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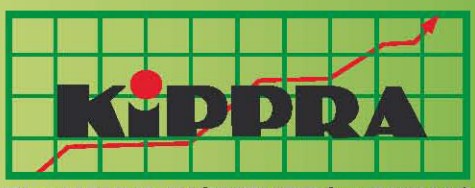

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Barriers to Value Addition in "Omena" Fisheries Value Chain in Kenya

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Research and Analysis

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Abstract

The purpose of this study was to identify barriers to value addition in "Omena" fisheries value chain and to analyze omena value addition for Suba sub-county in Homa Bay County. A barrier to value addition was defined as any social, economic, cultural, innovation, legal, policy and governance issue which negatively impacts value addition in the fisheries value chain. The value chain was defined to include Omena marketing channels in the main towns in Nyanza and Western regions and Nakuru, Nairobi and Mombasa cities, among others. A value chain analytical perspective was adopted for the study. Qualitative expert interviews with key informants and secondary data were used to address the research objectives. Socio-economic, institutional, and fishery production and marketing data were obtained for analysis. The barriers to value addition in Omena value chain include: lack of market information, poor processing technology, poor business skills, lack of legal and policy framework for Omena processing, lack of access to land, poor infrastructure development, as well as lack of technical specifications for processing and marketing of Omena. The productivity of the Omena value chain was greatest for wholesalers and animal feed processors compared to small scale processors and retailers. Policy and legal framework for land use at beaches and standards for processing dry Omena should be developed by stakeholders to facilitate infrastructure development at beaches and processing of Omena for quality achievement. Technical specifications for processing, transporting, distributing and marketing the product should be developed and agreed upon to ensure high product quality and food safety.

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1. Introduction

1.1. Background

The fisheries sub-sector in Kenya comprises of marine, inland fisheries and aquaculture. Inland fisheries include inland lake and riverine fisheries. Artisanal production dominates in fishery production. The industry contributes 0.5 per cent to the GDP (Government of Kenya, 2010a, 2013). It has been argued that fisheries contribution to GDP could be higher if value addition along the supply chain and interventions against post-harvest losses are initiated. Value addition is constituted by a sum of added value by activities in a value chain that are greater than the sum of individual added values at each stage of the value chain (Hempel, 2010). One of the fisheries affected by post-harvest losses, which range from 20-50 per cent or more depending on season is Rastreneobola argentea ("Omena"). Post-harvest losses are substantial and estimated at US$ 32 billion annually in East Africa (Ibengwe and Kristófersson, 2012).

The lake-wide contribution of Omena to the total fish catch in the three Lake Victoria riparian countries increased uniformly from a negligible proportion in 1968 to 30 per cent of total landings by 2004 (Manyala and Gitonga, 2008). Omena took the first position in economic importance in contribution to income, employment, food security in Kenya and second position in Uganda and Tanzania (Ibengwe and Kristófersson, 2012; Kabahenda et al., 2009; Ogutu-Ohwayo et al., 2002). On average, Omena contributes more than 40 per cent of the total fish landings in Kenya. Landings for the fishery surpassed that of Lates Niloticus (Nile perch) since the year 2000 (Government of Kenya, 2011). In 2011, Omena led in landings, contributing over 54 per cent by weight compared to Lates Niloticus (35%) and O. Niloticus - Tilapia (6%). Suba sub-county is leading in production (70%) as shown in Table 1.1, followed by Bondo sub-county and Busia County.

Table 1.1: Omena landings from Suba sub-county and lakewide in Kenya, 2007-2014

Omena landings (metric tons)				
	Suba sub-county		Lake ide (Kenya side)	
Year	Quantity Metric tons	Ex-vessel Value ('000 Ksh)	Quantity Metric tons	Ex-vessel Value ('000 Ksh)
2007	22,400	464,999	49,438	1,269,451
2008	21,280	604,499	46,966	1,650,256
2009	21,638	973,704	49,326	2,219,624

2010	29,632	1,333,440	47,716	2,225,780
2011	50,316	2,186,272	72,314	3,224,846
2012	25,158	2,813,882	52, 948	2,813,882
2013	19,969	629,031	66,717	3,552,513
2014	20,050	801,994	63,993	3,407,456

Source: Adapted from Suba sub-county fisheries annual report (2011); Government of Kenya (2011; 2012b; 2013)

The government has earmarked the Omena sub sub-sector for achieving food and nutrition security and economic development. The USAID-KBDS sub-sector Report (Karuga et al., 2003) had put Omena as a key contributor to domestic food (30%) and animal feeds (70%). Omena, unlike the Nile perch, is for domestic use and not for export. It is important as a source of rich protein to the local fishery community. Currently, the total number of people employed in the sub-sector is over 2 million. There is a problem because, overall, the catch for the main fisheries already mentioned declined in the 1980s-90s due to over-fishing resulting from commercialization of fishing in Lake Victoria (Othina and Osewe-Odera, 1996). This has led to the domestic and international demand for fish not being met. Consequently, fishermen and local traders have shifted to agriculture as a means of livelihood (Government of Kenya, 2009; 2010b).

The major issues for the value chain, including value chains in Uganda and Tanzania, are physical, quality and economic losses of Omena (Kumolu-Johnson and Ndimile, 2011; Kabahenda et al., 2009, 2000), under-development of the chain, lack of market information among stakeholders, environmental degradation, and sustainable resource use (Manyala and Adoyo, 2011). The government and partners have undertaken the promotion of private sector development, and improvement of Omena processing and marketing enterprise in Lake Victoria and promotion of private sector development, respectively (Government of Kenya, 2012a). The former project piloted solar drying of Omena using ultraviolet treated polythene sheets. The dry product was developed and certified by the Kenya Bureau of Standards (KEBS, 1998) and issued with International Universal Product Code. The latter project provided capacity building to Beach Management Units (BMUs) and fish traders on organization development, financial management, marketing and business planning (WIFIP, 2012). Other interventions included the development of fishery landing beaches, ensuring compliance with sanitary and safety standards of the KEBS and coordination of players. The initiatives are not adequate to address the problems (Table 1.2). Solutions to fishery value chain problems for developing countries should address constraints to market access,

market orientation (satisfying diverse needs), available resources, institutional voids and physical infrastructures; upgrading of the value chain; and reforming network structure, governance form and technological innovations, among others (Trienekens, 2011).

The Fisheries Act No. 5 of 1989 (revised 1991) guides on the use of fisheries. The policy framework enhances the contribution of oceans and fisheries sectors to wealth creation, increased employment for youth and women, food security, and revenue generation through effective private, public and community partnerships. The policy promotes fish filleting for export, rationalization of tariffs on inputs for fish processing and support to programmes for boats and gears for the fisher folk (Government of Kenya, 2008). The State Department of Fisheries has the mandate to manage the fisheries sub-sector. The Director registers fishing vessels, licenses traders, enforces offenses and penalties, and bans fishing to prevent fish depletion, among other functions (Government of Kenya, 2008).

The main constraints to the fishery industry include: inefficiency in fishery resource management; depletion of fresh water fish stocks; lack of infrastructure such as cold storage, roads, and electricity (Kabahenda et al., 2009); inadequate budgetary provisions and research-extension services; and invasion of Lake Victoria by water hyacinth. The latter has led to environmental degradation, affecting Omena production through aquatic environment change, and blocking of fishing grounds and fish landing sites (Government of Kenya, 2010a). Analyzing barriers to Omena value addition and status of value addition in this value chain can contribute to the ongoing programmes and Fisheries Policy Framework. It can provide inputs to address post-harvest losses and contribute to the GDP, improve fishery players' incomes, food security and nutrition, and lead to employment creation. The relationship between food security and the environment is likely to worsen the social conditions of the local community if Omena contribution to food security is not addressed. Analysis of value adding and barriers to it can provide insights on a strategy to contribute to a sustainable, efficient and effective fishery value chain where benefits are distributed equitably (Kariuki, 2011; Trienekens, 2011; Hempel, 2010). However, the barriers and status of value addition have not been systematically investigated.

The rest of this paper clarifies the study problem, objectives and a justification for the study. Literature review giving a background on the Omena fishery sub-sector is provided and the problem for study is further elaborated, identifying knowledge gaps. This is followed by a treatment for conceptualization of the research problem from a value chain perspective. The methods adopted for the study are then described followed by study findings. Conclusions then follow and recommendations for policy are made based on the results.

Table 1.2: Frequency of fishermen, landing sites, cold rooms, and fishing crafts in Suba Sub-county 2002-2012

Year	Number of fishermen	Number of landing sites	Portable water	Number of Toilets	Landing sites with BMU	Number of cold rooms	Small seines	Number of fishing crafts
2000	14,782	97	-	-	-	1	5,182	4,051
2002	16,727	100	1	49	-	-	674	3,267
2004	11,639	104	1	62	-	1	1,674	3,575
2006	15,585	108	1	73	-	-	1,235	4,910
2008	14,341	101	1	57	74	1	1,013	4,486
2010	15,131	107	-	75	53	1	1,138	4,855
2012	13,521	102	-	73	64	1	1,346	4,371

Note: BMU = Beach Management Unit

Source: Suba Sub-county Fisheries Annual Report 2012

1.2. Problem Statement

A barrier to value addition is used in this study to describe any social, economic, cultural, innovation, legal, policy and governance issue that negatively impacts value addition in the Omena value chain. Barriers to value addition are relevant to the fishery for many reasons. Omena is highly perishable due to its wetness, softness and high protein and fatty acid content. It is one of the three main fish species under depletion due to commercialization of fishing in Lake Victoria. It ranks as the most important fishery both to the local riparian community and to the East Africa regional economy. The fish is important as a source of rich proteins for domestic consumption to the riparian community and 70 per cent of the production is used for industrial feed meals. The fish is cheap, affordable to the majority of the poor domestic populations, and the essential proteins in the fish enhance its nutritional value especially for children in poor households. Finally, it is estimated to contribute about 35 per cent of per capita fish consumption in Kenya and more when contribution to animal feeds is taken into account.

