Consuming Urban Poverty Field Report No.1

Food systems description – Kisumu

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The project argues that important contributions to debates on urbanization in sub-Saharan Africa, the nature of urban poverty, and the relationship between governance, poverty and the spatial characteristics of cities and towns in the region can be made through a focus on urban food systems and the dynamics of urban food poverty. There is a knowledge gap regarding secondary cities, their characteristics and governance, and yet these are important sites of urbanization in Africa. This project therefore focuses on secondary cities in three countries: Kisumu, Kenya; Kitwe, Zambia; and Epworth, Zimbabwe.

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INTRODUCTION

This report is based on the fieldwork undertaken in Kisumu in May 2016. The report feeds into the overall Consuming Urban Poverty (CUP) study that aims at exploring food systems in secondary cities and determine how these food systems function.

Specifically, the overall study aims:

- To understand how their major configurations (formal vs. informal) differ in terms of environmental and social externalities;
- To identify the stages within the food systems with significant environmental and social impacts (also referred to as hotspots), and thereby suggest concerns that should be addressed in food systems governance.
- To describe the environmental and social externalities along the food supply chain for each case study city and where possible quantify these externalities.

To achieve the aim of the study, the fieldwork was undertaken to observe and highlight issues along the food value chain of key food items. This was supplemented by published literature.

The food system is Kisumu is made up of diverse stakeholders from the formal and informal sectors. Food production (agricultural, aquaculture & fisheries, livestock) is done at commercial and small-scale levels. Wholesaling and retail is done through urban markets, supermarkets, kiosks and street vendors. Consumption happens at different platforms as consumers have access to a diverse range of foods through various retail and catering outlets such as hotels, restaurants, canteens and street food. A simplified version of the food chain is shown in the Fig 1 below:
Figure 1: Overview of the System in Kisumu

- **Food production**
  - Food crops
  - Horticulture
  - Livestock & poultry
  - Fishing & aquaculture

- **Food processing**

- **Distribution**

- **Retail**
  - Supermarkets
  - Marketers
  - Street vendors

- **Food preparation**

- **Consumption**
  - Household
  - Restaurants, hotels

- **Waste disposal**

**Farm inputs**
- Seeds, fertilisers, agrochemicals
- Farm equipment, tools & machinery
- Extension services
- Animal health & nutrition
METHODS AND MATERIALS

This report is based on the fieldwork conducted in Kisumu that aimed at analyzing the flow of food within Kisumu. The information presented in this report is based on published literature, filed observations and informal interviews and discussions conducted with selected stakeholders. The different research methods and techniques used in carrying out the study are discussed below.

Desktop study/ Literature review

The desktop study was undertaken prior to the fieldwork to establish food production and consumption patterns in Kisumu as well as to understand the food value chains of specific food items. This entailed a literature search for academic articles, scientific literature government publications and research outputs from various institutions in the field of agricultural production and consumption. In some cases, the information used is not specific to Kisumu but other regions within Kenya. However, this information is relevant because of the complex nature of food system and the impacts upstream and downstream can be affected and influenced by what is happening in other regions.

Focus group discussion

Before commencement of the fieldwork, an information session was held with research partners and key stakeholders that were invited to the inception meeting held in Kisumu. During the session, the stakeholders advised on the markets to be visited that and the preliminary items to be tracked were discussed. Information was obtained about the key food items that are consumed in Kisumu. As a result of this discussion, some food items that had not be on the preliminary list were included in the research. The discussion also helped to identify the different institutions that we could engage during the project. As some of the stakeholders were from the Kisumu county and the marketers association, the discussion also facilitated the permissions required to conduct the research.
Interviews and discussions

Interviews were conducted with key government officials in Kisumu. These included the City Manager, Director of City Planning, public health officials and officials working in the area of soil and water conservation within Kisumu county. These interviews were set up the day before and permission was also granted to visit the different markets and neighbourhoods.

In the markets and residential areas, informal interviews and discussions were held with traders, market leaders, caterers and residents. The interviews were conducted at the spots in the markets or on the streets. The informal interviews started with a general introduction of the researchers and a brief overview of the project and the objectives of the work being undertaken. Once the participant had agreed to answer the questions, the researchers engaged them on their produce to ascertain where the food stuffs were coming from and how it had been prepared. In the markets, the marketers continued working and selling their produce during the interviews. Some of the traders refused to speak to the researchers and or demanded to be paid. In those particular cases, the researchers thanked the traders for their time and explained that no payments could be made. Interviews were conducted in a mix of English and the local languages. The researcher from Maseno University acted as an interpreter in most of the interviews and helped with the entire data gathering process. The interviews were not recorded but the researchers took down notes during each interview and permission was obtained to take photographs of the produce.

Participant fieldwork observations

Information was collected through direct observation of various activities at the landing sites, markets and retail spots visits. During these visits, various discussions were held with fishmongers, traders, market leaders, municipal officials, caterers and residents. All notes taken down during the fieldwork are attached in the appendix and all photographs have been uploaded to the CUP project Flickr webpage.
**Kisumu markets**

The team visited four markets where food is sold. These were namely Kibuye, Jubilee, Municipal Fish Market and Kowena Market (Nyalenda).

**Kibuye market**

Kibuye market is the biggest market in Kisumu operates daily and provides an outlet for both raw products and manufactured goods. The market houses approximately 7000 traders who operate from early morning till late at night (Onyango, George G. Wagah, Omondi, & Obera, 2013). Adjacent to the market is a number of artisans specialising in fabricating goods from timber and metal for the local market and for export into other markets within the region. A variety of goods can be purchased at both wholesale and retail units. There is a mix of shops, kiosks, stalls and open air traders within the market.

