# COLD CHAIN STORAGE MARKET ASSESSMENT

2023

EEP Africa

NDF Nordic Development Fund

Open Capital

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**Swiss Agency for Development and Cooperation SDC**

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# GLOSSARY AND ABBREVIATIONS

**CAGR**
Compounded annual growth rate: The compound annual growth rate (CAGR) is the rate of return (RoR) that would be required for an investment to grow from its beginning balance to its ending balance

**Cold Chain Infrastructure (CCI)**
Cold Chain Infrastructure or cold chain storage is the part of cold chain that helps in the preservation of goods such as perishable commodities and vaccines

**Evening Milk**
Milk produced from the final milking of the day; typically, of lower volumes compared to the first milking of the day

**FFV**
Fresh Fruit and Vegetable

**PAYG**
Pay as you go: An energy service provider rents or sells solar PV systems (including PUE systems) in exchange for regular payments including through mobile payment systems. In cases of non-payment, the service provider can remotely disconnect the service

**PUE**
Productive use of Energy: Productive uses of energy are those that increase the profitability of micro, small and medium-sized enterprises (MSMEs) and individuals through increased income and productivity.

**Post-harvest loss**
Food loss across the food supply chain from harvesting of crop until its consumption

**SMF**
Smallholder Farmers

Market insights on East and Southern Africa
Cold chain supply and demand

# East Africa supply & demand

# East Africa's cold chain infrastructure (CCI) solutions market is growing on the back of growing demand and increasing activity

## SNAPSHOT OF COLD CHAIN SOLUTIONS IN EAST AFRICA (EA):

### DRIVING FACTORS

- **EA's growing population (2.5x world growth rate) and incomes and increasing urbanisation and exports** (legumes, avocados) is driving increased demand for food production[3]
- Public and private sector organisations such as GIZ, Rockefeller foundation, are **pushing to address challenges in agricultural value chains to reduce post harvest loss** to support efforts to meet growing demand for food[4]
- **Changing consumer patterns, improved value chain margins, cheaper technology, drive to reduce post harvest losses** and thereby increase supply (~40%) and development of government strategies has helped to support growth in cold chain solutions demand.[1,4,5]

### TRENDS

- **In East Africa, the cold chain solutions market is still nascent with Kenya at the forefront** which has seen an influx of new companies, business models, and technology; solar refrigeration unit sales in East Africa represented 42% of total SSA sales in 2022 indicative of the region's growing demand for solutions[2]
- **Growing trend of cold chain solutions geared towards addressing first mile losses** across all value chains such as fresh fruit and vegetables (FFV), meat, fish, and dairy outside of the value chains known for cold chain use such as the floriculture value chain, certain key fresh fruit and vegetable (FFV) value chains, and aspects of dairy and meat value chains that used cold chain solutions
- **Growing trend of companies entering the market to address value chain player needs.** For example, Baridi developed a PAYG enabled solar powered cold chain storage solution targeted towards meat markets supplying local butcheries while Cold Solutions Kenya is developing a 15K sqm facility that will help businesses manage large scale storage and transportation across multiple value chains

## KEY FACTS AND FIGURES:

**>2.5X**

EA's annual avg. pop. growth rate (2.7%) is >2.5x bigger compared to the rest of the world (1%)[1]

**42%**

East Africa's share of solar refrigeration units sold in Sub Saharan Africa in 2022[2]

## SUPPLIERS

InspiraFarms

solar now
power your life

SokoFresh

ecolife FOODS

baridi

ENdep
renewable | efficient | clean

MG Fresh

Sources: 1. World Bank, link; (average calculated between years '18-'21) 2. GOGLA: Global Off-Grid Solar Market Report Semi-Annual Sales and Impact Data – January – June 2022, Link; 3. Growing incomes and middle-class populations, link, link 4. Assessment of the cold chain market in Kenya and Nigeria, link 5. Rwanda National Cooling Strategy, link
Note: East Africa for the purpose of this report refers to Kenya, Uganda, Tanzania, Rwanda, and Ethiopia

# Drive to meet growing food demand requires the increased uptake of CCI solutions to stem losses across East Africa

**While all the listed countries will benefit from supplier market entry, activity to date, political stability, production volumes, and population growth are all factors that further influence the decision**

| | Kenya | Uganda | Tanzania | Ethiopia | Rwanda |
|---|---|---|---|---|---|
| **Production** (Tonnes '21)[5] | **14.4M** | **13.4M** | **13.4M** | **8.4M** | **4.3M** |
| Fresh fruit and veg | 7.7M | 10.6M | 8.7M | 3.1M | 3.9M |
| Meat | 0.6M | 0.4M | 0.8M | 0.9M | 0.1M |
| Dairy | 6.0M | 1.7M | 3.3M | 4.3M | 0.3M |
| Fish (2020 data) | 0.1M | 0.7M | 0.6M | 0.1M | 0.04M |
| **CAGR Prod. Growth ('19-'21)%**[5] | 5.2% | -0.89 | 4.2% | 4.1% | 4.9% |
| **Est. % growth in pop. ('23-'30)**[6] | 15% | 20% | 21% | 18% | 16% |
| **Political stability ('21)**[7] | -1.09 | -0.86 | -0.44 | -2.07 | 0.17 |
| **CCI Sector activity and awareness** | High | Medium | Low | Medium | Medium |

- Kenya and Uganda offer large opportunities for cold chain storage interventions owing to the large production volumes of fresh produce and export volumes with both benefiting from existing sector activity via multiple programs and private investments[1]
- Ethiopia's cold chain market is predominantly geared towards commercial export ventures (e.g., flowers), with limited engagement with first mile operators and traders. However, there is growing effort to boost the sector for produce, meat and dairy, as signalled by increasing government efforts[4]
- Tanzania's current production, population size and expected growth ensure that it remains a large market opportunity, however, limited sector activity and awareness signals a need for further private and public sector support to drive growth[2,3]
- While Rwanda offers a smaller market opportunity, high government support and private sector engagement and a stable political system, leave it well placed for the piloting of innovate cold chain solutions to address end-to-end value chain needs prior to scaling in geographically large markets such as Ethiopia

Sources: 1. OCA analysis 1. AGRA, Food Market Demand & Competitiveness: East Africa Region Report, 2021, Link 2. New Yorker: Africa's Cold Rush and the Promise of Refrigeration, Link 3. InspiraFarms, Link 4. National cool logistics network in Ethiopia, link 5. FAOSTAT, Link 6. World Bank, Databank, Link 7. Political stability, Link. Level of competition indicated as follows: score of 5 for countries that have more than 10 companies. Score of 3 for countries that have between 5-10 companies and score of 1 for companies <5Note: Sector activity and awareness is a measure of the level of cold storage activity occurring in the country as highlighted by gov't and development partner programs and initiatives and private sector activity at the time desk research was conducted (March to April 2023)

# **Case study 1:** Despite being a smaller market, Rwanda's ecosystem is well suited to serve as a testing ground for CCI solutions

| Value chain | Production, tonnes[1] in '21 (*millions*) | Est. cold room units required ('000)* |
|---|---|---|
| Fresh produce | 3.9 | 388-776 |
| Meat | 0.1 | 10-21 |
| Dairy | 0.3 | 26-52 |
| Fish | 0.04 | 4-7 |
| | **4.3** | **428-856** |

## Rwanda's cold storage ecosystem is comprised of a mix of state and private enterprises

- Rwanda's CCI market is very nascent with early entrants including companies such as Ox and InspiraFarms validating opportunity[2,3]
- As of 2019, 6,162m$^3$ of cold storage was available in Rwanda, with 58% of this capacity used to cater to flowers for export; this capacity is in turn owned and operated by leading exporters including Garden Fresh Rwanda[4]
- Excluding ownership by private companies, various government agencies such as the National Agricultural Export Development Board (NAEB) and Rwanda Agriculture Board (RAB) own and operate a large portion of the capacity in the country[4]

### BARRIERS TO SCALE

- Affordability at first mile requires patient capital and subsidies as >75% of households that derive income from working on other people's farms have the highest incidence of poverty[5]
- Companies will need to educate first mile users to encourage adoption

### OPPORTUNITIES

- The National Cooling Strategy identifies the need for climate friendly cooling solutions in agriculture and health providing potential avenues to support achievement of Objective 6 'Scale up Cold Chain and Off-Grid Cooling Infrastructure to support productive sectors'[6]
- Use of innovative financing mechanisms by pioneers for example, Coolease that provides opportunities to tackle affordability through partnerships[7]

Sources: 1. FAOSTAT 2. EconLife; What the OX adds to Rwanda's Cold Chain, Link 3. InspiraFarms: Reshaping Africa's Rural Food Systems And Cutting Food Losses, Link 4. National Agricultural Export Development Board, Link 5. IFAD: Rwanda, Link 6. Ministry of Environment: Rwanda National Cooling Strategy, Link 7. BASE: Supporting The Transition To Sustainable Cooling Technologies In Rwanda, __ Note: *- Est. Cold room units required is an estimation of the total no. of cold rooms needed to store total volumes produced. Calculated as total production divided by avg. cold room capacity of between 5,000 – 10,000 kgs per unit; Estimate likely to be lower owing to consumption at source and post harvest losses

Market insights on East and Southern Africa
Cold chain supply and demand

# Southern Africa supply & demand

# CCI market is more developed and geared towards exporters; however, growing push to support other value chain participants

## SNAPSHOT OF COLD CHAIN SOLUTIONS IN SOUTHERN AFRICA:

### DRIVING FACTORS

- **Growing middle class, increasing urbanisation and exports, and food insecurity** is driving increased demand for food production.[1] For example, Southern Africa's fruit exports grew by ~15% from '20-21 reaching USD 4.5Bn driven by increased South African exports[2]
- Regional governments are **acting to increase production to address food insecurity and fuel economic growth**, For e.g., Zimbabwe's biggest meat processor, Cold Storage company, is set to reopen after 20 years. Similarly, Namibia's industrial development agency recently commissioned a new cold chain facility (12.5K T capacity) to support fish exports
- Subsequently, **on the back of government action, a drive to meet local and export demand, and a need to adapt to climate change**, there is a growing interest in cold chain infrastructure and solutions

