

**ANALYSIS OF MARKET PERFORMANCE: A CASE OF 'OMENA' FISH IN
SELECTED OUTLETS IN KENYA**

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DECLARATION AND RECOMENDATION

Declaration

I declare that this is my original work and has not been presented in this or any other University for any other award.

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DEDICATION

I dedicate this work to my beloved parents Stephen and Susan, my brothers Willy and John and my sisters Fridah and Anne. “For you gave it all so that I could get it all”.

God bless you.

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This thesis is a part of the results of my two years work as a Collaborative Masters in Agricultural and Applied Economics (CMAAE) student at the department of Agricultural Economics and Business Management of Egerton University (Kenya) in collaboration with the department of Natural Resources and Agricultural Extension of University of Pretoria (South Africa). This work would not have been completed without valuable input rendered by many institutions and individuals.

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ABSTRACT

The role and contribution of the fisheries sub-sector in Kenya cannot be underestimated. In particular, the contribution of *Rastrienebola Argentea*, commonly referred to as *Omena*, or *Dagaa* is increasingly being recognized and appreciated by several Government institutions and Non-Governmental organizations. *Omena* production is valued at 200 million dollars while its trade supports more than 2 million livelihoods. Different interventions by the government and the Non-Governmental organizations have resulted to increased production of *Omena* fish. However, increased production alone is not enough to effectively develop this industry. Information on the marketing functions and the efficiency with which these functions are carried out is lacking. In addition, distribution of costs and benefits along the *Omena* marketing chain is not known while fluctuations in supply affect price transmission between different markets. The main objective of this study was thus to assess the performance of *Omena* marketing in Kenya. The specific objectives of the study included: assessing the effectiveness of the *Omena* marketing channels; evaluating the price spreads along the different marketing channels; and to determine whether the spatially separated markets for *Omena* are integrated. Primary data was collected in two purposively identified regional markets in Kenya (i.e. Kisumu and Nakuru) while additional secondary data from the Nairobi region was included only for the purposes of analyzing market integration. Selection of markets was based on whether the markets are deficit or surplus regions for *Omena*. A multistage sampling procedure resulted to a total of 43 fishermen; 42 small scale processors; 20 wholesalers; 31 retailers; 32 domestic consumers; and 7 industrial consumers making a grand total number of 175 respondents. Questionnaires were adopted as the major tools of data collection using one-on-one interviews. To analyze the resultant data, the study utilized gross margin analysis and co-integration modeling. Results indicate that *Omena* marketing channels are to a large degree effective as it regards to meeting the consumption needs. However, results also indicated that longer marketing channels resulted not only to high costs and thus high retail prices; but also to lower returns to the fishermen. Further, the study identified that there is no integration amongst *Omena* markets in Kisumu and Nakuru and that a weak degree of integration existed between Kisumu and Nairobi. Information generated by this study is important in guiding policy makers to identify points of interventions as well as in designing effective and efficient *Omena* marketing channels.

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LIST OF ACRONYMS AND ABBREVIATIONS

ADF –	Augmented Dickey-Fuller test
ARIMA-	Autoregressive Integrated Moving Average
BMUs –	Beach Management Units
CMA -	Centered Moving Average
ECM –	Error Correction Model
EEZ –	Economic Ecological Zone
FBOs –	Faith Based Organizations
GDP –	Gross Domestic Product
GMMp-	Gross Producer Marketing Margin
GoK –	Government of Kenya
LOFTA-	Lake Victoria <i>Omena</i> Fish Traders Association
LVFO –	Lake Victoria Fishers Organization
MFI –	Microfinance Institutions
MoF-	Ministry of Fisheries
NGOs-	Non-Governmental Organizations
NMM-	Net Marketing Margin
PSDA –	Private Sector Development in Agriculture
TGMM –	Total Gross Marketing Margins

CHAPTER ONE

INTRODUCTION

1.1 Background Information

Fish production in Kenya comes from two broad sectors, namely aquaculture and capture fisheries. Capture fisheries, which are further divided into marine and freshwater accounts for the bulk of the national nominal production contributing about 99% annually. According to GoK (2006), the Kenya fisheries sub-sector has the potential to significantly contribute to the national economy through employment creation, foreign exchange earnings, poverty reduction and food security support.

Most of the fishing activities are carried out in the Lake Victoria in the western part of the country. Among the fish species in the lake, the most common are the Nile perch (locally known as “*Mbuta*”) and the *Rastrineobola Argentea* (locally known as “*Omena*” or “*Dagaa*”). Other species include tilapia and cat fish. Although Nile Perch has over the years constituted the highest landings in volume, most of it is exported. In contrast, *Omena* are sold to end consumers (who include households and animal feed processors) through outlets in the domestic market. This makes *Omena* an important source of livelihood for many poor Kenyans. In addition the prices for *Omena* are much lower compared to any other species in the lake while their divisibility into small quantities and the fact that *Omena* exports are minimal makes it very affordable both for consumption and as a raw material in animal feed processing.

A survey carried out by Manyala and Gitonga (2008), clearly shows that *Omena* (*Rastrineobola Argentea*) is a source of livelihood for more than 2 million people in terms of employment, income and provision of nutrition. It thereby ranks as the most important fish industry in its contribution to the local and East African regional economy. *Omena* fishery is valued at US \$ 200 million against a total Lake Victoria fishery valued at US\$ 600 million (GOK, 2008). According to Abila, (2000); Bokea and Ikiara, (2003), *Omena* accounts for 35% of the estimated per capita fish consumption in Kenya. However, the report also indicates that there has been a reduction in consumption from 6kg per person per annum to between 3 and 5 kg per person per annum. *Omena* species contains vital proteins that serve to enhance its nutritional value and is thus increasingly

becoming important in the relief foods diets; as a component in consumption particularly for children.

The main players in *Omena* fish industry include the fisher folk, small scale processors, wholesalers, importers, stockists, retailers and industrial processors. The *Omena* industry is dominated by women, though they have major limitations particularly in accessing and controlling resources required to develop their businesses. The industry is also quite human resourceful due to the youthful nature of the major players (Manyala and Gitonga, 2008). Valuable institutions include Non Governmental Organizations (NGOs), Lake Victoria Fisheries Organization (LVFO), Lake Victoria *Omena* Fish Traders Association (LOFTA), Ministry of Fisheries (MoF), Beach Management Committees/Units (BMUs), Micro-Finance Institutions (MFIs), Faith-Based Organizations (FBOs), Commercial Banks etc.

To promote production and to ensure enough supplies of *Omena* fish to the consumers at reasonable prices, quantities and with high quality, an efficient *Omena* fish marketing system would be required. Three issues are thus important. These include arbitrage in time (storage), in space (transport), and in form (processing). Storage will ensure that enough supplies will be available during the off-season. Transport is a service to transfer *Omena* from surplus areas to deficit regions in the country. Finally, processing provides different kinds of finished products to meet the diversified demands of final consumers. Price differences may reflect market functioning, while arbitrage in time, space, and form increases the value of the product.

Aggregate market performance is better understood by measuring effectiveness of the existing marketing channels (i.e. testing whether the existing marketing channels offer proper service outputs or the right services in relation to consumer preferences), by analyzing price spreads (marketing costs, price margins and profitability) among the different marketing activities, and through studying the level of market integration that exists. Information regarding market performance and price transmission mechanisms between spatially separated markets is important for fish producers and other fish industry players since it affects their marketing decisions (buying and selling), which in turn affects decisions related to logistical matters and eventually profits realized (marketing

margins). This information also guides policy makers in determining points of policy intervention. Moreover, it is increasingly being recognized that the formulation of market-enhancing policies to increase the performance of the local market requires a better understanding of how the market functions (Uchezuba, 2005).

1.2 Statement of the Problem

In Kenya, *Omena* fish is only produced in Lake Victoria while it is widely consumed around the Lake Victoria region and in major cities and towns across the country; both as a raw material in animal feed production and for human consumption. An effective marketing system would ensure that products are available for consumption throughout in the right quantities and quality. In presence of varying consumption needs, and preferences, the question is how effective the *Omena* marketing channels are as it regards offering proper service outputs or the right services in relation to consumer preferences.

Omena is marketed locally by various agents. An efficient marketing system would also ensure fair distribution in benefits, but with research directed towards export markets, there is inadequate information on price spreads along the marketing channel while the distribution of costs and benefits amongst participants is not established.

If markets are efficient and interlinked, then it is likely that prices in different markets will move together. This has not been established in the *Omena* fish markets. In addition, little is known on the factors that may cause differences in market prices, the price transmission mechanisms between the different markets and whether the spatially separated *Omena* markets are integrated and if so; to what degree.

1.3 Objectives of the Study

Main objective

The main objective of the study was to examine market performance for *Omena* fish in selected markets in Kenya.

Specific objectives

To meet its main objective this research sought to meet the following specific objectives:-

1. To assess the effectiveness of the existing marketing channels for *Omena* fish;
2. To determine the price spread along *Omena* marketing channels; and

3. To examine the extent to which selected markets for *Omena* are integrated.

1.4 Hypotheses of the Study

1. The existing marketing channels for *Omena* are not effective
2. There are no significant differences in price spreads along the different *Omena* marketing channels
3. The regional markets for *Omena* are not integrated

1.5 Justification and Importance of the Study

The *Omena* industry in Kenya provides a source of livelihood to an approximated 2 million people. An *Omena* fish market performance study thus comes in handy in providing valuable information (on price transmission mechanism and price spreads), which can be used in developing the *Omena* value chain strategy in Kenya.

A study on marketing margins and costs will help in estimating the total costs incurred on marketing process in relation to the prices received by each agency. This information will help in identifying the reasons for high costs of marketing and the possible ways of reducing them. In addition, this study will facilitate the identification of possible areas for support from involved actors (government, NGOs etc). This can particularly be achieved through identifying points of intervention leading to formulation of efficiency enhancing policies.

The decisions of the stakeholders in the *Omena* fish industry are dependent on the prices prevailing in the various *Omena* markets. An understanding of the price dynamics and the ability to forecast future market prices can thus go a long way in understanding the market as a whole. This study will contribute to understanding the price dynamics in the *Omena* fish markets in Kenya.

1.6 Scope and Limitations of the Study

The research was restricted to analysis of market performance amongst *Omena* fish markets in Kenya. To achieve its objectives, the research utilized both primary and secondary data (monthly wholesale *Omena* fish prices collected for the years 2007 to 2009). Although there are many species of fish, this study only focused on *Omena* and will include selected market outlets despite the fact that there are many other market outlets.

Marketing channel approach was adopted to examine and describe the domestic *Omena* fish trading activities. This implies that the problem was examined from the viewpoint of a commodity. It concerns the internal functioning of the market and the relationships between the actors within the marketing channels. The exclusivity of the traders (i.e. selecting those who only deal with *Omena*) was observed as a major limiting factor for the study.

Availability of secondary data and access to traders' records were also limitations for this study, while reliance on memory recall, for those traders who do not keep records may have as well affected precision of data collected.

1.7 Definition of Terms

Market: The set of actual and potential buyers of a special product, (Kotler, 1997). In this study, a market is conceptualized as any structure that allows buyers and sellers to exchange any type of goods, services and information.

Market performance: Refers to economic results that include effectiveness, equity, productivity and profitability, (Stern *et al.*, 1996). In this study, aspects of effectiveness of marketing chains, equitable distributions of gross margins and integration of the spatially separated markets for *Omena* fish were applied to infer on market performance.

Market efficiency: Refers to the degree to which commodity prices accurately reflects current information in the market place. Market integration was utilized to infer on the levels of market efficiency.

Marketing channel: Alternative routes of product flows from producers to consumers, (Kohls and Uhl, 1990).

Effectiveness: The ability of the marketing channels to result to (or offer) proper service outputs or the right services in relation to consumer preferences.

Market integration: Market integration concerns the free flow of goods and information, (and thus prices) over form, space, and time.

Market co-integration: An alternative procedure for evaluating spatial market linkage in the presence of stochastic trends in price series. It requires that deviations from equilibrium conditions between two economic variables, (which are individually non-stationary in the short-run) be stationary in the long-run.

1.8 Organization of the Study

Subsequent to chapter one that presents the general introduction, chapter two, presents literature review on the various aspects related to this study. Chapter two also provides theoretical and conceptual frameworks whereas chapter three presents the methodologies used in answering objectives of the study. Chapter four presents the results of the research while the last chapter (chapter five) presents the conclusions and recommendations from the study. All other supporting documents are attached as annexes.

CHAPTER TWO

LITERATURE REVIEW

2.1 Industry Overview

As earlier mentioned, fishery production in Kenya comes from two broad sectors which are aquaculture and capture fisheries. Amongst the capture fisheries, Lake Victoria contributes approximately 95% of the total catch within the country. The other 5% are contributed from the marine fisheries which despite having great potential remain unexploited especially within the Economic Ecological Zone (EEZ). *Omena* is only caught from Lake Victoria alone. This species contributes more than 40% of the total fish landings in Kenya and about 58% by weight to the total fish landings. It is closely followed by Nile perch that now stands at less than 40% (GoK, 2007; GoK, 2008).

The fisheries sub-sector contributed 0.5% to GDP in the year 2007 (GoK, 2008). On its own, *Omena* fishery plays an important role in terms of provision of employment, income, food and livelihood to the riparian communities [(Ogutu-Ohwayo *et al.*, 2002); as quoted in Manyala and Gitonga, (2008)]. The value of *Omena* fishery in the region is US \$ 200 million on the average against a regional total fishery value of about US \$ 600 million (ibid).

According to Baer [(2001); as quoted in Manyala and Gitonga, (2008)], *Omena* has increasingly been used for the production of animal feed in addition to be a major food especially for the riparian communities. Manyala and Gitonga (2008), estimated that even with a nominal number of two dependents, the *Omena* sub sector provides a source of livelihood for more than two million people and provides a full time employment to an estimated 847,418 Kenyans.

Production, processing and marketing

Production/fishing

Omena is only caught from Lake Victoria. Its production (landings in metric tons) has been increasing and for the last 2 years it by-passed Nile perch production. A survey by Manyala and Gitonga (2008), shows that production of *Omena* had increased from 34,679 MT in 2004 to 67,929 MT in 2006, while that of Nile perch decreased from 69,479MT to

55,261 MT over the same period. The increase in production has been attributed to introduction of an *Omena* fishing ban starting 2002 between the months of April and July.

