

**International
Institute of
Social Studies**

Erasmus

RESEARCH PAPER

**Unpacking the Feasibility of Upgrading Strategies
in Kenya's Emerging Aquaculture Sector
Claims vs. Realities**

by:

CHELSEA ELLINGSEN

United States

in partial fulfilment of the requirements for obtaining the degree of
MASTER OF ARTS IN DEVELOPMENT STUDIES

Major:

Agrarian, Food, & Environmental Studies

(AFES)

Supervisor:

Dr. Lee Pegler

Second Reader:

Dr. Peter Knorringa

The Hague, The Netherlands
2022

Disclaimer:

This document represents part of the author's study programme while at the International Institute of Social Studies. The views stated therein are those of the author and not necessarily those of the Institute.

Inquiries:

International Institute of Social Studies
P.O. Box 29776
2502 LT The Hague
The Netherlands

t: +31 70 426 0460
e: info@iss.nl
w: www.iss.nl
fb: <http://www.facebook.com/iss.nl>
twitter: [@issnl](https://twitter.com/issnl)

Location:

Kortenaerkade 12
2518 AX The Hague
The Netherlands

Abstract

This study seeks to illuminate the feasibility of upgrading pathways in Kenya's aquaculture sector, with a specific focus on fish cages situated on Lake Victoria. Possibilities for businesses, fish farmers, farm workers, fish traders are examined. This is explored through borrowing concepts from social enterprise and class-based Marxist agrarian political economy. Previous research has indicated there is a weak link between business expansion (economic upgrading) and beneficial outcomes for workers (social upgrading). The broad strokes for what is needed for a commercially viable aquaculture enterprise are defined, followed by the impact various business models can have on the value chain. Constraints of fish farmers are further elucidated through mapping of value chains. Particular attention is paid to risk and uncertainty. My argument is that the feasibility for social upgrading in aquaculture depends on the positioning of the actor, and that this is magnified by social differentiation.

Relevance to Development Studies

The role of small-scale fisheries to rural livelihoods is indisputable (March, Failler, 2022, p. 1). Fish is regarded as a linchpin for food security (Rothuis, 2011, p. 53, Fiorella *et al*, 2015). Unlike sugar, cotton, or coffee, fish provide irreplaceable nutrients fundamental for brain development, including Omega 3s, long chain fatty acids, vitamins (B, D), minerals (calcium, phosphorous) (Moreau, 2018, p. 831). Unsold fish can be consumed by the household.

Kenya has a massive fish deficit. The national per capita fish consumption is 4.7 kg, half of the global average of 10 kg (Kimani *et al*, 2018, p. iii). Kenya has been importing frozen Chinese Tilapia to meet the gap (Obwanga, 2017, p. 14). Kenya's population has surged to 55 million, and is expected to increase by one million each year at 2% (World Bank, 2022). With the Lake Victoria fishery in steep decline, the aquaculture sector has received renewed attention and funding (Kimani, 2018, Mena Report, 2018). With the sector poised for new growth, much more needs to be understood about the potential impacts and fallout for upstream actors. Studies tend to emphasise income opportunities and neglect the level of risk being faced by smallholders (Ponte, 2008, p. 6). It is imperative to better understand how the risks and benefits to participants in aquaculture are distributed, and to see how risks can best be mitigated. This would allow participants to upgrade without undue hardship.

Keywords

Aquaculture, cage fish farming, Kenya, economic/social upgrading, local value chains

Acknowledgements

This would not have been possible without my many hosts in Kenya, who showed me the true meaning of hospitality. Thank you for all of the wisdom and the fish. Thank you to Megan for exemplifying curiosity and facilitating the re-discovery of Dr. Suess rhymes. Thank you to Karen for the unwavering support and belief, especially when I didn't have it, whether it was for interviews, Temp shifts or writing this. Thank you to Haris and Mariya for the uncountable discussions on Islamic epistemology and for showing resilience in crazy times. And also for cooking me dinner every night during Ramadan, even though I didn't fast. I would also like to thank my second reader Peter Knorrninga for clutch references and for Lee Pegler's guidance and patience.

