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AgrInvest-Food Systems Project

Increasing sustainable investments in the Kenyan cage aquaculture chain



ecdpm

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Abbreviations and acronyms

AAK	Aquacultural Association of Kenya
ABDP	Aquaculture Business Development Programme
AFC	Agricultural Finance Cooperation
AFIPEK	Association of Fisheries Exporters of Kenya
CASK	Commercial Aquaculture Society of Kenya
ECDPM	European Centre for Development Policy Management
ESP	Economic Stimulus Programme
FAO	Food and Agriculture Organization of the United Nations
IFAD	International Fund for Agricultural Development
KEBS	Kenyan Bureau of Standards
KeFS	Kenya Fisheries Service
KFMA	Kenya Fish Marketing Authority
KMFRI	Kenya Marine and Fisheries Research Institute
KRE	Dutch Embassy
LBDA	Lake Basin Development Authority
LREB	Lake Region Economic Bloc
LVFO	Lake Victoria Fisheries Organization
NARDTC	National Aquaculture Research Development and Training Centre
NARIG	National Agricultural and Rural Inclusive Growth Project
SACCO	Savings and Credit Cooperative Societies
SDFBE	State Department for Fisheries, Aquaculture and The Blue Economy

1 Introduction

1.1 Aquaculture can contribute to sustainable development in Kenya

Food systems around the world are changing rapidly and are confronted with unprecedented, interlinked sustainability challenges requiring responses at the local, national, and international levels. Consensus is growing on the need for a transformation in the way food is produced, processed, distributed and consumed (D'Alessandro *et al.*, 2021; Willett *et al.*, 2019). The 2030 Agenda for Sustainable Development highlights the key role food systems play in tackling global challenges such as malnutrition, poverty, the loss of biodiversity and ecosystem services, and climate change. More and better-quality private sector investment in food systems is necessary for the achievement of the Sustainable Development Goals (Morrison *et al.*, 2018).

Box 1 The AgrInvest-Food Systems Project

The Food and Agriculture Organization of the United Nations (FAO), in partnership with the European Centre for Development Policy Management (ECDPM), is implementing the project “AgrInvest-Food Systems: Enabling inclusive and efficient private sector investment in agri-food systems”. The AgrInvest-Food Systems Project (AgrInvest-FS) aims at attracting private investment into agri-food systems aligned with the Sustainable Development Goals (SDGs) by leveraging public funds. The initiative strives to contribute to national development strategies, as well as to the upcoming Food Systems Summit to be convened by the United Nations Secretary-General in 2021. AgrInvest-FS’s overarching goal is to help stakeholders understand and manage the complex choices that affect the sustainability of agri-food systems, and to accelerate progress toward the SDGs.

The first output for Kenya mapped Kenya’s food system and highlighted its main sustainability outcomes, followed by an analysis of its key political economy factors (Rampa and Dekeyser, 2020). The indigenous vegetable and aquaculture value chains were selected for their investment potential, favourable political economic position and their ability to contribute to wider food system sustainability. Rampa and Obiero (forthcoming) further discuss the indigenous vegetable value chain.

AgrInvest-FS benefits from the financial support of the Government of Italy and is being implemented in Burkina Faso, Ethiopia, Kenya and Niger. More information is available at fao.org/in-action/agrinvest-food-systems

The world now produces more fish from aquaculture than is caught in the wild. While Asia produces 92percent of live-weight aquaculture outputs, the growth rate in Africa exceeds Asia’s in the past two decades. A 20-year retrospective review of global aquaculture (Naylor *et al.*, 2021) points to growth in volume and value, an improvement in fish feed sustainability, and in contributions to income and food security. But over-intensification, nutrient pollution, and disease have often created industry consolidations that have left poorer producers out.

The United Nations General Assembly has declared 2022 the International Year of Artisanal Fisheries and Aquaculture (IYAFA 2022). With this declaration, the UN recognizes the role that fish farmers play in providing healthy and nutritious food to millions, if not billions of people. IYAFA 2022 can be an opportunity to enhance the dialogue between the different actors to support aquaculture producers and to shape Kenyan aquaculture policy. Aquaculture development can contribute to achieving some Sustainable Development Goals in Kenya (Rampa and Dekeyser, 2020).

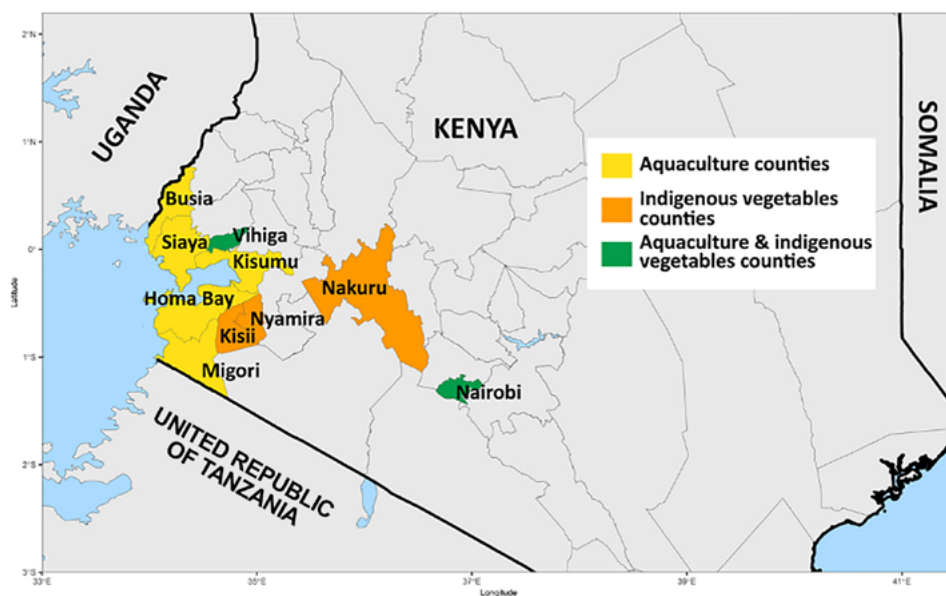
Kenya imports more tonnage of fish than it exports, but the total value of fish exports is higher than that of imports. This is mostly thanks to fish exports to the European Union of catch from the Indian Ocean and Kenya's lakes, as Kenya exports high-value fish and imports low-value fish. The export-oriented fish chain is only loosely connected to Kenya's domestic fish chains. Kenya's capture fishing for the local market, decreasing due to falling fish stocks, cannot satisfy domestic consumption. The falling fish stocks are squeezing fishers' livelihoods. At the same time, Kenya has a growing population where urbanites, in particular, eat more fish. A growing population, greater per capita demand, and declining wild catch mean that aquaculture is looked upon to provide high-quality and affordable fish sustainably. Kenya's current domestic fish demand is higher than what wild capture and aquaculture can provide, thus imports fill up the gap (Rampa and Dekeyser, 2020). It is considered that there is "great" or "enormous" potential for aquaculture production in Kenya (FAO, 2016; Munguti *et al.*, 2014). The aquaculture chain is prevented by several obstacles from fully taking advantage of the opportunities that the Kenyan fish markets provide. Better governance and coordination are seen as key to overcome these obstacles and attract more investments.

1.2 Selection of value chain and area

This report builds on ECDPM's sustainable food systems approach (Dekeyser *et al.*, 2020) and the first Kenyan report on AgrInvest-FS (Rampa and Dekeyser, 2020). ECDPM's sustainable food systems approach aims to navigate the complexity of food systems and to help design systemic interventions for greater sustainability. This approach has four components: the food system; sustainability; political economy analyses; and the resultant recommendations. These components were adapted to the aquaculture chain.

Aquaculture was selected because of its investment potential, favourable political economic position and ability to contribute to wider food system sustainability (Rampa and Dekeyser, 2020). Aquaculture is fish culture in cages, earthen and lined ponds, dams and integrated fish farming. In this report, we focus mostly on cage aquaculture in the riparian counties of Lake Victoria (Migori, Homa Bay, Kisumu, Siaya and Busia) and Vihiga County, with the inclusion of Nairobi County as an end market (Figure 1).