Omena fishing is concentrated on the inshore areas where boat seining method is commonly used. Although the industry is dominated by women only a few own fishing crafts and gears (less than 5%). Usually it is the men who go into the lake to carry out actual fishing. According to Prado *et al.*, [(1991); as quoted in Manyala and Gitonga, (2008)], seining nets for *Omena* are constructed from 5-10mm mesh material of 100m length and 250-440 meshes depth. The distribution of *Omena* seine nets is skewed towards Bondo, Busia and Suba districts; these are in addition the main landing sites for *Omena*.

Processing market

An approximated 30% of total *Omena* landings are used for human consumption. Between 60-70% is processed as animal feed or for pets (Prado *et al.*, 1991). The primary processing of *Omena* by sun-drying is done entirely by women at the beaches as its shelf life can only be extended when the product is well dried and stored. This implies that the product has to be dried immediately after landing to avoid spoilage. The conversion of *Omena* into other products for animal feed is more uniform only that many of the animal feed processors have branded some of their products with generic poultry feeds trade names and have different capacities. According to Abila (2000), *Omena* contains 55-60% crude protein. However, he also observed that the price of *Omena* is only half as compared to imported fish meal; a situation that has promoted more use of *Omena* as a raw material in the animal feed industry.

Divisibility of *Omena* into small quantities implies that small scale actors (with low capital) can easily access the market. This has encouraged the participation and domination of women in the *Omena* value chain; not necessarily as retailers but also as small scale processors at the beaches. This process is however not without problems as cases of adulteration of *Omena/Dagaa* fish; particularly by adding sand and shells, have compromised the quality of processed animal feeds and increased costs of processing.

Wholesaling and retailing

During the ban season there is a general shortage of *Omena*. Wholesalers (who also act as stockists), sell the dried fish to the retailers and the millers. During the high season (fishing period) the retailers acquire the fish either directly from fishermen or from

wholesalers depending on their location. Small scale processors buy from fishermen and sell to stockists/ wholesalers and the millers. However, these activities are not without problems. For example the unit of measurement for dry *Omena* is not standardized and various containers are used as a measure. This situation opens avenues for hard bargaining at markets especially for retailers and wholesalers. In some cases, cheating may arise while in other cases, wide price fluctuations occur to keep pace with the units of measurements.

Manyala and Gitonga (2008), notes that although different containers are used (such as containers for cooking oil, margarine, jam, marmalade), these containers (and sacks) differ in diameter and height, thereby making them less precise for transaction by different retailers and wholesalers. The study also identified four supply channels for *Omena*; with one of the two main channels being dedicated towards *Omena* meant for human consumption, and the other for *Omena* meant for industrial uses.

2.2 The Merchants in the *Omena* marketing chain

a) Fishermen

These are mostly men who go into the lake to capture fish. Most *Omena* fishing is done at night (6pm to 5 am), using small boats and nets. Often four or more men share a boat during the fishing trip. Fishermen sell their fresh catch to the small scale women processors at the beaches. They are not involved in storage or transport services.

b) Small-scale women processors

These are the first link between the fishermen and other middlemen. They take title and collect several smaller lots of scattered fish by their own capital and combine them into a single load at one location; usually next to the landing sites. The small scale processors are primarily involved with *Omena* drying they also sell at the beaches but may provide storage and transport services in addition to assembly and drying.

c) Wholesalers

A wholesaler concentrates the various loads and puts the product into large, uniform units. The wholesaler provides information to suppliers (e.g., farmers, rural assemblers) and assumes to a varying degree the risks associated with the transfer of property rights attached to the goods and services being bought and sold. A wholesaler also facilitates mass and specialized storage operations, transportation and, in general, the subsequent

distribution operations involving retailers. The distinction between wholesaler and retailer is well known: wholesaling is concerned with the activities of those persons which sell to retailers and other merchants and commercial users, but do not sell in significant amounts to final consumers (Kotler, 1997). Wholesale traders can be subdivided into rural assembling traders, collecting wholesalers and distributing wholesalers (Lutz, 1994 and Dijkstra 1997).

d) Retailers

The main function of the retailer is to buy from wholesalers and sell to consumers at convenient locations and times in various forms and quantities. In urban centres, retailers often buy from wholesaler-distributors or their brokers and resell to domestic consumers. They may also travel to assemble in at the beaches. In addition, the retailers may have a fixed base: a stall, a shop or a place on the ground, or they may be hawkers, who carry their products around (Kotler, 1997). In the case of *Omena*, most retailers are found in open air markets or in stalls located in residential areas.

e) Industrial consumers

These are Enterprises which use agricultural commodities as raw materials. They change the form of the product, eg *Omena* fish is changed into various forms of animal feeds including poultry and pet feeds. The industrial processors usually procure in bulk usually in tons from wholesalers or stockists.

f) Domestic consumers

These are consumers who buy *Omena* basically for home consumption. They particularly buy from the retailers at the markets often in small quantities. Those located near the beaches also buy from the small-scale processors.

g) Other agents

Commission agent – Broker

These agents work for a commission on behalf of other participants, (Kotler 1997). They operate at all levels of the marketing channel. Typically, they work for either a flat rate or percentage (of the selling price) commission. Brokers bring buyers and sellers together and assist in negotiations on a more ad hoc basis. Brokers do not invest in trade, nor do they take any price- risks. They provide an insight into the functioning of the market as they are relatively better informed than wholesalers. Moreover the existence of commission agents or brokers permits wholesalers to devote their energy to the

commercial functions for which they have a comparative advantage.

Facilitators

Traders not only use brokers but also facilitating intermediaries. Kotler (1997) refers to three types of facilitators: first, physical distribution firms, including warehousing firms and transportation firms; second, marketing service companies, including marketing research firms, advertising agencies, media firms, and marketing consultancy firms; and other firms that help finance and/or insure risks associated with the buying and selling of goods.

In sum, the above classification of marketing agents is useful for this study. The classification was applied for analyzing in more detail all types of actors/agents that perform different marketing functions in the *Omena* marketing channels in Kenya.

2.3 The Concept of market performance

Kotler (1997) defined a market as the set of actual and potential buyers of a special product. This market consists of a set of marketing channels through which the commodity is transferred from producers to consumers. The marketing channel links producers and final consumers. According to Stern *et al.*, (1996), “Marketing channels can be viewed as sets of interdependent organizations involved in the process of making a product or service available for consumption or use”. Kohls and Uhl (1990) defined marketing channels as “alternative routes of product flows from producers to consumers”. The performance of a marketing channel is related to its structure and the strategies (conduct) of the actors operating in these channels.

According to Stern *et al.*, (1996), market performance is a multi-dimensional concept that can be assessed by considering a number of dimensions including effectiveness, equity, productivity, and profitability. Market performance refers to economic results: product suitability in relation to consumer preferences (effectiveness); rate of profits in relation to marketing costs and margins; price seasonality and price integration between markets (efficiency). In sum, market performance refers to the impact of structure and conduct as measured in terms of variables such as prices, costs, and volume of output (Bressler and King, 1979).

2.4 Theoretical framework

To analyze market performance, the theoretical framework for this study focuses on two aspects namely; the degree of effectiveness; and efficiency of the marketing channels. This section reviews the concepts of effectiveness and the two commonly used methods for determining market efficiency (i.e. marketing margins and market integration)

2.4.1 The Effectiveness of Marketing Channels

The effectiveness of the marketing channel is assessed by examining how well these channels respond to consumers and producers demand for services in relation to their preferences. In a properly functioning market, marketing channels have to guarantee that consumers can buy and that producers can sell their products at reasonable prices in the market place; they have to balance supply and demand in each market segment at any time (Luu, 2002). In this study, the effectiveness of *Omena* fish marketing channels was assessed in relation to the different services that the channels have offered in the market in order to maximize consumer satisfaction. In broad categorization, these functions include: assembling, distribution (exchange functions); storage, transport (physical functions); grading, financing (facilitating functions) etc. All these functions are aimed at creating consumer convenience in terms of time, form and place. Consumers usually prefer to deal with a marketing channel that provides a higher level of spatial, time and/or form convenience. These are related to three major functions: transport, storage, and processing, (ibid)

2.4.2 Marketing costs and margin analysis

A marketing margin measures the share of the final selling price that is captured by a particular agent in the marketing chain. It refers to the difference between prices at different levels in the marketing system. The total marketing margin (TMM) is the difference between what the consumer pays and what the producer/farmer receives for his produce. In other words, it is the difference between retail price and farm price. A wide margin means usually high prices to consumers and low prices to producers.

Several calculations can be done for the different marketing margins [i.e. total gross marketing margin (TGMM), producers gross marketing margins (GMMp) and the net marketing margin (NMM)]. The total marketing margin may be subdivided into different

components: costs of marketing services and the profit margins or net returns. The cost of marketing includes all the costs involved in the creation of place, time, and form utilities. In an efficient marketing system, such costs should be recovered plus a reasonable return to investment (Pomeroy and Trinidad, 1995). Costs vary depending upon the services rendered. The marketing costs usually include wages as return to labour; interest as return to borrowed capital; rent as return to land and buildings; and profit as return to entrepreneurship and risk capital. An analysis of marketing costs would estimate how much expenses are incurred for each marketing activity. It would also compare marketing costs incurred by different actors in the channel of distribution.

2.4.3 Temporal price analysis

Time series of either prices or quantities can be analyzed using various methodologies ranging from simple graphs, regressions or autoregressive integrated moving average (ARIMA) models. The “classical model” has been continuously used to decompose a time series into its different components such as trend (T), cyclic (C), seasonal (S) and random (E) indices (Goetz and Weber, 1986). Mathematically, a price series is represented as:

$$P = T * C * S * E.$$

2.4.4 Spatial Market integration analysis

In making inferences about market efficiency from data on prices the concept of integration has been central. Market integration can be vertical, spatial or inter-temporal. Spatial market integration refers to a situation in which prices of a commodity in spatially separated markets move together and price signals and information are transmitted smoothly across the markets (Ghosh, 2000). If two markets are integrated, a shock to the price in one market should be manifested in the other market's price as well. Spatial market integration can thus be seen to be synonymous to co-movement of prices in different spatially separated markets. An integrated market is synonymous with pricing efficiency, i.e., prices as defined by Fama and Eugene (1970), "should always reflect all information".

Spatial price behavior in regional markets is an important indicator of overall market performance. Markets that are not integrated may convey inaccurate price information distorting the marketing decisions of producers and contributing to inefficient product movements. Therefore, an important part of market performance analysis focuses on

regional price analysis and market integration between different market places. Several methods for measuring price integration have been used beginning with simple bivariate correlation coefficients. This is the simplest way to measure the spatial price relationships between two markets. However, this method clearly has some limitations.

Harris (1979; as quoted by Barrett 1996) argues that simple bivariate correlation coefficients require filtering to eliminate bias toward spurious integration due to common exogenous trends (e.g., general inflation), common periodicity (e.g. agricultural seasonality), or autocorrelation. This makes price spread observations unreliable indicators of market integration or competition, since those spreads vary seasonally. In addition, these simple statistics fail to recognize the heteroskedasticity common in price data of reasonably high frequency (Barret, 1996). Other methods include Variance Decomposition Approach (Delgado, 1986) and Radial Market Integration Approach (Ravallion, 1986). However, these methods have over the time been criticized for one reason or another.

One method for measuring the degree of price integration, and which takes the above mentioned critique into account is the co-integration procedure. This econometric technique provides more information than the correlation procedure, as it allows for the identification of both the integration process and its direction between two markets. The concept of co-integration was developed and applied by Engle and Granger (1987), and further extended by Engle and Yoo (1987). It is an alternative procedure for evaluating spatial market linkage in the presence of stochastic trends in the price series. Its underlying importance is that it ensures deviations from equilibrium conditions between two economic variables, (which are individually non-stationary in the short-run) are stationary in the long-run.

Regional prices move over time because of various shocks. If in the long run they exhibit a constant linear relation, then we say that they are co-integrated. The presence of co-integration between two series is indicative of inter-dependence. In other words, co-integration indicates non-segmentation between the two series. Co-integration analysis is a useful tool to give an answer about the existence of a relation between two economic time series. Following the same argument, the long-run equilibrium relationship (Engle-Granger) for analyzing market integration used in the previous studies, e.g. Goodwin

and Schroeder (1991), was used to test for market integration after the individual time series for the three different markets were proved to be stochastic.

2.5 Conceptual Framework

A product supply chain consists of participants such as those described under section 2.2. All these participants help move the product in a certain chain called a market channel; which in turn develops to form a market. Participants in the channels perform different activities and thus different channels seem to offer different service outputs depending on the intended consumers need. The performance of these channels can then be evaluated using performance indicators such as effectiveness & efficiency; which in turn comprise of measures such quality, prices, costs, quantity, delivery time, Product form, and market integration. This framework forms the basis for evaluating the effectiveness and efficiency of the *Omena* marketing channels.