**Jubilee market**

Jubilee market is one of the main markets in Kisumu and has about 2000 traders (Onyango et al., 2013). The main produce that is sold is fish, cereals, fresh vegetables and fruit.

**Municipal Fish market**

The fish market is an offshoot of Jubilee market and houses approximately 250 traders (Onyango et al., 2013). The market is located within close proximity to the Central Bus Station providing easy access for fish traders to bring their fish to the market.

**Kowena market (Nyalenda)**

Kowena market is located in Nyalenda which is one of largest informal settlements in Kisumu (Frediani, Walker, & Butcher, 2013). Besides Kowena market, there are various small markets along the roadside and stall markets in front of homesteads.

**Supermarkets**

Various supermarkets were visited. These include Kibuye Mart, Nakumatt and Uchumi. These are local brand supermarkets and stock a wide range of products.
General market operations

In all the market visited, the marketers pay licence fees to the Kisumu county. The fee differs in each make. For instance, in the fish market traders pay a monthly fee of 600 Kenyan shilling per stall and in Jubilee market the monthly fee is 500 Kenyan shillings. In Kibuye market, traders can pay a monthly fee or a daily fee of 10KES. In addition to this fee, all delivery vehicles pay a fee to the council for each delivery. The fee is determined according to the size of the truck or can be according to the quantity of produce being brought in.

In both Kibuye and Jubilee markets, there is a presence of middlemen who act as gatekeepers to the markets and play a large role in determining the price of food. The middlemen often also connect the farmers to the market traders. According to the traders, the price of food fluctuates depending on the weather patterns and seasons. Food items that are in season are cheaper as there are more quantities available than food stuff that is not in season. The traders also indicated that buying directly from the farmers is cheaper but the transportation costs varies.

The provision of water supply, toilets and electricity in the markets is another issue. The extent to which these facilities are provided varies in each market. Generally, the facilities are either not adequate for the number of traders within the market or the cleanliness of the facilities is problematic. Research conducted by Onyango et al. (2013) revealed some markets have the appropriate facilities but there are various challenges such as access, control, vandalism and inadequacy. In some markets, traders have formed associations which are in charge of ensuring security, waste management and general cleanliness of the markets and related facilities. In others, Kisumu county is in charge of providing security and solid waste management services.

Security is a major concern to all the traders who were interviewed is the security and storage of their goods overnight. In Kibuye market, traders cover up their wares at the end of the day and pay a security guard to watch over their goods. However, there is still theft of their merchandise. The traders are also at risk of fire outbreaks. This is largely due to the use of construction materials that are highly combustible. The stalls are closely knit together making it easy for the fire to spread to the entire market.
ENERGY

Kenya’s energy sources consists of biomass (68%), petroleum (21%) and electricity (9%), with the remaining 1% consisting of a mix of other alternative energies such as solar and wind (Owiro, Poquillon, Njonjo, & Oduor, 2015).

Biomass

Biomass is an energy source organic material and can be derived from plant, vegetation, animal and agricultural waste (Owiro et al., 2015). Biomass constitutes mostly of wood fuel and charcoal and caters to approximately 80% of the Kenyan population (Mbugua, 2001). A survey conducted by the Kenyan government revealed that 34.3 million tonnes of biomass is consumed annually. Of this, 15.1 million is firewood and 16.1 million is charcoal (Owiro et al., 2015). Both wood fuel and charcoal are used in for cooking and space heating in the rural areas and in poor urban households. In the urban areas, charcoal is preferred as it is the cheapest cooking fuel and easier to transport than firewood. Small-scale businesses and restaurants rely on charcoal. Charcoal is also used predominantly for curing tobacco and smoking fish. The high demand of biomass in Kenya and the current consumption patterns has led to the unsustainable exploitation of forests and woodlands resulting in soil erosion and land degradation. While the government has tried to address this, the firewood and charcoal production sectors are entirely informal and thus the enforcement of regulations is a serious challenge (Owiro et al., 2015). In addition to this, charcoal production is a highly inefficient process as approximately 10kg of wood is needed to produce 1kg of charcoal. This means the CO₂ emissions resulting from charcoal production and its subsequent combustions are significantly higher than those resulting from firewood combustion (Owiro et al., 2015). The current charcoal and firewood kilns and cooking stoves are also highly inefficient meaning more quantities of wood and charcoal need to be used. Improving the technologies and or the efficiencies of the kilns is one strategy that can decrease in the quantity of wood and charcoal used thereby minimizing the environmental impacts of firewood and charcoal production.

In addition to firewood and charcoal, biogas and biofuels are used in Kenya, but on a very small scale. Biogas has been adopted especially in the rural areas but it’s use
remains constrained due to the high capital costs, available technology and lack of extension programs (Mbugua, 2001). According to the Energy Regulatory Commission (2016), there are currently about 8000 biogas plants installed and these utilizing various raw materials such as municipal wastes, agricultural wastes and slaughterhouse waste. However, there is no consolidated data regarding biogas production and this poses a challenge with determining the overall biogas capacity in Kenya (Energy Regulatory Commission, 2016). The biofuels are namely bio-ethanol from molasses from the sugar cane industry and bio-diesel from jatropha species (Owiro et al., 2015). Despite biofuels ability to substitute for petroleum fuels, the development of the biofuels sector faces opposition as it reduces the amount of arable for food production(Owiro et al., 2015).