There are several challenges to Omena due to inappropriate processing by sun drying on the ground, rocks, grasses, and sand; inadequate technology in sun drying; high humidity, ambient temperatures and rainy conditions in Lake Victoria regions; and unhygienic packaging, storage and transportation conditions which reduce aeration. The combination of heavy microbial contamination by sand, soil, debris and insects and the harsh environments lead to biodegradation, which continues through the value chain. The fatty acid oxidation and biodegradation cause offensive smell to consumers. This reduces businesses and employment.

The challenges due to contaminants and harsh environments result into physical, quality and economic post-harvest losses (15-50% or more) to Omena, which accrue substantially at the primary processing stage among small processors. Domestic food security policy cannot be met especially among the riparian communities. Further, because of the heavy contamination of the dry product and partial drying and unhygienic storage conditions, more fish is lost from microbial biodegradation later in the downstream value chain. Much of this product is lost to human consumption and channelled to animal feed processing. A lot is rejected and wasted.

Insights on barriers to value addition, which link the challenges for post-harvest losses and value addition among stakeholders (fishermen, local fish processors, traders, industrial processors and marketers) have not been systematically investigated. The insights can help link effects and causes. The costs related to barriers to value addition are also not known. Knowledge of the costs of barriers to value addition could provide information for evaluating the policy options for

interventions on the barriers to remove them. This is particularly so given that the Nile perch, which has a production of 35 percent in Lake Victoria, is mainly exported.

This study therefore seeks to address the gaps in knowledge on barriers to value addition in the Omena fisheries value chain in Kenya. Because Suba sub-county (Table 1.2) in Homa Bay County contributes most to the total Omena landings in Lake Victoria (70%), the study was undertaken in the Suba sub-county value chain.

1.3. Objectives and Research Questions

The following research questions guided the study.

1. What are the main barriers to fishery value addition in Omena fish species among fishermen, traders, processors and marketers in Suba sub-county fishery value chain?
2. What is the value added in Omena fish species among fishermen, traders, processors and marketers in Suba sub-county fishery value chain?

The following objectives will be satisfied by the study;

1. To analyze the main barriers to fishery value addition in Omena fish species among fishermen, local processors, traders, industrial processors in Suba Sub-county fishery value chain.
2. To analyze value addition in Omena fish species among fishermen, traders, processors and marketers in Suba sub-county fishery value chain.

Issues of relevance to policy include the fact that post-harvest losses in the Omena value chain are substantial. Since the riparian communities have been dependent on fisheries, and Omena fishery plays a major role in the local community and domestic market and food supply, there are threats to food security, nutrition, incomes, employment and poverty reduction. This is especially the case given that the demand the Nile perch, which is also locally consumed, has increased internationally and not generally available to locals.

1.4. Justification and Policy Relevance

The post-harvest losses of Omena (15-50% or more) that mainly occur at primary processing substantially reduce the physical product, its quality, and economic value. The lost food and the nutrients are not available for human consumption. Thus, food security and nutrition policy cannot be met. Second, since a large

amount of Omena that is contaminated and adulterated by sand and other debris cannot be accepted by humans for consumption, it is channelled for animal feed processing. A substantial amount of the Omena is rejected. Insights on barriers to value addition in Omena can thus assist in reducing competition for the fishery between humans and animals. Fishery supply can be increased when competition is reduced and more and cheaper fish can be available for humans. Food security and nutrition can be enhanced, since Omena is rich in proteins and minerals. This is the case since Omena affords many riparian communities and the domestic population access to a cheap source of nutrients.

Third, addressing barriers to value addition will reduce physical, nutritional and economic losses to businesses in the value chain and increase productivity and profitability of the value chain by enhancing incomes and employment. Because women make over 85 per cent of the stakeholders in local Omena processing, addressing constraints to value addition will reduce the gender gap in economic opportunities to women vis-a-vis men. Fourth, the need for grading the fish between human and animal feeds is required to minimize competition between the two. Addressing value adding can increase product hygiene and quality for public health and safety. Insights on barriers to value addition can help in the development of standards for handling Omena for human food and animal feeds. Fifth, addressing barriers to value addition can increase Omena supply and avail it for food fortifications and diverse products such as anti-oxidants, medicines, lubricants, varnishes, soap and margarine.

Further, the market potential for Omena is great. A major problem in the value chain is the lack of market information to the stakeholders and linkages between different components of the chain. This has resulted into those at the production not knowing product preferences and requirements of stakeholders at the downstream value chain. Consequently, the profit margins of small scale processors and wholesalers are lower compared to those of importers, stockists and industrial processors (stakeholders). Additionally, industrial consumers perceive that the colour of Omena, moisture content, and level of impurities and its size have to do with its quality, protein content and the quality of animal feeds manufactured from it. In short, developing insights regarding barriers to value addition and status of value addition is an important way of making the value chain meet the needs and preferences of diverse consumers efficiently, competitively and timely. The insights can assist policy makers and market players ensure sustainability of the value chain by providing means for evaluating options for an efficient and effective fishery value chain regarding information gaps and equitable distribution of benefits.

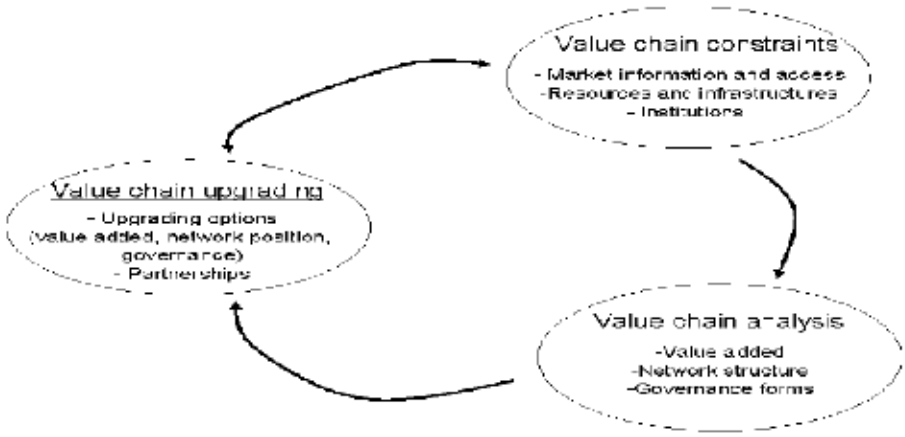
2. Literature Review

2.1 Theoretical Literature Review

Based on the objectives, this study addresses aspects of value chain analysis. According to Hempel (2010), value chain analysis can be descriptive or analytical. Descriptive analysis involves describing activities in the value chain and the linkages among them. Analytical study identifies value chain activities and linkages among them to discover relationships and causal effects among them (Hempel, 2010). Trienekens (2011) similarly conceptualizes a value chain as a network of horizontally and vertically related firms that work towards the provision of products or services to a market using competitive resources within institutions. A value chain is therefore characterized by network structure, governance form and value added. The scholar proposes a framework for analyzing a value chain for developing countries comprising of value chain analysis constraints, value chain upgrading, and value chain analysis (Figure 2.1).

Value chain constraints relate to market access (local, regional, international), market orientation (satisfying diverse markets needs), available resources, institutional voids and physical infrastructure. Value chain upgrading is "... a process of improving the ability of a firm or an economy to move to more profitable and/or technologically sophisticated capital and skill-intensive economic niches..." (McDermott, 2007, cited in Trienekens, 2011). Value chain analysis characterizes a value chain in terms of its network structure (market outlets), value added throughout the chain (high, quality, cost and delivery time, etc) and governance

Figure 2.1: Framework for developing country value chain analysis



Source: Adapted from Trienekens (2011) and Almazan et al. (2011)

form. In Figure 2.1, the arrows reflect a possible order for analyzing a value chain. The rest of literature outlines the Omena value chain in Suba sub-county in terms of production, technology, stakeholders, network structure, activities, costs, resources and institutions. Local, regional and international literature regarding value chain analysis and constraints aligned to study objectives and research methodology are then presented, including knowledge gaps.

2.2 Empirical Literature Review

The Omena sub-sector is worth U$ 200 million of the total annual US$ 600 million fishery value in Kenya. The demand outstrips the supply. About 10 per cent of the deficit is imported from Uganda and Tanzania (Manyala and Adoyo, 2011). The value chains in Kenya and riparian countries are under-developed in safe handling, processing, cold storage, grading, packaging and product development (USAID, 2010; Hempel, 2010). The products mainly consist of medium and high grade food. Industrial processing of Omena (using 70% of Omena caught) in Kenya adds most value in low and medium grade animal and high grade pet feeds (Kariuki, 2011; Manyala and Gitonga, 2008).

Fishing operations in Kenya and Uganda take place inshore using seine nets. In Tanzania, catamarans with lift or scoop nets are used offshore. Men conduct fishing operations in the riparian countries, and only 5 per cent of the boats are owned by women. Seine nets make up 20-30 per cent of all the listed gears in East Africa. Bondo and Suba sub-counties and Busia County are leading in the nets and as sources of Omena in Kenya. The number of small seines was 4,137 nets in Kenya in 2014 (State Department of Fisheries, 2015). The estimates of stakeholders were 12,724 fishermen, 25,448 small scale processors, 5,896 wholesalers, 50,896 retailers, and 847,418 employed. Over 2 million people depend on Omena for livelihoods.