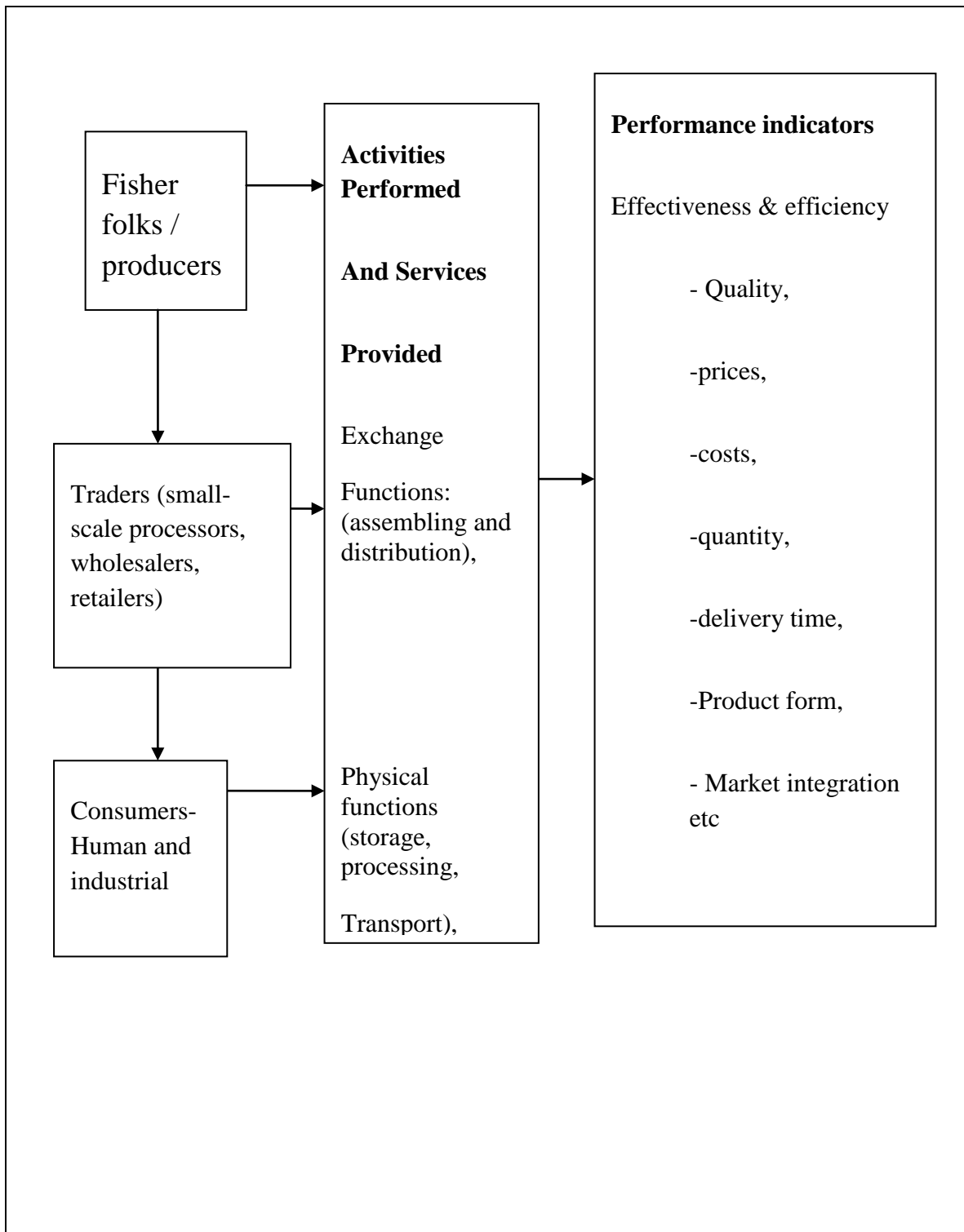


Figure 1: Conceptual framework

Source: own conceptualization,(2009).

CHAPTER THREE

METHODOLOGY

3.1 Study Areas

The study involved three selected *Omena* markets in Kenya. The criteria for selecting the markets was generally based on their position i.e. whether surplus or deficit region, and the potential demand for *Omena* fish and fish products. These markets were purposively selected because of the following reasons:

1. Kisumu is one of the largest fresh *Omena* market both for wholesale and retail business. It is also adjacent to the Lake Victoria, the producing centre and thus a surplus region.
2. Nakuru is a major cosmopolitan town with a relatively high demand for the *Omena* fish and fish products. It is also among the major towns that demand *Omena* for industrial purposes.
3. Nairobi is the country's capital with a high real and potential demand for *Omena* fish and fish products. In addition it is generally a deficit region being far away from the producing region.

3.2 Sampling procedure and Sample size

A multistage sampling procedure was adopted for this study. After the three regions had been pre-selected, a stratified sample of fishermen, small scale women processors, wholesalers, retailers and consumers (industrial and domestic), was selected. Fishermen and small scale processors were only sampled in three pre-selected beaches (Dunga, Kichinjio and Osindo) around Kisumu municipality while wholesalers, retailers and consumers were sampled at two municipal markets (Kibuye and Oile) within Kisumu municipality and two markets within Nakuru municipality (Wakulima and Top market). Industrial consumers (millers) were only sampled within the Nakuru industrial area.

Participants from each stratum were randomly selected until the required sample size was achieved. In total 43 fishermen; 42 small scale processors; 20 wholesalers; 31 retailers; 32 domestic consumers; and 7 industrial consumers were interviewed making a total number of 175 respondents for the study.

3.3 Data Types and Sources

The study utilized both primary and secondary data. Secondary data consisted of monthly wholesale *Omena* prices over a three years period (from 2007 to 2009), for three regions (including Nairobi). This data was collected through desk reviews and from publications in the Ministry of Fisheries Development provincial offices and from annual statistical bulletins in the Ministry. Other sources included Lake Victoria Fishers Association (LVFA), Lake Victoria *Omena* Fisheries Association (LOFTA) and Kenya Marine and Fisheries Research institute (KeMFRI). The data was recomputed to get the average monthly prices per a kilogram of *Omena*.

Table: 1 Variables used in the analysis.

Variable	Abbreviation	Variable.....	Abbreviation
Producer/ Fishermen price	Pp	Retailers (wholesalers, millers, local assemblers) selling price (KSh)	SPr (SPw, SPm, Spa)
Consumer price (KSh)	Cp	Wholesale price (KSh)	Wp
Producers selling price (KSh)	SPp		
Producers marketing costs (KSh)	MCp		
Quantity handled by each trader (KGs)	Q		
Retailers (wholesalers, millers, local assemblers), buying price (KSh)	BPr (BPw, BPm, BPa)		

Primary data was collected from the various agents participating in the *Omena* marketing channels (fishermen, small scale processors, wholesalers, millers and retailers) using a pre-tested interview schedule. Target data included cost items and their monetary values, buying and selling prices and the quantities handled by different agents.

3.4 Data Analysis

Primary data was entered in the SPSS spread sheet and cleaned for irregularities. The cleaned data was summarized into descriptive format in terms of frequencies, percentages and central tendencies. Secondary price data was entered into EXCEL spreadsheet and cleaned. The data was then recomputed to reflect prices per kilogram. It was later deseasonalised using a 2-12 months moving averages. SPSS and STATA data analysis softwares were used in the analysis. Based on the primary and secondary data, the average prices at different market levels were estimated, after which average price margins for different types of *Omena* traders were computed. The percentage shares of total marketing costs for each type of *Omena* trader were then calculated after which the marketing margins for each type of participant and the fishermen's share of the total gross margins were determined. Market integration analysis was used to measure the degree of price variation between different surveyed *Omena* fish markets.

3.4.1 Analysis of Effectiveness of the Marketing channels

The effectiveness of the various marketing channels was analyzed based on how well they meet the consumers' preferences (human and industrial). These preferences were identified from interviewing both industrial and domestic consumers. The preferences are associated to the cost, nutritive value, accessibility, quality and unit quantity that can be purchased at a given time. The effectiveness of *Omena* marketing channels was assessed by considering the different services that the channels have offered in the market in order to maximize consumer satisfaction. Some of these included: assembling; distribution (exchange functions); storage; transport; (physical functions); grading; financing; (facilitating functions).

3.4.2 Analysis of Price Spreads

This involved estimating marketing costs, price margins and profitability among the different *Omena* marketing activities. The share of the consumer price that goes to each trader, to marketing costs and to marketing margins was also estimated.

Estimation of Marketing Costs

Different types of marketing costs (including transport, levies, cess, packaging e.t.c) relating to the latest transaction of *Omena* fish traders and marketing costs relating to the last month of business for each trader (fishermen, women processors, wholesalers, and

retailers) were recorded.

The weighted average method was used to obtain the average marketing costs for each different kind of trader; where average marketing costs were computed as:

$$AMC_i = X_i Q_i / Q_i \dots\dots\dots (1)$$

where;

Q_i = quantity handled during the latest transaction for each *Omena* trader; used as a weighing coefficient.

X_i = Different types of marketing costs of the latest transaction incurred by each *Omena* trader.

Estimation of Marketing Margins

Marketing margins for the various *Omena* fish traders were estimated using the following formulas.

$$TGMM = [(C_p - P_p) / C_p] * 100 \dots\dots\dots (2)$$

$$GMM_p = [(C_p - MGM) / C_p] * 100 \dots\dots\dots (3)$$

where;

TGMM = total gross marketing margin

AMC = Average marketing cost for each *Omena* trader

C_p = consumer price

P_p = producer price

GMM_p = producers gross marketing margin

MGM = gross marketing margin

The producer's share of the consumer price was determined as:

$$(C_p - P_p) / C_p \dots\dots\dots (4)$$

where;

C_p = consumer price

P_p = producer price (calculated as producers selling price per unit less producer's marketing cost)

3.4.3 Temporal and spatial price analysis

In order to examine pricing behaviour the study focused on temporal price analysis where seasonal price fluctuations were examined. Secondly, a spatial model was developed to analyse market integration.

Temporal price analysis

Secondary data on monthly retail *Omena* market prices was used to estimate a price trend line and seasonal fluctuations for each market. To establish the price trend, a simple linear regression of monthly retail prices in each market against time was specified as:

$$P = f(t) \dots\dots\dots (5)$$

where;

$$t = (1, 2, 3 \dots n), \text{ and}$$

$$P = \text{nominal price}$$

To establish the seasonal price patterns (de-seasonalisation of data), a seasonal index (S) was estimated using the Centered Moving Average (CMA) over 12 months. The CMA was deemed necessary so as to eliminate the short- term fluctuations existing in the price series: and thus eliminating seasonality and randomness. The classical model was specified as:

$$SE = (P / CMA) * 100 \dots\dots\dots (6)$$

where;

$$P = \text{Price}$$

$$SE = \text{seasonal and random index}$$

$$CMA = \text{Centered Moving Average}$$

The deseasonalised price data was used to estimate the trend (T). The model was specified as:

$$T_i = a + bt_i \dots\dots\dots (7)$$

where;

$$T_i = \text{trend value during period } i$$

$$a = \text{constant estimated by regression}$$

$$b = \text{estimate of the trend coefficient}$$

$$t_i = \text{value of the variable (} Omena \text{ price) during period } i$$

Testing for Spatial market integration

To analyze spatial market integration among the three regional markets in Kenya, the study utilized monthly retail prices of *Omena* fish. Since the method of estimation depends on the stationarity properties of the independent time series, Augmented Dickey-Fuller (ADF) tests were applied to check for the stationarity in price series. Co-integration analysis was then used to test for price connection among the regional markets; based on the model as developed by Engle and Granger (1987) and as used by Goodwin and Schroeder (1991).

Co-integration approach to market integration

Co-integration analysis was used to check for the relationship among prices in different locations. When a long-run linear relation exists among different price series, these series are said to be co-integrated. If geographically separated markets are integrated, then there exists an equilibrium relationship amongst them [Goodwin and Schroeder (1991), Sexton *et al.*, (1991)]. The long run equilibrium relationship for analyzing market integration as used in the previous studies, e.g. Goodwin and Schroeder (1991), was specified as:

$$Y_t = \alpha + \beta X_t + U_t \dots \dots \dots (8)$$

where; Y_t and X_t = commodity prices of a homogenous good ('*Omena*' in this case), in two different markets at time t , and α and β are parameters to be estimated.

If two markets are perfectly spatially integrated, then $\beta = 1$. If this holds, then price changes in one market are fully reflected in alternative market. When $\beta \neq 1$ (i.e. $\beta < 1$ or $\beta > 1$), then the degree of integration may be evaluated by investigating how far the deviation of α_1 is from unity, (equation9).

Since price time series are usually non-stationary and because standard statistical models do not allow explicit determination of α and β , a 2- step model by Engle and Granger (1987) was used. The first step was to determine the "order of integration" of each price series by checking for stationarity. A time series (say Y_t) is stationary if the joint distribution of Y_t and $Y_{t+\tau}$ is independent of time (t). This will be guaranteed by ensuring that the time series is integrated of order zero [I (0)]. Since most price series have trends in them if only because of inflation, they are usually I (1) and thus they need differencing once to obtain I (0) process.

Augmented Dickey-Fuller test was used to determine the order of integration. This was achieved by regressing ΔY_t on Y_{t-1} and several lags of ΔY_t (enough to avoid autocorrelated disturbances).

The model was specified as:

$$\Delta Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \sum \alpha_{k+1} \Delta Y_{t+k} + \varepsilon_t \dots \dots \dots (9)$$

where: ΔY_t is the first difference of prices in market Y, Y_{t-1} is the lagged price of *Omena* in market Y, α_0 and α_1 are parameters to be estimated, ε_t is the error term.

The t-statistic on the estimated coefficient of Y_{t-1} was then used to test the hypothesis that:

$$H_0: Y_t \sim I(1) \quad Vs \quad H_1: Y_t \sim I(0)$$

If the null (H_0) above cannot be rejected then Y_t cannot be stationary, it can be integrated of order one or even higher. To find out the order of integration the test was repeated with ΔY_t in place of Y_t thus regressing $\Delta \Delta Y_t$ on a constant ΔY_{t-1} and several lags of $\Delta \Delta Y_t$. ADF test was then used to test the hypothesis that:

$$H_0: \Delta Y_t \sim I(1) \quad Vs; \quad H_1: \Delta Y_t \sim I(0)$$

$$i.e \quad H_0: Y_t \sim I(2) \quad VS; \quad H_1: Y_t \sim I(1)$$

This process was continued until the order of integration was established. The second step then involved testing for co-integration based on the idea that if two time series (eg. Y_t and X_t) are each $\sim I(1)$, then their residual (say U_t) will be integrated of order zero (stationary). Where $U_t = Y_t - \alpha - \beta X_t$. The residual (U_t) was then be tested for stationarity. The ADF tests applied to these residuals should yield statistics which are large and negative so as to reject the null hypothesis of $I(1)$ in favor of stationarity.

If the first step shows that each time series is integrated of order one, and if the second step results to a stationary residual, then the two time series are said to be co-integrated. This implies that long run (or equilibrium) relationship exists between the two sets of prices. In addition, to make a clear distinction between short-run and long-run integration an Error Correction Model (ECM) was used. This allows for derivation of the speed of price transmission from one location/market to another. Within the context of market integration, it is important to consider the speed of adjustment as one dimension of integration.

The error term in the cointegration regression was treated as the equilibrium error. To tie the short run behavior of \mathbf{Y}_t to its long run value, the Error Correction Model (ECM) was specified as:

$$\Delta \mathbf{Y}_t = \alpha_0 + \alpha_1 \Delta \mathbf{X}_t + \alpha_2 \mathbf{U}_{t-1} + \varepsilon_t \dots \dots \dots (10)$$

Where; Δ = first difference operator, ε_t = random error term and $\mathbf{U}_{t-1} = (\mathbf{Y}_{t-1} - \alpha - \beta \mathbf{X}_{t-1})$
 ECM states that $\Delta \mathbf{Y}_t$ depends on $\Delta \mathbf{X}_t$ and also on equilibrium error term, while absolute values of α_2 decide how quickly equilibrium will be restored (speed of adjustment).

