

Value-chain analysis of sun-dried mukene in Uganda

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Marketing of mukene (Rastrineobola argentea), a freshwater lake sardine, has become a lucrative business in Uganda after decades of underutilization. However, little was known about its value chain which prompted a 20-day study at two selected landing sites on Lake Victoria in Uganda and several fish markets in Kampala. About 200 fisher-folk were interviewed to identify key stakeholders, linkages, and economic variables along the mukene value chain. Results indicated that 70 per cent of dried mukene was marketed for human consumption and 30 per cent for animal feed production. Boat owners incurred the highest inputs and local traders incurred the lowest. Although fisher-folk and processors influenced mukene quality, their profit margins were only 10 per cent and 12 per cent, respectively, compared with boat owners/traders' profits of 90 per cent and 48 per cent for human consumption and animal feed, respectively. These key players along the mukene value chain played indispensable roles regardless of their profit margins.

Keywords: value-chain actors, lake sardine, Lake Victoria

Value-chain analysis is used to examine the supply of a product from a producer to a consumer (Taylor, 2005). It demonstrates relationships between key players and allows management of challenges and optimization of activities along the value chain (Dekker, 2003). In addition, Kaplinsky (2000) noted that value-chain analysis provides insight into policy formulation and implementation. In the sun-dried mukene (*Rastrineobola argentea*) value chain, the relationships between different players are dictated by gender roles, capital input, and type of market outlet.

Mukene is a sardine-like fish with an average length of 5 cm and average weight of 15 g. It is the third most popular commercially exploited fish species in Uganda after Nile perch (*Lates niloticus*) and Nile tilapia *Oreochromis niloticus*. Although recent total mukene catches in Lake Victoria seem to be decreasing, the value has stabilized at around US\$1 m, which is a significant contribution to the Ugandan national economy (DFR, 2010). A large quantity of mukene is processed at landing sites on the numerous islands of Lake Victoria. There are three large-scale and numerous small-scale mukene processing plants for animal feed around Kampala. Previously, about 80 per cent of mukene was processed into animal feed and only 20 per cent was marketed for human consumption, but since 2009 there has been an increase in mukene for human consumption as the price of other sources of animal protein has risen sharply. Some local consumers, who had previously attached a negative social stigma to mukene, have reverted to its consumption. Additionally, as security in neighbouring countries has improved, a substantial undocumented increase in

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trade has occurred across the porous borders with Republic of South Sudan, Rwanda, and the Democratic Republic of Congo (DRC), where mukene is sold for human consumption. These markets are so large and lucrative that mukene of questionable quality is sold at a high price.

The value added to mukene by key players as it moves along the distribution chain varies with their level of contact and ability to cause change: for example, key players in direct contact with the product include boat owners, fishers, processors, and traders, who add value by extending the shelf-life through preservation or packaging. However, value addition in the mukene fishery also depends on other variables, including fish quality, nutrient content, intended use of the product, level of competition, handling practices and facilities, stakeholders' behaviour regarding quality, and the level of income for each player in the value chain. Although policy-makers may not have direct contact with the mukene product, enforcement of their policies may affect the mukene value chain. Value-chain analysis in the Uganda mukene fishery is quite complex and this study was designed to understand a small component of the interactions between the different players and the value added to mukene. The overall objective was to analyse the economic market variables and specifically the study focused on identification of key players, the linkages between them, identification of inputs and profits at different segments along the value chain, and finally generation of information for policy formulation to streamline the mukene sector.

Methodology

Information on economic market variables was collected using a structured questionnaire at Kasekulo and Kiyindi landing sites in the Districts of Kalangala and Buikwe, respectively. The criteria for selection of the landing sites were based on quantities of mukene landed per day in comparison with other landing sites along the Ugandan portion of Lake Victoria. These two sites were the most economically vibrant in their respective districts, with most of the key mukene value-chain actors available. The choice of Kampala was based on its having several fish markets that play a pivotal role in the mukene value chain. About 132 randomly selected boat owners, processors, and traders who are directly engaged in the mukene business were surveyed. Their responses were analysed using SPSS statistical package version 16.0.1. The cost of inputs at each stage of the chain was determined and used to compute the final input cost per 100 kg bag of sun-dried mukene. The profit margin was calculated from the final retail selling price of the bag.