Figure 1 Selection of Kenyan counties by the AgrInvest project



Source: Natural Earth, 2021.

Note: Besides Nairobi County, all the selected aquaculture counties are members of the Lake Region Economic Bloc.

Cage farming was selected because of its lower land cost requirements and its ability to generate inclusive employment in an area with declining traditional fish livelihoods. The riparian counties were selected because of their potential for cage farming and Vihiga County for its large hatchery supported by the local county government, which supplies cage farms in Lake Victoria. The report is based on Rampa and Dekeyser (2020), literature reviews, interviews, field visits, and two workshops held between February 2020 and February 2021.

2 Mapping the aquaculture value chain

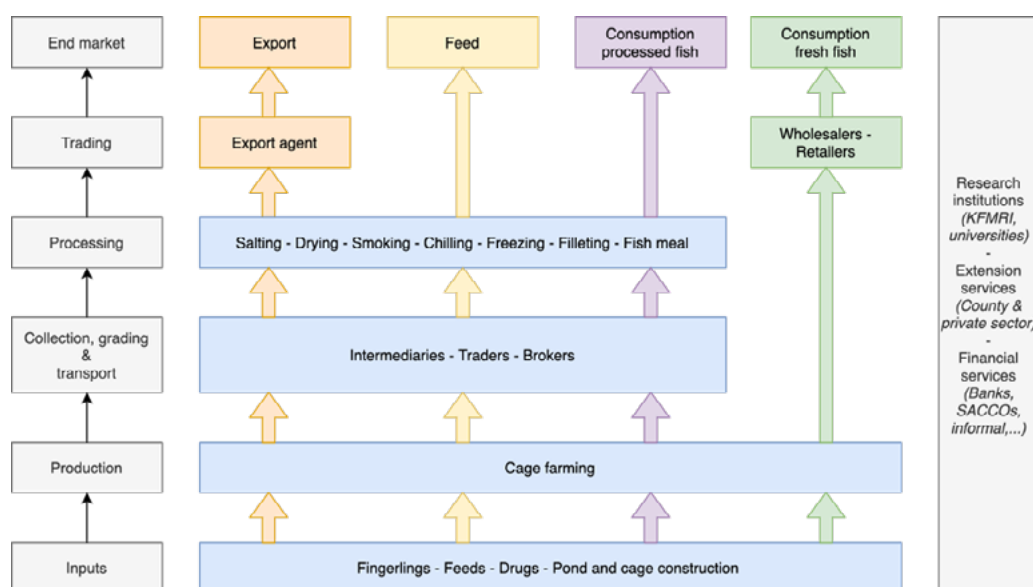
2.1 Activities in the aquaculture chain

The Government of the Republic of Kenya, through the 2009-13 Economic Stimulus Programme (ESP), promoted smallholder aquaculture fish production through targeted support for input supply, fish production, and post-harvest management. The ESP achieved a rapid expansion of fish ponds, including in regions with little history of fish production or consumption. The programme supported hatcheries and community-level fish feed mills and provided subsidized inputs. But aquaculture production declined after the subsidies stopped (Rampa and Dekeyser, 2020). Even after the ESP, only 0.014 percent of suitable areas were used for aquaculture, 95 percent of which were small-scale (Munguti *et al.*, 2014). The failure of the ESP to boost aquaculture production sustainably shows the need for more than just favourable loans and input support. After the devolution of agricultural responsibilities to the county level, some counties continued to support aquaculture. In 2017, aquaculture was contributing up to 15 percent to the domestic fish supply.

2.1.1 Inputs supply

The inputs involved in the production of farmed fish are fingerlings, fish feeds, fertilizers, drugs and materials for the construction of fishponds or cages.

Figure 2 Cage aquaculture value chain map in Kenya



Source: Authors.

Fingerlings. Current fingerling demand stands at more than 100 million fingerlings. Only 23 million Tilapia fingerlings and 2 million catfish fingerlings are produced by privately held (82 percent) and government-owned (18 percent) hatcheries. While these hatcheries have a production capacity of 96 million fingerlings, the industry still grapples with quality standards and genetics (Obwanga and Lewo, 2017; Opiyo *et al.*, 2018). Implementation and monitoring of standards through the Kenya Marine and Fisheries Research Institute (KMFRI) and the Kenya Bureau of Standards (KEBS) is limited (Nyonje *et al.*, 2018).

Aquaculture Feeds. Farmers either produce fish feed themselves or buy it at an agricultural store. About fourteen fish feed suppliers operate in Kenya (Opiyo *et al.*, 2018). Most farmers feed their tilapia using mash and sinking pellets (Farm Africa, 2016). Despite their superior quality, small fish farmers find imported feed too costly (USD 1.2-2 per kg) and use it solely to supplement the local feeds. Feeds are mainly imported from the Netherlands, Norway, Denmark, Israel, Mauritius, Uganda and Ghana. Sufficient domestic production of floating fish feed remains a challenge since only a few companies (Unga Holdings Ltd and Sigma Feeds Ltd) have the necessary technology (Rurangwa *et al.*, 2018). Few agrovets stock floating fish feed due to their small profit margins, at times as low as KES 20-50 (USD 0.2-0.5) per bag.

2.1.2 Raising and producing fish

Kenya farmed about 27 125 tonnes of fish in 2015, of which 75 percent tilapia, 17 percent catfish, 6 percent carp, and <1 percent trout. Aquaculture in Kenya is predominantly based on semi-intensive culture systems, mainly through ponds. However, new farmers have invested heavily in intensive fish farming technologies, such as cage culture. The cages come in various sizes, from 2 by 2 metres for subsistence use to larger ones for commercial ventures. A 6-12 m depth is preferred, with high water currents necessary for waste removal. In 2019, a portion of the lake contained 4 357 fish cages covering 62 132 m² (Hamilton. *et al.*, 2020). Nile tilapia is the recommended species for cage fish farming in Kenya, although the African catfish can also perform well. These species are Kenyan natives, but would further benefit from improved genetic quality.

2.1.3 Harvesting and distribution of farmed fish

Harvesting is done when the fish reaches the market size of about 300 g. The fishers sell at an average of KES 320 per kg (USD 3.2) at the landing sites while farmed fish is sold at an average of KES 300 per kg (USD 3.0). In Kenya, tilapia is ready for harvesting within six to nine months depending on the size at stocking, target harvest size, water temperature and the level of farm management. The time of harvesting is determined by regular sampling, ideally done monthly. Wholesale traders often buy directly from the farmers once the fish has been harvested. The farmers often have informal arrangements with the traders, however, due to insufficient storage facilities, they are at times forced to sell the fish at low prices to avoid production cost overruns or spoilage. Rio Holdings, a fish processing plant in Migori County, has a phone app where fish farmers can update the status of their fish. This enables Rio to plan how much to collect and schedule harvesting programmes with the farmers.

Fish should ideally be transported in cold storage vehicles, however, domestic-market fish is usually packed in ice placed in polythene bags and then transported in traditional baskets. This makes the fish vulnerable to physical damage, exposure to microorganisms and the elements. Transport to Nairobi is often overnight. Once in Nairobi County, many fish are sold to major markets such as the Gikomba and

Kangemi markets, which also source other urban wholesale markets. Fish from the wholesale market is distributed to smaller urban and rural retail markets throughout the country. Tilapia prices in the domestic market (Nairobi) vary from KES 500 per kg (USD 5.0) for fresh fish to KES 200 per kg (USD 2.0) for rejects). In the urban centres, fishmongers may keep fish fresh in small refrigerators. Food safety is better in Kenya's supermarkets compared with smaller private retail outlets, as they prefer selling tilapia after it is cut into fillets, packaged and chilled. Some common brands found on the supermarket shelves in Kenya include Farmer's Choice and Alpha Foods, with fish fillets selling at KES 2 000 per kg (USD 20) and whole fish at KES 500 per kg.