Stakeholders in the Omena value chain can be characterized by either the volume of produce they handle per period and also by the magnitude of the capital outlay used for business. Small scale processors acquire Omena from fishermen from one or several beaches and sell it at the beach and/or local markets (Kariuki, 2012; Manyala and Gitonga, 2008). A small scale processor can manage upto 10 sacks per week. A wholesaler bulks Omena from small processors. They can handle a maximum of about 32 sacks (70-90 kg) per week. Wholesalers that supply the animal industry can handle over 100 sacks per week. Retailers buy their product from wholesalers or small scale processors. Transporters deal with the logistics of moving the product from beaches to towns and major urban areas for human consumption and animal feed processing. Many groups (Women Associations,

Self Help Groups) modeled on social welfare service provision also operate in the value chain. The welfare nature of the groups limits the entrepreneurship skills important for business management. However, the members perceive functions of the groups to be credit provision and business support, including marketing and savings (USAID, 2008, 2010; Kariuki, 2012; Manyala and Gitonga, 2008).

The capital outlay of small scale processors and retailers ranges from Ksh 1,000 to Ksh 10,000. Importers, stockists and transporters handle from Ksh 15,000 to Ksh 200,000 per week. Wholesalers have the widest range of operational capital of Ksh 15,000 to over Ksh 1,000,000. Industrial processors convert Omena into animal feeds. Dealers incur variable and fixed costs. This depends on the source of the product. The estimated costs incurred by a trader who spends three days thrice in a month at a collection centre in production localities and who has the capacity to handle 10 sacks per trip intended for human consumption are as illustrated in Table 2.1 (Manyala and Gitonga, 2008). The feeds are branded with different trade names, which are generics of standardized formulations of various animal feeds.

Omena businesses are limited in access to capital for production, processing and marketing (Hempel, 2010; USAID, 2008, 2010). About 70 per cent of the capital that stakeholders access comes from several sources; self (23%), family (18%), credit (20%) and savings (8%). This could vary for different beaches. The data was not broken down by the part of the value chain. Credit access is acute for upstream businesses relative to the downstream ones. At least 12 percent of the capital used in the business is from farming (Manyala and Gitonga, 2008).

The markets for human consumption are in Western and Nyanza regions (Government of Kenya, 2010b; 2011). A reduced share of Omena for human consumption relative to that for animal feed is marketed in Nairobi, Nakuru and Mombasa. The main markets for disposal by traders targeting the animal feed industry are Nairobi, Nakuru, Eldoret, Mombasa, Thika, Kisumu, and Kitale. Pricing of the products depends on the method of acquiring it (outsourcing, on-site sourcing), market-source distance and the demand for Omena. Pricing variations during high and low demand seasons are as shown in Table 2.2 and 2.3. The problem of price fluctuations is further compounded by the units of measurement, which are based on sacks, trough and tins.

Table 2.1: Fixed and variable costs incurred by dealers who source Omena from different localities in the production area and markets

Expense category	Source			
	Same Beach	Other Beaches	Islands	Markets
Fixed costs				
Traders' licences	350.00	350.00	350.00	350.00
Health certificate	800.00	800.00	800.00	800.00
Annual fixed cost	1,150.00	1,150.00	1,150.00	1,150.00
Monthly fixed costs	96.00	96.00	96.00	96.00
Variable costs				
Fare (Round trip)	Nil	200.00	600.00	Nil
Subsistence/Accommodation	100.00	600.00	1,200.00	200.00
Package transportation	Nil	500.00	1,000.00	Nil
Casual labour for packaging	300.00	300.00	300.00	Nil
Loading costs	100.00	100.00	100.00	100.00
Landing fee	Nil	100.00	100.00	Nil
BMU charges	5.00	100.00	100.00	Nil
Municipal/County Councils	400.00	400.00	400.00	400.00
Variable costs per trip	905.00	2,300.00	3,800.00	700.00
Monthly variable costs	2,715.00	6,900.00	11,400.00	2,100.00

Source: Manyala and Gitonga, 2008.

Table 2.2: The average buying and selling prices of Omena (Ksh) during the low demand seasons

	High Buying				High Selling			
	Average buying (Ksh/2 kg tin)	**Average buying (Ksh/ Sack)**	**Kg (Ksh)**	**Trough (Ksh)**	**Average selling (Ksh/2 kg tin)**	**Average Selling (Ksh/ sack)**	**Kg (Ksh)**	**Trough (Ksh)**
BMU				650.00	90.00			900.00
Importer		4,500.00				4,700.00		
Retailer	76.67	4,810.00		669.23	85.53	5,100.00		850.00
Small Scale Processor	70.00			420.00	65.00			333.33
Stockist		5,000.00				6,200.00		
Transporter			40.00				60.00	
Wholesaler	80.00	3,550.00	36.67	550.00	100.38	4,166.67	50.00	2,100.00

Source: Manyala and Gitonga (2008)

Table 2.3: The average buying prices of Omena (Ksh) during the low demand seasons

	Low Buying_Other Units				Low Selling _Other Units			
	Average buying (Ksh/2 kg tin)	Average buying (Ksh/Sack)	Kg (Ksh.)	Trough (Ksh)	Average selling (Ksh/2 kg tin)	Average selling (Ksh/ Sack)	Kg (Ksh)	Trough (Ksh)
BMU				275.00	65.00			500.00
Importer		2,800.00				4,000.00		
Retailer	41.00	2,988.89		326.92	51.11	3,300.00		392.00
Small Scale Processor				241.67	20.00			205.00
Stockist		2,600.00				3,500.00		
Transporter			20.00				30.00	
Wholesaler	40.00	2,683.33	40.00	264.00	55.25	2,928.57	60.00	1,100.00

Source: Manyala and Gitonga (2008)

The units of measurement that are mainly transacted with retailers and wholesalers are unconventional and problematic. The weights for the units can vary according to the size and degree of dryness of the fish. Such units do not contribute to pricing efficiency (Kariuki, 2011; Shiferaw et al., 2009). Industrial processors require standard metric weights for pricing.

The demand and supply pattern for Omena depends on multiple factors such as high and low supply seasons, lunar cycle, and the suitability of weather for drying fish. According to Manyala and Gitonga (2008), the span of time for high and low demands and high and low supply may be separated by a peak as short an interval as a week. The strategies for mitigating the impact of high and low demand and their per cent frequencies are: price reductions (37), use for animal feed (1), storage for sale during high demand (10), stock reduction (12) and absorbing low sales (9). Further, a negligible proportion of the stakeholders revert to businesses in tilapia and other fish and agriculture. During bans on fishing, only 14 per cent of stakeholders were found to stop business activities, while the rest carry on with illegal fishing. Eight per cent of importers were found to relocate to Uganda and Tanzania to procure the fish while 12 per cent sell old stock.

Rejection of Omena by clients due to poor handling and processing is related to four quality parameters and high and low demand seasons. The parameters and their per cent frequency (bracketed) are as follows: quality related to dampness (39), debris including sand and other materials (27), discolouration (14) and presence of fresh water shrimp Caridina (8) (Manyala and Gitonga, 2008). Small scale processors milling 1.5 tonnes of the fish per day can reject at least 250kg (15-25%). Small scale processors can overcome low quality fish by purchasing product at low prices and re-drying and sieving sand and debris from the product. Industrial processors were estimated to reject 6 tonnes per week (10-15%). The approaches that make up 62 per cent of the approaches for correcting for Omena quality are: price reduction (24), storage (12), use for animal feeds (18), and diluting with better stock (8). Appropriate approaches (cleaning in fresh water, re-drying, re-cleaning and sorting) are used only 16 per cent of the time.

The main strengths of the value chain include: reliable consumers, availability of some capital for business, unrestricted access to product supply, established supply chain, knowledge of seasonality of fish supply and demand, and reliable millers in the animal feed industry (Kariuki, 2012; Manyala and Adoyo, 2011). Other strengths are: high demand for Omena, socio-economic stability of the stakeholders, availability of standard marketing structure, access to group credit, and the possibility for multiple sources of the product (Manyala and Adoyo, 2011). The main weaknesses in the value chain include inadequate marketing information, heavy taxes and levies that are beyond the financial means of small

scale stakeholders, inadequate funds to expand business, losses and spoilage, and poor infrastructure. The taxes and levies charged by county councils, municipalities and the Ministry of Health vary widely between areas and across stakeholders, with importers, transporters, and wholesalers most burdened (Kariuki, 2011).

The ability of some of the players to adopt innovative processing methods that ensure quality, safety, marketability and income from the products constitute a major opportunity for the fishery. Although this is the case, stakeholders were not able to pinpoint alternative processing methods. A relatively large number of players dry the fish on racks. This ensures hygienic and complete drying that improves fish quality (Manyala and Adoyo, 2011). Because of the business and food supply potential available from the value chain, the possibility to add value from the sustained losses (15-50%) and the substantial generation of income, employment and nutrition that comes with this, there is need to unlock the potential by developing insights on knowledge gaps on the barriers to value addition and the status of value addition. Policy options in overcoming barriers to value addition could be selected for implementation based on the pertinent costs and benefits to unlock the value chain potential.

A number of services are provided by the public, NGOs and the private sector along the value chain. For Omena, product development, microfinance and market development have been the main support services provided by the government, NGOs, and microfinance institutions such as Faulu Kenya, K-Rep and donors. The private sector provides inputs such as fishing gears.

International research on value addition on sardine fish species, which is similar to Omena and other species were accessed. Sánchez-Muniz et al. (1992) found that deep frying of sardines in different culinary fats led to an exchange between the fats in the sardines and frying media fats at primary processing. Thus, deep frying leads to low nutritive and quality of the product and only a modest shelf life. Kabahenda et al. (2009) confirmed this in literature review in Uganda.

Roheim et al. (2007) tested the effects of retail value addition for frozen seafood segments such as price difference between product forms (fillets, steaks, nuggets, and cakes) for the same species, different species, different produce brands and different package sizes and process form (natural, battered, breaded). The analysis was made for two UK regions from scanner data. The sample consisted of each seafood segment including sardines, which were modified to exclude negligible and products sold for shorter periods. The statistical results indicated that product prices were dependent on the attributes of value addition, except for process form.