Results and discussion

Key players in mukene fishery

At the landing site, the key players in the mukene fishery include local authorities at sub-county level in charge of revenue collection, boat owners, fishers, and processors. Boat owners may be female or male, whereas fishers are always male

and have different nationalities, including Rwandese and Congolese. Processors are principally women and young men. Every mukene fishing boat pays a monthly landing fee and about 35 per cent of the collected revenue is retained at the sub-county to finance other government services such as education and health. The other key players include Beach Management Units (BMUs), traders, fish inspectors, and policymakers. BMUs consist of members of the fishing community at each landing site, who are mandated by Act of Parliament to manage the fisheries resources. BMU committees, comprising both men and women, are responsible for ensuring fish quality at landing sites, among other tasks, although this does not always feature highly in their list of priorities. The traders appear to be the main drivers of the mukene fishery and in their absence, the upstream segment of the value chain would become cut off. Traders may be either men or women and have different nationalities; at the study landing sites, Rwandese, Congolese, and Burundians were the most common. Since implementation of a decentralization policy in Uganda, recruitment of fish inspectors, whose mandate is to ensure fish quality among other duties, is the sole responsibility of the districts. However, the assurance of mukene quality has eluded their scrutiny with negative consequences for the sector. Finally, policymakers at the pinnacle of the fisheries sub-sector formulate policy, but it is the district authorities that ensure implementation of the policies. However, with regard to mukene quality, implementation has been left to market forces. There is also a disregard for quality among consumers, which may be attributed to lack of knowledge about factors that influence fish quality and the high cost of living, which forces most consumers to consider quantity as opposed to quality when purchasing fish.

Inputs at various stages along the mukene value chain

The value added to the product along the distribution chain depends on several variables, which include:

- quality and nutrient content;
- intended use;
- level of competition dictated by supply and demand;
- handling practices and available drying facilities;
- attitudes of stakeholders to quality parameters; and
- the level of income for each player in the value chain.

At each stage in the chain, the inputs and outputs (Table 1) vary depending on weather conditions, geographical location, and accessibility to markets, infrastructure (road network and communication), and sources of funding.

The inputs, production costs, and average investments highlighted in Table 1 varied significantly among the different actors depending on the type of service being offered, terms of payment and whether the business enterprise dealt solely with mukene or had other merchandise (e.g. most supermarkets in Kampala deal with other products unrelated to mukene which complicates the calculation of investment in the entire business).

Table 1 The inputs, costs, and average investment incurred by various actors along the mukene value chain (consumables are charged for 100 kg bag of mukene product)

| <i>Value-chain actor</i> | <i>Basic required inputs</i> | <i>Production costs (UGSh '000s)</i> | <i>Average investment (UGSh '000s)</i> |
|---------------------------------------|--|--------------------------------------|--|
| Boat owner | Fishing vessel (1) | 3,000–5,000 | 10,000–15,000 |
| | Net (1 x 7 rolls x 100 m) | 1,000 | |
| | + floats + sinkers | 350 per month | |
| | Boat maintenance | 6,500 | |
| | Engine | 10 per trip | |
| | Kerosene | 5 per day | |
| | Net repair | 20–30 per fishing trip | |
| | 2–4 crew members | | |
| Fisher | Food | 5 per day | 10–15 |
| | Landing fee | 1–2 per day | |
| | Offloading charge | 0.2–0.3 per day | |
| | BMU charge | 0.3 per day | |
| Primary processor | Labour | Equivalent 1 basin of fresh mukene | |
| Local trader | Vehicle hire | 100 per trip | 2,000–1000 |
| | Dried mukene | 120–150 per bag | |
| Regional trader | Vehicle hire | 600 per trip | 20,000 |
| | Dried mukene | 120–150 per bag | |
| Secondary processor | High quality raw materials (mukene + composite flour from cereal or tuber) | 120 per bag | 100,000–150,000 |
| | Hammer mill | 25,000 | |
| | Workforce (3–4) | 300–600 per month | |
| | | | |
| Mukene retailer for human consumption | High quality mukene | 135 per 100 kg bag | 200–250 |
| | Market dues | 1–15 per month | |
| | Monthly rentals | 5 per month | |
| Supermarkets | High quality and packaged | 150,000 | 500 (on mukene alone) |
| | Monthly rent for shelf | 10–15 | |
| Primary consumer | Transport to market | 1–2 per occasion | 5 |
| | Cost mukene (1 kg) | 1–2 | |
| Feed manufacturer | Raw materials (mukene + maize or rice bran/husks) | 100–120 per bag | 10,000 |
| | Hammer mill | 7,000 | |
| | Workforce (1–2) | 250–500 per month | |
| Local feed trader | Vehicle hire | 5–10 per bag | 5,000–7,000 |
| | Mukene based feed | 2–3 per kg | |
| Regional feed trader | Vehicle hire | 600 per trip | 100,000+ |
| | Dried mukene | 90–120 per bag | |
| Retailer for animal feeds | Mukene-based feed | 2 per kg | 10,000 |
| | Monthly rentals | 50–100 | |
| Secondary consumer | Transport to feed shop | 1–2 per day | 20–50 |
| | Charge for mukene (10 kg) | 20–30 | |

