credit terms			
Better prices			
Cost of finding a new buyer is high			
Personal relations and contacts			
Presence of legal contracts			
Others ( <i>specify</i> )			

**e) Mobile traders**

Reasons	True	Partly true	Not true
Out of habit			
Reliability			
Better credit terms			
Better prices			
Cost of finding a new buyer is high			
Personal relations and contacts			
Presence of legal contracts			
Others ( <i>specify</i> )			

**f) Others, please specify**

Reasons	True	Partly true	Not true
Out of habit			
Reliability			
Better credit terms			
Better prices			
Cost of finding a new buyer is high			
Personal relations and contacts			
Presence of legal contracts			
Others ( <i>specify</i> )			

8. Which of the following best describes the buying frequency of your customers? *Please indicate by ticking as applicable below.*

Type of buyer	Regular buyer	Irregular buyer
Neighbors		
Hotels		
Milk bar/kiosk		
Cooperatives		
Farmer groups		
Processors		
Mobile traders		
Brokers		
Others(specify)		

Appendices

9. Which of the following best captures your knowledge of milk prices in the market? *Please tick one for each of your buyers?*

Type of buyer	I always know prices in advance	I sometimes know prices in advance	I hardly know prices in advance	Other please specify
Neighbors				
Hotels				
Milk bar/kiosk				
Cooperatives				
Farmer groups				
Processors				
Mobile traders				
Brokers				
Others(specify)				

10. How useful are each of the following as sources of market price information for your milk? *Please tick as appropriate using the scale: 1 = not useful 2= a little useful 3= useful 4= very useful*

	1	2	3	4
<b>Information source</b>	<b>Not useful</b>	<b>A little useful</b>	<b>useful</b>	<b>Very useful</b>
From neighbors and other producers				
From traders and buyers				
From government organizations				
Through mass media (radio, TV, Newspapers)				
Through negotiations				
Others, <i>please specify</i>				

11. In the table below you are requested to provide information on your buyers by filling as appropriate in the table.

Type of buyer	Price	units	Price over last one year		Quantity sold under each method of payment			
			low	High	cash	In kind	Credit sales	
							Length of credit	Quantity paid within credit period
Neighbors								
Hotels								
Milk bar/kiosk								
Cooperatives								
Farmer groups								
Processors								
Mobile traders								
Brokers								
Others( <i>specify</i> )								

Appendices

12. For each of the buyers of your milk, what kind of selling arrangements do you use? *Please provide also information about the agreements by filling in the table below.*

Type of buyer	Quantity sold under each type of selling agreement				
	No agreements	Verbal agreements		Written agreements	
	Quantity	Duration of agreements	Quantity	Duration of agreement	Quantity
Neighbors					
Hotels					
Milk bar/kiosk					
Cooperatives					
Farmer groups					
Processors					
Mobile traders					
Brokers					
Others( <i>specify</i> )					

13. If you were to increase the quantity of milk produced for example by 50% (half), how much would you be able to sell successfully) *Please tick one.*

- I would be able to sell all of it
- I would be able to sell part of it
- I would not be able to sell at all
- I don't know

14. Please indicate by ticking how often you experienced shortages and excess milk production in your enterprise over the last year.

	Always	Sometimes	Rarely	Never
Shortages	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Excess supplies	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

15. How serious are each of the following problems in your trading with your buyers) *Please indicate the seriousness by ticking using a scale of 1- very serious, 2-serious, 3-moderate and 4- not a problem.*

	1	2	3	4
<b>Type of problem</b>	<b>Very serious</b>	<b>Serious</b>	<b>Moderate</b>	<b>Not a problem</b>
Milk is not collected				
Milk goes bad while being transported or handled				
There are not enough buyers in the market				
Water/chemicals are added to milk by buyers				
Our buyers fail to pay us on time				
Prices are sometimes too low				
Others, <i>please specify</i>				

Appendices

16. What quantity of your milk is wasted on average at each of the following points? *Please indicate also how frequent this problem occurs on average in a month by filling below.*

Point where loss occurs	Quantity lost or wasted	How frequent (times) problem occurs in a month
On farm during and after milking		
During transport		
During storage (spoilage)		
Failure to collect or deliver milk		
Others ( <i>please specify</i> )		

17. In cases of milk scarcity, how much milk are you normally able to offer each of your buyers on average? *Please tick as appropriate for each of your buyers.*