### TRENDS

- South Africa's cold chain market is the **most sophisticated owing to the well-developed infrastructure** in place that supports local, regional, and international demand for produce
- Majority of cold chain solutions are **geared towards large commercial farms** since they account for **80% of food security in SA** and are responsible for the bulk of exports. Cold chain solutions are therefore **self owned or provided by third party logistic providers**
- In countries such as Zambia and Zimbabwe, production is varied and dependent on the value chain thereby influencing cold chain solutions availability. In Zimbabwe for example, **horticultural exporters have access to airport based cold storage facilities.**[3] However, initiatives geared towards introducing off-grid solar cold chain technologies to smallholder farmers to help address challenges such **as post harvest loss, electricity and fuel challenges** also exist[4]

## KEY FACTS AND FIGURES:

**~15%**

Growth in fruit exports in Southern Africa ('20-21)

**13M$^3$**

Of cold storage per 1000 residents in South Africa; Largest in sub-Saharan Africa[5]

## SUPPLIERS

taatisolar Quality Solar Home Systems

PST SALES & DISTRIBUTION

Solar Cooling Engineering

InspiraFarms

Phaesun

CCS LOGISTICS

SunDanzer DC-Powered Refrigeration

Source: OCA analysis 1: How much you need to earn to be middle class in SA, Link 2: ITC trade map, Link 3:FX Logistics adds to cold chain capabilities ahead of the 2022 export season, Link 4: Zimbabwe Cold room, Link, 5. Pan Africa cold chain logistics platform, link Note: Southern Africa for the purpose of this report includes South Africa, Namibia, Zimbabwe, Zambia, and Botswana

# Zambia and Zimbabwe offer expansion opportunities beyond South Africa, fuelled by growing local and international demand

## Zimbabwe and Zambia production volumes offer expansion propositions, but political and macroeconomic factors may influence viability

| | South Africa | Zimbabwe | Zambia | Namibia | Botswana |
|---|---|---|---|---|---|
| **Production** (Tonnes '21)[2] | **18.6M** | **2.0M** | **1.5M** | **0.6M** | **0.5M** |
| Fresh fruit and veg | 10.7M | 0.6M | 0.6M | 0.1M | 0.1M |
| Meat | 3.5M | 1.0M | 0.3M | 0.1M | 0.1M |
| Dairy | 3.8M | 0.4M | 0.4M | 0.1M | 0.3M |
| Fish | 0.6M | 0.03M | 0.2M | 0.3M | 0.00 |
| **CAGR Prod. Growth ('19-'21)%**[2] | 2.24% | 6.6% | 0.15% | 0.5% | 4.16% |
| **Est. growth in pop. by '30 (%)**[3] | 7% | 15% | 20% | 12% | 11% |
| **Political stability ('21)**[4] | -0.71 | -1.03 | 0.06 | 0.55 | 0.98 |
| **Sector activity and awareness** | High | Medium | Low | Medium | Low |

- South Africa is the most mature cold chain market owing to its history of exports to regional and international markets and is highly competitive with numerous third-party players serving the large commercial farms, agro-processors, and exporters. The country's deepening electricity crisis may provide an opportunity for players to provide off-grid cold storage solutions
- With Zimbabwe's production slightly exceeding that of Zambia, and with South African and other local companies supporting the cold storage needs of horticultural producers, Zimbabwe offers a market entry opportunity. SunDanzer for example, has explored pilots working with smallholder farmers in light of electricity rationing challenges.[5] However, prevailing economic and political difficulties may raise challenges for companies looking to enter CCI market[6,7,8]
- The Zambian government is aiming to diversify the economy away from mining and expand agricultural output.[9] The increasing local and regional demand for food and opportunities for export is likely to drive increased interest within the CCI space, presenting opportunities for CCI products across the value chain

Sources: 1) Open Capital analysis Link 2. FAOSTAT, Link 3. World Bank, Databank, Link 4. Political stability, Link, 5. Launching solar cold rooms in Zimbabwe, link, link 6. Curious case of Zimbabwe sanctions, link 7. Zimbabwe, The long shadows of Sanctions, link 8. Analysts predict economic struggles for Zimbabwe in 2023, link 9. Zambia to generate $2B from agriculture by 2026, link
Note: Southern Africa for the purpose of this report includes South Africa, Namibia, Zimbabwe, Zambia, and Botswana; Note: Sector activity and awareness is a measure of the level of cold storage activity occurring in the country as highlighted by gov't and development partner programs and initiatives and private sector activity at the time desk research was conducted (March to April 2023)

# **Case study 2:** Zambia's cold chain sector is under-developed, but new initiatives are driving increased capacity and uptake

| Value chain | Production, tonnes[1] in '21 (*millions*) | Est. cold room units required ('000)* |
|---|---|---|
| Fresh produce | 0.6 | 57-114 |
| Meat | 0.3 | 34-68 |
| Dairy | 0.4 | 38-76 |
| Fish | 0.2 | 15-30 |
| | **1.5** | **145-290** |

## Zambia's cold storage is donor and/or privately funded and largely aimed at pharma

- Cold chain in Zambia is constrained due to poor road infrastructure, further exacerbated in the rainy season; interventions by investors and other partners such as Frontier Technology Livestreaming and UKAid, have driven early traction through cold room pilots and 100kg mobile refrigerated trucks[2,4]
- With 60% of produce consumed in Lusaka produced around the city, Savenda Capital with backing from InfraCo and FCDO is developing 6,400 m² of market space, including on-site cold storage and market linkages for farmers to reduce loss, targeting FFV[3,4]
- Medical cooling in Zambia has seen a lot more traction, with multiple projects aimed at increasing immunisation in the country, supported by the government, in a bid to achieve Universal Health Coverage (UHC); development partners have included KfW, UNICEF, and World Bank[5,6]

### BARRIERS TO SCALE

- Affordability of CCI solutions will be critical to drive uptake as >60% of Zambians live below the poverty line[7]
- Poor road infrastructure limits the accessibility of various regions[4]
- Companies will need to educate first mile users to encourage adoption

### OPPORTUNITIES

- The government's drive to achieve UHC provides opportunities to companies providing mobile solar solutions to cater to this
- On-going activities by development partners create opportunities for technical partnerships with providers

Sources: 1. FAOSTAT 2. Frontier Technology Livestreaming, Pilot Story, Link 3. Food Business Africa, Link 4. FAO, RUAF Foundation: Assessing and Planning City Region Food System, Link 5. UNICEF: UNICEF Hands Over Cold Chain Equipment to Ministry of Health, Link 6. CIDRZ: Finding Efficiencies in Zambia's Immunisation Supply Chain, Link 7. IFAD: Zambia, Link

# Deep dive into Kenya and Uganda

# In both Kenya and Uganda, food insecurity and growing populations are key factors driving increased cold storage demand

**Growing population and incomes are helping drive increased demand for food**

- Population growth of 2% in Kenya between '12 – '22, a middle-class accounting for ~31% of the population and growing 5% annually, urbanisation growth of 4.3% between '16-20, and improving incomes as expressed by poverty reducing from 47% in '05 to 34% in '19 is driving increased demand for goods such as food with an increasing trend for customers to purchase through formal retail outlets[2,3,4]
- Uganda's annual population growth exceeds 3% and expected to double its population by 2031 to 70M people with Uganda's urban population expected to increase to 21 million by '40, therefore, similarly to Kenya, drive increased demand for food[5,6]

**While production has increased to meet demand, food insecurity and supply-demand deficit is a growing concern exacerbated by climate change related impacts and losses across the supply chain**

- Growth in Kenyan fresh produce production has grown 1.5 times between '16-'20, to meet local and international demand[1]
- Food consumption in Kenya continues to outpace production, with a need for annual production to grow 75% from '15 levels to meet consumption needs in '30; food losses of up to 40% exacerbate supply-demand deficit[7,8]
- The drought in Kenya in '22 left 4.5M people in need of food aid on the back of five successive below average successive rainy seasons[9]
- Uganda is the second largest producer of fresh fruit and vegetables in Africa, with >11M tonnes produced in 2020; fruit production has grown by 23% between 2016-2020 with most of this consumed internally.[1,10] While Uganda is also the 7th largest inland fishery production in the world, the sector also faces post-harvest losses of up to 20% owing to limited access to cold storage [11]
- While Uganda is more food secure than Kenya, the country is vulnerable to climate change with certain regions such as Karamoja and Acholi experiencing fluctuations in rainfall and therefore fluctuations in food production potentially affecting food security[12]

**Expanding availability and access to cold chain facilities will help improve livelihoods, tackle food losses, and meet food demand**

- While the fresh cut flower value chain in Kenya is known to employ end to end supply chain cold chain solutions, cold chain facilities for other value chains are not as extensive with prevailing solutions focused on urban areas and near airports, where they serve exporters of key crop value chains[13]
- Uganda's cold chain infrastructure is also known to vary; Value chains such as milk with strong organisation at small holder farmer level are known to have invested in cold chain facilities while others such as the fish value chain highlight opportunities for further investment[14]
- It is well accepted that cold chain solutions that can help reduce losses at farmgate and across the rest of the supply chain significantly improve SHF income and livelihoods and in turn help meet food demand[5]

Sources: 1. FAO, link 2. Business Daily: A third of Kenya's middle class heartbeat away from poverty, Link 3. UNHABITAT: Kenya, Link 4. World Bank, Link 5. International Energy Agency, Link, 6. Urban population to hit 21 million, Link,7. Institute for Security Studies, Link 8. Practical Action: Reducing Food Waste Across 3 Continents, Link 9. Kenya 2022 drought response in review Link 10. Ministry of Agriculture, Nature and Food Quality, Link 11. Rockefeller Foundation, Link. 12. Uganda country brief, Link 13.Assessment of the Cold Chain Market in Kenya Link 14. Cold chains lessons from Uganda, link