Note: US\$1 = UGShs2,500

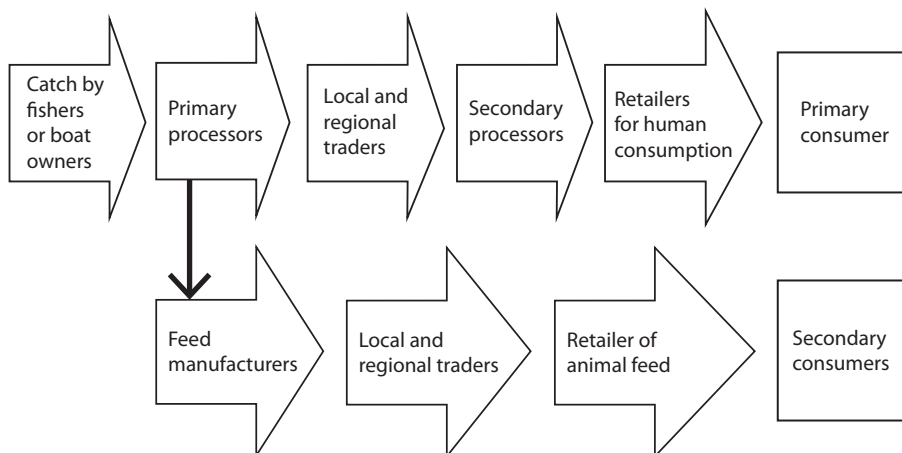


Figure 1 Interactions between different players along the mukene value chain

For clarity, only the principal areas of operation along the value chain are discussed. They include the fishing grounds, landing sites and drying areas, and local and regional markets. For the purposes of this paper, key value points along the mukene distribution chain and key players operating within the jurisdiction of each value point are discussed singly although it is acknowledged that interactions occur between different players (see Figure 1).

Landing site segment of the value-chain

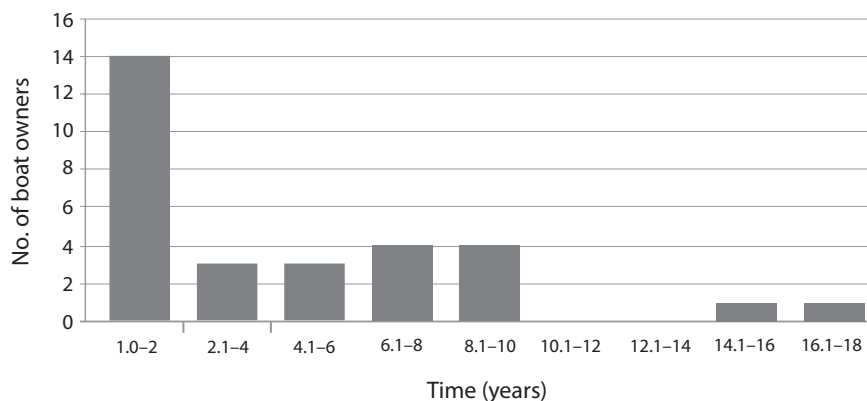
Fishers, boat owners, processors, transporters, and traders are the key players represented at landing sites. The gender and nationalities of key players in all segments along the value chain are shown in Table 2. Most key players were Ugandans; some were from neighbouring countries. It appeared that each player had a designated role at a specific segment along the value chain, but African Arrow Aquaculture (AAA), based near the Kiyindi landing site and considered large-scale by Ugandan standards, was involved at every stage of the value chain for mukene intended for human consumption. This company had eight boats, commonly known as rigs, each with a capacity of 400 kg per day, used for commercial fishing, about 15 raised drying racks with a total capacity of 3 metric tonnes per day, and a well-ventilated room for packaging and storage. Its products were traded at local as well as regional level. Compared with other fishers or processors at the Kiyindi landing site, this company was significantly ahead in terms of quality and quantity.