In sum, three steps were distinguished:

- (1) Testing stationarity of the price series
- (2) Testing long-term price integration with co-integration analysis
- (3) Testing short-run integration: measuring speed of adjustment.

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.1 The Organization of *Omena* Fish Markets in Kenya

The structure and the conduct of a market have a big effect on its performance. *Omena* fish flows from different participants at different stages and forms. These connections yield different marketing channels for *Omena*. In any typical market it is the consumers' needs and preferences that dictate how the marketing chains are organized and thus their ability to deliver consumers' needs. Given that different marketing agents perform different functions within the *Omena* marketing chains, the efficiency with which these functions are carried out becomes an important aspect of market performance. These two major aspects formed the basis for evaluating both the effectiveness and the efficiency of the *Omena* marketing channels.

The study survey revealed that the most active participants in *Omena* trade are: fishermen; small scale (women) processors; wholesalers; retailers; industrial consumers and domestic consumers. Fishermen comprise mostly of young and medium aged men. None of the fishermen who were sampled were female. Similar to observations by Manyala (2000), the actual fishing is carried out at night using small wooden boats and meshed nets while the catch is brought to the landing beaches early in the morning. Boat seining is the most commonly used method of fishing. On average three to four men would share a boat and consequently the proceeds from *Omena* sales. However, amongst those who went to do the actual fishing, 18% were employed by the boat owners and would be paid depending on the value of the catch. Of the sampled fishermen 48% owned boats while 52% hired at an average cost of ksh.50 per boat per night. Out of the total number of fishermen, 83% would share a boat when going fishing and consequently the costs and the proceeds after sale. Upon landing fishermen would only off load the *Omena* fish and sell it to women processors when still wet.

Table2: Attributes of fishermen

Attribute	Percentage		Total
Boat ownership	Own - 48%	Hire – 52 %	100%
Boat sharing	Yes – 83%	No- 17%	100%
Employed by boat owner	Yes- 18%	No – 82%	100%

Source: survey data, 2009

Small scale processors consisted majorly of women (98%). The women buy *Omena* fish directly from the fishermen at the lading beaches. The buying prices are rather pre determined by the respective beach management unit committees but the methods of measurement are not standardized. Similar to observations made by Manyala and Gitonga (2008) and Abila (1995), measurement tools/ containers included plastic troughs or small bowls (dish). In addition, the form of market was simple spot marketing; almost all of the small scale processors had no prior arrangement/ contracts with the fishermen. Where prior arrangements exist, (less than 4%); these arrangements would take the simple forms of orders or advance payments. Buying prices would range from Ksh.300 to kshs.600 per trough of wet fish (average 22kgs); with the mode frequency being Kshs.400 Processing at this stage involves only sun drying of the wet *Omena* to avoid rotting or spoilage. This is done by spreading *Omena* on the ground while using fishing nets; usually borrowed from the fishermen for free or after paying a minimal fee of KShs.10 on average.

Apart from drying, other functions include sorting which involved separating plant materials, shells, stones and fish fingerings from the *Omena*. The women would then sell to wholesalers (who also tripled as local assemblers and stockists); retailers; and domestic consumers (usually those residing near the beach). In cases where one would have very small quantities they would sell to other small scale processors often at a very small margin (Kshs. 5 per dish). Selling is done entirely at the beaches with a few exceptional cases (less than 25%) where orders or advance payments existed.

Wholesalers usually tripled as local assemblers, buying from different beaches, and also as stockists who would store *Omena* anticipating making voluminous sales or gain from high prices during the low/ban season. The majority of the wholesalers operated within the urban centers or the municipal markets. Consequently the majority (85%) comprised

of women. Apart from transportation and storage, most wholesalers perform no other functions. Similar to measurements at the landing beaches, there were no standardized containers. While polypropylene sacks were the most common transport and storage packaging, their weights would range from 85 kgs to more than 110kgs depending on who is packing the *Omena*. Buying prices fluctuated from beach to beach and from one season to another but averaged KShs. 4655 for a 90 kg bag of dried *Omena*. The wholesalers would then sell to retailers or to processing industries. A small percentage (less than 10%) would also sell to other wholesalers/ stockists; particularly those transporting *Omena* to regional markets such as Nakuru, Eldoret, Nairobi and Thika.

Retailers also comprised mainly of women. More than 90% of the retailers procured *Omena* from wholesalers in the same markets. Less than 10 % of the retailers would also directly buy from the small-scale processors or even fishermen at the landing beaches. These though were retailers who were located near the *Omena* landing beaches. Similar to observations by Abila (1995; 2000; 2002) Bokea and Ikiara (2000) and Manyala and Gitonga (2008), the units of measurements and lack of standardization was a major problem observed mainly amongst retailers. The study noted that different measures and containers are used for buying and selling *Omena*; including containers for cooking oil (*gorogoro*), margarine, fruit jam, marmalade, small troughs and sacks. All these differed in diameter and height, thereby making them less precise for transaction by different retailers and wholesalers. These also had implications on the sale volumes and margins. As concluded by Manyala and Gitonga (2008), variance in measurements introduced avenues for hard price and quantity bargaining, (commonly referred to as “*nyongeza*”).

For ease of analysis consumers were categorized into two: industrial and domestic. Industrial consumers included small and medium sized private companies that were involved in processing *Omena* fish. Most of these plants manufacture animal feeds. This explains their location in towns such as Nakuru, Eldoret and Thika; as these towns are surrounded by livestock farmers who demand processed animal feeds. Results indicated that the methods of conversion of *Omena* into animal feeds is more or less similar, only that the different companies use different brands for their products. Of the sampled companies less than 5% had agents who purchased *Omena* fish on their behalf. Procurements were done in terms of tones at frequencies ranging from monthly or once

in two months. Almost all of the industrial consumers bought *Omena* at prices ranging between Ksh. 55 and Kshs. 65; the average price being Kshs 58.4.

Domestic consumers comprised individuals or families who bought *Omena* for consumption purposes. More than 90% bought *Omena* from the markets either from wholesalers (13%) or retailers (85%). A minimum number of domestic consumers, at most 7%, located near the landing beaches would buy *Omena* directly from small-scale processors. Although the percentages are different the ratios confirm results by Abila 1995; concerning the consumers source of *Omena*.

In addition to the major participants outlined above, other stakeholders include: microfinance institutions (MFI); commercial banks; NGO's, Beach Management Units (BMU's); cooperative societies etc. all these played different roles that in one way or another affected the effectiveness of the *Omena* markets. Their roles are however discussed in details in the sections that follow.

4.2 Effectiveness of the Marketing Channels

As mentioned in Chapter 2, market performance refers to economic results that include effectiveness, equity, productivity and profitability. In this section, *Omena* market performance was examined along several dimensions including: measuring effectiveness of the existing marketing channels, i.e. testing whether the existing marketing channels offer proper service outputs or the right services in relation to consumer preferences; analysing marketing costs, price margins and profitability amongst the different *Omena* marketing activities; and through spatial price analysis to examine the extent to which *Omena* price patterns in different market-places co-move.

The effectiveness of the marketing channels was assessed by examining how well the marketing channels meet *Omena* consumers' (both industrial and domestic) and producers'/ fishermen demand for services in relation to their needs and preferences. Marketing channels are defined as alternative routes of product flows from producers to consumers, (Kohls and Uhl, 1990). Consequently effectiveness is defined as the ability of the marketing channels to result to (or offer) proper service outputs or the right services in relation to consumer preferences. In essence therefore, identification of the marketing chain precedes its analysis. This section presents results for the identified marketing

channels; activities carried along the channels; and the consumer preferences that the channels are designed to meet.

4.2.1. *Omena* Fish Marketing Channels

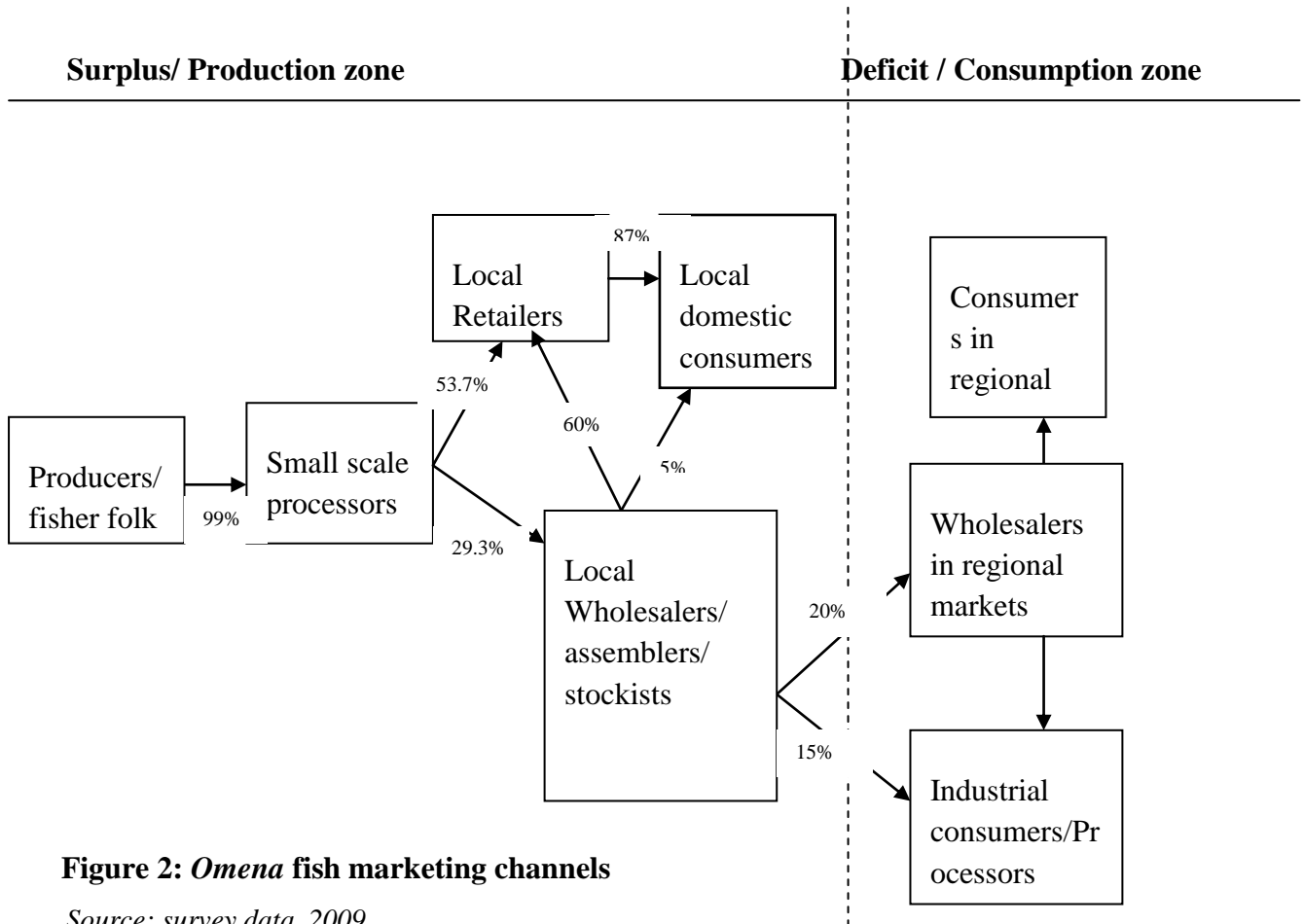


Figure 2: *Omena* fish marketing channels

Source: survey data, 2009

Results for the identified *Omena* marketing channels are presented in figure 2. From these results it was observed that *Omena* flowed from producers/ fishermen in the production region (Kisumu) to consumers both within the production zone and in other regional markets such as Nakuru and Nairobi. Results indicates that almost all 99% of fishermen would sell their *Omena* to small-scale women processors; out of which 53.7% of small-scale processors would sell to local retailers and domestic consumers, 29.3% to wholesalers and 17% to other small-scale processors.

Majority of wholesalers/ stockists sold their stocks to retailers in the local markets (60%), and to wholesalers in other regional markets (20%). The rest 15% of the wholesalers sold their stocks to industrial consumers while 5% sold to domestic consumers. Out of the

sampled retailers 77% bought *Omena* from wholesalers while the rest 23% bought from small-scale women processors. 87% of all the retailers sold their stocks to domestic consumers while the rest 13 % sold to other retailers who would in turn sell to domestic consumers.

In summary 2 major categories were identified. These two categories are:

- a) Channels supplying *Omena* meant for industrial consumption, and
- b) Channels supplying *Omena* meant for human consumption.

However under the two categories, the following channels were identified:

1. Fishermen → small-scale processors → local retailers' → local domestic consumers(Channel 1)
2. Fishermen → small-scale processors → wholesalers' → local retailers' → local domestic consumers. (Channel 2)
3. Fishermen → small-scale processors → local wholesalers' → regional wholesalers → regional retailers' → regional domestic consumers. (Channel 3)
4. Fishermen → small-scale processors → local wholesalers → regional → wholesalers industrial consumers(Channel 4)
5. Fishermen → small-scale processors → local wholesalers → industrial consumers (Channel 5)

N/B: local = surplus market zone (Kisumu)

: Regional = deficit market zone (Nakuru)

: → Means “sells to”

4.2.2 Consumer Preferences

As already noted, consumers were categorised into either industrial or domestic. Consumer preferences were analysed at the end of the channel. At this level the appreciation of final consumers and the degree of product suitability was observed from responses relating to quality, grading, packaging and form convenience. Table3 highlights some of the characteristics that consumers considered while buying *Omena*.

Table 3: Importance of *Omena* characteristics on consumers' choice

Characteristic	Percentage	
	Industrial consumers	Domestic consumers
Moisture content	33.3	-
Level of impurities	33.4	6.5
Colour of <i>Omena</i>	9.5	19.1
Size of <i>Omena</i>	23.8	20.2
Freshness	-	25.5
Cost	-	17.0
Odour/ smell	-	11.7
	100	100

Source: survey data, 2009

Results in Table 3 indicate that more than 89% of the industrial consumers were majorly concerned with characteristic such as moisture contents, level of impurities and the size of *Omena*. All these purportedly affected the quality of *Omena*, crude protein content and consequently the quality of feed produced. On the contrary, domestic consumers were majorly concerned with the freshness; cost; size colour and odour. The colour of *Omena* was associated with freshness while the size was associated with the protein content. Consequently, consumer preferences dictated the organization and the activities of suppliers along the chains. Some of these are discussed in section 4.2.3.