# Similar opportunities across both value chains with fresh fruits and vegetables offering a larger market opportunity

| Value chain type | Est. Market size in 2030 | Cold chain usage at each level of the value chain and the opportunities available |
|---|---|---|
|  Fruit and Veg. |  Kenya $1B[1]<br>  Uganda $0.7B* | **Production:** Opportunity to help reduce post-harvest losses and increase farmer incomes by approximately 30%[1]<br>**Aggregation:** Cold room used for storage enabling aggregation and better price negotiation; Exporters dealing in export value chains are likely to set up own cold chain facilities for aggregation[1]<br>**Transport:** Currently deployed predominantly by produce and flower exporters; transport for local consumption done without reefers and at night which therefore provides an opportunity for CCI providers to offer relevant products<br>**Processing:** Large processors install own cooling and ripening chambers with an opportunity to serve medium and large sized agro-processors. E.g., Inspirafarms installed for Twigafoods[1]<br>**Retail level and export:** Urban formal supermarkets in both countries utilise CCI to store and display produce. Along with providing solutions to supermarkets opportunities to serve local market traders and brokers also exist, for example FreshBox has sold several units to traders' associations. High capex costs associated with CCI Exporters that do use CCI rely on services offered by multinational firms owing to an underdeveloped third-party logistics market due to the high setup costs associated with CCIs.[1] Large opportunity for providers to offer affordable solutions and provide the financing to enable purchase of solutions |
|  Dairy |  Kenya $135M[1]<br>  Uganda $23M* | **Production:** Presence of low-tech cooling methods that lack temperature control and limited electricity access provides an opportunity for renewable sources of cooling that can especially be useful for evening milk. [1] For example, solar milk cooling systems offered by Wamala Energy in Western Uganda[2]. Price incentives could help support uptake of CCI solutions.<br>**Aggregation:** Cooperatives aggregate produce with numerous cooperatives engaging local governments to establish milk coolers; There is therefore an opportunity to engage government and cooperatives to provide affordable solutions to meet their needs<br>**Transport and processing:** Milk processing in Kenya and Uganda is dominated by large processors that operate end to end chilling solutions while transport for small volume local consumption is done via unrefrigerated stainless-steel and/or plastic cans; This creates an opportunity for providers to offer end to end solutions to processors |

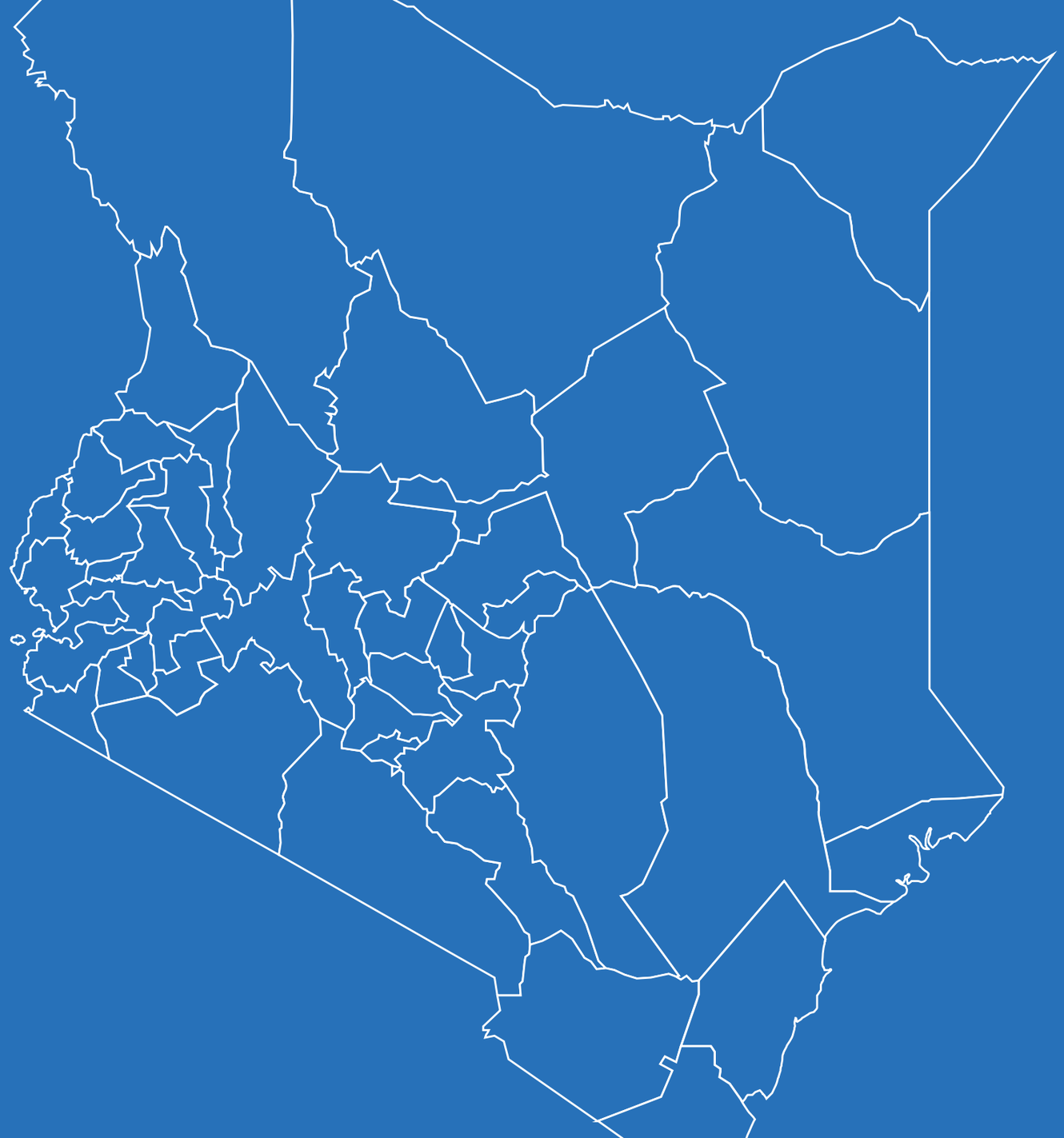
Sources: 1.Assessment of the Cold Chain Market in Kenya, Link 2. Wamala Farm-based Solar Milk Cooling Systems, link Notes: FFV – Fresh Fruits and Vegetables; * Market size of each value chain for Uganda calculated using estimated 2030 production volumes as a proportion of estimated 2030 Kenyan production volumes multiplied by US$ figures stipulated for Kenya in the Assessment of the cold chain market report. 2030 production volumes estimated using CAGR for '19-'21 FAO production volumes. Market size covers entire off-grid and on grid

# The meat and fish value chains employ some cooling solutions; however, opportunities across the supply chain still exist

| Value chain type | Est. Market size in 2030 | Cold chain usage at each level of the value chain and the opportunities available |
|---|---|---|
| Meat | Kenya: $35B[1]<br>Uganda: $42B* | **Farmgate/Production:** Limited cooling for red meat occurs at production level due to common practice of transporting live animals to slaughterhouses; 90% of poultry is slaughtered on farms with household refrigerators serving as the most common cold chain solution for storage.[1] Potential opportunity for providers to target this market segment<br>**Slaughterhouse:** Owing to the highly regulated nature of registered meat processing, slaughterhouses are required to have specific chilling and freezing facilities. This provides an opportunity for providers to install, replace, and maintain facilities necessary facilities.[1] Opportunities may also exist in providing services to unregistered slaughterhouses owing to CCI benefits<br>**Transport:** Existing regulation stipulates the need for refrigerated transport, however, outside of the big abattoirs and premium markets, there is limited CCI use in transportation, with most mainly using steel boxes for transport.[1] Opportunities exist to offer renewable and affordable CCI solutions for transport to butcheries and retail outlets<br>**Retail level and export:** Refrigeration use among retailers varies, extending from use of deep freezers (most common) to cold rooms (least common). With increasing electricity costs and shift in consumer trends and awareness, opportunity to offer cooling sources for purposes of storage and display[1] |
| Fish | Kenya: $1.0B[1]<br>Uganda: $2B* | **Production:** Use of ice blocks in cooling boxes that are stored on boats with bigger players such as Victory Farms (based in Homa Bay, Kenya) possessing their own ice making machines.[1] Adili (based in Kenya) offers ice flaking machines to smaller players.[3]<br>**Transport:** Fish typically transported using ice cooler boxes highlighting opportunities for more sophisticated transport cooling solutions such as refrigerated trucks<br>**Aggregation and retail:** Governments and development partners supporting installation of cold rooms with formal avenues such as supermarkets operating their own freezers and coolers |

Sources: 1.Assessment of the Cold Chain Market in Kenya, Link 2. Wamala Farm-based Solar Milk Cooling Systems, link 3. Adili Solar hubs, solar powered ice machines, link Notes: FFV – Fresh Fruits and Vegetables; * Market size of each value chain for Uganda calculated using estimated 2030 production volumes as a proportion of estimated 2030 Kenyan production volumes multiplied by US$ figures stipulated for Kenya in the Assessment of the cold chain market report. 2030 production volumes estimated using CAGR for '19-'21 FAO production volumes. Market size covers entire off-grid and on grid

# Kenya



# **Kenya:** Ecosystem players' concerted efforts are helping to create solutions that meet cold chain storage demand

## Suppliers are utilising innovative business models and offering diverse product ranges in response to local market dynamics…

| Company name | Business model | Connectivity | Product type | Customer type |
|---|---|---|---|---|
| FreshBox | Lease to own / Cash / CaaS | Off-grid | Cold rooms (FFV and now others) | Small scale farmers, farm produce organisations, aggregators, retailers, development partners & NGOs |
| SokoFresh | CaaS | Off-grid | Mobile cold room (FFV) | Farmers, aggregators, and traders |
| KeepIT Cool RAINO TECH4IMPACT | CaaS / PAYG | Hybrid | Hybrid cooling boxes and cold chain trucks to support all grid connectivity (Meat and fish) | Farmers and traders |