Table 2 Gender and nationality of key players in the mukene value chain: case study of Kiyindi landing site

| Key players | Males (%) | Females (%) | Ugandan (%) | Rwandese (%) | Congolese (%) |
|---------------------|-----------|-------------|-------------|--------------|---------------|
| Boat owners | 80 | 20 | 98 | 2 | – |
| Fishers | 100 | 0 | 95 | 5 | – |
| Processors | 10 | 90 | 85 | 15 | – |
| Transporters | 100 | 0 | 85 | 15 | – |
| Traders (Wholesale) | 85 | 15 | 75 | 20 | 5 |
| Market retailers | 95 | 5 | 100 | – | – |

Boat owners. Boat owners were usually medium-to-high income earners who may have been civil servants, business entrepreneurs, or fishers who had enough capital for large-scale investments. It appeared that most boat owners entered the mukene businesses for one or two years (see Figure 2) and then moved on to other less risky enterprises (e.g. hardware shops and commercial houses); 70 per cent of the respondents interviewed regarded the mukene business as risky because of its seasonality (see Figure 3), their lack of collateral to access credit, rampant theft of fishing gear, and an unstable market. Boat owners resided in urban centres or at a landing site depending on their other business interests. They dealt directly with fishers, processors, traders, BMUs, and local government officials. Boat owners incurred the initial cost of a boat, the boat landing fee, operational costs including fishing gear and boat maintenance at an estimated cost of UGShs3–5 m (\$1,200–2,000) depending on size of the boat and the net. They reported that a boat could be hired out, together with fishing gear, to a crew of 2–4 depending on the capacity of the boat, or the boat owner recruited the crew and paid them on a daily basis.

The terms and conditions of boat and crew hire varied with landing sites. They also paid for hire of a drying surface, drying operation, and packaging, which is performed by processors at a cost of UGShs5,000–6,000 (\$2.00–2.30) per day. Based

**Figure 2** Duration of boat owners in the fishery business

on the production of a 100 kg bag of sun-dried mukene, the boat owner incurred input costs of UGShs60,000 (\$23) and sold the mukene for UGShs180,000–240,000 (\$70–93) depending on type of market and seasonality (prices were lower during glut seasons than seasons of scarcity and regional markets were more lucrative than local markets). As such, the profit margin varied between 26 and 35 per cent, which was higher than in other business enterprises. However, the perceived risks involved in the mukene business did not allow most of them to stay long for fear of losing everything by any one of the risk factors.

Fishers. The mukene fishery is seasonal with distinct monthly variations. From the present study, most respondents indicated that December to February was more lucrative than April to August (see Figure 3). Owing to the open access policy in Uganda, fishermen did not pay to fish for mukene, but some landing sites charged a landing fee, which varied by district from UGShs10,000 to 20,000 (\$3.90–7.80) per month. Kasekulo landing site in Kalangala District charged UGShs10,000, Kiyindi landing site under Buikwe District charged UGShs300 (\$0.12) per basin (30 kg) of fresh fish or UGShs500 (\$0.19) per bag (50 kg) of dried mukene. In addition, BMU charged UGShs250 (\$0.10) per bag in Kiyindi, and Kalangala charged nothing. Essentially, Kiyindi fishers paid more charges on every amount of mukene landed than their counterparts in Kasekulo, although the charge was transferred to the boat owner. The difference has been attributed to bylaws enacted by different districts: Buikwe District, where Kiyindi is located, charged higher taxes than Kasekulo by virtue of being on the mainland and therefore accessible by road. These charges were ostensibly to reduce the number of people exploiting the natural resource base. In contrast, Kalangala District where Kasekulo is located could not make prohibitive charges because it is only accessible by water and many traders feared crossing large expanses of lake.