Bellagha et al. (2007) studied value addition at processing stage by determining the quality (a value addition dimension) of brined and dry salted sardines in

comparison to commercial sun-dried sardines. The fish was washed, scaled and gutted. The study used experimentation and surveys of consumers on their perceptions of fish quality. It was concluded that brined and dry salted fish had acceptable shelf life and consumers preferred brined sardines for taste, appearance, texture and acceptability. The level of microbial infestation for both products was below the counts allowed by the European Union (EU). Commercial sun dried sardines had the worst acceptability. Bille and Shemkai (2006) made similar findings for salted smoked-spiced Omena, including water content, which was significantly lower than for sun-dried fish in Tanzania. Literature review by Kabahenda et al. (2009) on the salted sun-dried fish made similar findings in Uganda to that of Bellagha et al. (2007). The salted sun-dried Omena is associated with rapid lipid oxidation and amino acid loss under Lake Victoria conditions (25°C, high humidity).

Owaga et al. (2009) noted that the harvesting and handling of Omena in Kenya is a potential source of bacterial, mould and fungal (aflatoxin) contamination due to lack of infrastructure for chilling, and hygiene facilities at the landing, processing and marketing sites. The researchers found that Omena pre-washed in 3 per cent salt and dried in oven at 50°C had the lowest yeast and mould counts compared to that pre-washed in chlorinated or tap water at 30 and 40°C. The sun-dried product had the most mould and yeast counts at marketing stage, but no aflatoxin risks. A similar pattern was found for the above Omena treatments under storage. This underlines the importance of hygienic handling of the fish throughout the value chain.

In evaluating the contamination of Omena in Lake Victoria used for food in Uganda, Mbabazi and Wasswa (2010) identified differentiated products for the fish. This provides evidence for the need for increasing demand for Omena. Because of its rich source of proteins, vitamins and minerals, the sun-dried product is usually ground into powder and commercially sold. The powder can be mixed with other foods for preparations of fortified meals for malnourished children and porridge, soups and stews. The fish can be processed into by-products such as anti-oxidants, cosmetics, lubricants, varnishes, soap and others (Mhongole and Mhina, 2012). Anti-oxidants can be added to food systems, pharmaceutical and nutraceutical products (Ogonda, 2013). All the by-products have greater value than the value of the raw commodity.

A case study of the distribution of benefits and identification of existing linkages between the different stakeholders in a mainly artisanal Moroccan sea fish value chains for various fish species that included sardines, a fish similar to Omena, was conducted by INFOSAMAK (2011). Fixed, variable, tax, crew and ship owner costs and profits for value added octopuses, sardines and other fish species

were determined. The differences between profit margins for ship owners and processors were minimal, and the margins for producers were relatively higher than for processors. The results are contrary to the situation of Omena in Kenya (USAID, 2010). The benefits, costs and value added for the studied fisheries were fairly distributed and similar, and can be expected to be more sustainable than the Omena value chains in Kenya.

Kariuki (2011) in analyzing the performance of the Omena market in Kisumu, Nakuru and Nairobi found a lack of standardization of the product for human or industrial processing. This suggests constraints to value addition when raw materials or products are not standardized. The study also found only basic value addition activities regarding drying, storage and sorting (removing impurities) performed mainly by small scale processors and wholesalers, save for industrial processing of Omena. Manyala and Adoyo (2011) analzed the demand and supply for high quality Omena value chain in Kisumu, Nakuru, Eldoret and Nairobi among fishermen, processors, wholesalers, retailers and consumers through primary data collection, a survey and stakeholder validation. The study found challenges related to lack of standards for grading and processing of Omena for human and animal feed, lack of savings for investments, and lack of proven processing technology, among other challenges in the value chain. An earlier study by Manyala and Gitonga (2008) made the same findings. The USAID (2008, 2010) also conducted two studies on profitability of the Omena value chain. The studies found that the business had potential for profitability, and recommended enhancing of financial and governance structures, and addressing socio-cultural and environmental concerns.

Studies have shown that sun-drying racks are one of the cheapest means for sun-drying Omena (Mgawe and Mandoka, 2008; Masette, 2005). Ibengwe and Kristófersson (2012) did a cost-benefit analysis of drying Omena on racks after the FAO established post-harvest losses for Omena at 59 per cent in Uganda and Tanzania based on traditional processing methods (sun-drying, hot smoking). Secondary data on post-harvest losses, costs of drying racks, and price differences between the dried product on ground and racks were used. The study found that public and individual investments in drying racks had a positive net present value (NPV) and could contribute to the productivity and access of Omena to East and Central African markets. The NPV was sensitive to sales prices of Omena but not investment and implementation costs.

Mhongole and Mhina (2012) reviewed literature on the smoking kiln introduced in Tanzania and Ghana in the 1990s. They demonstrated modern methods of hygienic handling and quality processing of Omena as opposed to the traditional methods used in East Africa (Kabahenda et al., 2009). They performed cost-

benefit analysis and surveyed traders, processors, transporters and retailers on the production of high quality products. Processing in smoking kiln involves washing in drinking water, then 3 per cent brine, spreading on wire mesh rack and heating in stove by convection for 3-4 hours. The smoked product had good flavour, acceptability, long shelf life, and high quality and safety. The challenges are poor storage infrastructure that causes product spoilage from ambient temperatures, micro-organisms, insects and rodents. Other barriers include lack of adequate fuel wood, lack of ready market for the product, and product development that include the addition of salt, chilly and spices to Omena and promotion of the value added product.

Calanche et al. (2013) evaluated quality (value addition) issues in fresh salmon and sardine processing and marketing in Spain as a function of cold storage manufacturing. The products were whole and filleted fish. Microbiological, Physical (pH, colour), and chemical measurements for the raw material and finished products were taken. The measures corresponded to the EU fish standards. Sampling for the products was scientific. Sensory, colour and freshness evaluations were done by a panel of judges. Other measures were taken by devices. A finding was made that the standard measures for freshness (quality) of the finished products were not determined by manufacturing practices but quality of the raw material (handling processes).

This literature review indicates that post-harvest losses of Omena in Kenya are substantial. This limits full realization of incomes, food security and employment for the sub-sector. Omena businesses are not adopting, for example, the drying racks demonstrated in pilot projects to produce a variety of clean, dry quality products to KEBS standards. There is knowledge gap on barriers to value addition related to hygienic handling of Omena at the landing, processing, storage and marketing stages of the value chain. This is so specifically in Kenya and generally in Lake Victoria riparian countries. Also, there is a gap in knowledge on the distribution of value addition among stakeholders regarding sustainability in equitable sharing of the benefits of the value chain. Assessing these knowledge gaps are the objectives for this study.

3. Methodology

3.1 Conceptual Framework

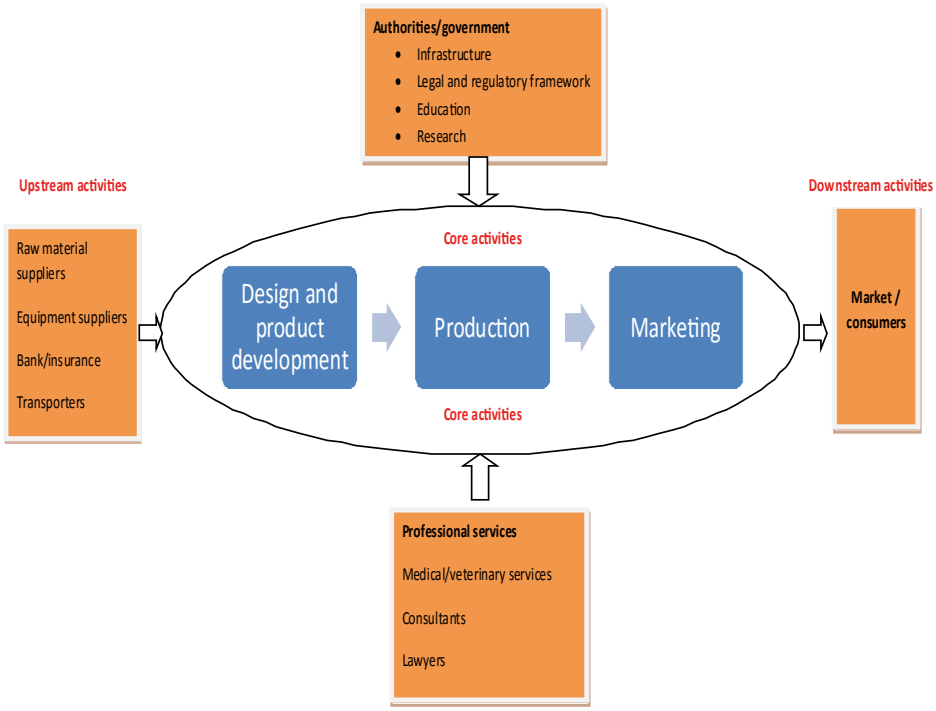
The concept of barriers to value addition was used in this study to describe any social, economic, cultural, innovation, legal, policy and governance and power relation issues that negatively impact value addition in the Omena fisheries value chain. The study used value chain analytical perspective to discover the causal relationships among value addition activities along the value chain and barriers to value addition. According to Hempel (2010), a value chain comprises all the activities required to realize a product or service from the initiation stage to the various phases of production, consumption to product disposal. The theoretical model comprises of downstream activities (research, insurance, equipment suppliers, etc), production, and upstream activities (transportation, marketing, retail, etc). The theory postulates that appropriate linking of activities and stakeholders (fishermen, processors, wholesalers, stockists, retailers, large processors) in the core of the value chain and the upstream and downstream will lead to a sum of added value of the value chain that is greater than the individual sums of added value for each activity in the value chain.