## …on the back of financial and other ecosystem support from investors, industry bodies, and development partners

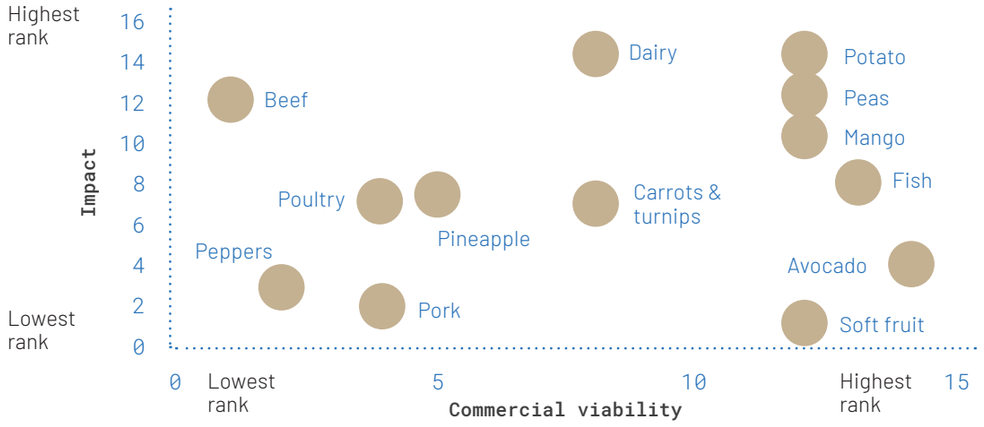
| Investors | Industry bodies | Development partners |
|---|---|---|
| KAWI SAFI; PREO Powering Renewable Energy Opportunities; SUNFUNDER | KEREA Kenya Renewable Energy Association; clasp; Kenya Climate Innovation Center; PFAN | POWER AFRICA; Shell Foundation; SNV; giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH; African Development Fund |

Sources: 1. Inspira Farms website, Link 2. "Inspira Farms gets $500k loan from SunFunder to deploy first-mile cold chain installations," Logistics Update Africa, Link 3. PREO: The Power of the Productive Use of Energy, Link 4. British International Investment, Link 5. Keep it Cool website, Link 6. Efficiency for Access, Link

# Mangoes, peas, and potato value chains represent a strong commercial and impact opportunity for intervention

## Value chain assessment in Kenya

Rank goes from lowest to highest across both axis




**Commercial viability** considers availability of alternative CCI solutions, product shelf life and export potential (export volume growth and margins). The higher the average score across the 3 categories, the larger the return-on-investment potential for CCI interventions across the value chains

**Impact** considers, for each value chain, the number of SMF, total production volumes, impact on livelihoods, and post-harvest losses. The value chains ranked highest represent those that are likely to benefit the most from CCI interventions. Avocados, for example, earned Kenya >USD 115M in 2020 but due to few estimated farmers in the value chain, reach of impact is lower despite high income[2]

## The following 5 value chains offer strong opportunity for intervention

**Mango** production grew >2x between '16 – '20 in preparation for the lifting of the self-imposed ban from exporting to the EU[1,2]

Farmer awareness on the need for cooling and the need for high quality export have driven >80% increases in **cow peas** production with exports increasing ~7x between '16 – '20[2]

**Fish** had ~73% higher than the average export margins of all value chains assessed resulting in greater returns on investment compared to other value chains[3]

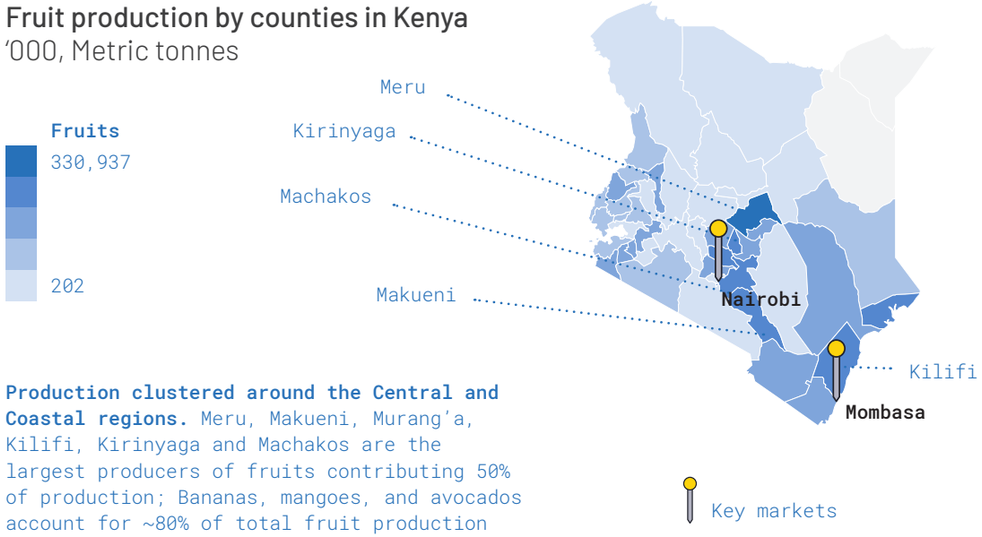
~83% increase in **avocados** produced from '16 – '20 fuelled by increased global demand with exports increasing by 69% in the same period[2]

~39% increase in **potatoes** produced from '16 – '20 fuelled global demand increase with exports increasing ~10x in the same period[2]

See Appendix for methodology; Export data from FAOSTAT only up to 2020 as of March 2023
Sources: 1. Business Daily, Link 2. FAOSTAT 3. Open Capital analysis

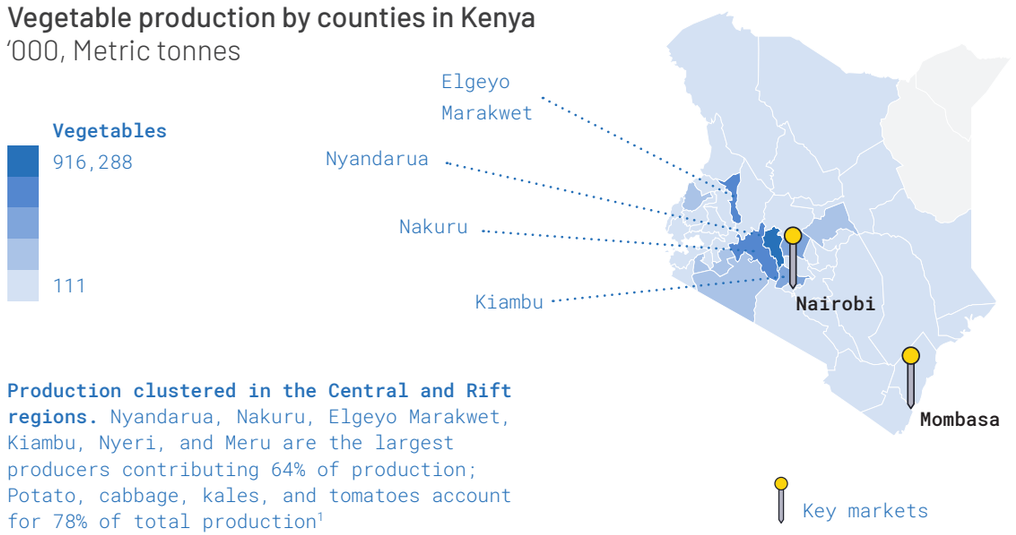
# **Fresh produce:** Potential for intervention geared towards first-mile & trader-level owing to production focus in Central & Coast areas

## Fruit production by counties in Kenya
'000, Metric tonnes




**Production clustered around the Central and Coastal regions.** Meru, Makueni, Murang'a, Kilifi, Kirinyaga and Machakos are the largest producers of fruits contributing 50% of production; Bananas, mangoes, and avocados account for ~80% of total fruit production

## Vegetable production by counties in Kenya
'000, Metric tonnes




**Production clustered in the Central and Rift regions.** Nyandarua, Nakuru, Elgeyo Marakwet, Kiambu, Nyeri, and Meru are the largest producers contributing 64% of production; Potato, cabbage, kales, and tomatoes account for 78% of total production[1]

## Owing to nascent cold storage facilities for FFV value chains, there are opportunities to offer solutions across the supply chain:

Existing and upcoming cold storage capacity >4K tonnes in production areas such as Meru and Nakuru point to opportunities at first-mile for cooling to cull up to 36% of fresh produce losses (~2.9M tonnes); secondary opportunities exist with traders at the main markets within those production regions [5,6]

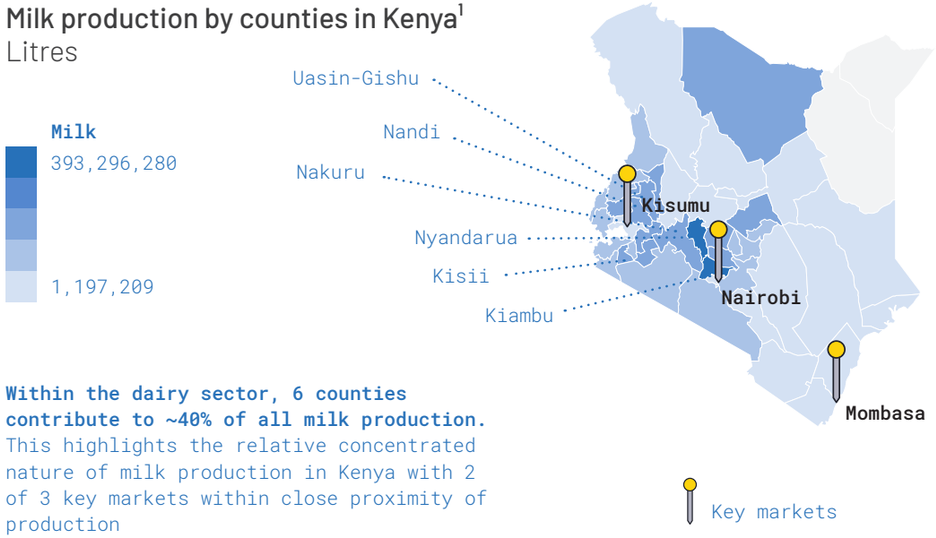
With Nairobi's Wakulima & City markets and Mombasa's Kongowea and Mwembe Tayari market operating as primary produce markets in key consumption cities, providers may consider offering solutions for produce that travels far (vegetables) and to brokers aggregating produce and traders operating within the markets. [1,2,3,4] In addition, while horticultural exporters are known to possess their own CCI, CCI providers can look to explore opportunities to provide cooling as a service thereby reducing the capital outlay for the exporters