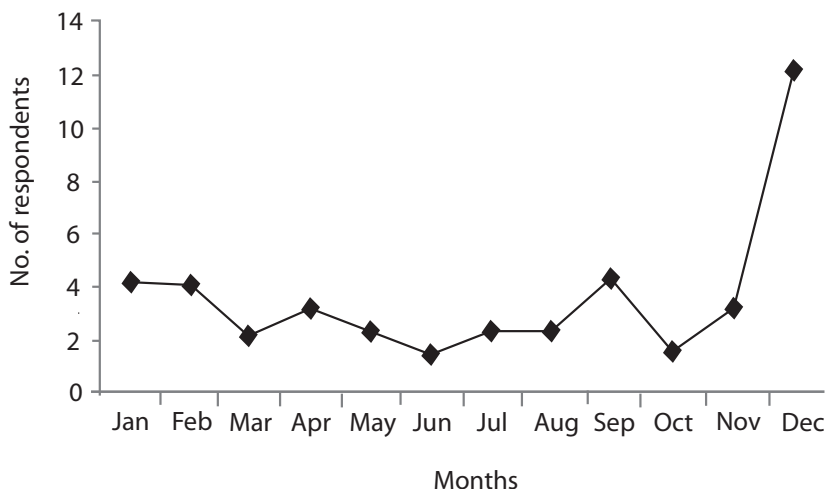


Figure 3 Mukene fishing by month

When fishing, fishers bought fuel, paraffin, and food, and on their return they subtracted the costs of these inputs and boat maintenance from the value of the catch and then divided the remaining catch between the crew and boat owner. At some landing sites, fishers were paid UGShs5,000 per day or one basin of mukene valued at UGShs4,000. In both scenarios, unscrupulous fishers who sold some of the catch while at the fishing grounds earned more from daily catches than did the boat owners. Based on production of a 100 kg bag of sun-dried mukene, a self-employed fisher incurred costs of UGShs64,000 (\$25) per day for paraffin and petrol to catch an average of 12–15 tins of fish (each tin containing 35–40 kg), which sold for UGShs10,000–12,000 (\$3.90–4.70). If the fisher decided to sun-dry the mukene, he would realize the same number of tins which sold at UGShs12,000–14,000 (\$4.70–5.50) – an extra UGShs2,000 (\$0.78) for every tin of dried mukene. Since 12 tins make up one bag, this gave a profit margin of 56.9 per cent for fresh mukene and 63.5 per cent for the dried product.

Transporters. There were different types of transportation along the mukene distribution chain, including boats, head-loads, trucks, pick-ups, lorries, and occasionally trains. Fresh mukene was usually carried from fishing boats as head-loads by women or youths that were hired by the boat owners. The charge for transportation varied with landing sites and distance carried: at some landing sites, labourers were paid one basin of fish for every 30 basins carried to the drying ground; whereas at other landing sites, UGShs5,000 (\$2) was charged for the service. The sun-dried mukene from the islands was transported to the mainland by boat and offloaded by women or young men for a fee of UGShs500–1,000 (\$0.19–0.39) per 100–120 kg bag. Their revenue therefore varied with the number of times that they were hired: on a busy day during the glut season, it was possible to realize UGShs10,000 (\$3.90). Transportation of the same quantity of dried mukene to more distant markets within Uganda using trucks or pick-ups was charged at UGShs10,000 per bag and transportation across borders to regional markets cost UGShs13,000 (\$5) per bag.

Processors. Processors were usually women or youths who were either employed by traders or boat owners and paid according to the quantity of mukene processed (e.g. UGShs500–1,000 per basin of sun-dried mukene, depending on landing site). In some cases, the women who carried mukene from the boat also continued with the sun-drying operation and charged one basin of raw mukene. Some processors were paid in kind, so that for every 30 basins of mukene transported from the fishing boat to the drying ground, they received a basinful of mukene, which they dried separately from the trader's or boat owner's fish. The drying operation involved periodically turning over the mukene to facilitate drying and after drying the processor accumulated the dried product until it reached saleable quantities (a basinful or a bagful). The quantities stored were related to the capital input: small-scale processors operating with less than UGShs100,000 (\$39) capital base kept their dried mukene in shacks, whereas large-scale traders/processors with a capital base of more than UGShs5,000,000 (\$2,000) kept their products in commercial stores. Kasekulo and similar landing sites with large stores acted as primary collection centres whereas small temporary landing sites supplied the large ones.