2.1.4 Processing and packaging

Processing preserves quality and adds value. Primary fish processing involves sorting, chilling and freezing. The Kenyan government has invested KES 240 million (USD 2.3 million) in building four fish cold-storage plants at Rongo, Imenti, Tetu and Lurambi in order to give fish farmers storage facilities for their products before marketing (FAO 2016). The plants in Rongo and Lurambi operate through a public-private partnership. The secondary processing involves filleting and further freezing. Fish for food is processed on a small scale mostly by women through either salting, sun-drying, smoking, chilling, freezing or filleting. The processes include evisceration, de-heading, scaling, cutting off fins and belly flaps, slicing of whole fish into steaks, filleting, skinning, and grinding. Some of the fish is processed into ingredients for the manufacture of animal feeds, especially spoiled fish.

The fish and fish products aimed at high-end and export markets need to meet the relevant food safety standards along each stage of harvesting, handling, processing and transportation. The processing is carried out in well-equipped facilities that meet international food safety standards. However, the gutting and popular value addition carried out through deep frying the fish in cooking oil at the market stalls in the pre-urban and urban areas is done in an unregulated environment with minimal attention to standards. The fish sold in the local markets is not well packaged. Whole tilapia fish is often sold at the local open markets and supermarkets in pieces and loosely (unpacked), while fish fillets - mostly Nile perch - are packaged in plastic wrappers.

2.1.4 Consumption

The inland aquaculture sub-sector in Kenya has been growing rapidly in response to declining capture fisheries and increasing national demand for fish. The gap between domestic demand and production is projected to increase to 360 000 tonnes by 2025, resulting in rising prices and a continuing decline in fish consumption – currently at 3.5 kg down from 5.5 kg per capita in 1993 and compared with a global average of 16.3 kg per capita (FAO, 2019; Republic of Kenya, 2017).

2.2 End markets

2.2.1 The domestic market

Fish for human consumption. The role and preferences of fish consumers are far less researched than the production side of aquaculture. “...*What consumers actually want is not properly known*” (Obwanga and Lewo, 2017: 26), but most Kenyans eat tilapia. While catfish are easier to breed, the fishes have not been successfully promoted yet. Over 70 percent of consumers in Kenya’s urban and pre-urban centres purchase fish from open-air markets, 18 percent from supermarkets, 10 percent from fish vendors, and less than 2 percent from fish farmers (Obiero *et al.*, 2014., Githukia *et al.*, 2014). Most eat fish for health benefits and prefer wild fish over farmed fish based on size and taste, even though the latter may be cheaper (Rurangwa *et al.*, 2018).

When considered collectively, the main reasons given by urban consumers for consuming fish were health (40 percent), taste (35 percent) and cooking convenience (12 percent); while availability (8 percent), price (3 percent) and status (2 percent) ranked lower. Consumers prefer tilapia for its taste. The demand for the more affordable catfish was found to be higher among people aged 18-24 years and among people from traditionally non-fish-eating communities. Tilapia is preferred by persons earning more than KES 20 000 a month, while catfish are preferred by those earning less than KES 5 000 a month. Even though overall fish consumption is low, it is likely mediated by geography, ethnicity, age and class. This means that the national average of per capita fish consumption might mask an uneven consumption distribution.

The most dynamic part of the aquaculture chain might be the fish consumers (especially urban ones), who demand more fish, are less beholden to taboos and look for affordable fish. Because of their limited production, farmed fish lack well-supported end-markets. Fish consumption, like fish farming, is mediated by cultural practices and beliefs. Consumers that hail from near the ocean and lakes prefer wild-caught fish. Given the position of Lake Victoria in the west, and the Indian Ocean in the east, the market for farmed fish might be mostly in central Kenya. Barriers to fish consumption include lack of skill in assessing the quality of fish (especially for fresh whole fish), unaffordable prices, limited preparation skills, safety concerns, unavailability, and, in the case of lungfish and catfish, lack of visual appeal. Some ethnic groups were not exposed to fish when young and find it unpalatable.

Those with food safety concerns might prefer either farmed or wild fish, depending on their perception of the water quality of Lake Victoria (a possible source of pollution) or of the presence of antibiotics in farmed fish. Kenyans have limited knowledge about fish and their fish cooking skills are limited. A major barrier limiting more fish consumption is its perceived high price. The recent rise of imported Chinese fish meets the need for more affordable fish, especially for urban dwellers and youths.

Fish for feed. Fish is also used as a raw material (fishmeal) as the protein ingredient for producing animal feeds for the growing livestock and dairy markets in Kenya. However, due to high competing demands for human consumption and the insufficient supply of tilapia, it is mostly low quality omena (dagaa), the second most marketed fish species from Lake Victoria, and Nile perch offal (skeleton and skin) that are used in producing feed.

2.2.2 Export market

Kenya has implemented the European Union’s quality standards for all export-oriented fish products. In 2018, Kenya had a positive trade balance of almost USD 29 million in fish products, mainly due to high-value fish exports to the European Union. The export-oriented fish chain is much more formal

than the domestic-oriented chain. Despite a steep increase of 74 percent in tilapia exports by volume, mostly to the European Union between 2015 and 2018, the export of tilapia is hampered by very low production volumes and is also actively discouraged by the Kenyan government which sees tilapia as a key source of protein for domestic consumption. Notably, tilapia's export prices have gone down. Tilapia global prices went down from USD 6 per kg in 2015 to only USD 2.3 per kg in 2017 (Wamucii, 2020).

2.2.3 Imports

Kenya has an annual fish deficit of 365 000 tonnes (Business Daily, 2019), which is filled through imports. Fish imports from China hit USD 17 million in 2018 having risen strongly since 2012 (Rampa and Dekeyser, 2020). This led to uneasiness among local traders who complained of being pushed out of the market by the cheaper suppliers. In 2019, fish traders in Nairobi's markets reported that importing fish was cheaper and affecting locally produced fish. A 10 kg carton from China was selling at KES 1 800 (USD 18), whereas the same quantity produced in Kenya was KES 3 500 (USD 35), making competition difficult.

2.2.4 Value addition

Value addition in tilapia and catfish includes gutting, filleting, pre-cooking, smoking, solar drying, packaging, branding (e.g. premium label) and labelling (e.g. environmental, regional, ethnic, marketing). Fillets can further be used to make fish products such as fish samosa, fish fingers, fish pies, fish skewers, fish gel, sausages, fish balls and fish soup which are currently being adopted in the day-to-day meals by households and in hotels as snacks. Other than food products, fish by-products such as offal can be ground into a slurry and used to manufacture fish oil. Tilapia and catfish unfit for human consumption are used to make fish meal for commercial purposes, such as animal feed.

2.3 Actors within the aquaculture chain

Key stakeholders include both individuals and organizations and were identified through the literature and referral by interviewees. Those with sufficient information were ranked according to their influence and interests in the Kenyan aquaculture chain, together with their potential for supporting or receiving investments (Figure 3).

Stakeholders in the Kenyan aquaculture chain were categorized into three groups, namely core actors, governance actors, and finance actors. Core actors are found in the pre-production, fish farming, and distribution and processing stages of the aquaculture chain. The governance stakeholders, which include both public and private governance entities, create the enabling environment for the core actors, and current investors comprise the third category.

2.3.1 Actors in the core value chain

Table 1 provides an overview of selected actor groups in the core Kenyan aquaculture chain. First are the fish feed providers. There are several companies producing fish feeds, which include mash, farm-made pellets, pressed pellets and floating feeds, such as Sare Millers Ltd in Kisumu.