List of Acronyms

BMU- Beach Management Unit, decentralised government structures who are the local authorities managing the beach and the adjacent lake waters.
ESP – Economic Stimulus Plan – Federally funded backyard pond fish farming program initiated and funded by the government of Kenya from 2009-2013.
GIFT – Genetically Improved Farmed Tilapia
GIZ - Government of Germany aid agency
GoK – Government of Kenya
GVC – Global Value Chain
GPN – Global Production Network
GSMA – Group Speciale Mobile Association. An industry organisation of 750 mobile operators who fund climate resilient SMEs.
IDH – big international non government organisation funded by Dutch government who fund business driven approaches to sustainable development
KEBS – Kenya Bureau of Standards
KSH– Kenyan Shillings, national currency. €10= Ksh1.200 KES (11/22)
KESAP – Kenya Climate Smart Agriculture Project, funded by World Bank
KMFRI – Kenya Marine Fisheries Institute, Research arm of the government
FFS – Fish For Sex, known in Luo as *jabooya*. Transactional sex practises that occur between female fish traders and fishermen.
INTELLECAP – donor advisor for gender responsive interventions
NUTRECO – Dutch Fish Feed Manufacturer
RAS – Recirculation Aquaculture System, an intensive form of aquaculture with indoor cages in a controlled setting.
SME – small medium enterprises

Table of Contents

<i>Abstract</i>	ii
RELEVANCE TO DEVELOPMENT STUDIES	II
LIST OF ACRONYMS.....	III
CHAPTER 1 NO TRICKLE-DOWN EFFECT.....	2
1.2 SOCIAL CONSEQUENCES OF FISH SCARCITY	3
1.3 SOCIAL DIFFERENTIATION OF FISHERFOLK	4
1.4 RESEARCH OBJECTIVES.....	5
<i>Research Question</i>	6
CHAPTER 2	7
LITERATURE REVIEW	7
2.2 CONCEPTUAL FRAMEWORK.....	9
CHAPTER 3 METHODOLOGY AND METHODS	11
CHAPTER 4 DATA COLLECTION.....	15
CHAPTER 5 NUTS AND BOLTS OF A SUCCESSFUL FISH FARM.....	18
CHAPTER 6	20
KENYA’S AQUACULTURE VALUE CHAIN	20
CHAPTER 7 ECONOMIC UPGRADING FOR LAKEFRESH	25
1 <i>Business Improvement</i>	25
2 <i>Functional Upgrading</i>	27
3 <i>Closer Value Chain Cooperation</i>	28
CHAPTER 8 SOCIAL UPGRADING FOR FARMER-OWNERS.....	30
8.7 SOCIAL UPGRADING FOR WHOM?	33
CHAPTER 9 THIEVES, SPOILED FISH, CASHFLOW: RISKS OF BUSINESS	35
9.6 <i>Environmental</i>	36
CHAPTER 10 FINAL THOUGHTS	39
REFERENCES CITED.....	41

List of Figures

FIGURE 1 VISUALISATION OF FRAMEWORK (RIISGAARD ET AL, 2010, P. 201)	11
FIGURE 2 MAP OF LAKE VICTORIA, EAST AFRICA.....	12
FIGURE 3 KENYA -- LAKE VICTORIA.....	13
FIGURE 4 THE BLACK STARS REPRESENT WHERE MY RESEARCH WAS. THE CITY OF KISUMU, OGAL BEACH IN KISUMU COUNTY, AND BEACHES NEAR USENGE IN SIAYA COUNTY..	13
FIGURE 5 LOCAL FISH VALUE CHAIN.....	22
FIGURE 6 REGIONAL FISH VALUE CHAIN.....	24

List of Tables

TABLE 1 INTERVIEWS.....	18
TABLE 2 IN-DEPTH INTERVIEWS	18
TABLE 3 FOCUS GROUPS	17
TABLE 4 GROUP INTERVIEWS.....	18
TABLE 5 LAKEFRESH ECONOMIC UGRADING STRATEGIES	32
TABLE 6 LAKEFRESH FISH GRADES PRICE SHEET	34

Chapter 1 No Trickle-Down Effect

If a fair share of the significant 'benefits' from international trade (. . .) does not reach those who labour to produce it, the problem is indeed importantly with the structure of trade and the nature of control over it (Kurien, 2004, p. 73, cited in Béné et al, 2010, p. 933).