**Petroleum and gas**

Petroleum is the main fossil fuel energy used in Kenya and is the major source of energy used by urban households, industrial and commercial businesses (Mbugua, 2001). While oil and gas discoveries are being made in the Rift Valley region, no extraction and production of the Kenyan reserves has commenced. As such, Kenya relies entirely on the imports of both crude and refined oil, lubricating oils and lubricating grease (Owiro et al., 2015). Crude oil and petroleum fuels account for approximately 90% of the total imports and the crude oil is imported mostly from Abu Dhabi and Saudi Arabia and refined by the Kenyan Petroleum Refineries Limited (KPRL) in Mombasa. The Mombasa refinery is outdated and over the past decade has been operating at a decreased efficiency. As a result, Kenya is imported more refined oil than crude oil. The various petroleum products include jet/turbo fuel, motor spirit, light diesel and illuminating kerosene. All the products except for kerosene are used to power engines for either aircrafts or motor vehicles. Kerosene is used for heating and cooking especially in low-middle class households.

**Electricity**

Electricity is the third largest source of energy in Kenya and serves about 23% of the population. Electricity is generated from hydro, thermal, geothermal, and wind. Production is done through Kenyan Electricity Generating Company (KenGen), which is a state-owned company. The Kenyan Electricity Transmission Company
(KETRACO) operates the transmission network and then distribution is done through Kenyan Power Lighting Company (KPLC).

**Hydro energy**

Kenya has a total installed hydropower capacity of approximately 816MW and an unexploited hydro potential of between 3 000MW and 6 000MW (Owiro et al., 2015). Hydro energy is heavily reliant on rainfall and as such the energy production can be affected significantly due to climatic variability. In addition to climate change effects, the Energy Regulatory Commission (2016) sites inadequate hydrological data and high installation costs as other factors that impede the exploitation of generating electricity from hydro.

**Geothermal**

Geothermal is the most promising renewable energy source in Kenya as it does not cause harm to the environment and is immune to drought and climatic variability (Energy Regulatory Commission, 2016; Owiro et al., 2015). Further to this, the technology has been mastered within the Kenyan energy industry and geothermal has the highest availability (capacity factor) at over 95 % (Owiro et al., 2015). Geothermal resources in Kenya are located within the Rift Valley. A total of 14 geothermal prospects have been identified and have an estimated potential of between 7,000 MW to 10,000 MW (Owiro et al., 2015). The Kenyan government, though the Geothermal Development Company (GDC) launched a Geothermal Development Plan and aims at installing a geothermal capacity of 1 120MW by 2018 and further expanding to 4 060MW by 2031 (Owiro et al., 2015).

**Wind**

The installed capacity of wind energy in Kenya is 5.1 MW(Energy Regulatory Commission, 2016). Although there are several projects to raise the installed capacity of wind energy, there is currently only one installation relying on wind and this is located in Ngong (Owiro et al., 2015). The low exploitation of wind energy in Kenya is a result of insufficient wind regime data and the high capital costs needed. In addition, most of the potential and suitable areas for wind energy generation are in remote areas
and therefore would require a lot of investment for transmission lines to connect these remote areas to the grid (Owiro et al., 2015).

Solar

Over the years, the use of solar energy has been increasing and mostly provides electricity to homes and institutions that are located in remote areas and far from the national grid (Energy Regulatory Commission, 2016). Solar energy utilisation is mainly for heating water, lighting, pumping water, drying and or generating electricity through photovoltaic solar systems (Owiro et al., 2015). Approximately 200 000 photovoltaic (PV) solar systems have been installed and produce 9GWh annually. The power derived from these PV installations is used mainly for telecommunication; pumping water; lighting and cathodic protection of pipelines (Energy Regulatory Commission, 2016; Owiro et al., 2015). Despite its growing popularity, the exploitation of solar energy is affected by the relatively high initial capital cost of the systems, poor consumer education and low awareness of the economic benefits of solar technology, and a lack of adherence to system standards by suppliers (Energy Regulatory Commission, 2016).

Overview of energy uses in Kisumu households and food sector

Various sources of energy are used in Kisumu (see Fig 2). Electricity sourced through Kenya Power is available in most middle to high income households. In low-income households and slum informal settlements, kerosene and charcoal are used for lighting and cooking respectively. Firewood, wood pellets and saw dust are also used a fuel for cooking. The charcoal comes from different provinces around Kenya and some is imported from Uganda. The charcoal sourced from Uganda is expensive but preferred by many consumers because of its high quality. The charcoal is transported in trucks or lorries and sold by the sackload from the trucks to the vendors. The charcoal vendors then decant it into tins and sell to the end consumer. Kerosene is burned in either wick stoves or wick lamps for cooking and lighting respectively. Kerosene can be purchased at petrol stations and is also distributed through re-sellers in residential areas as shown in the figure above. Liquid Petroleum Gas (LPG) is another source of fuel that is used for cooking in some. It is available in cylinders of varying sizes and can be purchased at petrol stations, supermarkets and kiosks.
Figure 2: Different fuel sources (truck carrying charcoal, sack of charcoal, kerosene kiosk in Nyalenda, kerosene stove, firewood) (Photos: Lesley Sibanda)
Transport networks and infrastructure in Kisumu

Food is transported via different channels such as by road, rail, air and marine. Road transport is the primary mode of transport system. Most of the roads are paved and tarred. A significant number of roads especially in the residential areas and informal settlements are graveled or earthed. In the markets, most of the traders who were interviewed stated that the foodstuffs (namely maize, millet, sorghum, cassava and vegetables are transported by road. Different modes of transport are used depending on the quantities of the foodstuff in question. Lorries and trucks are used to transport bulky items and large volumes while buses, public taxis and small vehicles are used for smaller quantities. Motorcycles (commonly referred to as boda bodas) are also used to transport food especially within the city boundaries. Traders mentioned that transportation costs are high and this affects the retail price of the food items. Most of the traders preferred buying direct from the farms as opposed to middlemen as this significantly lowers down the costs.