4.2.3 Services offered by the *Omena* marketing channels

In this study, the effectiveness of *Omena* marketing channels was mainly assessed by different services that the channels have offered in the market in order to maximize consumer satisfaction. Most of these included: assembling and distribution (exchange functions); storage and transport (physical functions); and grading and financing (facilitating functions).

Regarding assembling and distribution; and similar to an argument used by Luu (2002), spatial convenience factor of the service output was assessed. This mainly refers to the distribution of wholesale and retail shops as well as the availability of transportation services. In return the attractiveness of wholesale and retail shops to consumers is related to its location. Results indicated that *Omena* fishermen, small-scale processors,

wholesalers and retailers who targeted domestic consumers were located, or built their shops places that could offer some convenience for transport, loading and un-loading *Omena* or at a central place that customers can easily visit in order to attract more customers. Traders were located at local governments' stalls or designated market places which are easily accessible to consumers.

With respect to the transport function, most *Omena* traders used cheap transport means such as bicycles, motorcycles, carts, and public transportation means (Table 4). Sharing of transportation means was also common particularly amongst wholesalers; with 48% of the traders indicating that they shared transport modes and similarly transportation costs; 55.6 % of all traders shared costs by volumes transported. These in turn translated to lower cost of *Omena* to the consumer. On the supply side, traders did not experience any transportation problem.

Those traders who targeted industrial consumers would however not share transportation means as the quantities delivered were usually large and voluminous. As opposed to packaging *Omena* in bags as was the case for traders targeting domestic consumers, those selling industrial consumers used trucks and pick-ups to transport *Omena*.

Table 4: Means of Transport Used

Transport means	% of respondents	Participant/ location	Target market/ consumer
By head	27.4	Small scale processors / retailers (beaches & urban markets)	Both
Bicycle	19.4	Small scale processors / retailers (beaches & urban markets)	Both
Handcart	3.2	Wholesalers/ retailers within urban markets	Both
Public transport/ "matatu"	45.2	Wholesalers/ assemblers- local and regional markets	Domestic
Truck /pick-up	4.8	Wholesalers/ stockists	industrial
Total	100		

Source: survey data, 2009

With respect to storage, this study did not reveal any major local supply shortages of *Omena*. This observation though might have been affected by the fact that during the year of the survey (2009), the Ministry of Fisheries (MOF) did not effect the annual fishing ban; that comes between the months of April and. This implied that supply of *Omena* was not entirely stopped though there might have been distortions in quantity supplied. The results also indicated that 72% of all wholesalers and retailers stored their stocks. This implied that *Omena* is always available for both industrial and domestic consumption needs. For traders and feed processors located in Nakuru, storage was even a more important issue. Wholesalers and processors had to keep in store certain amounts of *Omena* in order to fulfil unexpected orders from either the industrial processors or animal feed buyers respectively.

Participants were also asked questions regarding other activities that they carried out including: drying, storage, preservation, sorting and grading. Results are presented in Table5

Table 5: Other Activities Offered Along the *Omena* Marketing Channels

Activity	Percentage of response		Total
	Yes	No	
Drying	52.5 %	47.5%	100%
Store	72.7%	26.3%	100%
Preservation	33.3%	66.7%	100%
Grading	19.2%	80.8%	100%
Sorting	75.8%	24.2%	100%

Source: survey data, 2009

Results in table 5 indicate that except for preservation and grading, more than half of the suppliers dried and sorted their *Omena* stocks. These implied that there were efforts in meeting demand at any time (through storage); lowering the level of impurities (sorting); and meeting the required moisture levels (drying). Overall these activities are geared towards ensuring that the quality requirements are met.

With regard to overall credit access 82.1% of all the respondents indicated that they had access to credit. However, credit sources were mostly informal.

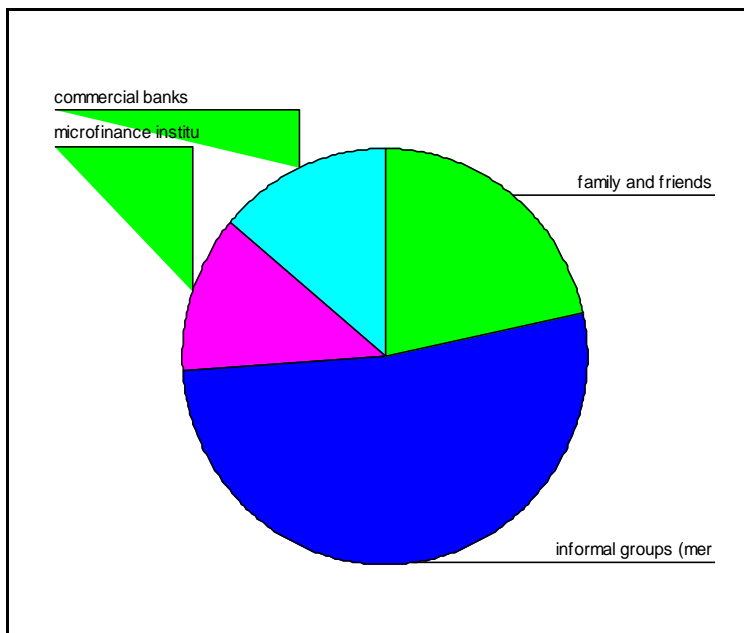


Figure 3: Sources of credit in the *Omena* marketing chain

Source: survey data, 2009

The results presented in figure 3 indicate that more than 50% of those who had access to credit sourced it from informal lending groups commonly termed as “*merry go rounds*” or “*chama*”. A further 17% sourced credit from family and friends while credit contribution from formal banks and micro finance institutions was approximately 21%. These results concur with observations by Manyala and Gitonga (2008), who noted that the industry was grossly credit constrained. Comparable to sources, uses of credit varied from purchase of nets, lamps and repair of boats by fishermen to increase stocks, meeting transport and storage costs for all other players in the marketing chain. Again these activities ensured to continuous supply of *Omena* to consumers in different market outlets.

4.3 Gross Margins and Price Spreads Analysis

For this objective to be met several conversions were necessary because of the nature of the *Omena*. For example, although fishermen sold *Omena* fish when wet, small scale processors dried it immediately after purchase to increase its shelf life. Drying though reduces the weight of *Omena* by almost 10 times, while it increases its volume one and a half times. In addition, packaging weights for the different participants were observed to be different.

After determining the average selling prices for each and every type of trader in both market zones (figure 4), gross marketing margin analysis was done using the formulas discussed in chapter 3. The margins were calculated basing on the two major marketing channels previously identified under section 4.2.1.

Surplus/ producing zone

deficit / consumption zone

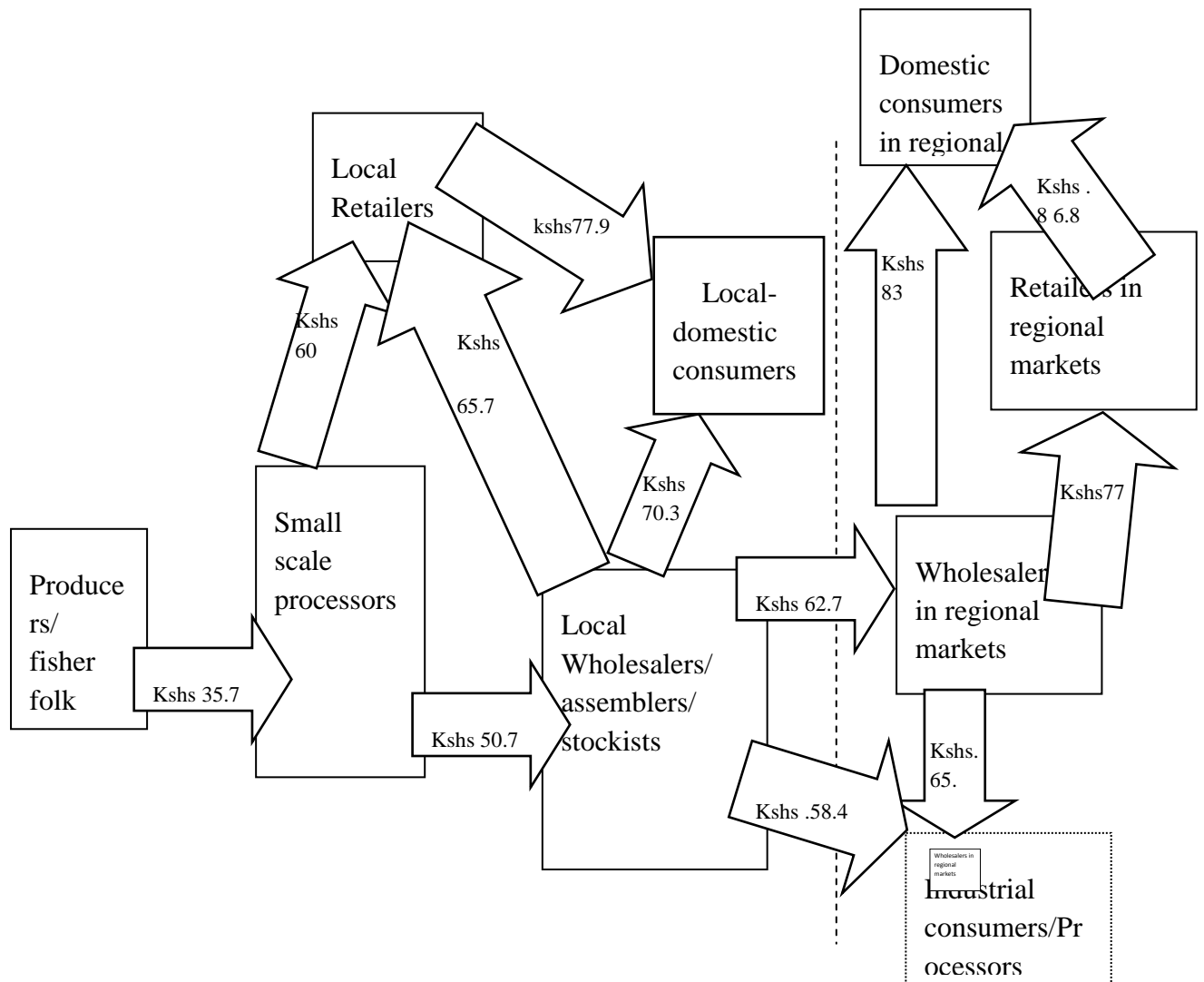


Figure 4: Average *Omena* selling prices for different traders (kshs/kg)

Source: survey data, 2009

Figure 4 generally indicates that longer channels resulted to high product costs to the final consumers. It was also observed that *Omena* meant for human consumption attracted higher prices than that meant for industrial use. These observations partially explains the differences in customer preferences on one hand and differences in quality of *Omena*; and thus functions performed along the chain, on the other hand.

Marketing costs were approximated using the weighted average method. Except for fishermen, small-scale processors and consumers, transport costs and market levy constituted more than 60% of the marketing costs. The rest being covered by storage costs, hired labor

and packaging materials. Different participants incurred different costs. The average marketing costs for each and every participant are as indicated in Table 6. After which marketing margins were calculated using formulas described in chapter 3.

Table 6: Agents Average Marketing Costs

Participant/ Agent	Average marketing cost (MC) Per kg –kshs.
Fishermen	4.2
Small-scale processors	9.8
Local wholesalers (Kisumu)	5.5
Local retailers (Kisumu)	4.1
Regional wholesalers (Nakuru)	7.2
Regional retailers (Nakuru)	4.5

Source: survey data, 2009

Table 7: Gross Marketing Margins by Channel

Marketing margins	Kisumu			Nakuru	
	Chan 1	Chan 2	Chan 3	Chan 4	Chan 5
TGMM	54.6%	54.6%	59.2%	45.5%	39.4%
Small-scale processors	31.6%	19.6%	19.9%	23.5%	26.2%
Local wholesalers (Kisumu)	-	19.3%	15.6%	18.5%	13.2%
Local retailers (Kisumu)	22.9%	15.7%	-	-	-
Regional w/salers (Nakuru)	-	-	18.6%	3.5%	-
Regional retailers (Nakuru)	-	-	11.3%	-	-
Total marketing costs (kshs/kg)	23.2 % (Kshs18.1)	30.3 % (Kshs.23.6)	35.9% (Kshs.31)	41.1% (Kshs.27)	33.4% (Kshs.20)
Fisherman's share	60%	60%	56%	52%	47%

Source: survey data, 2009

Results in table 7 indicated that channels 1 and 2 had rewarded fishermen the best while channel 4 and 5 had the lowest rewards. Worth noting is that channels 1 and 2 supplied domestic producers within the production zone (Kisumu), while channels 4 and 5 were dedicated to industrial consumers located in Nakuru. Producers share/ rewards for channel 3; which supplied domestic consumers of *Omena* in Nakuru, were relatively lower than those of channels 1 and 2 but higher than those in channels 4 and 5. In general, channels that supplied *Omena* for human consumption rewarded fishermen better than those dedicated to supplying *Omena* for industrial consumption.

The shares of the total marketing cost relative to the consumer prices indicated that traders in channels 5 and 1 made the highest profit margins while those in channel 4 and 3 made the lowest profit margins respectively.

4.4 Results for Integration Analysis

4.4.1 Seasonal index

Agricultural prices are usually affected by seasonality of production. Since 2002 the Kenyan government introduced a ban on *Omena* fishing during the months of April to July; this is the *Omena* breeding season. *Omena* is also scarce during the dry months but abundant during the rainy/ high moon season. To eliminate the effects of seasonal trends, 2-12 months moving averages were used.

4.4.2 Price trends

Price trends were determined using the formulas described in section 3.4.3 (Chapter 3). The results are as indicated in figures 5 through 8.