Small-scale processors sold their products to local or regional traders who in turn hired 7 t capacity boats to transport their consignments to the mainland. Processors sold their products to wholesale traders at UGShs13,000–15,000 (\$5.10–5.80), or to retailers at UGShs15,000–18,000 (\$5.80–7.00) per tin. Each tin of adequately sun-dried mukene weighed 4–5 kg, equivalent to 42 cups, and each cup weighed 100 g and cost UGShs800–1,000 (\$0.31–0.39) at local retail markets.

Traders (local and regional). In addition to the study landing sites, traders purchased sun-dried mukene from other landing sites along the shores of Lake Victoria, including Masese, Dimo, and Lambu. Mukene might be sold from these lucrative landing sites to other traders or the same traders might continue with their consignment to the major urban centres of Masaka, Jinja, and Kampala. Most of the traders at the urban centres were nationals of neighbouring countries and involved in regional trade. Most traders from DRC were women whereas traders from Rwanda were men, and in most cases they were also involved in fishing. Very few Sudanese were involved in the mukene fish trade.

Mukene from Lakes Victoria and Kyoga was also marketed in local urban centres. All the sun-dried mukene from Uganda that is traded regionally is used for human consumption regardless of the quality. The quantities exported across the porous Ugandan borders are not known, but information from the study landing sites indicated that daily quantities varied from 30 t per week at Kiyindi to 20 t per week at Kasekulo when in season. Rwandan traders took over 60 per cent of the mukene processed from these two landing sites, followed by DRC (20 per cent), and then South Sudan (10–15 per cent). Insignificant quantities were exported to Burundi and Central African Republic. It was reliably reported that Rwanda re-exported large quantities to Burundi while South Sudan also re-exported fish to the Central African Republic. Recently AAA started exporting salted and sun-dried Mukene to Zimbabwe, South Africa, and Zambia.

Usually the traders bought sun-dried mukene from either boat owners or processors, but on several occasions some traders, especially from Rwanda, bought mukene from boat owners before it was fished from the water and employed both the fishers and processors to fish and dry the mukene. The practice of advance payment to fishers or boat owners by Rwandese traders was estimated at UGShs2 bn (\$970,000) per month. It had a bearing on subsequent handling and processing practices in that such contractors were subjected to immense pressure to meet the conditions of the transaction. This resulted in a disregard of quality standards and the production of quality-compromised products. From a socio-economic viewpoint, the processors were in a poverty trap that ensured continued indebtedness, since it was a type of credit/loan they had to pay back. The system weakened the bargaining position of fishers and they could therefore not expect better returns than those imposed on them by the financiers. The trap was so inescapable that even when AAA offered to buy their raw mukene at the market price for the dried product and have it sun-dried hygienically for a better market price, the processors did not accept the offer because of the commitments they had to meet.

Given the stiff competition prevailing at landing sites, most traders kept their merchandise in stores at landing sites or the nearest urban centre until they had accumulated enough tonnage for the transport vehicle's capacity. Storage charges varied with locality from UGShs500 (\$0.19) per bag per day at Kiyindi to UGShs200 (\$0.08) at Kasekulo. There was another group of traders who purchased dried mukene in relatively large quantities, from 1 t to 14 t, for distribution to local retailers at UGShs120,000–150,000 (\$47–58) per 100 kg bag, depending on the final destination. Other traders involved in distant markets in South Sudan or DRC purchased larger quantities to ensure their business profitability.

In the absence of a large quantity of mukene and traders at a landing site, it was packed into gunny or hessian bags and stored in individual houses or BMU stores until larger quantities were accumulated. An average house had a capacity to store 2–5 bags of 100–120 kg each; the BMU stores could handle 100–500 bags at a cost of UGShs500 per bag per day. At the final destination, each 100 kg bag was sold for UGShs300,000 (\$116) in Kampala, or the equivalent of UGShs600,000–900,000 (\$233–349) at regional markets, with South Sudan offering the highest price. Reportedly, Rwandan traders purchased mukene from Uganda, re-packaged it and exported it to South Sudan at 20–30 per cent profit. There was also unsubstantiated information that some of the Ugandan mukene was sold on the market in the Central African Republic. Owing to the long distance involved, the retail price probably exceeded the Sudanese price of \$5.00 per 100 g sachet.