Railway transport offers another mode of transport particularly for bulky goods. Rail is not very popular due to the delays and unreliability of the train. In addition, the rail infrastructure had depreciated due to poor maintenance especially after the collapse of the East African Community. Air transport provides easy access to the region and external markets. This mode of transport is used mostly to transport high value exports and imports especially perishable food items. However, there are no cargo flights from Kisumu airport to regional and international destinations. As such, most of the food is flown into Nairobi and then transported by road to Kisumu.

Currently, lake transport is not used extensively to transport goods or people. This is largely due to the degraded infrastructure.
Overview of waste management in Kisumu

Solid waste management is pressing issue in Kisumu and both the municipality and the private sector provide waste management services. The municipality collects from communal dumpsites while the private sector offers door-to-door collection services. The private waste collectors collect mainly in the major estates around the city and from institutions such as schools, universities, hospitals and business complexes. The low-income areas and informal settlements receive less waste services because of poor accessibility and as a result most of the waste is dumped by the roadside and designated spots. On average, the amount of waste generated within the city daily ranges between 350 to 400 tons. Of this, only 20% of the total waste generated is collected, 10% by the municipality and 10% by private collectors (Munala & Moirongo, 2011). The waste is typically collected by trucks and transported to the dumpsite. The most common disposal method of the inorganic waste collected is either incineration or burying it in the ground. Organic waste is used as compost and or livestock feed. There are also some informal waste operators or pickers who scavenge from public bins, disposal sites and along roadsides, and drainage systems searching for recyclable materials. This waste is sold to recycling companies. An illustration of how the waste management system works is shown in Fig 5 below.

Figure 3: The three bin system in Kisumu (Photos: Lesley Sibanda)
Waste management in the markets

A large amount of solid waste is generated within the markets. The waste constitutes a mainly of organic waste although inorganic waste is also generated. Some of the traders have containers at their stalls for disposing organic waste. Other traders just dispose organic waste by throwing it on the ground. This makes the market dirty and poses a health risk especially in the rainy season. There are two main streams for the organic waste. According to the traders, some of the organic waste is picked up by pig breeders and used as animal feed. The rest of the organic waste is collected, sorted and taken to a nearby site to be composted. At Kibuye market, this is done by traders who have formed a cooperative aimed at generating compost from the organic waste. The composted manure is then ground into fine particles and sold to farmers as a fertiliser. Inorganic waste is separated and materials such as metal and plastic are either reused or recycled. The rest of the organic waste is put in bins or skips and collected by the municipality for disposal at landfill (Fig 3). The observations in the markets are consistent with what has been published.

Waste management in Nyalenda

One of the sites visited was Nyalenda. Nyalenda is an informal settlement located in Kisumu city. The major problem with regards to waste collection in Nyalenda is a lack of sites for waste to be effectively collected and transported to the municipal dump sites. According to the residents, the city had skips at strategic locations around the neighbourhood which would then be emptied once a week. However, the skips are no longer available although residents continue to throw away waste at the sites where the skips were located. One of the residents speculated that the skips are not fully operational because the tractors needed to mechanically empty the skips are too few and not adequately maintained.

Currently, most of the neighbourhood inorganic waste is discarded along passageways, roads and empty plots of land. These piles of garbage are unsightly, smell bad and are a breeding ground for flies, rats and mosquitoes. The dumps also pose a serious danger to children playing around them and animals such as goats and cows that scavenge for food in the garbage piles. Because collection is not always possible, most of the
garbage piles are incinerated which causes additional challenges such as air and soil pollution. Organic waste is deposited in a compost pit or a garbage container as illustrated in Fig 4 below. According to some of the residents, the organic waste is collected by pig breeders and used as livestock feed. The current method of organic waste disposal poses a serious health hazard as the compost pits create a favorable environment for the growth of bacteria and microbial pathogens. Clean-up activities are undertaken by youth through a government initiative and this has improved the situation. However, because there are no proper disposal facilities, the clean-up activities are redundant as the residents continue to throw their waste on the streets.

Figure 4: Uncollected waste in Nyalenda and Organic waste disposal in a compost pit (Photos: Lesley Sibanda)
Figure 5: Kisumu’s solid waste management system

- **Organic waste**
  - Temporary waste storage onsite (bins)
  - Collection by municipality
  - Collection by private sector
  - Informal waste pickers
  - Recycling industries
  - Disposal at Landfill

- **Composting**
  - Compost sold & used for agriculture

- **Solid waste generation from**
  - Households
  - Markets
  - Industries

- **Informal disposal (of uncollected waste)**
  - Incineration
  - Burying

- **Solids & liquids**
  - Animal feed
MAIZE

Maize is a primary cereal crop in Kisumu and is consumed by a majority of households as a staple food and provides approximately 36% of the recommended daily food caloric intake to about 30 percent of Kenyans (Ariga, Jayne, & Njukia, 2010; USAID, 2010). According to Ariga et al. (2010), an individual consumes about 88 kilograms of maize products annually. In addition to household consumption, a portion of the maize is used to make livestock feed (Rao et al., 2015). This maize reaches consumers via a series of pathways (Fig 8). Maize production in Kisumu is mostly subsistence farming and primarily for household consumption. A significant proportion of the maize found in Kisumu is imported from Kisi (in the Nyanza district), Busia (Western province) and Kitale. This maize is transported to Kisumu in its pre-processed form as maize grain in trucks.