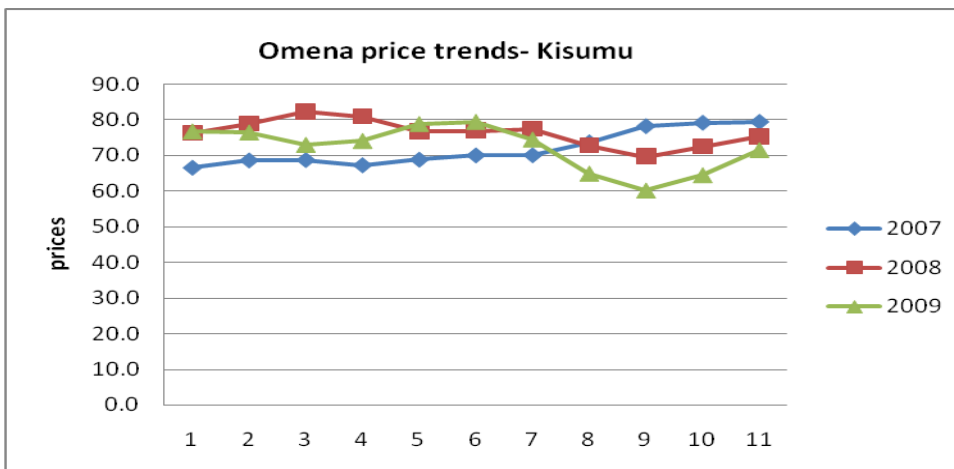


Figure 5: *Omena* price trends, Kisumu (nominal prices)

Source: survey data, 2009

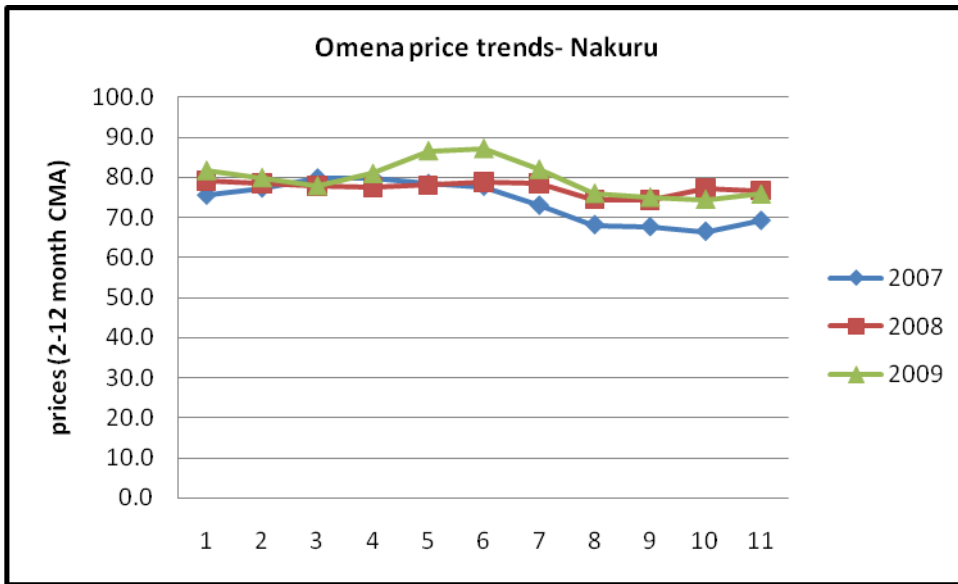


Figure 6: Omena price trends,Nakuru (nominal prices)

Source: survey data, 2009

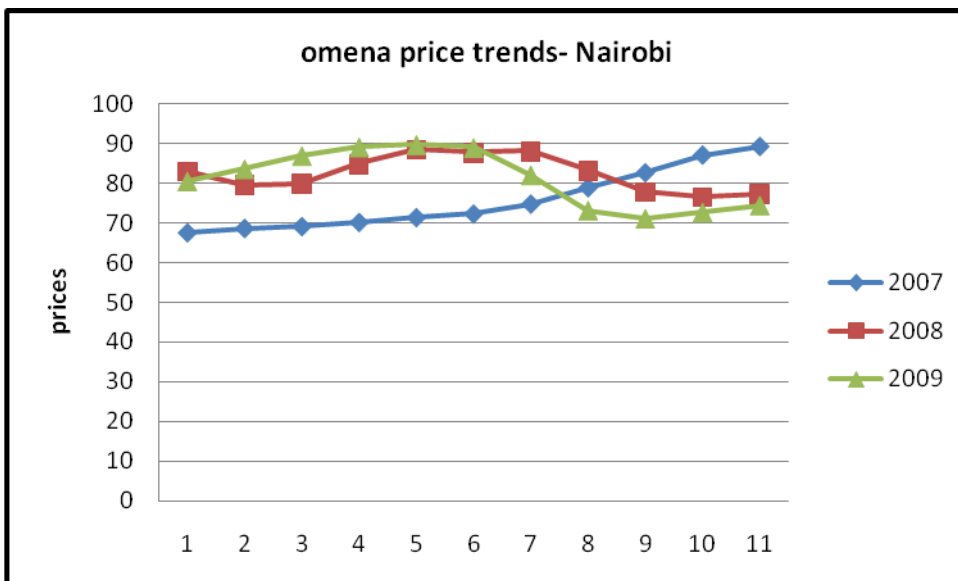


Figure 7: Omena price trends,Nairobi (nominal prices)

Source: survey data, 2009

Despite being located far from the consumption zone, *Omena* prices were relatively low in Nairobi. Being a major urban centre many traders target and supply this market. Oversupply and a relatively low demand for *Omena* may be some of the explanations for the low prices.

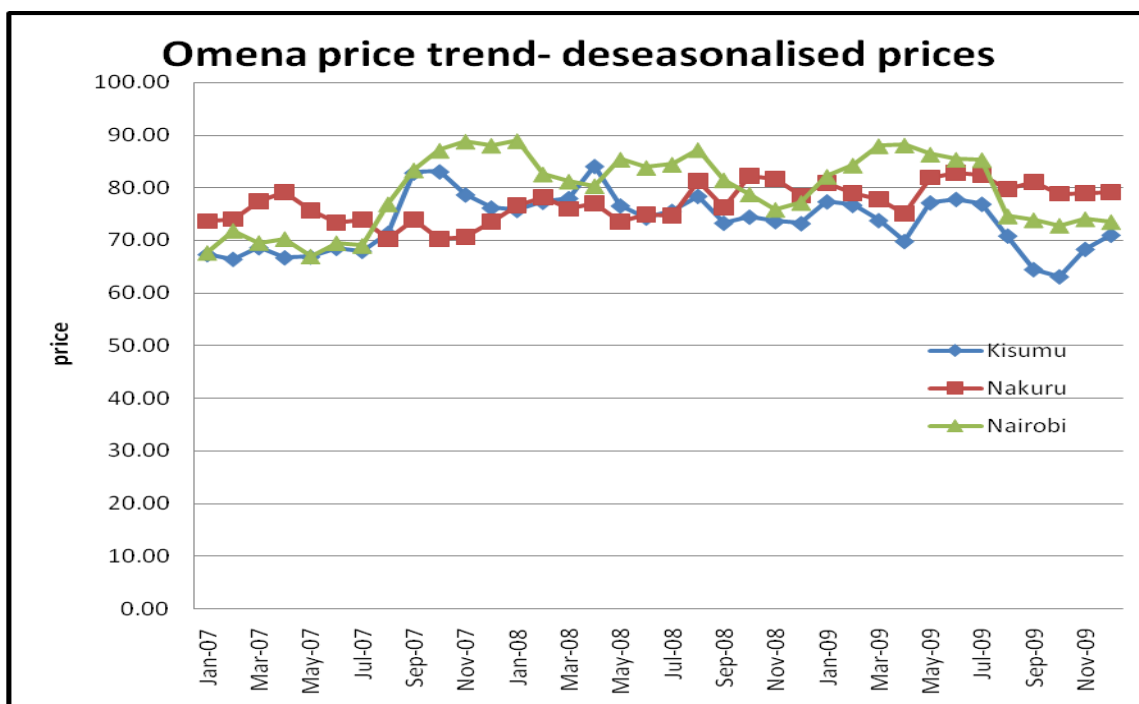


Figure 8: Omena price trends 2007-2009 (deseasonalised prices)

Source: survey data, 2009

General trends indicate that *Omena* retail prices have remained relatively high (above kshs 60) per kg. Prices are higher in Nakuru as compared to Nairobi. This can be explained by a high presence of small and medium *Omena* processing which act as competition for *Omena* meant for human consumption. In addition, Nakuru is a cosmopolitan town with a high demand for *Omena*. Similarly high demand for *Omena* (it's a major food and protein source) in Kisumu may have contributed to high retail prices, despite the fact that this is the major production region. The statistical characteristics and correlation coefficients for *Omena* prices in the selected markets are presented in tables 8 and 9 respectively.

Table 8: Statistical characteristics of the deseasonalized prices (Jan 2007- Dec 2009)

Market	Minimum (Kshs)	Maximum (Kshs)	Mean (Kshs)
Kisumu	63.11	84.07	73.51
Nakuru	70.26	82.89	77.11
Nairobi	66.99	88.94	79.59

Table 9: Pearson correlations for the selected markets deseasonalised prices

Market	Kisumu	Nakuru	Nairobi
Kisumu	1.0000		
Nakuru	-0.0503	1.0000	
Nairobi	0.7549	-0.0125	1.0000

4.4.3 Unit root test results

Stationarity tests on each of the price series (P_t) preceded co-integration tests. The null and alternative hypotheses were as follows:

H_0 : P_t is a unit root, against the alternative

H_1 : P_t is a trend stationary process.

Table 10 shows the results of the unit root test levels and of the first difference of the selected markets for the period 2007-2009. Using ADF, the null hypothesis (presence of unit root) was rejected in all cases meaning that Kisumu, Nakuru and Nairobi *Omena* markets are stationary series. There was no need therefore to test the first differences of the price series to determine the order of integration. For further confirmation we test for market co-integration for the selected markets.

Table 10: Unit root test results for the selected *Omena* markets 2007-2010

Series	Level test statistics (*ADF)
Kisumu	-2.45
Nakuru	-2.71
Nairobi	-1.97

Source: Field survey data (2009) * (ADF) levels critical values for H_0 : Unit root with drift, H_1 : Linear trend stationarity: $< -1.692(5\%), < -1.308 (10\%)$

4.4.4 Co-integration test results

If two prices in spatially separated markets (or different levels of the supply chain) p_{1t} and p_{2t} contain stochastic trends and are integrated of the same order, say $I(d)$, the prices are said to be co-integrated if:

$$p_{1t} - b p_{2t} = u_t \text{ is } I(0) \dots \dots \dots (11)$$

b is referred to as the co-integrating vector. To confirm whether the selected markets are co-integrated, the above relationship was estimated utilizing Ordinary Least Squares OLS (Engle and Granger, 1987). The null of no co-integration was tested by applying unit

root tests on the residuals (u_t) for each of the price series. The hypotheses $H_0: U_t \sim I(1)$ was tested against $H_1: U_t \sim I(0)$. Results are presented in the table 11 below.

Table 11: Co-integration results

Markets	Test statistic	Critical values	
		5% (*ADF)	10% (**ADF)
Kisumu- Nakuru	-1.63	-2.972	- 2. 618
Kisumu- Nairobi	-3.53	-2.972	- 2. 618
Nakuru- Nairobi	-1.83	-2.972	- 2. 618

Source: survey data (2009): * - 5% significance level; **- 10% significance level.

To be able to reject the null (no co-integration), the t-statistic needed to be large and negative. Results in table 11 indicate that except for Kisumu– Nairobi markets which exhibited co-integration, all the other markets were not integrated and therefore a long run relationship amongst prices existed. The presence of co-integration in the Kisumu-Nairobi markets is not amazing. This is because domestic consumption prices were considered in the analysis. Most of *Omena* supplied to Nakuru was used in the feed processing industries. Storage and procurement in bulk would essentially indicate lack of price transmission. This property and the inability of the Engel and Granger model to explain reasons for integrations are some of its limitations.

In order to make a clear distinction between short-run and long-run price relationships amongst *Omena* Markets in Kisumu and Nairobi, an Error Correction Model (ECM) was used. This allows for derivation of the speed of price transmission from one location/market to another; an important dimension of integration.

As indicated in chapter three, the Error Correction Model (ECM) resulted to the following coefficients:

$$\Delta X_t = 0.013 + 0.495 \Delta Z_t - 0.587 U_{t-1} + \varepsilon_t \dots\dots\dots (12)$$

Where; Δ = first difference operator, ε_t = random error term and $U_{t-1} = (X_{t-1} - \alpha - \beta Z_{t-1})$

X_t is *Omena* prices in Kisumu while Z_t are *Omena* prices in Nairobi.

The ECM shows that *Omena* price changes in Kisumu depended on the price changes in Nairobi and also on equilibrium error term. In addition the absolute values of α_2 (0.587) indicated that whenever prices were not in equilibrium they would be restored within a period of slightly more than half a month. This speed of adjustment is rather low implying a low degree of integration amongst the two markets for *Omena* fish (i.e. Kisumu and Nairobi)

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

After a thorough analysis of marketing effectiveness, this study concluded that the channel of *Omena* distribution is quite effective in providing the form and quality of *Omena* required to satisfy consumer preferences. However, if we link this result with assortment of *Omena* it is evident that at the beach level, wholesale, and retail level, the grading standard of *Omena* quality is not consistent. At the fishing level, *Omena* catch is differentiated only by the level of impurities and is sold while wet. At the small-scale level the effectiveness of sorting and drying, and the method of drying (whether on racks or on nets spread on the ground) affects the quality of *Omena*. At this stage high chances of adulteration occur including mixing *Omena* with sand and shells to add on weights particularly if *Omena* is meant for industrial use. At the wholesale level no more sorting or grading occur as *Omena* is sold in bulk. In addition packaging is un-standardized.

On the other hand, retailers do sort *Omena* to meet consumer preferences (as discussed in chapter four). In practice, *Omena* retailers in the markets usually sell *Omena* to consumers by different measures without packaging. This form of product is very convenient to consumers. The major problem is however a consistent lack of standardization as in all other levels of marketing. Industrial consumers such as animal feed processors receive sales services from the *Omena* wholesalers/ suppliers in terms of free delivery of the product to their premises. The *Omena* wholesalers usually contact and negotiate with wholesale consumers by telephone and samples before final delivery. Again samples can be quality deceiving and lack of standard grade becomes a major issue. The only advantage at this level is that *Omena* is delivered in tonnes and therefore the quantity standards are observed. Weight losses may however result to losses especially if the fish was not well dried.