Market stage of the value chain

The key players in mukene markets included traders in the following categories: wholesalers and retailers for human consumption, animal feed manufacture, and supermarkets. The quantities required by each player varied with demand and the supplies available from landing sites. During December (Figure 3) when there was a glut, some local government authorities designated special stores for mukene storage. Elsewhere, in the absence of government storage space, it was the responsibility of the trader to find alternative storage facilities, which were invariably charged for. At Kiyindi, for example, a public store with a capacity of 20–30 bags of dried mukene was rented at UGShs50,000 (\$19) per month. In other cases, a fee was charged on a daily basis on each bag of mukene, which varied from UGShs 200 to 500 per bag, depending on the location. At Kiyindi landing site the storage was free at the Fisheries Department store but UGShs300 for a private store and at Kasekulo it was UGShs200. Most stores in Kampala charged UGShs500 per bag.

There were also some medium-scale feed processing enterprises near to major urban centres, including Samba Youth, Formula Feeds, and Kagodo Feeds, which produced about 5 t of feed per day. There were also numerous small-scale feed production units in the slums of Kampala producing 1 t of mukene-based feed per day. However, the feed from these slum areas was highly adulterated, with wood dust and sand constituting about 40 per cent of the total (Masette, 2008).

Supermarkets. There are five large-scale supermarket chains in Uganda with the highest concentration of stores in major urban centres. Small-to-medium scale

'supermarkets' are numerous and may be found along almost every street in urban centres. Until a few years ago, mukene for human consumption was not sold in supermarkets but since 2009 they have sold 500 g sachets packaged in 5–20 kg packs. The 500 g sachets were sold at UGShs2,500–3,500 (\$1.00–1.40) depending on the supermarket. Mukene is also available in other forms, including spiced and deep-fried, packaged in 50 g sachets with a price of UGShs2,500. Mukene powder is also available in 100 g packs costing UGShs2,500. These products are purchased from processors that have enough capital to sustain a regular supply for the low price of UGShs500 (\$0.19) for the 500 g sachets and 50 g deep-fried versions, which allow supermarkets to make colossal profits. Small-to-medium scale supermarkets sell similar products but at a 20 per cent reduced price with corresponding smaller profits. They too are supplied by small-scale processors or small-scale traders from landing sites. The demand for high-quality mukene products surpassed available supplies, especially during periods of scarcity.

Feed manufacturers. There are several feed manufacturing plants that use mukene as a source of protein and minerals such as calcium and phosphorus. The large-scale plants include Ugachick located 27 km north-east of Kampala, Novita in Jinja town, and Biyinzika in a suburb of Kampala. Each of these plants requires substantial quantities of raw material to produce 5–10 t per day average. In 2010, Ugachick changed from using mukene to soybeans on account of the low mukene quality. However, according to AAA, the local firm which was supplying them, Ugachick was offering UGShs3,500 (\$1.40) per kg for high quality sun-dried mukene when some market outlets in Southern Africa were offering the equivalent of UGShs20,000 (\$7.80) per kg for the same product. Undoubtedly, the switch from mukene to soya was partly due to stiff regional competition with corresponding high mukene prices. Besides the price, the lack of high quality (clean) mukene, compelled feed manufacturers to use mukene that was highly adulterated with sand and other extraneous material that damaged their extruders. The profit margin for the feed manufacturer was not only reduced but this also negatively affected secondary consumers; for example, Masette (2008) reported low performance in the poultry sector.