Different varieties of maize are grown in Kenya either in one season annually or twice a year depending on the agricultural zone of production (Rao et al., 2015). The productivity also ranges from between 1.5t/ha to 3t/ha in the zones that cover Kisumu, Homa Bay and Siaya (Rao et al., 2015). Bungoma and Kissi are considered higher potential maize zones and have higher maize yields which vary between 6 and 7 tonnes per hectare (Rao et al., 2015).

Private millers also buy from the farmers and process the grains into mealie-meal, other associated maize products and livestock feed (Rao et al., 2015). These products are available in various retail outlets. In the market place, maize is traded predominantly as dry grains although a smaller proportion of green maize can be found. The small proportion of green maize available in the market could have been a time issue. The markets were visited after the harvest season for maize. Maize intermediary agents purchase maize directly from the farmers and other regional markets and supply marketers in Kisumu. The grain can be milled by small-scale millers that are located either in the markets or near the markets. Figure 6 below shows a milling operation located in Nyalenda.
In Kisumu, maize is commonly consumed as ugali which is a thick porridge of maize meal. However, ugali can also be prepared from other cereals such as sorghum, millet, cassava and or a combination of these (Vilakati, 2009).

Figure 6: Milling operation in Nyalenda (Photos: Lesley Sibanda)

Figure 7: Maize meal on sale from different supermarkets (Photos: Lesley Sibanda)
Figure 8: Maize value chain

Commercial & small holder farming

Pre-processed maize grain

Intermediaries/agents

Kibuye Market (wholesale)

Jubilee Market

Estate markets

Processing (hammer mills)

Processing (milling)

Household preparation & consumption

Commercial processing

Distribution

Retail

Food service industry preparation & consumption

Disposal

Imports (Processed and or milled maize)
**FISH**

The fishing sector industry is perhaps the largest supplier of protein for the majority of the population in Kisumu as well as the broader country of Kenya. The pathways by which consumers access fish in Kisumu are diverse and complex (Fig 10). Most of the fish in the country comes from Lake Victoria and accounts for approximately 96% of the total fish production in Kenya (Deloitte, 2015). With a total surface area of 68 800 km², Lake Victoria is the world’s second largest freshwater and is shared by Kenya, Uganda and Tanzania (Obiero et al., 2015). Although there are many different species of fish in Lake Victoria, the catch comprises mostly of the Nile perch, tilapia, okoko and the omena. The Nile perch is sold either fresh, smoked, fried, and or sun-dried. It can be sold whole or cut into pieces mainly the head, midsection and tail. Often the Nile perch are gutted and filleted at the landing sites. The skin and carcass are sold as food (Fig 9). The Nile perch that is larger in size frequently has a fatty layer around it and this is melted down by the traders and used as cooking oil. While the Tilapia is sold fresh at the landing sites and markets that are in close proximity to the lake, more of the tilapia is smoked or sun-dries to preserve it. Preserved tilapia is also sourced from surrounding towns as well as from Uganda and Tanzania. The omena is a small fish that forms the diet of many households in Kisumu. The fish is also referred to as kapenta or dagga. It is typically eaten with ugali (maize meal) and sukuma wiki (collard greens) for lunch and or dinner. Other people also eat the omena with tea for breakfast. Typically omena is sold in a dried state although fresh omena is available but not popular. Over the years, the fishery sector and fisheries-related activities have declined in Kisumu over the years. According to data collected by the Lake Victoria Fisheries Organization (LVFO), the decline in the Nile perch and tilapia catch between 2005 and 2008 is approximately 55% and 9% respectively (Deloitte, 2015).

Because of the declining stock, fish prices have increased making it less affordable for low-income households. Fish trading in Kisumu varies from small scale level operators who deal with very small consignments of fresh and or processed fish within the local vicinity to large scale commercial companies with massive tonnages of fish and export it to other districts, neighbouring countries and even overseas.
A large proportion of the catch is sold and consumed fresh while the rest is processed into different forms. The processing can either be freezing, sun-drying, smoking, and or frying and is done in order to extend the transit time from the landing site to the consume. Some of the fish is frozen before resale though this is not very common with small scale traders as they do not have sufficient facilities to allow for frozen and or chilled fish products. Chilled and frozen products are more dominant in the large scale commercial sector and formal retail markets meaning this product is available mostly to higher income groups as it’s also highly priced. Most of the perch catches are processed onsite at the landing site for fillets and or sometimes offsite at the fish factories. After filleting, the other parts of the fish such as the fish head and carcasses (fish bones) are sold to low-income individuals. The carcass is sold either fresh or deep-fried as a means of preserving it.

Figure 9: Image showing the Nile perch fillet (left) and carcass (right) (Photos: Lesley Sibanda)

Smoking is a method of processing that is used in Kisumu and is used mainly to cure tilapia. The fish is placed over a fire set in a either an earthen oven or over an open fire. The smoking is typically done using charcoal and or firewood. Another processing method that is prevalent is deep frying. With this method, the fish is fried in oil. While almost all varieties of fish can be fried, this method is used mainly with the Nile perch. Sun drying is used to preserve the small sized fish especially the omena. Drying of the fish is mainly done on the beach and the fish is sometimes salted. If the fish is salted, the fish is first sprinkled with salt and then left to dry in the sun. The fish is dried on
old nets that are spread on the ground, on the grass, on rocks or on sacks that have been laid on the ground. Once the fish is dried, its packed into sacks and taken to nearby markets namely Kibuye market and Jubilee fish market. The drying process can be affected by rains resulting in poor quality of the finished product. In the case of omena, lower quality grades are sold as chicken feed.