Sources:1. Agriculture and Food Economics, Link 2. FPEAK: Fresh Produce Logistics Study, Link 3. Kingdom of Netherlands: Fresh Vegetable Market in Kenya - Fresh Fruits, V
vegetables, Avocado's and Beans, Link 4. Kingdom of Netherlands: Horticulture Study, Link 5. MSEA: Timau Cold Storage, Link 6. Mitigation Action Facility: Solar Powered Cold Chain, Link
Notes: County percentage contribution analysis for fruit and vegetable are based on 2016 county agriculture data

# **Dairy and meat:** Production spread across Northern, Central, and Eastern regions with Nairobi and Mombasa as core destinations

## Milk production by counties in Kenya[1]

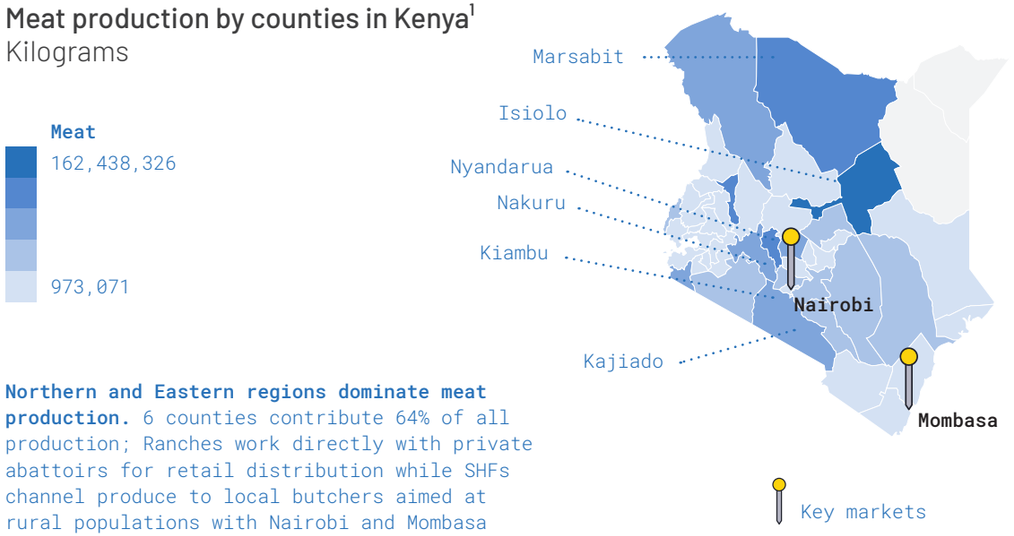
Litres




**Within the dairy sector, 6 counties contribute to ~40% of all milk production.** This highlights the relative concentrated nature of milk production in Kenya with 2 of 3 key markets within close proximity of production

## Meat production by counties in Kenya[1]

Kilograms




**Northern and Eastern regions dominate meat production.** 6 counties contribute 64% of all production; Ranches work directly with private abattoirs for retail distribution while SHFs channel produce to local butchers aimed at rural populations with Nairobi and Mombasa representing major destinations,[7]

**Low uptake within a large customer base offers opportunity for suppliers.** Large milk processors provide large ticket size but fewer total opportunities owing to the small number. However, solutions geared to smallholder farmers (1.8M) and cooperatives to cover transport and storage can help address challenges such as 'evening milk' thereby raise farmer incomes and potentially drive sales of add-ons[2,3,4,6] However, quality related price incentives, availability of affordable feed, and training will influence uptake of solutions.

**Opportunity to stem post-slaughter losses related to hot meat chain**. Absence of cold chain is estimated to leads to 14% in post slaughter losses, highlighting an opportunity for providers to offer CCI solutions that cover transport to and storage within butcheries and retail outlets outside of urban areas served by formal supermarkets[8]

Sources: 1. Livestock products by county, link 2. The Conversation, Link 3. Agriculture and Food Security, Link 4.EADD: The Dairy Value Chain In Kenya, Link 5.CGIAR, Link 6. USAID: Powering Agriculture, Link 7. Ministry of Agriculture, Nature and Food Quality, Link 8. Assessment of the Cold Chain Market in Kenya, Link
Note: County percentage contribution analysis for Milk and Meat are based on 2015 county agriculture data

# **Fisheries:** Lake Victoria serves as the major production hub, however, limited CCI solutions offer intervention opportunities

**Fish production is almost exclusively from freshwater lakes across the Rift and Western parts of Kenya:**
Lake Victoria accounts for ~67% of all fish production in Kenya with marine capture accounting for 14%; Fish farming contributed ~19K MT (11% of total) in 2019, led by Western and Central regions; Kakamega, Bungoma, Kisii, and Meru having >18K ponds[1,2]. The FAO estimates that should Kenya utilise its 1.4 million hectares identified as suitable for fish farming, it could produce close to 14 million tonnes annually.[6]

**Fish production by counties in Kenya**[1]
Tonnes

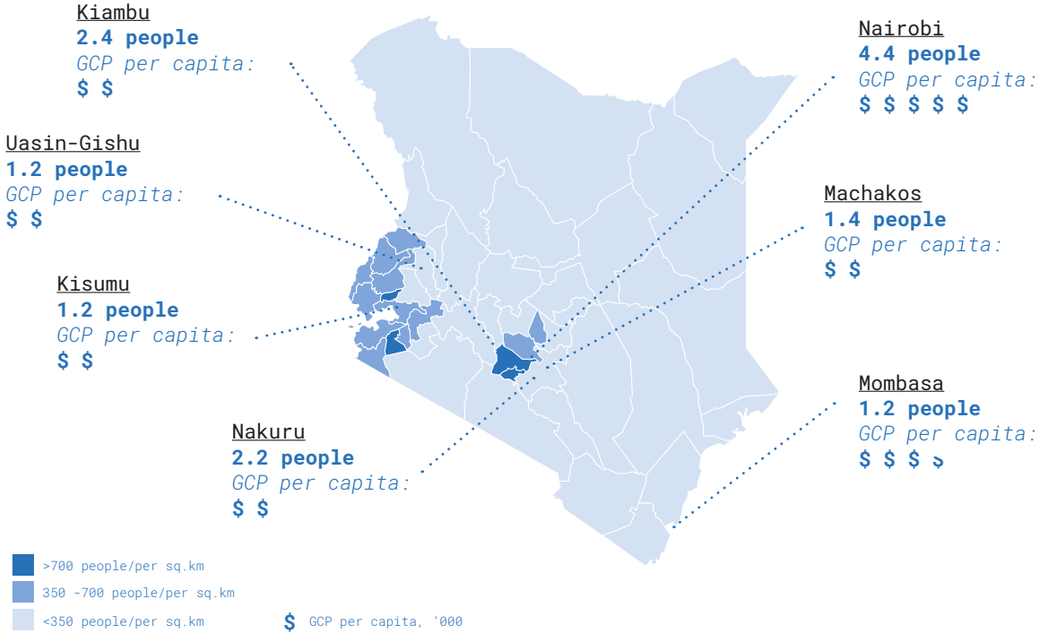

**Fish typically destined to Nairobi is sourced from Busia at the border of Kenya and Uganda:**
Nairobi is the largest domestic fish market with City Market and Gikomba representing the main fish markets; Busia market, receives fish via non-cooled motorbikes, from Kenya and Uganda and is the 2nd largest market supplying ice packed fish to Nairobi[3,4]

**Opportunity to provide solutions that address challenges between fish sources and intermediate distribution points.** Limited precooling i.e., use of ice and refrigeration post-capture provides opportunities for cold storage companies to limit up to 28% of losses at the first-mile; current use of bicycles in Busia provides opportunities for cooling on the go through retrofitted motorcycles[4,5]. Government initiatives to increase local production and limit importation are likely to provide additional opportunities for cold chain infrastructure across the supply chain[7]

Sources: 1. Kenya Marine and Fisheries Research Institute, Link 2. ResearchGate, Link 3. FAO Fisheries & Aquaculture, Link 4. Farm Africa, Link 5. FAO: Post-harvest losses in small-scale fisheries, Link 6. Kenya's fish sources, link 7. Kenya seeks to compete with Chinese farmed inputs, link
Notes: Lake Victoria spans multiple counties in Western Kenya

# **Consumption:** High income urban areas and high-density areas drive consumption, offering opportunities to meet CCI needs

## Population, density and Gross county product per capita[1]




**Kenya's key economic hubs and other regional hubs also represent its key areas of consumption**

- With Nairobi serving as the capital city and with Mombasa as the gateway for all goods into the country and beyond, both counties lead the rankings across key demographic indicators such as population, population density, and standards of living and therefore, serve as key geographic areas of consumption within the country[1]
- Other key regional areas that serve as intermediate markets include Kiambu county, the 2nd most populous in Kenya that serves as a commuter town to Nairobi as well as housing business and manufacturing companies, Nakuru county houses the 4th largest Kenyan town, and serves as the home to several universities and is a key tourist destination[1]
- With population expected to grow from 47.5M[4] in 2019 to 96M by 2050[5], urban migration expected to increase ~3.5 times from 12M in 2015 to 41M by 2050[6] and GDP per capita also projected to increase 3 times from ~2100 in 2021[7] to 6500 by 2050[8], demand for food sources and consumption of food will substantially increase.