Type of buyer	Full share	Less than full share	None
Neighbors			
Hotels			
Milk bar/kiosk			
Cooperatives			
Farmer groups			
Processors			
Mobile traders			
Brokers			
Others( <i>specify</i> )			

18. In cases of excess milk production, what happens to the extra milk? *Please tick the appropriate ones from the list below.*

- Sell at reduced prices
- Use at home
- Find new buyers for it
- Convert into other milk products to sell later
- Dispose or give away free
- Others, (*please specify*)

19. What other arrangements would you prefer for your milk given your available resources and abilities? *Please tick the appropriate arrangement below.*

- I would prefer to increase amounts of milk I produce and sell
- I would prefer to produce less
- I would prefer no change
- Others, *please specify*



Appendices

20. Using a five point scale where 1 is very unsatisfied, 3 is neutral, and 5 is very satisfied, please indicate by ticking how satisfied you are with the following aspects of your relationships with the selected buyer(s) over the last 12 months.

**Neighbors**

	1	2	3	4	5
<b>Performance item</b>	<b>Very unsatisfied</b>	<b>Dissatisfied</b>	<b>Neither satisfied nor dissatisfied</b>	<b>Satisfied</b>	<b>Very satisfied</b>
Continuous milk purchases over the year					
Prices they pay for the milk					
Communication and information sharing					
Quality standards demanded by buyer					
Reputation of the buyer					
Trustworthiness of buyer					

**Hotels**

	1	2	3	4	5
<b>Performance item</b>	<b>Very unsatisfied</b>	<b>Dissatisfied</b>	<b>Neither satisfied nor dissatisfied</b>	<b>Satisfied</b>	<b>Very satisfied</b>
Continuous milk purchases over the year					
Prices they pay for the milk					
Communication and information sharing					
Quality standards demanded by buyer					
Reputation of the buyer					
Trustworthiness of buyer					

**Milk bars/kiosks**

	1	2	3	4	5
<b>Performance item</b>	<b>Very unsatisfied</b>	<b>Dissatisfied</b>	<b>Neither satisfied nor dissatisfied</b>	<b>Satisfied</b>	<b>Very satisfied</b>
Continuous milk purchases over the year					
Prices they pay for the milk					
Communication and information sharing					
Quality standards demanded by buyer					
Reputation of the buyer					
Trustworthiness of buyer					

**Cooperatives**

	1	2	3	4	5
<b>Performance item</b>	<b>Very unsatisfied</b>	<b>Dissatisfied</b>	<b>Neither satisfied nor dissatisfied</b>	<b>Satisfied</b>	<b>Very satisfied</b>
Continuous milk purchases over the year					
Prices they pay for the milk					
Communication and information sharing					
Quality standards demanded by buyer					
Reputation of the buyer					
Trustworthiness of buyer					

**Other farmer groups**

	1	2	3	4	5
<b>Performance item</b>	<b>Very unsatisfied</b>	<b>Dissatisfied</b>	<b>Neither satisfied nor dissatisfied</b>	<b>Satisfied</b>	<b>Very satisfied</b>
Continuous milk purchases over the year					
Prices they pay for the milk					
Communication and information sharing					
Quality standards demanded by buyer					
Reputation of the buyer					
Trustworthiness of buyer					

**Processors**

	1	2	3	4	5
<b>Performance item</b>	<b>Very unsatisfied</b>	<b>Dissatisfied</b>	<b>Neither satisfied nor dissatisfied</b>	<b>Satisfied</b>	<b>Very satisfied</b>
Continuous milk purchases over the year					
Prices they pay for the milk					
Communication and information sharing					
Quality standards demanded by buyer					
Reputation of the buyer					
Trustworthiness of buyer					

**Mobile traders**

	1	2	3	4	5
<b>Performance item</b>	<b>Very unsatisfied</b>	<b>Dissatisfied</b>	<b>Neither satisfied nor dissatisfied</b>	<b>Satisfied</b>	<b>Very satisfied</b>
Continuous milk purchases over the year					
Prices they pay for the milk					
Communication and information sharing					
Quality standards demanded by buyer					
Reputation of the buyer					
Trustworthiness of buyer					

**Brokers**

	1	2	3	4	5
<b>Performance item</b>	<b>Very unsatisfied</b>	<b>Dissatisfied</b>	<b>Neither satisfied nor dissatisfied</b>	<b>Satisfied</b>	<b>Very satisfied</b>
Continuous milk purchases over the year					
Prices they pay for the milk					
Communication and information sharing					
Quality standards demanded by buyer					
Reputation of the buyer					
Trustworthiness of buyer					