Despite the switch from predominantly mukene-based feed to soya, Ugachick remained the sole supplier of high quality floating fish feed in the region, using small quantities of mukene in the formulation and breaking even. The selling price for mukene intended for animal feed varies between UGShs1,900 and 2,400 (\$0.74–0.93) per kg, depending on the quality of the mukene. The powder with off-flavours sold cheaply whereas whole mukene that was inadequately dried and had off-flavours sold expensively. The mixing ratio of mukene with other ingredients varies with the intended use of the feed product: in the poultry industry, the ratio varies from 12 to 15 per cent depending on the age of birds and whether it is fed to layers or broilers, with the final product sold at UGShs1,500 (\$0.58). However, in the formulation of animal feeds, mukene did not exceed 20 per cent, which meant that for every 100 kg bag of mukene, the manufacturer produced five bags of feed that were sold at UGShs150,000 (\$58) giving a profit margin of 44 per cent, which increased with lower mixing ratios (as high as 52 per cent with 12 per cent

mixing ratio). Small-scale plants with capacities between 100 and 1,000 kg per day are still using mukene in their feed formulations but the quality of their feed is highly compromised owing to inclusion of sawdust, sand, and other extraneous matter as a strategy to improve profit margins.

Retailers. Retailers purchase dried mukene from wholesalers either at the landing site or in local markets, at an average price of UGShs135,000 (\$52) per 50 kg bag. Their sale price of UGShs700 (\$0.27) per 100 g in the local market gives a revenue of UGShs336,000 (\$130). Retailers pay market dues or taxes on a monthly basis which varies with the locality: whereas the monthly market dues did not exceed UGShs1,000 (\$0.39) at landing sites, most fish markets in Kampala charged UGShs15,000 (\$5.80). In most cases, the storage charge was prohibitively high for the majority of retailers and they kept their small quantities in individual market lockers, which were charged at UGShs5,000 (\$1.90) per month by market tax revenue authorities. The two principal factors that retailers seemed to consider while engaged in the mukene business were the profit margin and the intended use of the mukene. Quality of mukene rarely featured as a concern during transactions, especially when the product had been branded as feed. However, if the product was meant for human consumption and did not meet consumer expectations with regard to quality, the retailer sold it at reduced prices which inevitably reduced profit margins.

The retailer also incurred expenses when the store was deemed damp and the retailer was compelled to re-dry the product during storage. Then the cost of re-drying was charged separately and indirectly recovered from customers – the retailer made a profit of at least UGShs280,000 (\$109) per 100 kg bag of dried mukene. At some regional retail markets, 100 g of dried mukene was charged at \$5, which was deemed quite lucrative by any standard.

Consumers. There are over 100 million potential mukene consumers within the East and Central African region. When purchasing sun-dried mukene from the local market, the two concerns uppermost in the mind of consumers are the cost per unit volume and the quality of the product (appearance, smell, levels of cleanliness or contamination, fragmentation, and lustre of the fish). In most retail markets in Uganda, mukene for human consumption was sold in plastic cups containing 100 g and cost UGShs700–1,500 (\$0.27–0.58) depending on the distance from the landing site. The same volume of mukene was sold at \$3 in the DRC and \$5 in South Sudan.

Conclusion

The mukene value chain in Uganda was found to be multi-faceted with different nationalities and gender participation at different stages in the chain. Gender disparity was influenced by socio-economic factors such as the labour intensity of the task and the capital investment required. The processing stage was dominated by women and male youths whereas fishing and trade were the mainstay of adult males. However, each chain actor played an integral part in the mukene value

chain. Lack of policies or the inability to enforce them has led to mismanagement within the chain. Consequently, the formulation and subsequent implementation of harmonized policies for improved quality or standardized measurement tools as a strategy to curb malpractices is an uphill task. As expected, some actors took advantage of the status quo to make huge profits and then move on to other enterprises. Boat owners incurred the highest cost of inputs whereas some hired processors and labourers loading mukene products on either boats or transport vehicles incurred the lowest input costs. The profit margins varied across the market outlets with the regional traders making the highest profits and the fishers and processors earning least. Regardless of profit margins, the various actors played irreplaceable roles and operated in tandem with market demands.

Recommendations

In view of the rampant malpractices within the East and Central African (ECA) region, it is prudent for each individual state that does not possess a policy on mukene quality to formulate one and for the policies to be harmonized to curb malpractice. It is also evident that regional cooperation among inspection services and border post agencies should be forged to promote trade in improved mukene products. It seems that chain actors are not aware of the challenges, risks, and other relevant information about the mukene fishery, and creation of market platforms would enhance sharing of this information. Finally, a detailed study within the ECA region should be conducted to better understand the mukene value-chain dynamics.

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