Table 1 Overview of selected actor groups in the core Kenyan aquaculture chain

Stage	Function	Actor group type	Selected actors	Main challenges	Investment characteristics	Objectives and interests	Area and influence	Agrinvest multi-stakeholder potential
Pre-Production	Feed production	Local feed producers	Sare Millers Ltd; Unga Feeds Ltd; Biofit Feeds; InsectPro	Low quality; Insufficient production; Raw material competition	Suitable for: asset loans; Business service support; Outgrowing; Contract farming	Substitution; Waste conversion; Improved technology; Domestic raw material supply	Farmers' raw material; Fish farmers; Distribution shops	Yes, fish feeds are a high proportion of production costs; investments in more sustainable feeds necessary
	Fingerling production	Private fingerling producers	Raanan Fish Feeds Jewlet Enterprises; Muga Fish Farm	High price Unreliable quality; Insufficient production; Market linkages; Loss	Suitable for: assets loans; Business service support; Outgrowing; Contract farming	Stable currency; Competition Improved technology; Business data and management; Improved genetics; Improved market linkages; Standards enforcement	Fish farmers Fish feed producers; Fish farmers	No, low investment potential Yes, fingerlings are crucial for quality and diversity aquaculture
Fish farming	Cage aquaculture production	Cooperatives and medium-scale farmers	NARDTC Kisii Tilapia Fish Farmers; Kamiti Fish	Funding Profitability; Market linkages; Attracting investment; Safety; Inclusivity; Brokers costs	Suitable for: (assets) loans; Business service support; Outgrowing; Contract farming	Research; Providing sufficient supply; Mentoring Improved technology; Adding value; Environmental sustainability; Representation; Aggregation	Local feed producers; Private and government fingerling producers; Off takers	Could possibly facilitate improved private fingerling production and expand genetic quality Yes, increased aquaculture production is key for the chain's sustainable development
	Large-scale farmers	Victory Farms	Community relations; Currency and international market hikes	Local vertical linkages; CSR; Export business model	Local feed producers; Feed importers; Local distribution; End-users	Yes, vertical linkages can result in contracts and investment, and actors can ensure offtake for other aquaculture (pre-) producers		
Distribution and processing	Traditional and mostly informal		Insufficient supply; Food safety	Suitable for: (assets) loans; Contracts	Improved technology; Value adding; Representation; Market knowledge; Aggregation	Fish farmers; End-users	Yes, for improving the distribution structure and lowering brokerage costs	
	Integrated	Victory Farms	Insufficient supply	Attracts FDI. Invests in cold/cool chain and retail stores		Fish farmers; End-users	Yes, because of their cold/cool chain expertise and possible outgrowers scheme.	

Source: Based on interviews and literature review.

Notes: FDI Foreign Direct Investments; CSR Corporate Social Responsibility; NARDTC National Aquaculture Research Development and Training Centre.

Other companies, mostly based in Nairobi, such as Raanan Fish Feeds, import fish feed from Uganda, Ghana, and European countries, as local production has a lower quality (Opiyo *et al.*, 2018). Eggs, fry and fingerlings are produced both by the government and private companies. Between 2010 and 2016, the government-owned National Aquaculture Research and Development Training Centre supplied almost a third of fry and fingerlings. Notwithstanding these companies, aquaculture pre-production lacks reliable and affordable high-quality feed and fingerlings (Obwanga and Lewo, 2017). Recently, start-ups such as InsectPro and Biofit feeds produce alternative fish feed based on insects raised on discarded food or by converting the invasive hyacinth plant.

The size of the business and the technology influence capital requirements and financing channels. Small producers often have low productivity and face disadvantageous economic relations in the chain vis-à-vis input suppliers, technical services, product markets and financial services providers. Smallholders buy small quantities of fish feed and might have low total feed consumption. For example, Unga Feeds Ltd. sells 90 percent of its fish feed to only six farms, while the rest goes to hundreds of smallholder farms through cascading channels. There are also medium- and large-scale businesses using advanced technologies, usually centred on fingerling and fish feed production (Republic of Kenya, 2017). Some smallholders have moved into contract farming with medium- and large-scale outgrower businesses. Intensive fish farming might be particularly interesting for youth given the high use of modern technology that reduces drudgery.

The aquaculture chain lacks sufficient cold storage, which leads to spoilage, quality degradation and food safety issues. The post-production costs of bringing fish from Kisumu to Nairobi would involve brokerage (52 percent of total post-production costs), packaging (20 percent), transport (17 percent), taxes (4 percent), and other items (7 percent). As such, broker costs are three times higher than transport costs for fish that travels from Kisumu to Nairobi, with relatively low taxes (Bayesian Consulting Group, 2016). These high brokerage costs are prevalent in inefficient distribution systems, where a good goes through many hands that add little value but each charge for their contribution. Farmers do not always have the best market information, and this can be exploited by brokers. Fish in Nairobi is bought primarily at open markets, followed by street selling (FAO, 2017).

Traditionally, women occupied the processing parts of the chain, which included gutting, smoking, frying or sun-drying. Processing and value addition is especially underdeveloped, but is targeted by the Aquaculture Business Development Programme – ABDP (Republic of Kenya, 2017). The Aquaculture Association of Kenya has been actively linking farmers to processors and markets (Obwanga and Lewo, 2017).

2.3.2 Governance actors

The national government and several counties are actively supporting aquaculture through their agricultural budget. Previously, between 2009 and 2012, the national government stimulated small-scale aquaculture by subsidizing fingerlings, feed, and pond construction, resulting in a four-to-sixfold growth in production. The distribution of the ponds was seen as more political than logical, which thwarted their viability (Opiyo *et al.*, 2018).¹ National public support slowed due to the devolution of agricultural responsibilities to the county level. Some counties chose not to extend aquaculture budget support as their region holds little aquaculture potential. The highest suitability for aquaculture is in western and central Kenya (Republic of Kenya, 2017). Other counties, such as those belonging

¹Through the Fish Farming Enterprise Productivity Program.

to the Lake Region Economic Bloc (LREB), cooperate across counties to support their aquaculture development (LREB, 2020). As a result, public support depends on the county, with some national support given by the Fisheries State Department. Currently, twelve counties give public support to aquaculture (Rampa and Dekeyser, 2020). In 2016, the national government established the Kenya Fish Marketing Authority (KFMA) to coordinate fair markets and promote fish. The lack of a strong regulatory framework, set by the government, is mostly felt in Lake Victoria, where expansion and competition for limited space are fuelling conflict and causing environmental degradation.

Box 2 Local governments cooperate for aquaculture investments through the Lake Region Economic Bloc

The Kenyan counties of the Lake Region collaborate to support development through the Lake Region Economic Bloc (LREB). Given the devolution of powers in Kenya to counties, the LREB is a network established to work more efficiently on shared interests by the relatively small counties. As Lake Victoria is a common-pool resource, the LREB can spearhead local government coordination and governance in Kenya. The LREB's interest in aquaculture development in Lake Victoria, particularly around policy frameworks and investment mobilization, led to a jointly organized FAO AgrInvest Project-LREB workshop in 2020 concerning aquaculture investments. Better public infrastructure was identified as well, such as upgrading fish landing sites, roads, electricity, and storage facilities. The LREB wants to attract cage fish farming by investing in or lobbying for public infrastructure, lowering taxes, and providing or lobbying for suitable regulations. Moreover, the LREB aims to actively support private investment by identifying opportunities and players, promoting aquaculture cooperatives, increasing specialization and value adding, and establishing a public-private partnership committee. This committee would be a one-stop shop for aquaculture investments in the LREB region.

Without proper guidelines and management practices, "...cage farming [in Lake Victoria] is likely to be an environmental disaster" (Njiru *et al.*, 2019: 7).

Private governance in aquaculture is not as strong as in more established sectors such as dairy and livestock. Kenya has a strong history of cooperatives, boasting 22 000 cooperative societies with almost 11 million members in 2018. Agriculture is especially well endowed with cooperatives, so much so that the responsibility for cooperative development shifted to the Ministry of Agriculture. However, aquaculture, given the novelty of the sector in Kenya, has considerably fewer cooperatives. This hampers access to more affordable credit, in that applying through cooperatives can be a way to pool risk (Nyandat and Owiti, 2013).