**Others, please specify**

	1	2	3	4	5
<b>Performance item</b>	<b>Very unsatisfied</b>	<b>Dissatisfied</b>	<b>Neither satisfied nor dissatisfied</b>	<b>Satisfied</b>	<b>Very satisfied</b>
Continuous milk purchases over the year					
Prices they pay for the milk					
Communication and information sharing					
Quality standards demanded by buyer					
Reputation of the buyer					
Trustworthiness of buyer					

**Please tell us more about yourself now by ticking one**

21. Sex of respondent (*please tick one*)

Male

Female

Appendices

22. Position in enterprise

Owner

Employee

Other, *please specify*

23. Year of birth

24. Your Highest Education level attained (please tick)

- |  |                                      |   |
|--|--------------------------------------|---|
| <input type="checkbox"/> None                            | <input type="checkbox"/> Class 1-4   | <input type="checkbox"/> Class 5-8      |
| <input type="checkbox"/> Form I-II                       | <input type="checkbox"/> Form III-IV | <input type="checkbox"/> A-level        |
| <input type="checkbox"/> College                         | <input type="checkbox"/> University  | <input type="checkbox"/> Adult literacy |
| <input type="checkbox"/> Other ( <i>please specify</i> ) |                                      |   |

Thanks a lot for your patience and responses

If there is any other information that you would like us to know about your operations, please feel free to express or write them in the space provided here.

**Appendix 2: Questionnaire for milk retail outlets**

Questionnaire Number

Field Researcher \_\_\_\_\_

Sub-location \_\_\_\_\_

Division \_\_\_\_\_

District \_\_\_\_\_

Please answer the following questions to the best of your knowledge.

1. When did you begin your milk operations? *Please state the year you began.*

2. In the table below, you are requested to provide information about the dairy products your firm trades in. *Please provide information about the products by filling in the table below.*

Milk product	Average quantity per day	Unit of measure	Price range		How long it takes to sell product	Quantity able to sell before expiry or spoilage
			Highest	Lowest		
Pasteurized milk						
Yoghurt						
UHT						
Fresh farm milk						
Ice cream						
Cheese						
Other (specify)						

3. What type of retail outlet do you operate?

- Type**
- a) Grocery shop
- b) Milk Bar/mini dairy
- c) Mobile trader
- d) Other (please specify)

Appendices

4.

a. How much milk do you currently handle per day on average? Please state also the units of measure.

Amount  per day units

b. Amount during peak season  low season

c. What is the maximum amount of milk you can handle in a day?

5. Considering the amount of milk in the question above (question 4 above), how does this amount compare to what you produced in the previous year and what you expect in the coming year? *Please tick as applicable.*

Compared to this year,  
last year was ....

Next year is expected to be .....

More

More

The same

The same

Less

Less

6.

a) What is the size of your dairy related workforce? *Please state their number.*

Permanent \_\_\_\_\_

Casual \_\_\_\_\_

Family labor \_\_\_\_\_

b) What major costs do you usually incur in your milk operations? *Please provide also information about the costs by filling in and ticking as applicable.*

Cost component	Quantity/amount	Frequency	Trend over last five years		
			Increasing	Constant	Decreasing
Wages					
Power					
Fuel					
Water					
Rent					
Licenses					
Packing costs					
Transport costs					
Others ( <i>specify</i> )					

(NB: frequency = daily, weekly, bi-weekly or monthly)

Appendices

7. a) Please specify in the following table who the main suppliers of your milk products are. *Please provide also information about them as requested in the table.*

Type of Supplier	No. of suppliers	Quantity bought	Units	Distance in km	Average time	Transport means	Transport costs	Who delivers/collects	Commissions
Individual farmers									
Cooperatives									
Other farmer groups									
Processors									
Hawkers									
Others, <i>please specify</i>									

b) Who are the main buyers of your milk products? *Please provide information about them in the table below.*

Type of buyer	No. of buyers	Quantity bought	Units	Distance in km	Average time	Transport means	Transport costs	Who delivers/collects	Other costs
Consumers									
Hotels									
Institutions (schools hospitals)									
Processors									
Others, <i>specify</i>									

8. a) What reasons explain why you trade with your current suppliers? *Please tick for each as appropriate.*