A generalized conceptual model for the analysis is presented in Figure 3.1. The mentioned theoretical framework was adopted because a value chain is affected by downstream and upstream activities and stakeholders who may not be in the core activities of production and marketing, for example. Additionally, the decision or constraint within and without the value chain, such as the legal-policy frameworks, may determine the outcomes of other activities in the link, meaning that other chain links may be negatively influenced. This can affect the outcomes and value addition. Therefore, understanding the relationships among activities in the value chain demands a holistic analysis of the value chain. According to Hempel (2010), value chain analysis can help shift the focus from only the producer and over to the market and the consumer, while at the same time paying adequate attention to all the steps in between.

In a market economy, this is important, for if we produce products that the consumers do not want or need, we will soon be out of business. Activities and stakeholders were analyzed and/or described for the specific variables that act as barriers in relation to value addition in the fisheries value chain. The nature and scope of these variables acting as barriers to value- addition were determined.

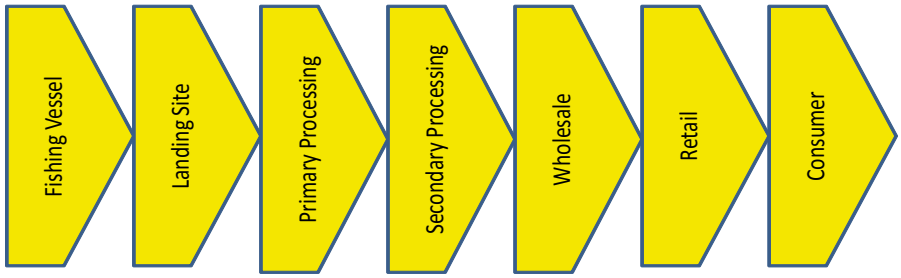
There are five main generic activities in a value chain, namely: inbound logistics, operations, outbound logistics, marketing and sales and service provision (Figure 3.2). Inbound logistics in the Omena value chain concern fishing, handling and landing of fish for purchase by small scale processors. Operations include sun-

Figure 3.1: A generalized value chain



Source: adapted from Hempel, 2010

Figure 3.2: Example of a model value chain in inland fisheries



Source: adapted from Hempel (2010)

drying and use of other technology for processing (sorting, cleaning, chilling, canning) the product. Outbound logistics involve transportation, distribution, packaging, branding and labelling of the product. Marketing and sales is conducted after product processing. Typical activities add value and are supported by service

providers. The value chain concept requires that stakeholders strategically place themselves in businesses where they can reduce costs and out-compete others. Alternatively, stakeholders can focus on activities where their capabilities and competencies outperform their competitors through differentiation of the products (Kariuki, 2011; Hempel, 2010; Manyala and Gitonga, 2008). The research questions were asked of the different activities and stakeholders along the fisheries value chain in Suba sub-county in Homa Bay County. Uncovering the barriers to value addition in Omena fish and costs related to such barriers could leverage the national and regional food policies and also contribute to solving the unemployment problem.

A conceptual model for inland fisheries guided the study in analyzing barriers to value addition (Figure 3.1). Because the fisheries industry actors may differ according to the perspectives they have, two concepts of producer-driven value chain and buyer-driven value chain were used for analysis of barriers to value addition in the fisheries value chain in addition to the already mentioned variables.

3.2 Data and Model Specification

A strategy of mixed methods was used for the study – case study. Literature review and secondary data from past studies were mainly used to analyze barriers to value addition and value added in the Omena value chain. This was supplemented by interviews of 15 key informants (5 officials and 10 stakeholders). Kwena et al. (2012) used key informant interviews with stakeholders in the fishery value chain in Kisumu County. Secondary data for at least a period of five years (2007-2012) was analyzed to address the research questions. Data was collected from the perspective of the value chain concept; that is data on the activities performed by the key stakeholders in the value chain were acquired. The literature review, analyses of secondary data, and participant responses were synthesized into findings.

Literature review from local and international sources was done first to clarify the concepts of barriers to value addition and value added. Second, to assess barriers to value addition, more literature research was obtained to aggregate more secondary data for analysis because of logistical constraints to collect primary data. The weighted averages for the degree to which stakeholders perceived issues to be barriers to value addition were computed and associated with results for stakeholder validation of specific barriers. These outputs were used to interview 5 officials associated with services in the value chain and 10 stakeholders (fishermen, processors, wholesalers, and industrial processors) in Suba Sub-county, Kisumu and Nairobi to validate the results. A semi-structured questionnaire with initial

list of barriers in value addition was used to interview the stakeholders. A ranking of the barriers was not done because the participants generally agreed that the barriers were nearly of equal weight in importance. Data for the second objective of research was obtained from secondary sources and qualitative expert interviews. Literature review provided information for the context of the study.

Some of the methods used by researchers for similar research were questionnaire surveys combined with focus group interviews as well as literature reviews combined with questionnaire surveys or focus group interviews. This study used secondary data and key informants to compensate for possible biases resulting from unavailability of primary data.

Population

The population for this study comprised of service providers and fishermen, local processors, traders and industrial processors of Rastreneobola argentea (omena). The population included participants based in Suba sub-county and away from Suba sub-county.

Sampling

A purposive sample of 5 service providers and processors, wholesalers and industrial processors was selected as key informants. The 15 key informants represented individuals with expert knowledge in the Omena value chain. Two researchers, two policy implementers, and one NGO staff involved in the value chain development were among those interviewed by phone. An interview with a fishery official in Nairobi was used to access individuals who were likely to provide unbiased responses. A semi-structured questionnaire with outlines of issues on barriers to value addition, costs related to value addition, and the two research questions were used for the interviews.

Data analysis

Data was analyzed into frequencies and weighted averages where possible. Sample sizes for stakeholders used (fishermen, small processors, wholesalers and industrial processors) and frequency statistics for each study finding were tabulated. Because the literature used for secondary data was limited, the finding from stakeholder validation/focus group result associated with each study finding was documented. A weighted average statistics was computed for a specific barrier to value addition issue when available from different studies. The sum of sample sizes of studies with findings on specific barriers was totalled and used for weighting percentage results on the perceptions of stakeholders on the degree of an issue as a barrier to value addition. The patterns for weighted averages and the associated focus group findings were described to shed more light into the

findings. Interview results were used to validate the statistical data. Qualitative data was synthesized by content analysis. The literature review for studies on barriers to value addition and value added was used to elaborate on the barriers for the different stakeholders under study results.

Model Specification

In estimating value added to the Omena value chain, a costs chain model was used to assess value addition from production through to domestic and industrial consumption where C_1, C_2, C_3, C_4 represented various costs such as: C_1 = costs of fishing and landing fish or production costs (sorting, etc); C_2 = primary processing and transfer costs to secondary processing site to wholesalers (sorting, cleaning, drying, etc); C_3 = secondary processing at wholesale and transfer costs to retailers, stockists, industrial processors (partial drying, packaging, transportation); and C_4 = tertiary processing and transfer costs to consumers/tertiary processing by industrial processors and transfer costs to animal feed consumers.

A value chain analysis was then undertaken for the various cost components to estimate the different value added components at each stage of value addition. From the theory of the firm in production economics, the following assumptions were made: Price (p) = Marginal cost = Marginal revenue (R) under competitive market conditions and Value = (price * quantity). The values of the commodities at different stages of the value chain were defined as follows:

(i) Vj = value of commodity j in the absence of activity i;

(ii) Vj* = value of the commodity j after undertaking activity i on commodity j.

Then the proportion of value added (VA) to commodity j after undertaking activity i is given by:

The following are given:

(i) Let quantity of Omena loaded at production site be Q_0 whose cost is $C_1 = P_0$. Then the value of the fish is $P_0 Q_0$ (First degree processing);

(ii) Let the quantity of fish at primary processing (being quantity of fish obtained from fishermen after primary processing) be Q_1 whose cost of processing and transfer to secondary processing is $C_2 = P_1$. Then its value V_j^* is $P_1 Q_1$ (Second degree processing). The proportion of value added after primary processing (Second degree processing) is then:

$$VA = \left[\frac{\left(P_1 Q_1 - P_0 Q_0 \right)}{P_0 Q_0} \right] * 100\%$$

(iii) The value added after secondary processing (Third degree processing) at wholesale is given by:

$$VA = \left[\frac{\left(P_2 Q_2 - P_1 Q_1 \right)}{P_1 Q_1} \right] * 100\%$$

(iv) Similarly the value added at tertiary level processing (retail and industrial/ animal feed processing, fourth degree processing) is given by:

$$VA = \left[\frac{\left(P_3 Q_3 - P_2 Q_2 \right)}{P_2 Q_2} \right] * 100\%$$

A meta-analysis methodology used in this study contributes to a validation of the existence of barriers to value addition in the value chain. For example, studies by USAID intended to facilitate the provision of private credit found consistently higher figures for lack of access to credit compared to other studies. The demand for credit by the private sector for development of the Omena sub-sector can now be better estimated from findings of this study on value addition in the value chain. Also, the study collated findings between barriers with weighted averages and barriers validated by stakeholder workshops, giving a greater practical confidence to the statistical findings. The study also provides for the first time actual added values in the chain. The results are now presented.

4. Findings

Results on barriers to value addition are reported for the relevant stakeholders at specific value chain levels concerned. The following stakeholders and value chain activities have been reported; fishermen (production/landing sites), small processors (operations), wholesalers (outbound logistics), transporters (outbound logistics), retailers, and consumers (industrial processors, importers and exporters).

4.1 Results

4.1.1 Descriptive Statistics for Barriers to Value addition

A summary of descriptive statistics for the studies that made findings on specific barriers to value addition in Kenya is provided (Table 4.1). The problems related to barriers to value addition in Omena rotate around lack of appropriate technology for sun-drying Omena, poor adoption of the new technology piloted, lack of legal and policy framework for processing dry Omena , inadequate entrepreneurial skills among stakeholders in the value chain, under-development of infrastructure, lack of market information and linkages and standards for handling Omena for human and animal feeds. The weighted average calculated from secondary data and validation workshop/focus group results and inferential analyses in combination indicate the above issues to be constraints crucial for value addition in the value chain (Table 4.1).