Form convenience is the last factor that affects the level of satisfaction of consumers in the market. *Omena* is a relatively a homogenous product, thus, at the retail market; form convenience refers largely to quality. Finally, regarding the finance function, this study found that in particular large-scale traders face credit constraints. Most private *Omena*

traders borrow money from informal sources such as friends, relatives; a small portion however borrows from banks and micro-finance institutions. In sum, the *Omena* marketing channels in Kenya are organized quite effectively. *Omena* producers and traders in the channels try to offer convenient forms of product and good services to final consumers. The effectiveness of the *Omena* marketing channels is quite satisfactory, except the lack of standardization and constrained access to credit; which in turn acts as a barrier for many private traders to further development of their businesses.

Gross margin analysis indicated that longer channels resulted to high product costs to the final consumers. It was also observed that *Omena* meant for human consumption attracted higher prices than that meant for industrial use. These observations partially explained the differences in customer preferences on one hand and differences in quality of *Omena*; and thus functions performed along the chain, on the other hand. Channels that supplied domestic producers within the production zone (Kisumu) were found to be more rewarding to fishermen while those dedicated to industrial consumers located in Nakuru rewarded fishermen poorly. With regards to costs the study concluded that the major cost drivers for *Omena* traders were transportation and market levies which constituted more than 60% of the marketing costs

Integration results indicated lack of integration between Kisumu and Nakuru and Nakuru-Nairobi but presence of integration between Kisumu and Nairobi markets. This integration was however weak as depicted by long periods of price adjustments.

5.2 Recommendations

Striving for an improved access to credit, market information, transportation and grading are important objectives. Poor infrastructure, namely transport and communication services, gives rise to large marketing margins because of the high costs of delivering products to destinations. They may also hinder the transmission of price signals because of non-competitive behaviour amongst traders. On the other hand, infrastructural development can play an important role in supporting the integration of *Omena* markets, facilitating competition, encouraging investment, and allowing a more efficient allocation of resources and enhancing market oriented production.

Promotion of exports would require observation of high grading and standards. To be able to achieve this necessary mechanisms such as policy support, technical and training support is necessary along the entire *Omena* marketing channel. Particularly, establishment of a code of standards and a grading system will improve and formalise *Omena* marketing. While high costs may erode competitiveness and push retail prices high as to lower the demand for *Omena*, the government should improve the local transportation and marketing infrastructure. The development of an effective *Omena* fish value chain is urgently needed.

REFERENCES

- Abila, R.O. (1995). Structure, Conduct and Performance of Kisumu Fish Marketing System. MSc Thesis, University of Nairobi.
- Abila, R. O. (2000). The Development of Lake Victoria Fishery: A Boon or Bane for Food Security. IUCN Eastern Africa Programme on Socio-Economics of the Lake Victoria Fisheries. Report No. 8. June 2000.
- Abila, R.O. (2002). A Socio-Economic Analysis of the Fishery Cooperatives of Lake Victoria (Kenya). PhD Thesis, University of Hull.
- Abila, R.O. and Jansen, E.G. (1997 a). From Local to Global Markets: The Fish processing and Exporting Industry on the Kenyan Part of Lake Victoria: Its Structure, Strategies and Socio-Economic Impacts. Centre for Development and the Environment, University of Oslo, Oslo.
- Abila, R. O. and Jansen E. G. (1997 b). From Local to Global Markets: The Fish Exporting and Fishmeal Industries of Lake Victoria – Structure, Strategies and Socio-economic Implications in Kenya. IUCN Eastern Africa Programme on Socio-Economics of the Lake Victoria Fisheries. Report No. 2. October, 1997
- Barret, C.B (1996). Market Analysis Methods: Are our enriched toolkits well suited to enlivened markets? *American journal of agricultural economics* 78: 825 – 829.
- Barret, C.B (2001). Measuring Integration and Efficiency in International Agricultural Markets, *Review of Agricultural Economics*, 23:19 – 32. Cambridge University Press.
- Bokea C. and M. Ikiara (2000). The Macro Economy of the Export Fishing Industry in Lake Victoria (Kenya). Socio-Economics of Lake Victoria Fisheries, IUCN Report No. 7
- Bressler, R. G. and King, R. A. (1970). *Markets, prices and international trade*. New York: John Wiley
- Davidson, R., and MacKinnon J.G., (2004). *Econometric Theory and Methods*. New York: Oxford University Press, Inc.
- Delgado, C.A. (1986). Variance components approach to food grain market integration in northern Nigeria. *American Journal of Agricultural Economics*, Vol. 68(4): 970-979.
- Dickey, D.A. and Fuller, W.A. (1979). Distribution of the estimators for autoregressive

- time series with a unit root. *Journal of the American Statistical Association* 74(366): 427-431
- Dijkstra, T. (1997). "Horticultural Marketing Channels in Kenya: Structure and development", *Ph.D. Thesis, Wageningen University, The Netherlands*
- Engle, R.F, and Granger C.W.J (1987). Co-integration and Error Correction: Representation, Estimation, and Testing. *Econometrica*, 55: 251 – 276.
- Engle, R.F. and Yoo, B. S. (1987). Forecasting and Testing in Co-integrated Systems. *Journal of Econometrics* 35(1): 143-159
- Fama M, and Eugene (1970). Efficient Capital Markets: A Review of Theory and Empirical Work, *Journal of Finance*, 25, pp. 383-417.
- Ghosh, M. (2000). Cointegration Tests and Spatial Integration of Rice Markets in India, *Indian Journal of Agricultural Economics*, Vol. 55, No.4, October-December, pp.616-625.
- Goletti, F., Ahmed, R., Farid, N. (1995). Structural Determinants of Market Integration: The Case of Rice Markets in Bangladesh. *The Developing Economics*, xxxiii – 2
- Goletti, F., and Babu, S. (1994). Marketing Liberalization and Market Integration of Maize Markets in Malawi. *Journal of Agricultural Economics*, Vol. 11: 311-324.
- Goodwin, B.K., and T.C. Schroeder (1991) Co-integration Tests and Spatial Price Linkages in Regional Cattle Markets. *American Journal of Agricultural Economics*. 73(2): 452-64.
- GoK. (2005). Fisheries Annual Statistics Bulletin, Kenya.
- GoK. (2006). Fisheries Annual Statistics Bulletin, Kenya
- GoK. (2007). Fisheries Annual Statistics Bulletin, Kenya
- GoK. (2008). Fisheries Annual Statistics Bulletin, Kenya
- GOK. (2008) Ministry of Agriculture/Private Sector Development in Agriculture (PSDA). Annual bulletin, Kenya
- Gujarati, D.N. (2003). *Basic Econometrics*. McGraw-Hill Higher Education. International
- Herman, D. L., and Fateh, M. M. (2006). Testing Integration in Regional Onion markets of Pakistan: An Error Correction Model in Presence of Stationarity. *International Research Journal of Finance and Economics*.
- Jystish P. B. (2006). Co-integration and Market Integration: An Application to the Potato Market in Rural West Bengal, India. Paper Presented at the Economists Conference in Gold Coast, Australia.

- Kohls R .L, and Uhl J.N. (1998). *Marketing of Agricultural Products*. Fifth Edition, Macmillan, New York.
- Kotler, P. (1997). *Marketing Management: Analysis, Planning, Implementation, and Control*, 9th Edition. Upper Saddle River, NJ: Prentice Hall International.
- Lutz, C.H.M. (1994). “The Functioning of the Maize Market in Benin: Spatial and Temporal Arbitrage on the Market of a Staple food Crop”, *Ph.D. Thesis*, University of Amsterdam, The Netherlands.
- Luu T.D H., (2002). The Organization of Liberalized Rice Market in Vietnam. Unpublished Ph.D. Thesis, University of Groningen, Netherlands. Retrieved (29th May 2009) from www.dissertations.ub.rug.nl/FILES/faculties/econo/2003/l.t.d../titlecon.pdf.
- MacKinnon, J.G (1991) Critical values for co-integration tests. In Engle, R.F. & Granger, C.W.J. (eds.) *Long-Run Economic Relationships: Readings in Co-integration*. Oxford University Press, Oxford.
- Maddala, G. S. and Kim, I. M. (1998) *Unit roots, co-integration, and the structural change*.
- Manyala, J. O. (2000). Surplus Production for Lake Victoria (Kenya): Application of Auto Regressive Integrated Moving Average (ARIMA) for Fish Catch Prediction. *In: Proceedings of the Lake Victoria 2000 A New Beginning*. pp. 202 – 209.
- Manyala, J. O. and Gitonga, N. K. (2008). *A Study on Marketing Channels of Omena and Consumer Preferences in Kenya*. Second Draft Final Report Presented at Omena Stakeholders Workshop at Tom Mboya Labour College, Kisumu, Kenya.
- Pomeroy, R. S, and Trinidad A.C. (1995). Industrial Organization of Market Analysis: Fish marketing. *Prices, products and people: Analyzing Agricultural Markets in Developing Countries*. International Potato Centre.
- Ravallion, M. (1986). Testing Market Integration. *American Journal of Agricultural Economics*, 68(1): 102 -109
- Sexton, R.J.; Kling C.L., and Carman H.F. (1991) Market Integration, Efficiency of Arbitrage, and Imperfect Competition: Methodology and Application to U.S. Celery. *American Journal of Agricultural economics*, 73(3):568-80.
- Stern, L.W., Ansary, A.I.E. and Coughlan, A.T. (1996). *Marketing Channels*, 5th Edition, Upper Saddle River, NJ: Prentice Hall International.
- Tuan, Vu Anh (2000). “The Improvement of Omena Marketing Channels of Omon

District, Cantho Province, Vietnam”, Unpublished MSc. Thesis, SEBA, Cantho University. Retrieved from www.dissertations.ub.rug.nl/FILES/faculties/eco/2003/1.t.d.../titlecon.pdf.

Uchezuba, D.I. (2005). Measuring Market Integration for Apples on South African Fresh Produce Market: A Threshold Error Correction Model. Unpublished MSc. Thesis, University of Free State, Bloemfontein. South Africa. Retrieved (21st June 2009) from [www. ageconsearch.umn.edu/bitstream/28065/1/mt05uc01.pdf](http://www.ageconsearch.umn.edu/bitstream/28065/1/mt05uc01.pdf).

APPENDICES

APPENDIX 1: PRODUCER'S / FISHERMEN'S QUESTIONNAIRE

TITLE: ANALYSIS OF MARKET PERFORMANCE: A CASE OF 'OMENA' FISH IN SELECTED OUTLETS IN KENYA

The purpose of this study is purely academic and aimed at contributing to the understanding of the performance of *Omena* fish markets in Kenya. You are kindly requested to participate in filling in the questionnaire while being assured that any information shared will be confidential. Thank you.

CODE.....-

Name of interviewer.....

Name of respondent.....

Place of interview (*Beach*).....

Date.....

1. How long have you been fishing *Omena*? (1) Less than 1 year (2) 1-2 years (3) 3-4 years (4) 5-6 years (5) over 6 years
2. How many days in a week do you harvest *Omena*? (1) 1-2 days (2) 3-4 days (3) 5-6 days (4) everyday
3. Do you own or hire a boat (1) Own (2) Hired
4. If hired, how much do you pay KShs..... /night?
5. Do you share the hired boat with others? (1) Yes (2) No
6. If yes, how do you share the costs? (1) By weight/ volume of harvest (2) Equally
7. What quantities of *Omena* do you harvest in a normal busy day? (Take the applicable measurement units) (1) 1-5 Troughs (2) 6-10 Troughs (3) 11-15 Troughs (4) 16-20 Troughs (5) 21-26 Troughs (6) Above 26 Troughs
8. Where/ to whom do you sell your harvest? (1) Women processors (2) Stockists / wholesalers (3) Millers (4) Retailers (5) Consumers
9. At what price do you sell your *Omena* presently? Ksh / trough or Ksh/dish.....
10. How do you determine the selling price for *Omena*? (1) In advance (2) At the market place (3) Other (specify)
11. What other marketing costs do you incur in harvesting *Omena*? (Costs relating to fishing and marketing should be completed by fishermen)

Cost Item	Unit	Cost/Unit (Ksh)/ Wk
Fuel/Paraffin		
Net hire/repair		
Lamp hire		
Levy/Society fees		
Hired labour		
Storage		
Others (specify)		

12. Do you have access to credit? (1) Yes (2) No

13. If yes, where do you acquire credit? (1) Family and friends (2) Informal saving and credit groups (3) Microfinance institutions (4) Commercial Banks (5) Others (specify)

14. What kind of losses do you usually incur in *Omena* trade?

Type of loss	Approximate monetary value (KSh)	Frequency of occurrence
Spillage during handling		
Rotting/ spoilage		
Theft		
Adulteration		
Others (specify)		

15. What are the main problems that you encounter in *Omena* marketing?

Type of problem	Frequency of occurrence

16. Generally, how do you view *Omena* marketing?.....

THANK YOU FOR YOUR TIME

APPENDIX2: SMALL-SCALE/ WOMEN PROCESSOR QUESTIONNAIRE

TITLE: ANALYSIS OF MARKET PERFORMANCE: A CASE OF ‘OMENA’ FISH IN SELECTED OUTLETS IN KENYA

The purpose of this study is purely academic and aimed at contributing to the understanding of the performance of *Omena* fish markets in Kenya. You are kindly requested to participate in filling in the questionnaire while being assured that any information shared will be confidential. Thank you.

CODE

Name of interviewer.....

Name of respondent

Place of interview (beach).....