**a) Individual farmers**

Reasons	True	Partly true	Not true
Out of habit			
Reliability			
Better credit terms			
Better prices			
Cost of finding a new buyer is high			
Personal relations and contacts			
Presence of legal contracts			
Others ( <i>specify</i> )			

**b) Cooperatives**

Reasons	True	Partly true	Not true
Out of habit			
Reliability			
Better credit terms			
Better prices			
Cost of finding a new buyer is high			
Personal relations and contacts			
Presence of legal contracts			
Others ( <i>specify</i> )			

**c) Other farmer groups**

<b>Reasons</b>	True	Partly true	Not true
Out of habit			
Reliability			
Better credit terms			
Better prices			
Cost of finding a new buyer is high			
Personal relations and contacts			
Presence of legal contracts			
Others ( <i>specify</i> )			

**c) Processors**

<b>Reasons</b>	True	Partly true	Not true
Out of habit			
Reliability			
Better credit terms			
Better prices			
Cost of finding a new buyer is high			
Personal relations and contacts			
Presence of legal contracts			
Others ( <i>specify</i> )			

**d) Mobile traders**

<b>Reasons</b>	True	Partly true	Not true
Out of habit			
Reliability			
Better credit terms			
Better prices			
Cost of finding a new buyer is high			
Personal relations and contacts			
Presence of legal contracts			
Others ( <i>specify</i> )			

**e) Others, please specify**

<b>Reasons</b>	True	Partly true	Not true
Out of habit			
Reliability			
Better credit terms			
Better prices			
Cost of finding a new buyer is high			
Personal relations and contacts			
Presence of legal contracts			
Others ( <i>specify</i> )			



Appendices

b) What reasons explain why you trade with your current buyers? *Please tick for each as appropriate.*

**a) Consumers**

Reasons	True	Partly true	Not true
Out of habit			
Reliability			
Better credit terms			
Better prices			
Cost of finding a new buyer is high			
Personal relations and contacts			
Presence of legal contracts			
Others ( <i>specify</i> )			

**b) Hotels**

Reasons	True	Partly true	Not true
Out of habit			
Reliability			
Better credit terms			
Better prices			
Cost of finding a new buyer is high			
Personal relations and contacts			
Presence of legal contracts			
Others ( <i>specify</i> )			

**c) Institutions (Schools and Restaurants)**

Reasons	True	Partly true	Not true
Out of habit			
Reliability			
Better credit terms			
Better prices			
Cost of finding a new buyer is high			
Personal relations and contacts			
Presence of legal contracts			
Others ( <i>specify</i> )			

**c) Processors**

Reasons	True	Partly true	Not true
Out of habit			
Reliability			
Better credit terms			
Better prices			
Cost of finding a new buyer is high			
Personal relations and contacts			
Presence of legal contracts			
Others ( <i>specify</i> )			

**f) Others, please specify**

Reasons	True	Partly true	Not true
Out of habit			
Reliability			
Better credit terms			
Better prices			
Cost of finding a new buyer is high			
Personal relations and contacts			
Presence of legal contracts			
Others ( <i>specify</i> )			

9. a) Which of the following best describes the buying frequency of your customers? *Please indicate as applicable below.*

Type of buyer	Regular buyer	Irregular buyer
Consumers		
Hotels		
Institutions		
Processors		
Others( <i>specify</i> )		

b) How would you classify the frequency with which you transact with your suppliers? *Please indicate as applicable in the table below.*

Type of supplier	Regular buyer	Irregular buyer
Individual farmers		
Cooperatives		
Farmer groups		
Processors		
Mobile traders		
Others( <i>specify</i> )		

10.

b. Which of the following best captures your knowledge of milk prices in the market? *Please tick one for each of your buyers?*

Type of buyer	I always know prices in advance	I sometimes know prices in advance	I hardly know prices in advance	Other please specify
Consumers				
Hotels				
Institutions				
Processors				
Others( <i>specify</i> )				

Appendices

b) Which of the following best captures your knowledge of milk prices in the market? *Please tick one for each of your suppliers?*

Type of supplier	I always know prices in advance	I sometimes know prices in advance	I hardly know prices in advance	Other please specify
Individual farmers				
Cooperatives				
Farmer groups				
Processors				
Mobile traders				
Others( <i>specify</i> )				