The national private platform organization for fish farmers in Kenya is the Aquacultural Association of Kenya (AAK), boasting 15 000 members. The organization provides a stakeholder platform and serves as a link between fish farmers, the national and county governments, development partners, other farmers' organizations and stakeholders within the aquaculture sub-sector (AAK, 2020). The smaller Commercial Aquaculture Society of Kenya (CASK) likewise provides a platform for exchange of ideas, common positions and networking opportunities, but does not include subsistence production. Strengthening existing organizations can benefit the coordination and representation of actors.

2.3.3 Finance providers

There is consensus that a lack of credit is a major constraint to the growth of aquaculture. Credit is as important to intensive aquaculture as it is to semi-intensive and extensive aquaculture (Obwanga and Lewo, 2017). Cage aquaculture is particularly capital intensive in the set-up stage, necessitating long-term asset loans. Building production capacity - either ponds for fingerlings or cages for outgrowth -

represents the largest cost of the start-up. Capital can also be needed in the planning stage, for example to test suitable production sites and for the mapping of environmental impacts if permits require this. For cage production, the growth cycle of tilapia is eight months from fingerling to harvestable size. Medium-term loans (<2 years) can be necessary to bridge the set-up phase to full production. There is no contract farming similar to what is common in sugar and rice farming (Obwanga and Lewo, 2017).

Few private investors specifically target Kenya's aquaculture chain. Different needs and scales generate different financial instruments and providers, but there is a general perception that private finance providers - especially banks - lack products tailored to aquaculture's needs. Nevertheless, standard products are provided. The Rabobank Foundation, through Equity Bank, is providing loans for infrastructure expansion and production. The Kenya Women Microfinance Bank provides loans to construct fish ponds, buy fingerlings and purchase feeds. Given their reach into communities, it is likely that Savings and Credit Cooperative Societies (SACCOs) provide finance to aquaculture, but getting a clear picture is difficult due to their decentralized operations. The same goes for more informal loans: it is likely that they provide high interest credit especially to small-scale producers, but data is hard to obtain.

A host of public-led and non-profit organizations invest as well: charities like Farm Africa (€4 million input subsidies, extension support and training, and market linkages), the Tony Elumelu Foundation (seed funding), the UK AID-funded Msingi project (feed, hatcheries, and production). The Government of Kenya, through the African Finance Corporation, provides various loans for fish production. Particularly interesting is IFAD's Aquaculture Business Development Programme, a USD 143 million project aiming to expand Kenya's aquaculture sustainably between 2017 and 2026.

Another feature of the Kenyan financial sector is the intervention of a high number of impact investment funds, of which many target small and medium-sized agribusinesses through debt and equity financing (Republic of Kenya, 2017). Conservation International Ventures, for example, provided USD 500 000 in credit to Victory Farms. More miscellaneous international partners include embassies that have development projects (such as the Embassy of the Kingdom of the Netherlands through Farm Africa), research institutions with or without international research projects, non-governmental organizations and other development partners.

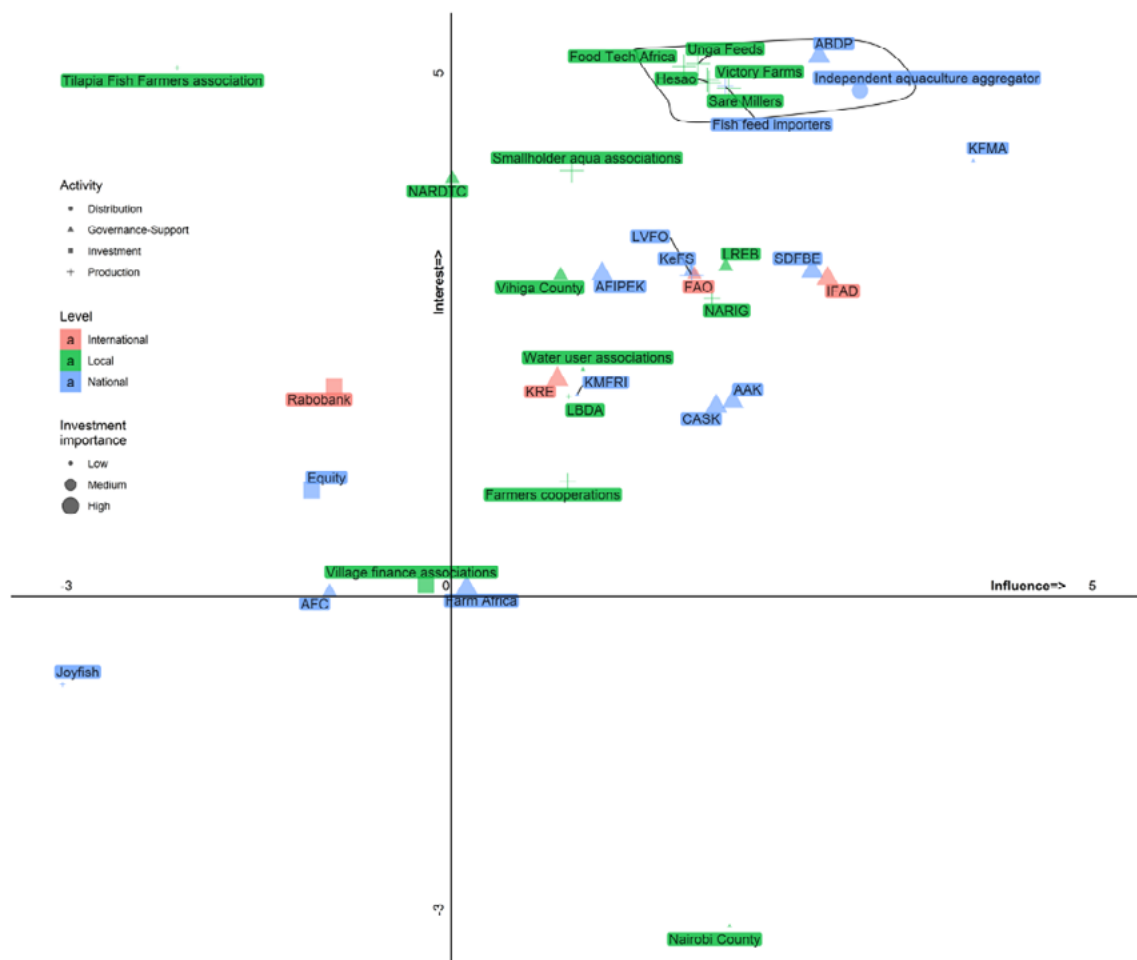
2.4 Ranking of stakeholders' interest and influence

Those stakeholders, for which sufficient information was available, were ranked according to their influence and interest in the Kenyan aquaculture chain, together with their potential for supporting or receiving investments (Figure 3). Given that FAO's AgrInvest-Food Systems Project in Kenya is partly focused on promoting sustainable investments for aquaculture value chain development, the selection of stakeholders skews towards government and support actors, companies or associations, and investors. A few observations can be made at this point. First, there are not many significant international stakeholders, with Rabobank Foundation, the Netherlands Embassy, FAO and IFAD being notable exceptions. This may explain the slow progress of the aquaculture chain, as the role of most international actors is to support aquaculture development. Second, county governments differ not so much in their influence, but strongly in their interests. Nairobi County, as the largest end market, does not prioritize fish in its agriculture policy but rather it focuses on food safety, waste, and markets. The counties around Lake Victoria are more interested in aquaculture given its importance for the local economies and livelihoods. Third, the investors identified are neither influential nor do they have a strong interest in investing. This might indicate the low profile of investors in aquaculture, or

uncertainty about their interest and influence. Fourth, a group of private actors (circled in Figure 3) mostly focused on fish input and fish farming, stands out from the other stakeholders both for their strong interest and influence. These stakeholders can be the first to be approached to intervene in the chain given their high level of interest and influence.