**Opportunities therefore exist to address current and anticipated future demand, with a focus on serving storage and transit hubs and formal and informal retail outlets within the last mile in selected cities**

- CCI providers can cater to the storage and transit needs of aggregators, distributors, and retailers in cities that serve as hubs and key markets for their regions. For example, Nairobi a key transit point, offers the largest storage and transit CCI market; Lodwar or Garissa offer regional access
- Low- and middle-income areas with high population density also offer opportunities to serve both formal and informal last mile retail outlets with products that meet their needs. For e.g., local cold chain facility that serves multiple 'hot meat' butcheries

Sources: 1. KNBS, link, link 2. ILRI, Link, 3. Ministry of Agriculture, Nature and Food Quality, Link 4. Link 5. Link 6. Link 7. Link 8. Link
Notes: Gross county product per capita used as a proxy for standard of living and average income level. 2. Each dollar sign represents KES 100,000 per capita

# Supporting market development and increasing patient capital will be critical in driving uptake of cold storage

## BARRIERS TO SCALE

### CUSTOMER-LEVEL

**High acquisition costs and limited financing solutions**

- High costs of cold rooms (USD 11K – 30K) and lack of availability of affordable consumer financing solutions is a key barrier that limits uptake of CCI solutions[1,3]

**Limited incentives and awareness:**

- Within the milk value chain, the low avg. volumes produced by farmers and the minimal price difference between warm and chilled milk does not translate to a strong incentive to chill milk[3]
- Limited awareness (varies by region, education etc.) of cooling technologies and their benefits also limits uptake of CCI solutions [1,2]

### SUPPLIER-LEVEL

**High cost of acquiring and importing products**

- Companies incur significant taxation costs (12% import duty + 11% VAT) in importing CCI products into the country consequently making products more expensive[2]

**Long payback periods and high interest rates limit access to commercial capital**

- Solutions geared towards consumer groups such as smallholder farmers are likely to require longer time to become commercially viable and therefore can prove unattractive to commercial investors. High interest rates charged on debt facilities (>14%) also constrain growth of lease to own models[2,3]

## OPPORTUNITIES

**Support market development through business model innovation, increased awareness, and capacity building**

- Innovative financing solutions to consumer groups such as farmers, increased awareness of the necessity and benefits of cold storage (increase affordability and farmer incomes), increased technical assistance to CCI can help increase the uptake of CCI solutions [2,3]
- For e.g., multi-year donor programs could support market development activities and in doing so, promote successful pilots and reduce risk perception across all stakeholder groups

**Increase the availability of patient capital**

- Opportunities to crowd in commercial capital targeted towards CCI manufacturing and distribution companies or institutions providing consumer financing to farmers, through structures such as first loss guarantees from grant providers or RBFs[3]

**Lobby government to reduce taxes and therefore product prices**

- Multistakeholder groups can lobby government to reduce taxes, increasing affordability especially at the first mile, thereby increasing uptake [3]

Sources: 1) Engineering for Change: Assessment of the Use and Barriers of Evaporative Cooling Technologies by Small Holder Farmers in Kenya, Link 2. PREO: The Power of the Productive Use of Energy, Link 3. Efficiency for Access: Assessment of the Cold Chain Market in Kenya, Link


Uganda

# **Uganda:** Like Kenya, active effort by suppliers to address similar challenges faced within the FFV, dairy, meat & fish sectors

## Suppliers are utilizing innovative business models and offering diverse product ranges in response to local market dynamics…

| Company name | Business model | Connectivity | Product type | Customer type |
|---|---|---|---|---|
| KAZI | Lease model/ rent/ direct purchase | On-grid | Refrigerated transport, warehousing, refrigerated containers, cold rooms etc. | Commercial |
| WE | Revenue sharing | Off-grid | Solar milk coolers | Farmers, fishermen |
| ecolife FOODS | CaaS | Off-grid | Solar cold rooms | Agricultural cooperatives, fishermen associations |

## …on the back of financial and other ecosystem support from investors, industry bodies, and development partners

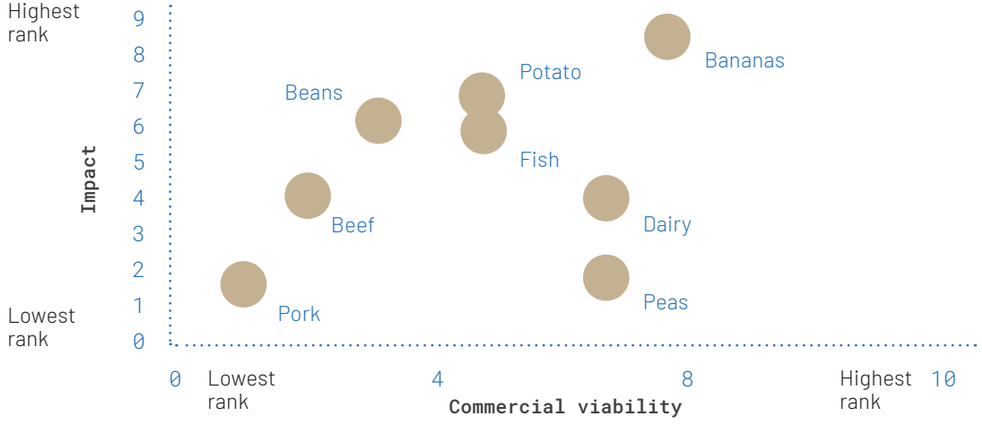
| Investors | Industry bodies | Development partners |
|---|---|---|
| GRASSROOTS BUSINESS FUND, ICCO COOPERATION, OIKO CREDIT, SUNFUNDER, EEP Africa | UNREEEA, ClimateLaunchpad, clasp | POWER AFRICA, Shell Foundation, SNV, giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH |

Sources: 1. KAZI food logistics, link 2. Wamala Energy, link 3. ecolife foods, link
Note: FFV – Fresh fruit and vegetable

# **Uganda:** Bananas, fish, and peas are examples of value chains that offer strong business case for cold-storage solution companies

## Value chain assessment in Uganda

Rank goes from lowest to highest across both axis




**Commercial viability** considers availability of alternative CCI solutions, product shelf life and export potential (export volume growth & margins). The higher the average score across the 3 categories, the larger the return-on-investment potential for CCI interventions across the value chains

**Impact** considers, for each value chain, the number of SMF, total production volumes, impact on livelihoods, and post-harvest losses. The value chains ranked highest represent those that are likely to benefit the most from CCI interventions.

## The following 3 value chains offer strong opportunity for intervention

**Banana production grew ~185%** between 2016 – 2020 fuelled by exports to Kenya and other neighbouring countries with exports growing ~2x in the same period[1]

**~85% of fish produced in Uganda is exported**, providing a large opportunity for companies to serve Africa's 6th largest producer of fish; exports of Nile perch and tilapia destined for non-African markets with smaller fish consumed regionally[2]

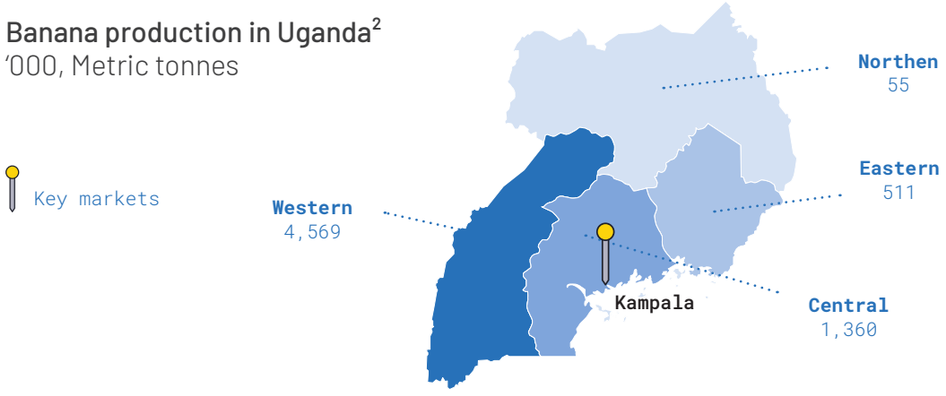
**Export of dairy products grew 56% between 2018 (USD 131M) to 2020 (USD 205M)** highlighting that the dairy sector consistently ranks as one of the leading agricultural commodity export income earners in Uganda[3]

Notes: Bubbles represent the most commercially viable value chains for off-grid solar cold chain; See Appendix for methodology

Source (s): 1. Wageningen: The Uganda vegetables and fruit sector, Link, 2. Asoko Insight: Uganda's Fishing Industry, Link 3. Dairy sector export, link

# **Fresh produce:** 2nd largest producer of F&V in Africa provides significant opportunities to cater to local and export markets