11. a) How useful are each of the following as sources of market price information for your milk? *Please tick as appropriate for your buyers using the scale: 1 = not useful 2= a little useful 3= useful 4= very useful*

Milk suppliers	1	2	3	4
<b>Information source</b>	<b>Not useful</b>	<b>A little useful</b>	<b>useful</b>	<b>Very useful</b>
From neighbors and other producers				
From traders and buyers				
From government organizations				
Through mass media (radio, TV, Newspapers)				
Through negotiations				
Others, please <i>specify</i>				

b) How useful are each of the following as sources of market price information for your milk? *Please tick as appropriate for your suppliers using the scale: 1 = not useful 2= a little useful 3= useful 4= very useful*

Milk buyers	1	2	3	4
<b>Information source</b>	<b>Not useful</b>	<b>A little useful</b>	<b>useful</b>	<b>Very useful</b>
From neighbors and other producers				
From traders and buyers				
From government organizations				
Through mass media (radio, TV, Newspapers)				
Through negotiations				
Others, please <i>specify</i>				

12. a) In the table below you are requested to provide information on your buyers. *Please fill in the table as applicable.*

	Price	units	Price over last one year		cash	Quantity sold under each method of payment		
			low	High		In kind	Credit sales	
Type of buyer						Length of credit	Quantity paid within credit period	
Consumers								
Hotels								
Institutions								
Processors								
Others( <i>specify</i> )								

Appendices

- b) In the table below you are requested to provide information on your suppliers. *Please fill in the table as applicable.*

	Price	units	Price over last one year		Quantity sold under each method of payment			
			low	High	cash	In kind	Credit purchases	
Type of supplier							Length of credit	Quantity paid within credit period
Individual farmers								
Cooperatives								
Farmer groups								
Processors								
Mobile traders								
Others( <i>specify</i> )								

13. a) For each of the buyers of your milk, what kind of selling arrangements do you use? *Please provide also the requested information about them by filling in the table.*

	Quantity sold under each type of selling agreement				
	No agreements	Verbal agreements		Written agreements	
Type of buyer	Quantity	Duration of agreements	Quantity	Duration of agreement	Quantity
Consumers					
Hotels					
Institutions					
Processors					
Others( <i>specify</i> )					

- b) For each of the suppliers of your milk, what kind of buying arrangements do you use? *Please provide also the requested information about them by filling in the table.*

	Quantity sold under each type of selling agreement				
	No agreements	Verbal agreements		Written agreements	
Type of supplier	Quantity	Duration of agreements	Quantity	Duration of agreement	Quantity
Individual farmers					
Cooperatives					
Farmer groups					
Processors					
Mobile traders					
Others( <i>specify</i> )					

Appendices

14. If you were to increase the quantity of milk you handle for example by 50% (half), how much would you be able to sell successfully) *Please tick one.*

- I would be able to sell all of it
- I would be able to sell part of it
- I would not be able to sell at all
- I don't know

15. Please indicate by ticking how often you experienced shortages and excess milk in your business over the last year.

	Always	Sometimes	Rarely	Never
Shortages	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Excess supplies	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

16. a) How serious are each of the following problems in your trading with your buyers? *Please indicate the seriousness by ticking using a scale of 1- very serious, 2-serious, 3-moderate and 4- not a problem.*

	1	2	3	4
<b>Type of problem</b>	<b>Very serious</b>	<b>Serious</b>	<b>Moderate</b>	<b>Not a problem</b>
Milk is not collected				
Milk goes bad while being transported or handled				
There are not enough buyers in the market				
Water/chemicals are added to milk by buyers				
Our buyers fail to pay us on time				
Prices are sometimes too low				
Others, <i>please specify</i>				

b) How serious are each of the following problems in your trading with your suppliers? *Please indicate the seriousness by ticking using a scale of 1- very serious, 2-serious, 3-moderate and 4- not a problem.*

	1	2	3	4
<b>Type of problem</b>	<b>Very serious</b>	<b>Serious</b>	<b>Moderate</b>	<b>Not a problem</b>
Milk is not collected				
Milk goes bad while being transported or handled				
There are not enough buyers in the market				
Water/chemicals are added to milk by buyers				
Our buyers fail to pay us on time				
Prices are sometimes too low				
Others, <i>please specify</i>				

17. How much of your milk is wasted on average at each of the following points? *Please indicate how frequent this problem occurs on average in a month below.*