Figure 3 can also be used for strategic engagement with stakeholders. Those with high interest, but little influence, need a connection to the other actors in the aquaculture chain, including Rabobank and Equity bank. Those with high influence but little interest, such as the Nairobi County Government, need convincing to use their influence to advance the aquaculture chain.

Figure 3 Influence and interest diagram for stakeholders in Kenya’s aquaculture chain



Source: Visualization by Koen Dekeyser for ECDPM; data from interviews and expert validation.

Notes: Scale of -5 to 5;

AFC Agricultural Finance Cooperation; AAK Aquaculture Association of Kenya; ABDP Aquaculture Business Development Programme; AFIZEK Association of Fisheries Exporters of Kenya; CASK Commercial Aquaculture Society of Kenya; KFMA Kenya Fisheries Marketing Authority; KeFS Kenya Fisheries Service; KMFRI Kenya Marine and Fisheries Research Institute; LREB Lake Region Economic Bloc; SDFBE State Department for Fisheries, Aquaculture and The Blue Economy; NARDTC National Aquaculture Research Development and Training Centre; Hesao Hesao Integrated Fish Farming Organization; IFAD International Fund for Agricultural Development; FAO Food and Agriculture Organization; KRE Dutch Embassy; LVFO Lake Victoria Fisheries Organization; LBDA Lake Basin Development Authority; NARIG National Agricultural and Rural Inclusive Growth Project; Rabobank Rabobank Foundation; Equity Equity Bank.

3 Political economy obstacles to investments in Kenyan aquaculture

Aquaculture has favourable conditions for growth in Kenya. A rising population, declining wild catch, and increasing demand provide ample opportunities for a strong domestic-oriented aquaculture chain. To materialize these opportunities, more investments are needed. But investments in the Kenyan aquaculture chain are hampered by low productivity and profitability, and a lack of sufficient chain and regulatory governance. This section overviews selected political economy issues related to investments in Kenya's aquaculture chain while the next section provides recommendations to promote more investment in the chain.

3.1 Input costs are high while productivity is low

Input costs for fish farming in Kenya are high, particularly because fish feed is costly but of low quality. Fish feed regularly accounts for more than 60 percent of production costs in Kenya, and more than 90 percent of the environmental impact of aquaculture farming globally (Naylor *et al.*, 2021). Fish feed substitution is not regarded as a political imperative, but the current and future inability of Kenya to feed itself directly (van Ittersum *et al.*, 2016) shows the limits of using scarce land for fish feed instead of producing food for direct human consumption. When fish feed directly competes with human diets, as is the case for omena fishmeal, price rises and scarcity make it more difficult for poorer households to access high-quality protein. Growth of fish feed derived from domestic crops will thus lead to more cereal imports to satisfy Kenya's food energy needs. Ideally, future fish feed might be imported or else made from by-products or waste.

General productivity lags due to problems in managing basic production, with technical support deemed insufficient (Obwanga and Lewo, 2017; Personal communications, CASK, 22 November 2020). This includes a lack of knowledge on setting up ponds, fish densities, fingerlings selection (e.g. some farmers source fingerlings from open rivers), feed (timing, quantity, and profile) and post-harvest care. Interviewees indicate that theft of fish from cages in Lake Victoria is an issue, resulting in the policing of cages by their owners.

Only four types of fish are commonly farmed in Kenya, namely tilapia, catfish, common carp and rainbow trout. Tilapia accounts for 75 percent of production, showing the chain's heavy reliance on one type of fish (Republic of Kenya, 2017). Little, if any of the aquaculture chain is concerned with niche markets, such as shellfish or seaweed, even though molluscs and algae farming have great environmental benefits and a good nutritional profile. Fish are not often processed and value is rarely added.

Box 3 Victory Farms - rapidly scaling cage farming in Lake Victoria

Founded in 2015, Victory Farms became the fastest growing fish farm in sub-Saharan Africa by 2021, with possibly the second largest hatchery in the world. Indeed, its aim is to become the largest fish farm in the world. The farm only produces tilapia, besides a small pilot project with catfish. Fish feed comes from the global markets because of a better price, quality, and consistent volumes. But Victory Farms does support local feed providers, as increasing the supply of local feed improves resilience from foreign exchange and price swings in the global market. The fish is for domestic consumption, distributed either through one of the 38 Victory Farm retailers or sold directly to large distributors. Through the retail channel, Victory Farms integrates hatcheries, growth, and distribution vertically. The farm is driven by international investments, which offer better rates than the Kenyan capital market. Investments come from impact investors such as Conservation

International Ventures and DOB Equity, a Dutch Fund. These investments support Victory Farms' ambition to become the first carbon negative fish farm. Besides carbon, the sustainability advantages are mainly a better managed Lake Victoria ecosystem, more affordable fish, and better livelihoods through paid employment. A (wrongly, according to Victory Farms) perceived take-over of an important waterway led to a violent community protest with fishermen, but overall community relations seem to have improved. There seems to be little direct competition with traditional fishermen because they supply different market segments and a growing general fish market with limited supply. Rather, their competitors are the Chinese imports that market fish at a lower price. But projected efficiency gains at both Victory Farms and in China might close that gap, as better Chinese production would decrease their exports to Kenya, which is seen as a secondary market, but increase domestic consumption and exports to the European Union.

Victory Farms is an industrial model of aquaculture development because of its scale, vertical integration, and funding sources. Its operations are large-scale compared to inland small ponds that were the focus of the Kenyan government's stimulus programme. Victory Farms is vertically integrated with hatcheries and retail, and sources its funding from outside Kenya. Their linkages with the traditional food system are limited: local input producers cannot provide the feed and fingerlings at the quality, price and volume that international markets can provide. Victory Farms developed fast within a generally underdeveloped aquaculture sector, hence the need for international supplies. Victory Farms can compete with Chinese imports because of its scale and efficiency. To achieve the same level of efficiency and coordination with many smaller producers and distributors is not impossible, but more difficult than with a single industrial company. Kenyan companies might benefit from Victory Farms' growth by domesticating and supplying the production of inputs, starting from fingerlings and feed. While previously the low volumes of fish farming did not warrant investment in inputs, the arrival of a large player like Victory Farms might change the market and provide investment viability to more commercial input producers.

Source: Author's compilation based on interviews, Victory Farms, 15 January 2021.

3.2 Imported fish is widely available

The aquaculture chain in Kenya faces competition from domestic wild catch and imports. Wild catch does not have the same start up and input costs as fish farming, and consumers prefer its taste. But while the price of caught fish rises due to their limited availability, until recently imports rather than domestic production has profited. Particularly cheap farmed Chinese fish started to dominate Kenya's fish imports (Rampa and Dekeyser, 2020). Domestic aquaculture producers see this as dumping because of the perceived Chinese Government support of their aquaculture sector. Kenya also imports fish from Uganda and Tanzania, which occupy most of Lake Victoria's surface. The decline in wild-caught fish and rising fish demand does not necessarily lead to the development of a domestic aquaculture chain in part due to competition from fish imports.

A ban, fee or quota on fish imports can be politically difficult to create and practically difficult to enforce, and might invite protests from fish consumers, who prefer affordable fish compared with the unstable, expensive, and declining supply of Kenya's wild-caught fish. China, the largest source of fish imports, is an important trading partner and invests in Kenyan infrastructure development, among other things, and Kenya withdrew a three-month fish ban following Chinese pressure (BBC, 2019). Even beyond regional trade legal considerations, trade restrictions might be difficult to enforce in practice given the porous borders of Kenya and the considerable volume of informal cross-border trade. Imports of affordable fish provide quality protein to many low-income households. Even with imports, a gap exists between the national fish supply and the rate of fish consumption the government wants to achieve. Rather than suppressing foreign competition, it might be more beneficial for the Kenyan government to create an enabling environment for the development of a competitive domestic-oriented aquaculture sector in Kenya.