The following patterns occur for results: each of the five barriers (about 50%) to value addition in Table 4.1 is confirmed as a crucial issue by at least two studies using appropriate samples of value chain stakeholders (3, 8, 9, 10, 11); two factors each with at least three stakeholder validation/focus group in combination with one descriptive study (1, 5); two factors each with at least four stakeholder validation studies (2,6); and two factors each with at least two stakeholder validation/focus group studies and/or with a statistically significant (4,7).

These findings were generally confirmed from phone interviews with a total of 15 value chain stakeholders (5 service providers and 10 small scale processors, wholesalers/stockists, industrial processors (Omena consumers). The findings for each barrier are further elaborated based on literature review and stakeholder interviews.

The lack of proven technology for processing Omena is evidenced by a number of studies that tested trials for handling and processing Omena by various methods in comparison to the traditional sun drying on rocks, sand and grass in East Africa. The studies found methods such as brining, salting and sun drying and hot

Table 4.1: Descriptive statistics for studies on Omena value chain in Kenya

No.	Barrier to Value Addition	Study and year	Sample Size, N	Frequency, F (%)	Weighted average (%)
1	Lack of proven technology for drying	a	200	*	-
		b	63	95	
		c	168	*	
		d	69	*	
2	Legal and policy framework for Omena processing	a	200	*	-
		b	63	*	
		c, d	168	*(*)	
3	Poor adoption of pilot/appropriate drying technology	a	200	57	65.3
		b	63	93	
		c, d	168(69)	*(*)	
		e	175	**	
		f		**	
4	Inadequate land/space for drying	a	200	*	-
		b	63	95	
		d	69	*	
5	Poor infrastructures for cold storage	a	200	*	
		b	63	95	
		c	168	*	
		d	69	*	
6	Inadequate entrepreneurial skills	a	200	*	-
		b	63	*	
		c, d	168(69)	*(*)	
7	Inadequate market information and linkages	a	200	*	-
		b	63	93	
		c	168	*	
		e	175	**	
8	Poor product quality/Lack of standards for handling (drying and storage etc.)	a	200	*	84.8
		b	63	96	
		c, d	168(69)	*(*)	
		e	175	80.8	
		f		**	

9	Lack of differentiated Omena products	a	200	99	99.5
		b	63	*	
		c, d	168(69)	*	
		e	175	100	
10	Poor transportation	a	200	*	95
		b	63	95	
		c, d	168(69)	*(*)	
		e	175	95	
11	Access to credit	a	200	*	25[1]
		b	63	20[1]	
		c, d	168(69)	31[1](*)	
		e	175	21[1]	

Note: a = Manyala and Adoyo (2011); b = Manyala and Gitonga (2008); c = USAID (2010); d = USAID (2008); e = Kariuki (2011); f = Owaga et al. (2009); * = Barrier validation by key informants; 1 = Proportion of finance for business from formal credit; ** = Study with significant inferential results.

smoking of Omena giving better quality product than sun-drying (Mhongole and Mhina, 2012; Kabahenda et al. (2009); Bellagha et al. (2007); Bille and Shemkai (2006).

The above studies also found almost all the other issues already identified in this study, ranging from lack of policy framework for drying Omena, poor adoption of appropriate technology, inadequate land for sun drying Omena to poor infrastructure for cold storage, among others. In particular, studies by Kabahenda et al. (2009), Mhongole and Mhina (2012) and Calache et al. (2013) found barriers to value addition ranging from hygiene in product processing, lack of standards for handling fish, inadequate market information about consumer preferences for differentiated products, to unhygienic transportation and storage as barriers to value addition.

4.1.2 Barriers to value addition in Omena

Fishermen

Good Omena quality is partly lost at the production stage because of contamination of Omena during capture by fresh water shrimp, *Caridina spp.* and debris (Table

4.1). The heaping of fish at the corner of a boat can lead to physical damage to the fish. It is a common practice for handling Omena by fishermen (Manayala and Adoyo, 2011; Kabahenda et al., 2009). As for value addition, fishermen cannot access ice for freezing fish due to lack of electricity supply and other facilities for making ice (Figure 1.1). Proper handling and processing of fish, especially preservation with ice, can minimize this contamination (Owaga et al., 2009).

Small scale processors

The main barriers to the realization of value addition for small processors are lack of ability of processors to attain good quality fish in sun-drying of Omena. Poor fish quality is represented mainly by crude protein content (CP) of Omena, which is less than 55 per cent, 10 per cent moisture content or more and sand and debris contamination which is 1 per cent of the product weight or more. Inadequate processing of Omena and quality product processing are related to land ownership, poor access to investment capital by processors, and lack of infrastructural development policy at fish landing beaches (Table 4.1). To the extent that poor quality Omena product is supplied to the value chain, this in itself constrains further value addition, since poor quality input is used in realizing output products such as in animal feeds.

Value addition in Omena in sun-drying using improved racks has been demonstrated to fish processors to result in high quality Omena product. However, the adoption rate for this technology is poor (Manyala and Adoyo, 2011). In natural resource management and agriculture, just as in fishery production, poor technology adoption can be attributed to a number of causes that have to do with institutional arrangements for innovation adoption, innovation characteristics, adopter characteristics, and the social nature of a community in which an innovation is being introduced and how it affects diffusion of an innovation (Rogers, 1995), among other factors. Insights developed as to which particular issues among the mentioned ones affect adoption can be used as input in addressing the adoption problems.

Omena traders are involved in Self Help Groups and savings and credit cooperatives, which offer credit and savings to members, like any other cooperative society in the country. The scale of these involvements is limited though. A number of microfinance institutions such as K-Rep are working with organized Omena groups. However, the main problems for the groups in benefiting from microfinance services are low technical skills, poor leadership qualities, lack of financial planning skills, and poor marketing knowledge. To this extent, the lack of cooperative institutions to encourage and demonstrate entrepreneurship for local traders could be a barrier to value addition in Omena business. A backward local culture of Lake Victoria fishery community, which is claimed by some

researchers not to promote savings and investments activities (Hempel, 2010) may also be a barrier to value addition. Additionally, lack of education of the local people in financial planning and entrepreneurship by the relevant institutions are barriers to value addition in the Omena value chain. However, cooperatives may not be a panacea because of the historical endemic political, management and human capacity problems experienced with them. Easy access to mobile money services has encouraged savings and credit access among Omena traders, however (Manyala and Adoyo, 2011). Finally, the County Cooperative Development funds established by Schedule 4 of the Kenya Constitution have been allocated to counties, but there was no information on fund allocation to fishery cooperatives and the allocation amounts in Homa Bay or any other county.

Market information about Omena product regarding what is in demand, its price and place of demand is lacking for the Omena value chain (Table 4.1). The market information problem is mainly caused by under-development of the value chain. In addition, lack of market information is also caused by lack of interest of Omena players in the downstream parts of the value chain in stakeholders, and issues in the upstream parts of the value chain. Information about the market is needed as input to product development for each market segment. This should satisfy a marketing mix consisting of a defined Omena product, distributed in a particular manner, sold at a given price and marketed in a particular way. Lack of market information is therefore preventing value addition to the product, equitable distribution of benefits among players in the market, and sustainable utilization of Omena resource.

Apart from market information, the lack of linkages among market players with legal statuses in the value chain is a problem to activities in the value chain, including value addition. Among the players in the value chain, only processors are legally registered businesses. This makes transactions among the players to be spontaneous and not legally binding. Value addition would require stable business and legally guaranteed relations, which should contribute to a stable demand and supply situation through each party meeting their part of a deal. Value addition is therefore affected by this (Manyala and Adoyo, 2011).

The units of measurement adopted for Omena for transactions are sacks (small, medium and large). Trough and a 2-kg tin, which weighs 500-800g of omena when fully filled are also used mainly by retailers and wholesalers. Because there are weight variations in these measurement units, the value for money by different consumers will differ depending on the degree to which the product is dried and the weight of the unit of measurement. Value addition can be affected this way because some buyers will have to charge more for their product to realize profit than others. This affects profit margins and therefore value addition. Omena for

the animal feed industry is measured in kilograms.

Finally, the charging of levies to small scale processors and other omena traders who already have poor access to capital and financial services is a barrier to value addition because the profit margin for Omena is quite limited. This means small scale processors cannot make even modest savings to invest in value adding technologies such as drying racks that have been demonstrated to fish traders to be practical and result in high quality Omena product.

Wholesalers

The barriers to value addition in Omena already inventoried for small scale processors also apply to wholesalers. Additional factors behind value addition in Omena are outlined below.

Wholesalers bulk Omena from small scale processors. They usually transport and distribute the product to markets near beaches or urban areas for storage and further processing of the product by sun-drying. Wholesalers handle quite large proportions of the fish before it reaches dealers, transporters, processors and consumers. Value addition problems, therefore, occur in the activities undertaken in this part of the value chain. Wholesalers confront similar barriers to value addition that are already mentioned for small scale processors because they are also involved in processing by drying the product. The problem of variations in Omena quality therefore multiplies among wholesalers. Barriers to value addition for quality product at this point of the value chain encompass sun-drying, transportation and storage. Barriers to processing by drying include lack of space and facilities in which bulk drying can be undertaken at landing beaches or near storage facilities for Omena (Table 4.1).

Space problem is caused by the absence of policy for the development of infrastructure and physical structures at landing beaches. There are no local government policies to facilitate the development of facilities for fish processing by individuals or private businesses. This problem is compounded by the status of land ownership at the beaches. There is no provision as to the ownership of the landing beaches and the manner in which access rights are given and utilization of the land and other facilities are guaranteed. There is also inadequate land for utilization in fish processing. Besides these problems, there are no universally agreed scientifically-based specifications by stakeholders in the Omena sub-sector on how the product should be dried and handled in order for quality, sanitary and safety requirements to be met.