## Banana production in Uganda[2]
'000, Metric tonnes



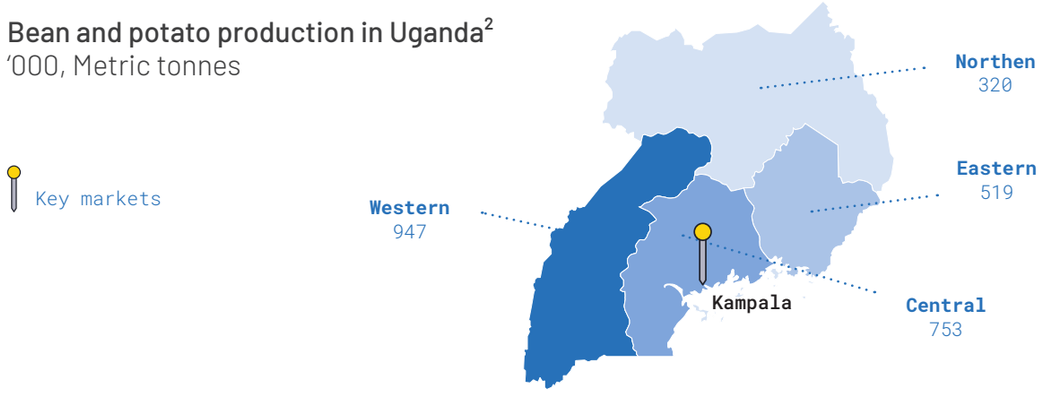

**Western Uganda dominates fruit and vegetable production in Uganda**

- Bananas dominate fruit production, but pineapples, passion, and avocados are growing in production; ~3x growth in pineapple production between '16 – '20; Beans and peas dominate vegetable production with >50% of all production but tomatoes and hot peppers are gaining traction[1]
- Mukono, Bulindi, and Mbarara are the largest banana producing districts all with production >100K MT annually; Mbarara, Mukono, and Rwetibaba are the largest bean producing districts, all with production >1M MT annually[2]
- Post-harvest, produce is either transported to informal rural market centres with limited cooling or through wholesale traders to urban markets with Kampala being the end destination; St. Balikudembe market (Owino market), Kalerwe market and Nakasero market are the largest markets1; limited used of cooling provides storage opportunities to cater to 11M tonnes of produce annually

**Significant exports, proximity to major consumption hubs and limited cooling provide opportunities for first mile cooling solutions.**

- Uganda exported 5.8M tonnes in 2021 (52% of production) with majority of this production within 250km of Kampala for local consumption; high SHF participation in production and limited cooling to cull current losses of 15 – 20% of total production provide opportunities, especially for peas and bananas
- With South Sudan as Uganda's 3rd largest export destination for FFV and owing to its central location, there are opportunities to develop CCI logistics solutions to serve these regional markets[3,4]

## Bean and potato production in Uganda[2]
'000, Metric tonnes

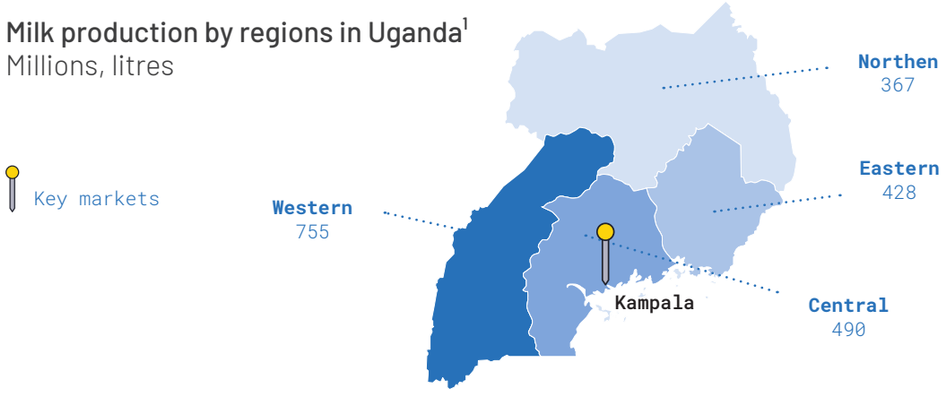



Sources: 1. Wageningen: The Uganda vegetables and fruit sector, Link 2. Uganda Bureau of Statistics Annual Agricultural survey 2019, Link 3. CABI: Uganda enjoys increased capacity to access more profitable regional and European markets, Link 5. ITC: Trade Map, Link
Note: SMF – Smallholder farmer

# **Dairy and Meat:** Informal milk production and limited cooling offers opportunities for CCI; beef constrained by monopolisation

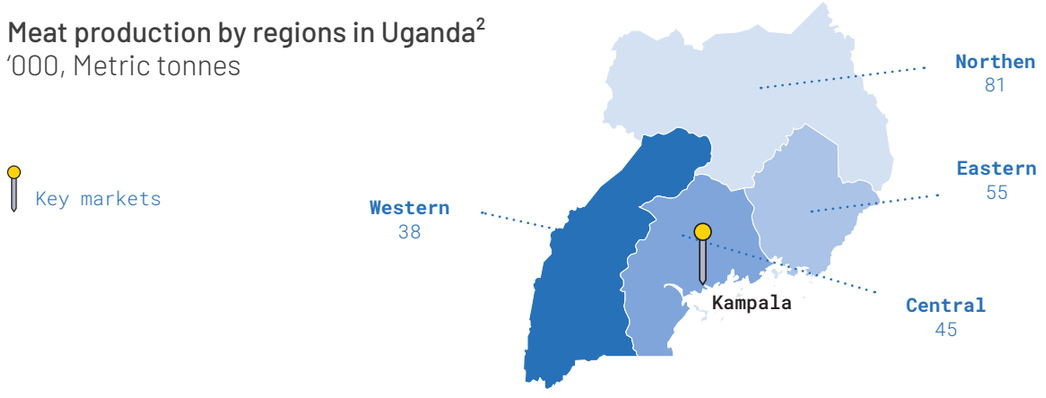
## Milk production by regions in Uganda[1]

Millions, litres




## Meat production by regions in Uganda[2]

'000, Metric tonnes




**Western and Central regions lead production but limited formal sales and cooling infrastructure inhibit sector:**

- Production concentrated in Southwestern and Central Uganda representing 70% of all production[1]
- 70% of milk is offered for sale with only 10% of this sold through formal channels; bicycle traders transport milk to 35 processors with limited bulking and cooling, except in the Central area[2,3,4]

**Northern and Eastern regions dominate beef production**

- Karamoja in North-Eastern Uganda controls >20% of all cattle in Uganda; poultry farming widespread across Uganda with 80% of production (~66K tonnes) consumed locally[5,6]
- Proximity to regional markets fuels poultry export with 70% of production consumed by Kenya
- Mainstream market (account for 80% of sales) served by roadside and market stall butcheries[7]

**First-mile opportunities present in the Western region.**
Highest production and developed bulking and transportation infrastructure in the region could provide opportunities to work with cooperatives; cooling on the go through retrofitted motorcycles could plug in to existing supply chains

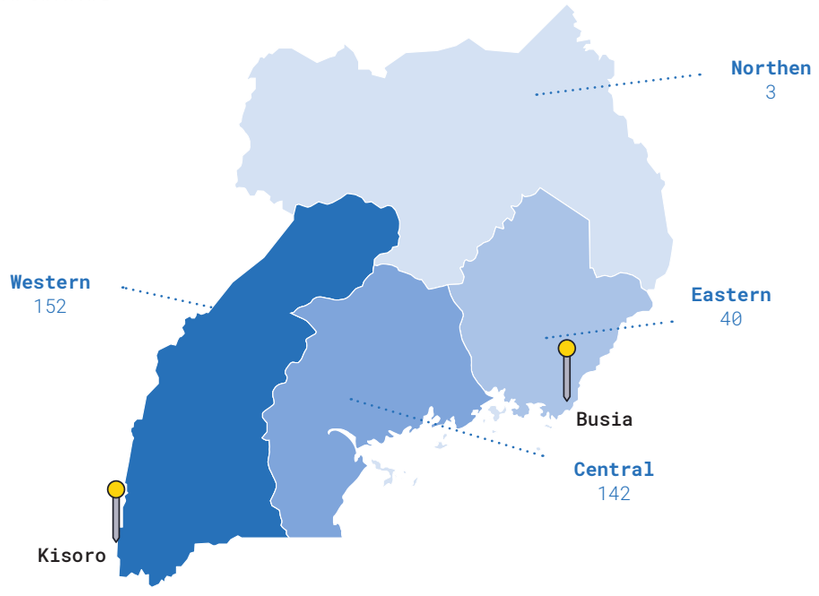
**Concentrated abattoir and meat processing sector limits entry, however, transport and storage for mainstream market provides entry opportunities. [7]**
SHF produce ~94% of all meat and with 80% of meat being consumed through roadside and market stall butcheries, opportunity to provide solutions to address the transport and storage needs of these sales channels

Sources: 1. Uganda Bureau of Statistics, Link 2. East Africa Dairy Development, Link 3. Ministry of Agriculture, Animal Industry and Fisheries, Link 4. NAMA: Climate-smart Dairy Livestock Value Chains in Uganda, Link 5. Uganda Investment Authority: Agriculture (Beef), Link 6. Netherlands: Agribusiness Market Scan for Uganda, Link 7. Agrifocus Uganda, Beef Sector Mapping, link

# **Fisheries:** High contribution to GDP, significant export markets and limited cooling, provide opportunities for CCI

## Fish production by regions in Uganda[1]

'000, Metric tonnes




Key markets

**Western and Central regions control fish production with large export market:**

- 83% of freshwater fish are captured in Lake Albert and Lake Victoria 25,000 fishponds and 5,000 cages being registered in the country that contribute a further 120K MT (20% of total)[2,3]
- 85% of production is exported to global and regional markets with of which a majority is sold to trader's markets i.e., Busia in Kenya and Kisoro in DRC but limited post-harvest cooling hampers sector growth despite fish and fish products being the third highest earning exports[2,4]