Point where loss occurs	Quantity lost or wasted	How frequent (times) problem occurs in a month
On farm during and after milking		
During transport		
During handling storage (spoilage)		
By processors and traders		
Failure to collect or deliver milk		
Others ( <i>please specify</i> )		

Appendices

18. In cases of milk scarcity, how much milk are you normally able to offer each of your buyers on average? *Please tick as appropriate for each of your buyers.*

Type of buyer	Full share	Less than full share	None
Consumers			
Hotels			
Institutions			
Processors			
Others( <i>specify</i> )			

19. In cases of milk scarcity, how much milk are you normally able to receive from each of your suppliers on average? *Please tick as appropriate for each of your buyers.*

Type of supplier	Full share	Less than full share	None
Individual farmers			
Cooperatives			
Farmer groups			
Processors			
Mobile traders			
Others( <i>specify</i> )			

20. In cases of excess milk production, what happens to the extra milk? *Please tick the appropriate ones.*

- Sell at reduced prices
- Use at home
- Find new buyers for it
- Convert into other milk products to sell later
- Dispose or give away free
- Others, (*please specify*)

21. What other arrangements would you prefer for your milk given your available resources and abilities? *Please tick one.*

- I would prefer to increase amounts of milk I produce and sell
- I would prefer to produce less
- I would prefer no change
- Others, *please specify*

Appendices

22. a) Using a five point scale where 1 is very unsatisfied, 3 is neutral, and 5 is very satisfied, please indicate by ticking how satisfied you are with the following aspects of your relationships with the selected buyer(s) over the last 12 months.

**Consumers**

	1	2	3	4	5
<b>Performance item</b>	<b>Very unsatisfied</b>	<b>Dissatisfied</b>	<b>Neither satisfied nor dissatisfied</b>	<b>Satisfied</b>	<b>Very satisfied</b>
Continuous milk purchases over the year					
Prices they pay for the milk					
Communication and information sharing					
Quality standards demanded by buyer					
Reputation of the buyer					
Trustworthiness of buyer					

**Hotels**

	1	2	3	4	5
<b>Performance item</b>	<b>Very unsatisfied</b>	<b>Dissatisfied</b>	<b>Neither satisfied nor dissatisfied</b>	<b>Satisfied</b>	<b>Very satisfied</b>
Continuous milk purchases over the year					
Prices they pay for the milk					
Communication and information sharing					
Quality standards demanded by buyer					
Reputation of the buyer					
Trustworthiness of buyer					

**Institutions (schools, hospitals)**

	1	2	3	4	5
<b>Performance item</b>	<b>Very unsatisfied</b>	<b>Dissatisfied</b>	<b>Neither satisfied nor dissatisfied</b>	<b>Satisfied</b>	<b>Very satisfied</b>
Continuous milk purchases over the year					
Prices they pay for the milk					
Communication and information sharing					
Quality standards demanded by buyer					
Reputation of the buyer					
Trustworthiness of buyer					

**Processors**

	1	2	3	4	5
<b>Performance item</b>	<b>Very unsatisfied</b>	<b>Dissatisfied</b>	<b>Neither satisfied nor dissatisfied</b>	<b>Satisfied</b>	<b>Very satisfied</b>
Continuous milk purchases over the year					
Prices they pay for the milk					
Communication and information sharing					
Quality standards demanded by buyer					
Reputation of the buyer					
Trustworthiness of buyer					

**Others, please specify**

	1	2	3	4	5
<b>Performance item</b>	<b>Very unsatisfied</b>	<b>Dissatisfied</b>	<b>Neither satisfied nor dissatisfied</b>	<b>Satisfied</b>	<b>Very satisfied</b>
Continuous milk purchases over the year					
Prices they pay for the milk					
Communication and information sharing					
Quality standards demanded by buyer					
Reputation of the buyer					
Trustworthiness of buyer					

22. b) Using a five point scale where 1 is very unsatisfied, 3 is neutral, and 5 is very satisfied, please indicate by ticking how satisfied you are with the following aspects of your relationships with the selected suppliers(s) over the last 12 months.