3.3 Government and elite interest is low but growing

Inadequate government regulation and enforcement constrain sustainable aquaculture development. This is particularly felt around Lake Victoria as a common-pool resource. Lake Victoria serves multiple - at times competing - demands, such as fishers' livelihoods, nature conservation, or clean water supply. Lake Victoria is responsible for 95 percent of inland fish production (LREB, 2020). The lake lacks an overarching regulation that handles the balance between social, economic, and environmental sustainability opportunities and demands. The lake is subject to regulations from different ministries and political levels, including international ones such as through the Lake Victoria Basin Commission. Current regulation is not always enforced. Regulations made in distant decision centres, which do not include the roles played by local leaders (Etiegni *et al.*, 2020), might lack the legitimacy needed to be successful in poorly-enforced areas. Insufficient enforcement is not always the fault of poor government capacity; those living around the lake "...implement what they perceive as acceptable to them based on their accepted norms and practices, influenced by informal institutions and the need to earn a livelihood" (Etiegni *et al.*, 2020: 501). For example, traditional leaders hold considerable sway. Irregular environmental enforcement increases the risks for aquaculture investments, as good water quality is crucial. Attempts by the State Department for Fisheries, Aquaculture and the Blue Economy to regulate cage farming in Lake Victoria was successfully complied with by the big producers, but not by the small ones. Without proper regulation, cage farming might continue to expand and could lead to conflict (Njiru *et al.*, 2019).

In the end, cage farming was banned for some time as haphazard implementation led to tensions with fishers for space, coupled with environmental concerns such as the introduction of invasive species and diseases. For example, waste feed from cage fishing increased the growth of the invasive water hyacinth in the lake, which at times can cover 1 percent of the shallow parts of the lake (Njiru *et al.*, 2019). This regulatory uncertainty adds risk to any investment in Lake Victoria cage culture.

Some social opposition to large cage farms raised their political sensitivity and risk. Fishers are likely to mobilize if they fear losing traditional access to fishing grounds. The lure of local jobs and more fish supply is at times insufficient to gather community support. Some large cage farms seek direct community support, for example through funding of community projects, to safeguard social peace. Community acceptance of cage farming might take some time. After all, access to the lake is seen as a traditional right and needs to be balanced against permitting private cages and exclusive farming zones. Even though it concerns public waters, marshalling the local opposition of fishers is far easier than gathering support from potential beneficiaries down the chain, such as Nairobi consumers. Marginalized communities around Lake Victoria must be identified as potential beneficiaries of aquaculture development (Republic of Kenya, 2017).

Scant elite support might be mainly due to the small economic size of the aquaculture chain and the few livelihoods that it currently provides. Aquaculture in Kenya is relatively small, and thus at times it is difficult to show its benefits. Its potential is still unproven. These dynamics can lead to a standstill in any new sector: without sufficient economic and political weight, aquaculture might not be able to muster the political and private support it needs to flourish and establish the political clout to advance its interests. Aquaculture in Kenya needs to establish a certain economic scale to overcome political economic challenges (Knapp and Rubino, 2016). Political risk (e.g. regulations and support) at the production phase might be higher than market risk (e.g. price hikes) or consumer risk (e.g. changes in preferences).

Low elite support translates into inadequate public infrastructure supporting fish production, such as landing sites without electricity or no all-season roads connecting landing sites with distribution points. The government's current extension support and training for aquaculture are seen as insufficient to bridge the gap of the poor production management and business skills of smallholder aquaculture producers and market demands (Personal communications, CASK, 27 November 2020). After production, absent regulations on fish transport contributes to spoilage and unsafe food. As regulations and standards are in place for the transport of other food, such as meats, the shortage in fish regulation might be due to inadequate government support.

Recently, the government increased their interest in aquaculture. The national government developed a robust policy and regulatory framework for fisheries that is aligned with Vision 2030. In 2011, the government identified aquaculture as the engine behind the growth of Kenya's fisheries sector in their National Oceans and Fisheries Policy. An overarching legal framework for fisheries and aquaculture was enacted in 2016 (Republic of Kenya, 2017). However, Kenya has not yet come up with a policy regarding cage culture in Lake Victoria. The Lake Victoria Fisheries Organization, an agency of the East African Community, started to draft guidelines for the establishment and operation of cage fish farming (Obwanga and Lewo, 2017). The lack of cage policies has not stopped recent initiatives, including the fastest growing fish farm in sub-Saharan Africa (Box 3). It is less clear if this also translated into better opportunities for smaller aquaculture producers.

3.4 The chain is mostly unstructured, with few cooperatives

Aquaculture aligns with Kenya's commitment to, for example, the global Sustainable Development Goals and the national Big Four agenda. This links its development with state interest, at least nominally. Both the national and local government levels have progressed on aquaculture policy frameworks, even though much still needs to be done (Obwanga and Lewo, 2017). What is worse, non-governmental governance of the chain is advancing less, with much of the chain unstructured and without much coordination.

The poorly structured aquaculture chain is not very well integrated and coordinated both horizontally and vertically, apart from large vertically integrated businesses. Businesses often operate informally, with contracts and records persistently absent. Existing organizations, such as CASK and AAK, struggle with the capacity needed to spur more chain coordination (Personal communications, CASK, 27 November 2020), and their membership base is small compared to other lobby groups representing established political and economic interests. The industry has no common voice, well-funded lobby group or message.

On the production side, most small-scale fish farmers are not sufficiently organized to enjoy economies of scale and they face a disadvantage in terms of their bargaining position in the chain, especially regarding inputs. This constrains their viability as an enterprise. In fishing communities, cooperatives remain one of the most critical catalysts of economic activities (Obwanga and Lewo, 2017). Aquaculture cooperatives formed as production and marketing clusters could make the dissemination of innovation easier and strengthen the position of small-scale producers.

But the most unstructured part of the chain is the "hidden middle", between production and consumption. Contracts are notably absent at the smaller scale, which contributes to producers' uncertainty. Larger players generally work on contract, but also integrate vertically. There is a lack of data and

oversight, but it is presumed that many people operate in the hidden middle through a cascading web of informal traders. Distribution might be a better livelihoods-of-last-choice than production because of the former's lower start-up costs. Coordinating this traditional system is challenging because it is decentralized, without much organization. But there are leverage points - such as long-distance transport and aggregation in the distribution system which can be more susceptible to intervention because there are fewer actors involved.

3.5 Uncertainty and risk hamper investments

Banks often misunderstand the capital intensity of aquaculture and have difficulty appraising risk in the chain. A particularly difficult problem for banks' risk calculation is the lack of a structured market to ensure offtake and the absence of proper records to showcase profitability to investors. Inclusivity of finance goes along gender and generational lines too: women and youth find it especially difficult to access affordable credit as they often lack collateral, a large amount of which is required to access bank loans. On the other hand, investors find it tedious to work with small-scale farmers because of limited volume, appraisal difficulty and their lack of business skills. Only when they were organized into farmers' groups or cooperatives were banks willing to engage with small-scale farmers. If banks tailored financial products for aquaculture and had a better understanding of the aquaculture chain, this could decrease transaction costs and improve efficiency, but would not strongly alter the risk-benefit equation. Kenya's aquaculture is trapped in a cycle: because of current low production and profitability, the necessary investments to increase production and profitability are not attracted. Larger farms, such as Victory Farms, bypass the national capital market and raise capital internationally. The disinterest of Kenyan banks might also be because of more lucrative investment opportunities elsewhere, such as the booming and capital intensive Nairobi real estate market. But several banks' strategies aim to increase their exposure to agriculture, making them at least nominally interested parties in any attempt to facilitate investment in aquaculture. This likely requires a better understanding of the different agri-chains on the banks' side beyond the usual horticulture, maize, potatoes, dairy and livestock. Current recorded investment mostly comes more from non-bank sources, including a large IFAD programme. But these investments have thus far not led to many aquaculture businesses transitioning from development loans to private capital. A combination of private, impact or philanthropic, and innovative financial instruments - such as index-based insurance - might be able to create the credit access and stability necessary to kick-start broader aquaculture development.