Most of the fish is sourced from Lake Victoria where its caught overnight by the fisherman and brought to shore in the mornings. The catch is placed on the bottom of the boat and covered by plastic sheets and in some instances covered with ice to protect it from spoilage. At the landing sites, the fish is unloaded from the fishing boats and sorted according to its type and quality. The fish is carried using plastic containers. The fish is distributed in different ways depending on the various factors such as demand and final market destination. Some buyers transport the fresh fish in basket loads on their heads or on bicycles and motorcycles. Other traders transport the fish in small passenger vehicles, pick-up trucks and buses. The large traders are also likely to use boats, rail, refrigerated trucks and air.
Figure 10: Fish value chain

- Small scale fishing
- Municipal fish market
- Processed fish imports (sundried, smoked, fried, salted)
- Middlemen/Brokers/Purchasing agents
- Estate/stall market
- Kibuye Market
- Jubilee market
- Processing
- Commercial fishing & fish farming
- Commercial processing
- Distribution
- Retail
- Food service industry preparation & consumption
- Commercial processing & fish farming
- Fresh & frozen imports
- Household preparation & consumption
- Disposal
- Exports
RICE

Rice is the third most consumed cereal crop after maize and wheat (Chemonics International Inc., 2010). Globally, the total production of rice (by volume) is second to maize and provides approximately one fifth of the calories consumed (Chemonics International Inc., 2010). As such, rice plays an important cereal grain with respect to calorific intake and nutrition. In Kenya, rice is the third most important cereal crop in Kenya after maize and wheat.

The supply chain is rice is illustrated in Figure 11. Rice is grown by both smallholder and large scale commercial producers as a cash crop, but the small-scale producers account for a larger proportion of the national production (Chemonics International Inc., 2010). The production areas fall within designated irrigation schemes and non-irrigated lowland and or upland areas. Approximately 80% of the rice grown in Kenya is under irrigation within Government-owned irrigation schemes which are spread across the Nyanza, Central, Coast and Western provinces (Pelrine, Besigye, Ssebbaale, & Awori, 2009). The rest of the rice is rain fed and this is mostly concentrated in the Coast and North Eastern provinces (Pelrine et al., 2009). According to Ariga et al. (2010), very little production is occurring within Kenya and as a result the importation of rice has increased rapidly in order to meet consumption requirements. Local production of rice is about 23% of the total domestic demand and the rest is imported rice (Pelrine et al., 2009). A significant proportion of the rice in Kenya is for human consumption (86%) and the rest is a combination of animal feed and various other industrial uses (Rao et al., 2015). After the paddy rice (grain-in-husk) is produced, the rice is harvested by cutting the rice plant either at the stem base or by head cutting. After harvesting, the paddy rice is packed into bags and stored to middlemen and brokers who transport it to local urban centers for processing. Alternatively, the paddy rice is sold directly to consumers. The processing consists of threshing the rice crop on a plastic sheet, tarpaulin or on the ground to separate the rice grain from the husk (Chemonics International Inc., 2010). This is done by small millers at the local level although there are big scale commercial millers. After processing, the rice is graded and packages as either 1kg, 2kg and 50kg bags and distributed to wholesalers and retailers in both local and regional markets. A large proportion of the milled rice is sold
unpackaged to traders and sold in the open markets. According to the traders in the marketplaces visited, higher grades of rice is exported and lower grades are sold in the markets as it is cheaper.
Figure 11: Rice Supply Chain

Small holder rice growers

Small scale millers and polishers

Kibuye market

Jubilee market

Estate markets

Stall/roadside market

Household preparation & consumption

Commercial rice growers

Commercial milling & processing

Distribution

Retail

Food service industry preparation & consumption

Imports (from Tanzania)

Agents/ Brokers

Disposal
EGGS

Eggs in Kenya are produced by a mix of large commercial producers, semi commercial producers and a significant proportion of Kenyan households (Pelrine et al., 2009). Commercialised production consists mainly of one industrial integrated producer (KenChic Ltd.) and seven producers spread across different towns in Kenya namely Nairobi, Mombasa, Kikuyu, Naivasha, Nakuru, Webuye and Kisumu (Pelrine et al., 2009) (Okello et al., 2010). An estimated 23,611 broiler and 11,311 layer farms make up the semi-commercial producers (Pelrine et al., 2009). Some of these are contract farmers for KenChick Ltd. Household egg production is undertaken on a non-commercial basis and approximately 1.5 million households have subsistence oriented setups in their backyards (Pelrine et al., 2009). The eggs are sold to provide additional household income and also for household consumption.

Egg producers sell to their eggs either directly to retailers and traders or through brokers, agents and intermediaries. In all the markets visited, eggs were available in abundance. Traders at Kibuye market stated that most of eggs were sourced through brokers who source locally from different places within Kenya. The traders also stocked eggs from commercial breeders in Uganda. These eggs were transported to the markets using lorries. Most of the traders sell eggs in varying quantities and according to the traders, wholesale is three crates and above; retail is one crate and household is a dozen eggs or less.
Figure 12: An egg trader at Kibuye market (Photo: Lesley Sibanda)
Figure 13: Eggs Value Chain

Household & small scale producers

Intermediaries/agents

Commercial & semi-commercial producers

Imports (from Uganda)

Kibuye market (wholesale)