**Individual farmers**

	1	2	3	4	5
<b>Performance item</b>	<b>Very unsatisfied</b>	<b>Dissatisfied</b>	<b>Neither satisfied nor dissatisfied</b>	<b>Satisfied</b>	<b>Very satisfied</b>
Continuous milk purchases over the year					
Prices they pay for the milk					
Communication and information sharing					
Quality standards demanded by buyer					
Reputation of the buyer					
Trustworthiness of buyer					



**Cooperatives**

	1	2	3	4	5
<b>Performance item</b>	<b>Very unsatisfied</b>	<b>Dissatisfied</b>	<b>Neither satisfied nor dissatisfied</b>	<b>Satisfied</b>	<b>Very satisfied</b>
Continuous milk purchases over the year					
Prices they pay for the milk					
Communication and information sharing					
Quality standards demanded by buyer					
Reputation of the buyer					
Trustworthiness of buyer					

**Other farmer groups**

	1	2	3	4	5
<b>Performance item</b>	<b>Very unsatisfied</b>	<b>Dissatisfied</b>	<b>Neither satisfied nor dissatisfied</b>	<b>Satisfied</b>	<b>Very satisfied</b>
Continuous milk purchases over the year					
Prices they pay for the milk					
Communication and information sharing					
Quality standards demanded by buyer					
Reputation of the buyer					
Trustworthiness of buyer					

**Processors**

	1	2	3	4	5
<b>Performance item</b>	<b>Very unsatisfied</b>	<b>Dissatisfied</b>	<b>Neither satisfied nor dissatisfied</b>	<b>Satisfied</b>	<b>Very satisfied</b>
Continuous milk purchases over the year					
Prices they pay for the milk					
Communication and information sharing					
Quality standards demanded by buyer					
Reputation of the buyer					
Trustworthiness of buyer					

**Mobile traders**

	1	2	3	4	5
<b>Performance item</b>	<b>Very unsatisfied</b>	<b>Dissatisfied</b>	<b>Neither satisfied nor dissatisfied</b>	<b>Satisfied</b>	<b>Very satisfied</b>
Continuous milk purchases over the year					
Prices they pay for the milk					
Communication and information sharing					
Quality standards demanded by buyer					
Reputation of the buyer					
Trustworthiness of buyer					

**Others, please specify**

	1	2	3	4	5
<b>Performance item</b>	<b>Very unsatisfied</b>	<b>Dissatisfied</b>	<b>Neither satisfied nor dissatisfied</b>	<b>Satisfied</b>	<b>Very satisfied</b>
Continuous milk purchases over the year					
Prices they pay for the milk					
Communication and information sharing					
Quality standards demanded by buyer					
Reputation of the buyer					
Trustworthiness of buyer					

**Please tell us more about yourself now by ticking one**

23. Sex of respondent (*please tick one*)

Male

Female

24. Position in enterprise

Owner

Employee

Other, *please specify*

25. Year of birth

26. Your Highest Education level attained (please tick)

None  Class 1-4  Class 5-8

Form I-II  Form III-IV  A-level

College  University  Adult literacy

Other (*please specify*)

Thanks a lot for your patience and responses

If there is any other information that you would like us to know about your operations, please feel free to express or write them in the space provided here.



Map 1 Map of Kenya showing the research area

Source: [www.4-siteplanning.com/.../maps-large.html](http://www.4-siteplanning.com/.../maps-large.html) Accessed on 3.5.2006

## ***Curriculum Vitae***

### **Eliud Abucheli Birachi, (MSc).**

Date and place of birth: In Kakamega, Kenya in November 1970

Citizenship Kenyan

### **Education**

- April 2004- July 2006 PhD Thesis, in the Departments of Food Economics and Consumption Studies and, Agricultural Economics (Specialization in Agribusiness Management), Christian-Albrechts-University Kiel, Germany  
Title: Determinants of Coordination and Supply Chain Performance: The Case of Fresh Milk Supply Chains in Kenya
- 1997 - 1999 Wageningen University & Research Center, The Netherlands. Masters of Science in Agricultural Economics & Management Specialization: Management Studies.  
Research Thesis on Supply Chain Management in the cut flower industry: The case of the Netherlands
- 1990 - 1995 Egerton University, Njoro, Kenya. Bachelor of Agribusiness Management
- 1986-1989 Ingotse High School: The Kenya Certificate of Secondary Education (KCSE), mean grade B plain. University entrance examinations.

### **Working History**

- 2003- 2006 Study leave at Egerton University, Kenya  
Assistant lecturer, Department of Agricultural Economics & Business Management, Egerton University, Njoro, Kenya.
- 1999- to date
- 1996 - 1997 Teaching Assistant, Department of Agricultural Economics & Business Management, Egerton university, Njoro, Kenya.