As regards transportation, there are no specifications by the main stakeholders in the Omena sub-sector on scientifically proven methods for handling, packaging, and transporting of Omena to achieve sanitary and food safety standards for

humans and animals. The materials for packaging Omena should be safe from any kind of contamination, whether microbiological, physical or chemical. The material must also allow adequate aeration of the product inside the bag (Owaga et al., 2009). There are no such universally agreed upon specifications for the transportation of Omena. Therefore, value addition is not necessarily achieved in packaging and transporting the product. The same can be said about storage. The methods for keeping the product dry, such as the use of hot or dry blowing of air to maintain product integrity and safety, are not specified and agreed upon by the stakeholders. Such treatment can ensure the product is safe from bacterial or any other contamination. Moreover, no basic technologies have been developed and applied in Kenya that address the maintenance of physical, biological and food safety standards for Omena. Although the Ministry of Health issues health certificates to all categories of stakeholders that are involved in commercial handling and exploitation of fish or Omena, no education on safe fish storage, handling and transportation is provided to the businessmen. Finally, there is no enforcement of such safety standards. Enforcement of such standards could positively affect demand and value addition for the product.

Transporters

The factors that affect value addition through packaging, storage and transportation of the product are not controlled for due to the fact that stakeholders in the Omena fishery sub-sector have not agreed on specifications of the conditions that influence the biophysical integrity and food safety of the products under transportation. For example, the fumigation of transport facility, the handling of the product, and the methods for stacking bags could affect the quality of the product (Kabahenda et al., 2009). The main factor behind this problem has to do with lack of basic and applied research knowledge in Kenya regarding safe and sanitary transportation of Omena. There are no guidelines available regarding how Omena should be compacted and stacked in bags to allow aeration of the product and avoid risks to food safety.

Retailers

Retailers sell the value added product to domestic consumers. Retailers, like processors, have the potential to create a number of differentiated products from Omena to satisfy consumer preferences. Retailers can do this by sorting, grading and packaging and creating more products out of Omena for different segments of consumers. More specifically, retailers in urban areas where effective demand for food in general is supported by income have a better chance of value addition than retailers in other poor income areas. High quality Omena products, which retailers sell mainly at supermarket channels, are dried, fried and stewed Omena packaged in plastic bags. Value addition is therefore limited by low incomes in

rural areas, especially in the local Omena production areas. Because of lack of market information on Omena, the demand for the differentiated products being offered in supermarkets in urban areas may be much lower than the actual demand if information was available. Value addition is therefore limited by lack of market information and marketing. Lack of knowledge of consumer preferences for Omena is therefore a barrier to value addition. The potential product consumers could demand are likely higher than or may be different from what is available given the market information asymmetry in the Omena value chain (Ibengwe et al., 2010).

Further, for retailers, value addition is limited by lack of standards for product handling, development, differentiation and packaging to satisfy customer preferences. The retailer is the end point from where human consumers buy the product. Because, there are no standards for food handling and safety by the stakeholders, some consumer demands are not being met here. For example, hazard analysis and critical point analysis (HACCP) is not available for Omena, such that all retailers are aware of the bare minimum or maximum temperature levels, durations over which product is to be stored, shelf life and handling to ensure food safety and quality. In the rural markets, for example, Omena is not packaged and hygiene safety is not guaranteed. Therefore, any value addition undertaken earlier is compromised by exposure to dust and dampness that the product is subjected to (Owaga et al., 2009).

Another example of lack of standards for the product concerns different packaged products in smaller and larger weight units at supermarkets with different price tags. First of all, consumers cannot be guaranteed about the shelf life and food safety of the packaged product since shelf life is not marked on the packets. Second, smaller units are costly while larger packaged units are less costly. This will affect demand, yet the packaging and pricing of the different weights (packaged) are not based on market research on consumer preferences. This, therefore, affects value addition through demand (Roheim et al., 2007). Retailers in rural areas have barriers related to access to capital and technology for processing and packaging Omena.

Industrial processors

The two main categories of processors of Omena are small and large scale processors.

Small scale processors

Small scale processors processing about 1.5 tons per day of the product reject upto about 250kg of the product per day or 15-25 per cent per week. Only about 12 per cent of the rejected product is normally recovered through re-drying, re-

cleaning and sorting. Therefore, 80-88 per cent of the rejected product is lost. The poor handling in sun-drying and processing of Omena at the landing beaches and storage by wholesalers leads to this magnitude of loss for value addition. The reasons behind poor handling and processing of the product by small processors and wholesalers are already outlined.

Large scale processors

Processors with large capacity for milling of Omena into animal feed product reject upto 6 metric tons per week (10-15%). Again, about 80-88 per cent of the rejected product is lost, since only about 12 per cent is recovered through re-drying, re-cleaning and sorting. The barriers to value addition at the level of small scale processors and wholesalers are already outlined.

In addition to the causes of barriers to value addition already mentioned, there is a barrier to value addition in terms of lack of policy and legal framework for dry fish standards related to the export and domestic markets (Table 4.1). There are no dry fish quality standards, including dry standards for Omena for the domestic, regional and international markets by the Kenya Bureau of Standards (KEBS). This applies to Omena product for both human and animal consumption. The potential markets for the product in the mentioned markets are huge. These markets are therefore lost because no value addition and trade in fish products is possible, since the importation standards of overseas and regional countries cannot be met. For the domestic market, losses are incurred from costs for re-processing of poor quality product and time loss. Such standards should be established and regularly reviewed by KEBS through collaboration with a technical committee appropriately composed. Such standards would be enforced via legislation and regulations by the Fisheries Department. The only KEBS standards registered as KS05-1516 Code of hygiene practice guiding the handling, processing, storage and disposal of fish in the market and which also meets the strict European Union standards (EU Directive 91/EEC) for fish exports to the EU address only fresh fish standards (Manyala and Gitonga, 2008). The lack of dry fish standards in Kenya is attributed to lack of scientific studies as a basis for such a standard.

The setting up of own standards by manufacturers of animal feeds for packaging, processing and storage can be deemed to be a barrier to value addition because such standards are not technically based on scientific evidence. The product manufactured may not be having the quality and productivity that it could otherwise have.

4.1.3 Value addition in Omena value chain

In this section, descriptions of the activities undertaken at the different stages

of the value chain (production, primary processing, secondary processing, and processing for production consumption (industrial/animal feed processing and human food processing) are provided followed by calculations for estimates of the valued added.

Production activities

Here, not many activities take place. Storage and ensuring arrival at the landing beach in the morning session and in time to minimize physical and chemical spoilage of fish is undertaken. Some level of fish sorting is also done.

Primary processing activities

At this stage of the value chain, small processors use lake water to clean the fish to remove sand and debris. Omena is then dried on grass, mats and raised racks for high quality fish. Sorting is further performed to remove sand and debris from the final product. Consolidation of more of the product may be undertaken at nearby landing beaches.

Secondary processing activities

This will involve collection of consignments of Omena from small processors and storage by the landing sites or in urban markets or towns near the landing beaches. Bulking of more of the product is undertaken from the nearby landing beaches. Some further drying of the product is undertaken. Packaging is done and storage as well. Transportation of the product to larger wholesalers or direct delivery of the product to industrial processors is undertaken.

Tertiary processing activities (Processing for consumption)

For human food, Omena is processed as salted or stewed product. The product is packaged in polythene in different weight units. For animal feed production, the fish is re-processed to remove debris, sand and other contaminants. Re-sorting and re-processing is done. Drying and sieving is performed. The fish is grinded and formulated into a ration with grinded maize, minerals and vitamins. Transportation of the animal feed and storage are done.

Value addition

The literature has indicated that about 70 and 30 percent of Omena is consumed by the animal feed industry and human consumers, respectively. About 8 percent of the supply of Omena in Kenya is imported from Tanzania and Uganda. Also, the literature has indicated that currently, there are minimal or no exports of "omena'" from Kenya to any other country. Additionally, no estimates have been made regarding losses of the product for human consumption. This is the case since the product for human consumption is known to generally meet high quality

standards as there are many options of choice for consumers. Any low quality product is always channeled to animal feed manufacturing. Loss of product related to value addition is therefore assumed to be minimal. It can be therefore assumed that costs related to value addition in Omena are related mainly to the animal feed manufacturing industry.

The following assumptions were made in estimating value added at the various stages of the Omena value chain.

1. Value of total production in Suba subcounty (Ksh.) = 2,186,272,000 (2.186 Billion) in 2011
2. Profit margins for small scale processor and wholesaler are, respectively, 37% and 79% (USAID, 2010).
3. Dry product from 2011 production (Suba Subcounty) = 50,316*1/3 = 16,604.28 tons
4. Dry product available for human consumption (30% total dry product catch) = 16,604.28*.3 = 4981.284 tones (11,623 tons for feed processing)
5. Quantities of different quality dry omena for consumption; (ordinary quality = 4981.28 - 1000) = 3981.28 tons; high quality omena = 1000 tons).
6. Price of omena (ksh. per kg.) including costs for feed quality Omena after primary and secondary processing by small scale processors, wholesalers, processors: producer = 44.85; primary processor = 61.45; wholesaler = 110; feed processor = 162.95
7. Price (Ksh.) of dry Omena per kg. after primary processing; (ordinary omena = ((267 + 20.50 (cost) + 63 (profit))) = 350.50; wholesale processing = 480; high quality Omena = ((300 + 43 (cost) + 107 (profit) = 450.00)).
8. All ordinary quality Omena and feed quality product are sold by small scale processors to wholesalers (price of sale by small processors of ordinary quality to local retailers and wholesalers is about the same).
9. Weight of dry omena in a 2 kg tin = 500 grams (.5 kg) for human consumed fish.
10. One sack of feed quality Omena contains an average of 70 kg dry Omena
11. The annual production of fresh Omena is equivalent to 1/3 of the dry product
12. The quantity of high quality Omena processed and sold for human consumption is 1000 tons annually
13. Most animal feeds is processed by large scale processors

Estimate of values added at primary processing by small scale (women) processors, secondary processing by wholesalers, and tertiary processing by retailers and feed manufacturers were computed. The results are shown (Table 7).