Jubilee market

Estate markets

Roadside stall

Household preparation & consumption

Commercial distribution

Wholesale

Retail

Food service industry preparation & consumption

Disposal
TOMATOES

The tomatoes produced in Kenya are predominantly the Italian processing varieties which include the Roma, Rio Grande and Money Maker (Chemonics International Inc., 2013). These tomato varieties are preferred as they are disease resistant, have high yield rates and longer shelf-life compared to other varieties. There are two main tomato production seasons which run from November to February and April to June and peak production with peak production occurring in May. The leading production area for tomatoes is Taita Taveta (15%), Kajiado (14%), Bungoma (14%), Migori and Kirinyaga (10%) and Makueni (7%) (Central Planning and Project Monitoring Unit, 2015b; Chemonics International Inc., 2013). The tomato value chain has various value-adding processing, which include packaging by quality, color and size, canning and production of tomato-based products such as ketchup and puree (Pelrine et al., 2009) (van der Lans, Snoek, de Boer, & Elings, 2012).

The tomatoes found in the market place consist of both indigenous and imported tomatoes. A majority of the traders selling indigenous tomatoes stated that the tomatoes were sourced from Pesi in Kitale. These tomatoes were preferred by most consumers as there are juicer and a disease resistant and therefore have a longer shelf-life than other varieties. The imported tomatoes are mostly from Uganda. According to the traders, the Ugandan tomatoes are big in size but are tasteless. In the marketplace, the tomatoes are graded according to size and presence of skin blemishes. Higher-grade tomatoes are sold at higher prices and tend to be the largest tomatoes without any blemishes. Lower grades tomatoes are sold at relatively lower prices together with soft and overripe tomatoes. This is to minimize wastage and the target market is the ‘hotels’ that buy for use on that same day. Rotten tomatoes are collected and sold to pig breeders for use as animal feed.

According to the traders, the price of tomatoes is largely dependent on where the tomatoes are sourced as well as the season. During tomatoes production season, the tomatoes are available in abundance and thus the price is very low and during the off-season the tomato prices hikes up significantly.
Figure 14: Tomatoes on sale at Kibuye market (Photos: Lesley Sibanda)
Figure 15: Tomato value chain

15: Tomato

Figure 15: Tomato value chain
INDIGENOUS LEAFY VEGETABLES

The annual production of vegetables in Kenya is over 1.5 million tonnes of vegetables on about 100,000 ha (Lenné et al., 2005). Of this, 90%-95% is consumed locally and the balance is exported. Smallholder farmers in mid-to-high-altitude zones of Central, Rift, Valley and Eastern provinces do most of the vegetable production (Lenné et al., 2005). There are many varieties of indigenous vegetables that are consumed in Kenya. The most commonly eaten include cowpea leaves, pumpkin leaves, jute, eggplant, amaranth, spinach, cassava leave and sweet potato (van der Lans et al., 2012). Their value chain is illustrated in Fig 17 below.

Kale is a popular leafy vegetable consumed in many households. In 2014, approximately 348 637 million tonnes of kale was produced on 24,422 hectares of land. Most of the kale production is in Kiambu, Kisii, Nyeri and Nyamira (Central Planning and Project Monitoring Unit, 2015a). Kale is referred to as Sukuma wiki, which literally means, "to push the week." It is a fast growing crop, has a high nutritional value and is relatively cheap (van der Lans et al., 2012). Cabbages are also a highly consumed and popular vegetable. It is mostly grown in wet areas around the country. Approximately 45% of Kenya’s total cabbage production occurs in Meru County with other production areas being Bungoma, Nyandarua and Kiambu (Central Planning and Project Monitoring Unit, 2015a). Cowpeas are produced in dry areas mainly in the Eastern province which accounts for about 90% of total national production (USAID, 2010). Within the Eastern province, cowpeas are produced in Mwingi, Kitui, Makueni, Mbeere and Tharaka districts. Other producing provinces include Nyanza, Coast, Rift Valley, Central, North Eastern and Western (USAID, 2010).

Indigenous leafy vegetables in Kenya are sold mainly in open markets, although some main chain supermarkets stock a small variety (Fig 16). Most of the traders sell the vegetables in bundles and some traders pre-process by cutting them to small pieces. The cabbage traders in the markets stated that most of their cabbages were sourced from Bomet, Molo and Kisi (Nyanza region). Some traders sourced directly from the farmers while others bought from middlemen who brought them to the marketplace. traders
who opted to buy from the farmers hired lorries which then ferried the load twice a week. The supply varies from 3000 to 5000 cabbages per load. The price of the cabbages is dependant mainly on quality and size. Other traders noted that the cabbage prices also fluctuates with seasons and also to takes into the current farm resale price, vehicle hire price and distance travelled. Most of the traders sold cabbage leaves to individuals rearing pigs and or chicken.

Figure 16: Various types of indigenous vegetables in Nyalenda (Photos: Lesley Sibanda)
Figure 17: Indigenous Leafy Vegetable Value Chain

- Small holder farming
- Purchasing agents/Brokers/Middleman
- Kibuye market (wholesale)
  - Commercial processing / packaging
  - Commercial farmers
- Jubilee market
- Estate markets
- Street vendor
- Household preparation & consumption
- Home garden cultivation
- Distribution
- Retail
- Food service industry preparation & consumption
- Disposal
- Exports to regional & international markets

Imports (from neighbouring countries)
MILLET, SORGHUM AND CASSAVA

Sorghum and finger millet are two important cereal crops in Eastern Africa and are cultivated mostly for home consumption. According to a study done by Schipmann-Schwarze, Orr, Mafuru, and Mulinge (2013) revealed that a majority of consumers considered sorghum and miller as healthy foods and particularly good food sources for babies and children.