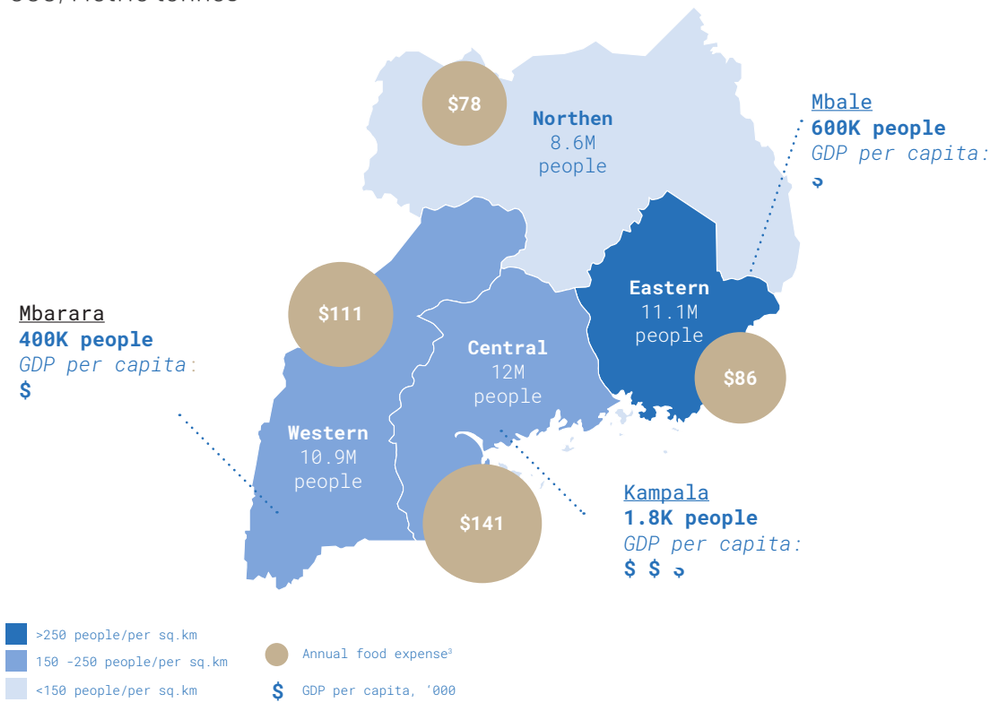
**Large and growing exports coupled with limited current cooling facilities provides significant opportunities to support farmers.**

- Exports expected to ~6x by '24/'25 and a 5-year 8% CAGR for fisheries, which when coupled with tax incentives for inputs to the aquaculture sector and limited cooling available provides an opportunity to cold storage companies to provide first-mile cooling to pond and cage farmers as well as supporting thermally controlled logistics to Kenya and DRC[3]
- High significance of traders in the value chain in facilitating movement of production could provide opportunities to increase incomes and drive adoption[2]

Sources: 1. Uganda Bureau of Statistics, link 2. Netherlands Enterprise Agency, Link 3. Netherlands: Agribusiness Market Scan for Uganda, Link 4. Asoko Insight: Uganda's Fishing Industry, Link
Note: CAGR: Compounded annual growth rate

# **Consumption:** Kampala is the leading consumer of produce owing to its large population and the higher incomes earned

**Population, density and food expenditure per capita**[1,2]
'000, Metric tonnes

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Sources: 1. Government of Uganda. Link 2. USAID: Estimating District GDP in Uganda, Link 3. Uganda Bureau of Statistics: National Household Survey 2019/20, Link 4. BMC: Urban Transformations, Link 5. NPJ: Urban Sustainability, Link

# Supporting market development and increasing patient capital will be critical in driving uptake of cold storage

## BARRIERS TO SCALE

### USER-LEVEL (FARMERS, TRADERS, AGGREGATORS)

**Low affordability, awareness, and cheaper less effective alternative solutions limit uptake**

- Low SHF incomes limit farmers' ability to afford off-grid cooling products as up to 66% of farmers earn less that USD 2.50/day[1]
- Presence of cheaper alternatives, like charcoal coolers in the aquaculture, impacts willingness to pay for more expensive solutions[2]

### SUPPLIER-LEVEL

**Limited pipeline of companies and largely commercial applications limits availability of cold storage**

- A nascent sector with few companies constrains the availability of different solutions which coupled with a large off-grid population inhibits the availability of affordable solutions to cater to SHFs[2]
- Knock-on effect of nascency of market is constrained capital to develop products catered to the market given affordability challenges, limiting the supply of affordable cold storage in Uganda[2,3]

## OPPORTUNITIES

**Support market development through business model innovation, increased awareness, and capacity building**

- Innovative financing solutions to consumer groups such as farmers, increased awareness of the necessity and benefits of cold storage (increase affordability and farmer incomes), increased technical assistance to CCI can help increase the uptake of CCI solutions [4,5,6]
- For e.g., multi-year donor programs could support market development activities and in doing so, promote successful pilots and reduce risk perception across all stakeholder groups

**Increase the availability of patient capital**

- Opportunities to crowd in commercial capital targeted towards CCI manufacturing and distribution companies or institutions providing consumer financing to farmers, through structures such as first loss guarantees from grant providers or RBFs[3]

Sources: 1. CGAP: Smallholder Household Survey Report, Link 2.USAID: Productive Use of Energy in Uganda, Link 3. EcoLifeFoods: An affordable Cold Room powered by solar energy, Link 4. PREO: The Power of the Productive Use of Energy, Link 5. Efficiency for Access: Assessment of the Cold Chain Market in Kenya, Link 6. Shell Foundation: Promoting Productive Uses of Energy in Uganda, Link

# Appendix

# We followed the below steps to assess and rank each value chain on their commercial viability and impact

| Step and description | Output |
|---|---|
| **1** Within the four value chains highlighted as per the scope, Identified and selected broad categories of fruits and vegetables suitable for cold storage based on available data | List of value chains that we assessed |
| **2** Developed two broad criteria and a scoring framework<br>**commercial viability**<br>• Availability of alternative solutions serving SHF and aggregators<br>• Shelf life of each value chain<br>• Growth in export quantity<br>• Value proposition for SHF/aggregators (Export price)<br>**and Impact potential**<br>• Number of SHFs<br>• Total production volumes<br>• Impact on livelihoods of SHFs and other value chain actors<br>• Post-harvest loss and spillage | Architecture of scoring framework and a relative scoring index from 1-5 for each criteria with a score of 1 indicating least favorable conditions for cold chain solutions and 5 for being most favorable. |
| **3** Conducted research to obtain supporting data to enable scoring of each value chain against each element of the scoring matrix, weighting the 8 metrics equally to obtain an average score under each broad category. | A filled scoring framework that ranks each value chain relative to the others based on its score across the two broad categories of commercial viability and Impact |

# Stakeholders are engaging in various initiatives to support growth of the sector (1/2)

| Stakeholder(s) | Description and objective of initiative |
|---|---|
| The Rockefeller Foundation | **YieldWise Initiative:** Intervene across representative value chains to halve food loss by 2030. In Kenya, this has been aimed at driving increased uptake of loss-reducing technologies in the mango value chain[1] |
| Mitigation Actior Facility | **Technical support and Climate finance:** Mitigation Action Facility provides technical support and climate finance for projects focused on decarbonising the energy, transport, and industry sectors. For example, the Kenya –Solar Powered Cold Chain Services (designed to reduce post-harvest losses) will deploy 3,900 tonnes of cold storage, connecting farming cooperatives in Meru and Nakuru counties to 33 end markets countrywide. Project will deploy 15M Euro in concessional loans, a credit guarantee and a tariff liquidity support facility to make it economically viable for service providers [2] |
| EEP Africa | **Clean Energy financing:** Provides early-stage grant financing to innovative clean energy projects, business models and technologies in 15 countries across Southern and Eastern Africa. For example, financed SokoFresh to pilot an integrated approach to aggregation of produce, food processing, and market linkages for smallholder farmers[3] |
| PFAN Accelerating Investment for Climate and Clean Energy | **Technical assistance and clean energy financing facilitation:** Hosted by UNIDO and REEEP, PFAN supports entrepreneurs by offering one-to-one business coaching and investment facilitation services to promising climate adaptation and clean energy projects at no cost. PFAN offers this service to countries within Sub-Saharan Africa among other regions[4] |
| giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH | **Green cooling initiative:** Seeks to implement sustainable cooling with the aim to transform the cooling sector in emerging and developing countries; offers policy advice, tech transfer and capacity building[5] |

Sources: 1. Rockefeller Foundation, Link 2. Mitigation Action Facility, Link 3. EEP Africa, link 4. PFAN:, Link 5. Green cooling initiative, Link

# Stakeholders are engaging in various initiatives to support growth of the sector (2/2)

| Stakeholder(s) | Description and objective of initiative |
|---|---|
| ARCH EMERGING MARKETS PARTNERS LTD | **Greenfield CCI investment:** The Fund will focus on investments in temperature controlled cold chain solutions across the East African region, supported by active local operations logistics partners with a target client focus on agriculture. The fund aims to develop a total installed estimated capacity of 100,000 pallets across East Africa in countries such as Kenya, Ethiopia, Uganda, Rwanda, Tanzania[1] |
| POWER AFRICA | **Technical assistance and grant financing:** Provides technical assistance including investment readiness support and grant financing to promote and increase access to off-grid technologies. For e.g., Power Africa supported GRS commodities in Uganda with technical assistance to develop commercially sustainable business models[2] |
| clasp | **Needs assessment-based grants:** Supported by DOEN foundation, IKEA foundation, FCDO and Good Energies foundation, CLASP and Efficiency for access are hosting a challenge, the 2022 Global LEAP Awards Off-grid Cold Chain Challenge that seeks to identify promising business models and energy efficient, sustainable technologies that helps reduce first mile food loss[3] |
| EFFICIENCY FOR ACCESS | Technical assistance and grant financing: Works to promote affordable high performing and inclusive appliances such as cooling technologies that address market barriers and increase clean energy access where it is needed. For e.g., Funded Smart Village Research group along with their local partner Ecolife foods to develop and test improvements to a low cost, locally developed cold chain storage solution in Uganda[4] |
| endev | **Technical assistance:** Provides support to governments, off-grid solution companies, donors, and other ecosystem players in creating environments that promote supply and demand of sustainable energy, developing partnerships between ecosystem players, and conducting analysis and disseminating findings to the broader market. For example, EnDev received an 8 million euro grant from the IKEA foundation to pilot projects to demonstrate the feasibility of productive use of renewable energy in agriculture through projects that will include activities such as milk cooling and vegetable drying.[5] |

Sources: 1. Blended Finance Taskforce, Link 2. Power Africa, Link 3. Clasp, link 4. SVRG, Link 5. EnDev, link, link

EEP Africa

Nordic Development Fund

eepafrica.org