4 Recommendation: A platform to attract investments and promote sustainability

4.1 A multi-stakeholder platform can coordinate actors

A multi-stakeholder platform can bring about the coordination needed to attract private investment while promoting sustainability improvements that bring in impact finance and increase the chain's long-term viability. Multi-stakeholder platforms regularly bring relevant actors together to share information, discuss improvements, build trust, facilitate compromises, coordinate action and monitor development impact (Bizzotto Molina et al., 2020). The platforms can mobilize and coordinate resources from different stakeholders to solve a common issue that no stakeholder can tackle alone (HLPE, 2018). Currently, Kenya's aquaculture chain is loosely structured and this impairs investments. For example, interviewees indicate that failures of past programmes were partly due to their limited focus, such as focusing on production improvements but not on distribution networks or consumer sensitization. In the workshop, interviewees were confident that an across-the-chain approach, focused on coordinating between businesses, would create a better business case. Once the business case is made, "money follows money, just get the business case in order and finding the money is not a problem. They [financers] will be lining up." (Personal communications, 27 January 2021). Coordination of business-to-business can be anchored on the LREB's public-private partnership committee (Box 2), which aims to be a one-stop shop for aquaculture investments.

4.2 More coordination can attract investment

A multi-stakeholder platform can increase coordination along a now largely unstructured chain, which is considered one of the main obstacles for investment. Several obstacles were raised by the interviewees that can be tackled, with suggestions for discussion points for the platform set out in Table 2. Locally-owned platforms do their own agenda setting and establish their own functional procedures, thus these discussion points are mere suggestions. Not all obstacles can be dealt with within a platform. But the platform can build the chain's representation and lobbying power in dealing with other private and political elites when opportunities to address these issues arise - such as enforcing environmental regulation in Lake Victoria.

Interviewees wanted the platform to tackle the need for better public aggregation, supporting cooperatives for input buying and marketing, and to discuss training in the value chain. A platform might be more successful in lobbying for public infrastructure such as public aggregation centres, and their locations, or they could facilitate food safety training along the chain. But the main point is the need for a better business case for the cage aquaculture chain and how to obtain financing. Interviewees indicate that a business case that involves actors along the cage chain (inputs, producers, distributors and support actors) is a good way to decrease uncertainty, which can bring financiers on board. For example, a business case can be built around an assured offtaker, with contracts between fingerling producers, innovative feed companies, farmers and an offtaker for fish production and distribution. This assured offtake could create a degree of security that could spur investments for those involved, differently from the current scattered and informal business dealings. By incorporating sustainability elements and improvements in the business case such as innovative feed or inclusivity for poorer groups, the platform can attract sustainability-focused financial institutions and blend capital. Which financial instrument works best for each part of the chain and actor is to be further discussed within the platform.

Table 2 Selected discussion points for a sustainable aquaculture stakeholder platform

Area	Topic
Governance	Chain representation
	Government regulation
	Coordinated policy across departments
	Cooperatives formation
	Whole-of-chain approach
	Food safety regulations
Sustainability	Public aggregation support
	Inclusivity through cooperatives
	Innovative feed
	Improved production management training
	Technology upgrading
	Product diversification
Finance	Decent livelihoods for all
	Tailored products
	Improved risk assessment
	Blending finance
	Contract support

Source: Authors.

4.3 Homegrown innovations and inclusivity can improve sustainability

Improving sustainability is not only crucial for long-term viability but can also attract sustainability-focused financial institutions, which can offer more favourable conditions than Kenyan private capital. Aquaculture sustainability concerns (Table 2) range from social (e.g. inclusivity of smallholders, youth and women) to environmental (e.g., more sustainable fish feed) and economic (e.g. improving profitability). Socially, including informal and marginalized actors - such as smaller producers and distributors - increases the development benefits. While the issue of producer cooperatives was raised, small actors operate along the whole value chain, opening up opportunities for improved organizations beyond only producers. While certainly not easy, more inclusive opportunities may also be found in the distribution segment. At the moment, the distribution system is changing through vertical integration driven by larger companies, which are generally less inclusive of smaller enterprises.

Of particular environmental concern is fish feed and water pollution, specifically the need for environmentally sustainable feeds. Homegrown innovations abound, with companies producing fish feed from waste and an invasive species. Economically, establishing and supporting cooperatives can be a way to better include smallholders by pooling knowledge, lowering transaction costs, and achieving economies of scale. For example, buying inputs through cooperatives can likewise increase profitability. This can increase profit margins and provide better livelihoods.

Resolving each of the sustainability points in Table 2, or dealing with all the points together, raises the sustainability profile of the aquaculture chain. But sustainable business cases can attract impact investors with more favourable financing conditions such as longer repayment terms as well.

² A selection of (impact) agricultural investment funds can be found at <https://www.inclusivefinanceplatform.nl/agtech-funds>

4.4 Building towards a sustainable aquaculture stakeholder platform

A strong facilitator is crucial to maximize the platforms' advantages and minimize disadvantages. Building the necessary common language, trust, and agreement necessarily takes time. Because of the many actors involved, transaction costs can be high. It needs to be made clear, especially to private sector stakeholders, what there is to gain. Lastly, large power asymmetries and different capacities need to be addressed to safeguard the inclusivity and effectiveness of any platform. For example, less powerful actors can be supported through dedicated sessions that prepare for the actual platform meeting (Bizzotto Molina *et al.*, 2020).

Some of these platform establishment costs can be reduced by linking to existing platforms or processes. Interviewees identified some platforms, but none were seen as particularly promising from a (cage) aquaculture chainpoint of view. The LREB's interest in aquaculture development in Lake Victoria was seen as promising because of its regulatory power and legitimacy (Box 2). Regulatory support is necessary to make cage aquaculture attractive for smaller players. To move forward, the participants of the two AgrInvest-FS workshops, which cover a range of aquaculture chain actors, can further discuss how a broader multi-stakeholder platform would work. The final group should be expanded by a more diverse group of finance and distribution actors, such as impact and development investors, and informal and formal fish distributors. Figure 3 can inform strategic actor selection but this needs to be progressively expanded.

A further discussion phase within the platform is necessary to flesh out the best combinations of actors, technologies and finance to build a sustainable business case. Would this include supporting cooperatives, or rather would it work better with the larger producers? What sort of distribution model would be supported, and how inclusive to more marginalized groups can that be? What are the right financial instruments to support, and is it possible to create more innovative products? It is difficult to plan the discussion points for a locally-owned platform, but several suggestions are given in Table 2.

5 Conclusions

More investment in aquaculture can contribute to Kenya's attainment of several Sustainable Development Goals. Cage fish farming in Lake Victoria is seen as especially promising because of its lower land opportunity costs. There is considerable large-scale development of this cage fish farming chain, but demand still outstrips supply. Attracting more investments - and aiming for maximal sustainability returns on each Kenyan Shilling invested - can be helped by a whole-chain approach, which builds stronger business cases by coordinating a value chain that is currently mostly unstructured. A multi-stakeholder platform can be the place to discuss this coordination, but it can also develop lobbying power to address the governance issues beyond business cases, such as environmental regulation.

There are many different investors with different mandates active in Kenya. The regular private capital market has shown little interest in aquaculture, with high demands for collateral and non-tailored instruments. With insufficient data in an unstructured chain, risk and uncertainty are deemed high. But regular private investors have the appetite to invest more in agriculture, and there are impact investors and other investors with more favourable capital conditions willing to invest in sustainable business cases. Building such cases is a good way to attract finance on good terms and create long-term viability.

A sustainable aquaculture stakeholder platform is thus the place to build sustainable business cases that aim to attract different finance streams. Both the AgrInvest-FS workshops and the LREB could be tapped into for such a platform, with subsequent discussions shaping the best way forward. The AgrInvest-FS project can support such processes and the aquaculture chain in terms of facilitation, stakeholder involvement, networking, and providing further analysis.

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