The Millet value chain is illustrated in Figure 18 below. Millet is produced mostly by small holder famers who grown it as both a food and cash crop. According to Rao et al. (2015) approximately 58% of the millet produced is for direct consumption while the rest is processed into flour (20%), used as animal feed (7.3%) and or used as recycled seed (3.6%). The millet is sold as grain to brokers who sell it to traders in local markets and in few case directly to the consumers. The middlemen bulk buy and transport to wholesalers and or traders in the open markets. In the market places, the traders sell the millet grain to other traders, consumers and small scale processor. In some cases, traders sell both grain and flour. The grain is milled by small-scale millers (posho millers) located in the markets and the millet flour is also sold to consumers. Alternatively, consumers buy the millet grain and then have it milled to flour. Millet processors buy grain directly from the farm, through brokers and agents or from market traders. The grain is then processed and packaged as millet flour for sale to wholesalers, retailers and consumers. The by-products of this is taken to make animal feed. A lot of the millet being sold in Kibuye and Jubilee markets had been sourced from Busia County.

The major production provinces for Cassava include Western, Coast and Nyanza with smaller production in Central, Eastern and Rift Valley (Chemonics International Inc., 2010). Cassava is an invaluable famine reserve because of its tolerance to drought. A significant proportion of the cassava grown in Kenya is consumed locally with considerable amounts of dried cassava being imported from Tanzania (USAID, 2010). A lot of the cassava that is produced is traded and consumed as fresh cassava and, in some cases, boiled. Many of the producers also dry the cassava and onsite which is later
sold to the traders within the markets. Cassava chips, fermented cassava and cassava flour are the main products retailed through the open markets.

The Sorghum value chain is illustrated in Figure 19 below. Sorghum production in Kenya is concentrated in the Eastern and Nyanza regions and these two regions account for about 75% of the total sorghum production (Chemonics International Inc., 2010). Sorghum is primarily grown as food, but is also used as animal feed and seed. Brokers buy sorghum grain directly from the farmers and also from local markets. The grain is transported to the urban markets and to wholesaler. Traders in the open markets sell it as grain and in other cases mill or pound into a fine flour. Most of the sorghum is sourced from Kisi and or Busia (Uganda). According to the traders, the sorghum from Kisi is preferred by their customers as it is cleaner than the sorghum imported from Uganda which contains a lot of soil particles. Both Sorghum and finger millet are mostly consumed in a mixture with other crops. The most popular is to combine sorghum, millet and cassava. The blended mix can then be used to make either uji (soft porridge) or ugali. This is mixed in a ratio of 1 tin sorghum, half a tin millet and half a tin cassava. Most of the traders already sell the ready mix as either a fine powder or as pellets. The pellets consist of the precooked powder mix which is mixed with water to form a paste, the paste is dried and then cut into pellets. This is preferred by a lot of consumers as it cooks faster and thus saves them time and energy. In most cases, the soft porridge which is commonly consumed in the morning for breakfast is made from a mixture of the sorghum flour with millet, maize and cassava (see Figure 20 for Cassava value chain). This porridge usually enjoyed with milk and sugar and is typically served with tea. It is also a popular foodstuff for infants. Other variations of this include blended ugali which comprised of maize and one other cereal such as finger millet or sorghum. The blended porridge can also be prepared from mixing millet, sorghum and cassava with either soya and groundnuts (Schipmann-Schwarze et al., 2013).
Figure 18: Millet value chain

Small holder millet growers

Small scale processors

Kibuye market

Jubilee market

Estate markets

Stall/roadside market

Food service industry preparation & consumption

Household preparation & consumption

Commercial milling & processing

DISTRIBUTION

RETAIL

Food service industry preparation & consumption

Disposal

Agents/Brokers

Commercial millet growers

Imports (from Uganda, Tanzania)

Small scale millers
Figure 19: Sorghum food value chain

Small holder millet growers

Small scale millers

Commercial millet growers

Agents/Brokers

Imports (from Uganda, Tanzania and Zambia)

Commercial milling & processing

Kibuye market

Jubilee market

Estate Markets

Stalls/roadside market

Household preparation & consumption

Retail

Food service industry preparation & consumption

Distribution

Disposal

Exports to regional & international markets
Figure 20: Cassava value chain

Small holder cassava growers

Processing /fermenting

Kibuye market

Jubilee market

Estate markets

Stalls/roadside market

Household preparation & consumption

Commercial cassava growers

Agents/Brokers

Commercial processing

Distribution

Retail

Food service industry preparation & consumption

Disposal

Imports (from Uganda & Tanzania)

Exports to regional & international markets
Fruit (oranges and apples)

Different fruit types were available in both the informal and formal retail sectors in Kisumu. This included mangoes, apples, oranges, avocados, lemons and bananas. In the market places, traders stock both local and imported fruit. The value chain for oranges and apples is illustrated in Figure 21. The local oranges are sourced mainly from the Rift valley province. The rest of the citrus fruit on the markets is imported from Uganda, Tanzania, South Africa and Egypt. Farmers also sell directly to wholesalers, retailers and sometimes to consumers. Middlemen and mobile traders source produce directly from the farms and bulk buy. The middlemen or brokers transport it to the urban markets for sale to market traders. They also supply wholesalers who then supply retailers. Some of these brokers operate on a local, regional and national level. A few of the brokers import fruits from different countries and supply the local Kenyan market. Apples are imported from South Africa and these are flown in to Nairobi and then transported to Kisumu by road.
Figure 21: Fruit value chain (Oranges & apples)
REFERENCES