Table 4.2: Omena value added at primary, secondary and tertiary processing in Omena value chain in Suba sub-county

Omena value chain stage		Value added (%)		
		Ordinary quality Omena	High quality Omena	Feed quality Omena
Primary processing		31.3(267/350.50)	50.2(450.5/300)	37(61.50/45)
Secondary processing		37(480/350)	37(617/480)	79(110/61)
Tertiary processing	Retailer	23(590/480)	8(666/617)	-
	Feed processor	-	-	48(163/110)

Note: Prices between value chain stages for the value addition activities between two consecutive stages

The results indicate skewed distribution of value added within different value chain stages contrary to the findings for sea fish value chain fisheries in Morocco (INFOSAMAK, 2011) and retail frozen fish value addition in the UK (Roheim et al., 2007).

4.2 Discussion

The problems related to barriers in value addition in Omena rotate around lack of appropriate technology for sun drying Omena; poor adoption of the newest technology so far piloted; lack of legal and policy framework for processing dry Omena, inadequate business and entrepreneurial skills among stakeholders in the value chain, under development of the value chain in terms of infrastructure, market information and linkages, among others, and lack of quality standards for handling and drying Omena due to lack of scientific studies for basing technical specifications crucial to food safety and human health. The other critical issues concern sustainability in the use of the resource; and a balance in the use of Omena among local communities, high value markets and the animal feed industry.

For the new technology, further research should be conducted to identify factors which influence its diffusion such as institutional arrangements, technology characteristics, adopter characteristics, and the nature of the social system in which the technology is under diffusion among other factors. As regards space and land issues required for drying at landing sites, the roles of the national and county governments in ensuring adequate land reflecting the total fishery production landed at the beaches cannot be overemphasized. Access to all processors must be equitable. Supporting facilities such as cold rooms, hygienic tap water and toilets must be adequately provided to ensure sanitary conditions. A balance must be struck between private and public utilization of infrastructures and land at the beaches. Realizations of these conditions would ensure high quality products and profitability for Omena businesses. KEBS needs to constitute a committee of experts drawn from the public, civil society, Omena value chain stakeholders, university food science departments, processors and the private sector to draw standards for Omena processing. This will facilitate a huge access of the product to high value markets including export markets. Legal and regulations for enforcing the standards by the State Department of Fisheries should be drawn by the expert committee. Market development capacity building should continue with clear identification of capacity building needs assessment which could be supported by taxes and levies from the product. Roles of the Ministry of Health in sharing levies should be reviewed and rationalized. Levies and taxes from the product should be used for development of the value chain including capacity building.

Removing barriers to value addition should be seen as a policy instrument for partly helping the government to make more food available especially to the local population. It should also be seen as a means of ensuring there is a balance for competition for Omena among local consumers, the animal feeds industry and high value markets. This should also contribute to sustainable use of the resource.

Studies that establish factors determining the processing, storage and handling quality for Omena need to be embarked on to promote value addition to the product. A Hazard Analysis and Critical Control Point (HACCP) framework should also be established for use by the various stakeholders involved in the value chain. These measures will allow the product to access large potential markets and increase productivity of the value chain.

Value addition analysis indicated that in general, there is a greater likelihood that businesses at the upstream end of the value chain gain least in value added at least for some of the Omena products. This is illustrated by the lowest gain in value addition for ordinary Omena for small scale processors and high quality Omena for retailers. Wholesalers and feed manufacturers with better capital, market access information, technology and market power seemed in general to recoup

the greatest gains in value added for at least feed quality Omena. The relatively high gain in value added to high quality Omena for human consumption by small scale processors illustrates that the introduction of technology, capital access for Omena processing and technical support can contribute to better competitiveness of small scale processors in adding value to Omena compared to wholesalers and feed processors. It is important to note that feed quality Omena and ordinary human consumed quality Omena quantities and values added are about the same in proportion to each other. This means that the quality addition for ordinary Omena is not high enough given that there is relatively minimal quality addition for the feed quality Omena at small scale processing level. Second, it is important to notice the high figure of value added for high quality Omena and yet at the production-processor stage, it almost adds nil value to the value added at that stage of the value chain. This point concerns mainly the very limited quantity of high value Omena which has value added to it with a minimal cumulative value addition compared to the other products.

5. Conclusion and Policy Recommendations

5.1 Conclusions

The following main conclusions can be made based on the findings of this study;

1. The barriers to value addition in Omena value chain in Suba sub-county, such as poor processing technology, poor adoption of solar drying innovation, poor business skills, legal and policy framework shortcomings on dry Omena processing, land access and infrastructure development, and lack of technical specifications for processing and marketing Omena are contributing substantial losses of the product and impacting negatively on business profitability and food security, especially for the locals.
2. The lack of information and linkages among fishermen, processors, wholesalers, and industrial processors will mean that the sharing of value benefits will be unequal, and the value chain sustainability is threatened.
3. Because of the relatively large loss from quality and physical losses of the product, the value for money for the animal feeds manufactured from low quality Omena may not be achieved by consumers of the feed products. This may be affecting animal production health and productivity.
4. The productivity of the Omena value chain is greatest for wholesalers and animal feed processors compared to small scale processors and retailers.
5. Further value chain development, increasing access to capital, technology and technical support can help reduce the gap in the advantage of value addition that wholesalers and animal feed processors have over retailers and small scale processors. The productivity of the value chain will be enhanced when the barriers to value addition are addressed in a systemic manner by interventions in the whole value chain.
6. Capacity development for businessmen, overcoming poor adoption of the new processing technology, appropriate legal and policy framework for processing dry Omena and infrastructure development are among the barriers to value addition that will greatly impact value addition in the value chain.
7. The market demand for Omena will be expanded when the value chain is developed by addressing the barriers to value addition.

5.2 Policy Recommendations

The following main recommendations can be made based on the findings:

1. Policy and legal framework for land use at beaches and standards (KS05-1516 Code) for processing dry Omena should be changed by stakeholders to facilitate infrastructure development at beaches and processing of dry Omena for quality achievement. The infrastructures should include portable water for cleaning fish, drying racks, crates for storage of Omena, replacement of boats with poor storage spaces and cold storage rooms. The State Department of Fisheries, Kenya Marine and Fisheries Research Institute, Food Science Departments of various state and private universities, KEBS, associations for the fish industry and the Ministry of Lands, Housing and Urban Development, among others, should address the requirements of land tenure at beaches and standards for dry processing Omena through platform discussions and research.

2. Technical specifications (water, temperatures, packaging, sanitation and handling) for processing, transporting, distributing, packaging and marketing the product should be developed, agreed upon by the above stakeholders in order to ensure high product quality and food safety. Basic and applied research studies by university food science departments and Kenya Industrial Research Development Institute should be the basis of the specifications.

3. The State Department of Fisheries, Fisheries associations and county governments in Omena value chain and other stakeholders should provide advisory education on value addition for Omena, especially in relation to increasing demand and incomes, nutritional health benefits, product quality and development of different products for various consumer requirements. Social media should be used for education. Development of Omena into differentiated products for increasing the quality of other foods as fortified food, soup, porridge and stew should be done to contribute to value addition. Publicity on product quality should include the piloting and demonstrations of small processor handling using crates and cold brined water and Omena processing using drying racks.

4. Market surveys for consumer preferences for different market segments for Omena should be conducted by county governments, universities and fishery associations and products preferred by consumers developed, tested and marketed. Fishery cooperatives should be facilitated to adopt drying technologies to ensure quality and food safety and to brand, package and market their products for diverse segments of Omena markets, including

potential markets in Eastern and Central Africa.

5. Local credit cooperative development among the key fishery stakeholders should be promoted by county governments in the Omena value chain in Kenya. This should facilitate easy access of credit by traders and especially small scale processors to enable them maintain and expand Omena businesses.

6. The standards developed for dry Omena processing and the technical specifications (water content, storage temperature, packaging, sanitation) should be developed by actors as in 1 in liaison with regional and international authorities. They should conform to international standards especially for the product earmarked for export.

7. Further development of the value chain, especially in relation to small processor and retailer capacity development in technical knowledge on Omena processing, marketing, storage and handling and product development should be enhanced and access to technology and capital should be facilitated by private-public partnerships, community-based organizations, and key policy and technical stakeholders.

5.3 Areas for Further Research

This study can be improved by updating the current situation of the Omena value chain regarding barriers to value addition and value added in view of the initiation of the devolved government system. This can be achieved by undertaking a market survey of the Omena value chain in respect of the research questions among the key stakeholders using a mix of methods including focus group interviews and questionnaire surveys.

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Appendix

Appendix 1: Composition of feed ingredients and ingredient costs per ton

Feed ingredient	Cost (Ksh. per kg)	Cost (Ksh.) of ingredient per metric ton	Composition (%)
Whole maize	22	4,400	20
Maize germ	13	650	5
Sunflower cake	25	2,250	9
Wheat bran	7	1,050	25
Wheat flour	30	1,500	5
Wheat pollard	11	110	8
Cotton cake	15	1,350	9
Omena fish	110	8,800	8
Brewers paste	48	480	1
Lime	6	540	9
(Table) Salt	17	25.50	.15
Premix	230	575	.25
Mycotoxin binders	700	.14	.02
Organic amino acids	400	0.2	.05
Enzymes	500	.175	.035
15 Gunny bags per ton @ Ksh 30	-	450	-
Total cost (Ksh) per metric ton	-	22,180	-

Source: Poultry feed manufacturer X for year 2011; De Groute et al. (2010)

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