1. How long have you been in small scale *Omena* processing? (1) Less than 1 year (2) 1- Years
(3) 3-4 years (4) 5-6 years (5) over 6 years
2. How many days in a week do you buy/sell *Omena*? (1) 1- 2 days (2) 3-4 days (3) 5- 6days (4) everyday
3. Do you operate in this beach only? (1)Yes (2) No
4. If No, which other beach?
5. What quantities of *Omena* do you process in a normal busy day? (Use the applicable measurement units). (1) Up to 1 bag (90 kg) (2) 1-5 bags (3) 5-10 bags
(4)10-20 bags (5) 20-50 bags, (6) 50-100 bags (7) Over 100 bags.
6. What is the source of your *Omena*? (1) Fishermen (2) Women processors
(3) Wholesalers (4) other (specify)
7. At what price do you buy *Omena*? KSh...../kg/bag/tonne/ trough (Select the appropriate units)
8. How do you determine the buying price? (1) Direct observation (2) Personal communication (3) Using agents (4) Using grades (5) Other (specify).
9. Are there any contractual arrangements in buying of produce? (1) Yes (2) No
10. If Yes what kind of arrangements?
11. Do you consider the buying price affordable? (1) Yes (2) No

- 12., What is your opinion on the quality of *Omena* that you buy? (1) Poor (2) average (3) good.
13. How far are you located from your buying point? (1) >1 km (2) 1-2 Kms (3) 3-4Kms (4)5 -6 Kms (5) Over 6 Kms
14. Do you transport your own stocks? (1) Yes (2) No
15. If yes what mode of transport, do you use? (1) By head (2) Bicycle (3) Handcart (4) Public transport (5) Truck/ pick- up (6) Donkey (7) Other (specify).
16. Is the transport mode own? Or hired? (1) Own (2) Hired
17. Do you share this mode of transport with others? (I) Yes (2) No
18. If yes, how do you share the costs? (i) By weight/ volume (2) Per trip (3) Equally (4) Per distance
19. How many trips do you make per week? (1) 1 trip (2) 2-3 trips (3) 3-5 trips (4) Over 5 trips
20. How is the transport cost determined? (1) Per weight/volume handled/ transported (2) Per distance (3) per trip (4) other (specify).....
21. Where/ to whom do you sell your produce? (1) Women processors (2) Stockists/ wholesalers (3) Millers (4) Retailers (5) Consumers
22. At what price do you sell your dried stocks presently? Ksh...../ (select the appropriate unit).
23. How do you determine the selling price for *Omena*? (1) In advance (2) At the market place (3) Other (specify)
24. What criteria do you use in determining the selling price? (1)Direct observation (2) Personal communication (3) Agents/ brokers (4) others (specify).....
25. What other marketing costs do you incur in marketing *Omena*?

COST ITEM	UNIT	COST/UNIT (KSh)
Levy and market fees		
Cess		
Gunny/ polypropylene bags		
Drying racks		
Electricity bills		
Hired labour		

Storage		
Others (specify)		

26. Do you undertake any of the following activities? (Tick where appropriate)

- 1. Drying (1) (yes) (2) {no}
- 2. Grading (1) (yes) (2) {no}
- 3. Storage (1) {yes} (2) {no}
- 4. Preservation (1) {yes} (2) {no}
- 5. Sorting (1) (yes) (2) {no}

27. Do you have access to credit? (1) Yes (2) No

28. If yes, where do you acquire credit? (1) Family and friends (2) Informal saving and credit groups (3) Microfinance institutions (4) Commercial Banks (5) Others (specify).....

29. What kind of losses do you usually incur in *Omena* trade?

Type of loss	Approximate monetary value (KSh)	Frequency of occurrence
Spillage during handling		
Rotting/ spoilage		
Theft		
Adulteration		
Others (specify)		

30. What are the main problems that you encounter in *Omena* marketing?

.....

.....

.....

34. Generally, how do you view *Omena* processing?

.....

THANK YOU FOR YOUR TIME.

APPENDIX3: TRADERS (WHOLESALE/RETAILERS) QUESTIONNAIRE

TITLE: ANALYSIS OF MARKET PERFORMANCE: A CASE OF ‘OMENA’ FISH IN SELECTED OUTLETS IN KENYA

The purpose of this study is purely academic and aimed at contributing to the understanding of the performance of *Omena* fish markets in Kenya. You are kindly requested to participate in filling in the questionnaire while being assured that any information shared will be confidential. Thank you.

CODE

Name of interviewer:

Name of respondent:

Place of interview (market place).....

Date:

1. Type of trader (1) wholesaler/stockist (2) Retailer
2. How long have you been in *Omena* trade? (1) Less than 1 year (2) 1-2 years (3) 2-3 years (4) 3-4 years (5) over 5 years
3. How many days in a week are you involved in *Omena* trade? (1) 1- 2 days (2) 2-3 days (3) 3-4 days (4) 4-5 days (5) Over 5 days
4. Do you trade in this market only? (1) Yes (2) No
5. If No, which other markets?
6. What quantities of *Omena* do you handle in a normal busy day? (Take the applicable measurement units). (1) Up to 1 bag (90 kg) (2) 1-5 bags (3) 5-10 bags (4) 10-20 bags (5) 20-50 bags, (6) 50-100 bags (7) Over 100 bags.
7. Do you buy *Omena* on behalf of others? (1) Yes (2) No
8. If yes, how much commission do you get? KSh per (Kg/ bag/ tone...take the applicable measurement units)
9. What is the source of your *Omena*? (1) Fishermen (2) Women processors (3) wholesalers (4) other (specify)
10. At what price do you buy *Omena*? KSh...../kg/bag/tonne. (Select the appropriate units).
12. How do you determine the buying price? (1) Direct observation (2) Personal communication (3) Using agents (4) Using grades (5) Other (specify).....

13. Are there any contractual arrangements in buying of produce? (1) Yes (2) No
14. If Yes what kind of arrangements?
15. Do you consider the buying price affordable? (1) Yes (2) No
16. What is your opinion on the quality of *Omena* that you buy? (1) Poor (2) average (3) good.
17. How long does it take to collect *Omena* from your buying point? (1) 1 day (2) 2-3 days (3) 5 days (4) 1 week (5) Over a week
18. Do you transport your own produce? (1) Yes (2) No
19. If yes what mode of transport do you use? (1) By head (2) Bicycle (3) Handcart (4) Public transport (5) Truck/ pick- up (6) Other (specify)
20. Is the transport mode own or hired (1) Own (2) Hired
21. Do you share this mode of transport with others? (1) Yes (2) No
22. If yes, how do you share the costs? (1) By weight/ volume (2) Per trip (3) Equally (4) Per distance
23. How many trips do you make per week? (1) 1 trip (2) 2-3 trips (3) 3-5 trips (4) Over 5 trips
24. How is the transport cost determined? (1) Per weight/volume handled/ transported (2) Per distance (3) Per trip (4) Other (specify)
24. Where/to whom do you sell your produce? (1) Stockists / wholesalers (2) industrial processors/Millers (3) Retailers (4) Consumers
25. At what p*Omena* do you sell your produce presently? Ksh / (select the appropriate unit).
26. How do you determine the selling p*Omena* for *Omena*? (1) In advance (2) At the market place (3) Other (specify).....
27. What criteria do you use in determining the selling price? (1) Direct observation (2) Personal communication (3) Agents/ brokers (4) others (specify).....
28. What other marketing costs do you incur in marketing *Omena*?

COST ITEM	UNIT	COST/UNIT (KSh)
Transport		
Levy and market fees		

Gunny/ polypropylene bags		
Water bills		
Electricity bills		
Hired labour		
Storage		
Others (specify)		

29. Do you undertake any of the following activities? (Tick where appropriate)

1. Drying (1) (yes) (2) {no}
2. Grading (1) (yes) (2) {no}
3. Storage (1) {yes} (2) {no}
4. Preservation (1) {yes} (2) {no}
5. Sorting (1) {yes} (2) {no}

30. Do you have access to credit? (1) Yes (2) No

31. If yes, where do you acquire credit? (1) Family and friends (2) Informal saving and credit groups (3) Microfinance institutions (4) Commercial Banks (5) Others (specify)

32. . What kind of losses do you usually incur in *Omena* trade?

Type of loss	Approximate monetary value (KSh)	Frequency of occurrence
Spillage during handling		
Rotting/ spoilage		
Theft		
Adulteration		
Others (specify)		

33. What are the main problems that you encounter in *Omena* marketing?

Type of problem	Frequency of occurrence

34. Generally, how do you view *Omena* marketing?

.....

THANK YOU FOR YOUR TIME.

APPENDIX4: INDUSTRIAL CONSUMERS (MILLERS) QUESTIONNAIRE

TITLE: ANALYSIS OF MARKET PERFORMANCE: A CASE OF ‘OMENA’ FISH IN SELECTED OUTLETS IN KENYA

The purpose of this study is purely academic and aimed at contributing to the understanding of the performance of *Omena* fish markets in Kenya. you are kindly requested to participate in filling in the questionnaire while being assured that any information shared will be confidential. Thank you.

CODE.....

Name of interviewer

Name of respondent.....

Place of interview.....

Date.....

1. How long have your milling business being operational? **(1)** less than 1 yr **(2)** 1-2 yrs **(3)** 3-4 yrs **(4)** 5-6 yrs **(5)** over 6 yrs
2. Where/ from whom do you source your *Omena*? **(1)** local wholesalers **(2)** wholesalers from other markets/ regions **(3)** producer/trader groups **(4)** importers **(5)** other industrial processors
3. How often do you procure *Omena*? **(1)** Weekly **(2)** After 2 weeks **(3)** Monthly **(4)** After 2 months **(5)** any other interval (specify)
4. What quantities of *Omena* do you procure per batch? **(1)** less than 0.1 tone **(2)** 1-2 tones **(3)** 3-4 tones **(4)** 5-6 tones **(5)** Any other (specify)
5. What quantities of *Omena* do you process in a normal day? **(1)** Less than 500kgs **(2)** 500- 1000kgs **(3)** 1.1 -1.5 tones **(4)** 1.6-2 tones **(5)** any other (specify)
6. At what price do you buy your *Omena*? Ksh..... / kg / tone.
7. How do you determine the buying prices?
8. Are there any contractual agreements between you and your suppliers? **(1)** Yes **(2)** No.
9. If Yes. What kind of arrangements? **(1)** Formal contracts **(2)** phone orders **(3)** any other (specify).....
10. Do you consider the buying price of *Omena* affordable? **(1)** Yes **(2)** No
11. If No. why?
12. What do you look for when buying *Omena*? **(1)** Moisture content **(2)** level of impurities **(3)** Color of *Omena* **(4)** size of *Omena* **(5)** any other (specify).....

13. In your own opinion how is the quality of *Omena* that you buy? (1) poor (2)Average (3) good

14. What costs do you incur when procuring *Omena*?

Type of cost	Unit	Value in Ksh
Transport	Per KM	
Loading and unloading	Per tone	
Hired labor	Per person	
Cess	Per batch	
Commissions	Per tone	
Others		

15. Do you undertake any of the following activities?

Drying (1) yes (2) No

Grading (1) Yes (2) No

Storage (1) Yes (2) No

Preservation (1) Yes (2) No

Sorting (1) Yes (2) No

16. Do you have access to credit? (1) Yes (2) No

17. If yes, what are your sources (1) savings and credit groups (2) microfinance institutions

(3) Commercial banks (4) any other (specify).....

18. What kind of losses do you incur in *Omena* trade?

Type of loss	Approximate monetary value/ tone	Frequency of occurrence
Spillage during handling		
Rotting/spoilage		
Theft		
Pests and rodents		
Adulteration		
Weight loss		

Any other (specify)		

19. What are your main substitutes for *Omena*? (1) Fish meal (2) soya beans (3) cotton seed (4) sunflower seed (5) others (specify)

20 Why would you prefer any of the alternative protein sources to *Omena*?

21. What types of animal feeds do you manufacture?

22. What determines the amount of *Omena* to use say per a kg of any feed? (1) Cost of *Omena* (2) protein requirements (3) selling p*Omena* (4) any other (specify).....

23. What are the main problems that you encounter in *Omena* trade?.....

.....

25. In your own opinion what needs to be done to improve *Omena* Quality, trade and processing?

.....

.....

THANK YOU, FOR YOUR TIME

APPENDIX 5: DOMESTIC CONSUMER'S QUESTIONNAIRE

**TITLE: ANALYSIS OF MARKET PERFORMANCE: A CASE OF ‘OMENA’
FISH IN SELECTED OUTLETS IN KENYA**

The purpose of this study is purely academic and aimed at contributing to the understanding of the performance of *Omena* fish markets in Kenya. you are kindly requested to participate in filling in the questionnaire while being assured that any information shared will be confidential. Thank you.

CODE

Name of interviewer

Name of respondent

Place of interview

Date

1. Are you a regular Buyer of *Omena* fish? (1) Yes (2) No
2. Where/ from whom do you usually buy *Omena*? (1) Retailers (2) Wholesalers (3) Small-scale processors (4) Fishermen (5) Others (specify)
3. How many times in a week do you consume/buy *Omena* ? (1) 1-2 (2) 3-4 (3) over 4 times.
4. What quantities of *Omena* do you buy in a week? (blue band tins/ Gorogoro)
5. At what price do you buy *Omena*? / (blue band tins/ Gorogoro)
6. Do you consider this price affordable? (1) Yes (2) No
7. What do you look for when buying *Omena*? (1) Colour of *Omena* (2) Quantity/measurement (3) Amount of foreign particles (4) Odour/ Smell (5) Freshness (6) Size of *Omena* (7) cost
8. What is opinion on the quality of *Omena* that you buy? (1) Poor (2) Average (3) Good
9. Are you satisfied with the way in which *Omena* is (A) packaged (B) Measured?
(1) Yes (2) No.
10. What would you like to see changed to improve the quality of *Omena* being sold for human consumption?

THANK YOU FOR YOUR TIME

END

ANNEX 6: COMPUTED AVERAGE MONTHLY PRICES *OMENA* FISH

Re-computed - <i>Omena</i> fish market prices Ksh/ kg									
	Kisumu			Nakuru			Nairobi		
year→	2007	2008	2009	2007	2008	2009	2007	2008	2009
month↓									
January	66.4	74.7	76.3	76.0	79.1	83.4	65.9	86.6	80.0
February	66.7	77.6	77.0	75.0	79.2	80.0	69.1	79.4	81.0
March	70.5	80.1	75.8	79.5	78.0	79.8	68.1	79.5	86.1
April	66.9	84.3	70.0	80.0	77.9	75.9	70	80.0	87.7
May	67.6	77.4	78.0	79.5	77.2	86.0	70.2	89.5	90.5
June	70.0	75.9	79.5	77.3	78.9	87.3	72.4	87.3	88.9
July	70.0	77.8	79.2	78.1	78.9	87.1	72	88.1	89.0
August	70.1	77.0	69.6	67.8	78.3	76.9	77.4	87.8	75.1
September	77.2	68.3	60.1	68.4	70.6	75.0	80.2	78.4	71.1
October	79.1	70.9	60.1	66.8	78.2	75.0	84.9	76.8	71.0
November	79.1	74.0	68.7	66.1	76.4	73.9	89.1	76.1	74.3
December	79.6	76.5	74.2	72.2	77.0	77.7	89.2	78.2	74.5
	863.2	914.5	868.5	886.7	929.7	958.0	908.5	987.7	969.2
Annual average	71.9	76.2	72.4	73.9	77.5	79.8	75.7	82.3	80.8