When assessing the impact of export fish trade on local fishing households across sub-Saharan Africa, Béné, Lawson, Allison failed to find any empirical evidence that would indicate a trickle-down effect (2010, p. 948). They did find that regional, low-value fish markets remain chronically under-supplied of fish, and that sub-Saharan Africa is the only part of the world with rising demand for fish yet falling consumption. They emphasise the integral role small-scale fisheries play in African economies, and they recommend focusing efforts on revitalising an “Africa-for-Africa” fish trade to impact rural livelihoods directly (Béné *et al*, 2010, p. 934). Studies on the Chad Lake Basin and the Democratic Republic of Congo have drawn much needed attention on the vitality of local markets (Neiland *et al*, 2004, (Béné, Steel, 2009, Medard *et al*, 2019).

Kenya’s Nile perch fishery on Lake Victoria epitomises the corrosive effects of the export fish trade (Abila and Jansen, 1997, Béné *et al*, 2010, Molony, 2007). At the height of the Nile perch boom in the 1990’s \$600 million was recorded on annual trade ledgers, while “the industry siphoned jobs, food, and livelihoods away from the surrounding fishing communities”¹ (Gibbon, 1997, Ogello *et al*, 2013, p. 107, Opondo *et al*, 2016, p. 202). The city of Kisumu, the site of 80% of the fish filleting factories, had the nation’s highest malnutrition and poverty rates for a municipality (Béné *et al*, 2010, p. 936). The status of small-scale fishermen and traders fell over time, in stark contrast to the soaring fortunes of the fish factories. (Ndanga, 2015). One prospered while the other struggled. In light of this troubling dichotomy, more equitable and livelihood strategies need to be prioritised. Aquaculture has been floated as one such alternative, but the sector has had anaemic growth (Farm Africa, 2016, Kimani *et al*, 2018, Obiero *et al*, 2019).

LakeFresh: An Alternative?

Luke Okech, a social entrepreneur born and raised in Kisumu, founded the company LakeFresh in 2019 to kickstart Kenya’s aquaculture value chain. LakeFresh provides quality inputs to smallholder fish farmers and links them to markets. Luke is pioneering a bottom-up, farmer-powered **business model** to generate sustained income for fishing communities on Lake Victoria’s shore. The stated goals, progress and plans of Lakefresh will be examined to see how a growing startup can improve the outcomes of its suppliers.

¹ Quoted, and paragraph paraphrased from Ellingsen (2022) “Exposing the Inherent Contradictions in “Modernity: The Case of the Nile Perch ‘Boom’ in Lake Victoria, Kenya” Politics of Agrarian Transformations

Setting the scene

In this paper I navigate between two juxtaposed fields: social entrepreneurship and Marxist Class-based Agrarian Political Economy. The evangelists of social enterprise—foundations, impact investors, government development agencies—fund market-based solutions to complex problems. Their underlying assumption is that scaling a business leads to better outcomes for workers.

Scholars who subscribe to a more Marxist orientation problematise this assumption. They see inequality as the bedrock of capitalism and exploitation as a prime driver of business (Gerber, Raina, 2018). Their studies argue the opposite of social enterprise world: the expansion of a business leads to worse outcomes for workers (Selwyn, 2013, Mayer and Pickles, 2011). Borrowing from these two approaches, I seek to uncover whether a company upgrading does result in better bottom lines for their workers.

I first provide a foundation for understanding the current predicament of fisherfolk through a Marxist historical analysis. Once we have set the scene, I then leave Marxism at the door and pick up capitalism, to see how helpful it is. I do not disavow capitalism, but don't think it should be adopted unconditionally. A full embrace of Marxism would send me into gridlock, and at the end of the day I am a realist who wants to see practical solutions being applied.

The rocky path of realistically accepting a capitalist framework while staying cognizant of the detrimental effect structural forces, past and present. To that end I am not here to villainize the sector and produce a blistering critique all that is wrong, as this can be its own fallacy. Rather than stand here and point out all that is wrong (cite HIV articles, ineffective BMU's, corruption) I prefer to leave aside the wider questions of aquaculture and focus attention on something more practical: on the entry and participation of fish farmers. I am also primarily interested in the meso-level of change, as policies and governance feel too intangible and out of reach. Seeing how to carve a way through these two is the what is propelling me to write this RP.

1.2 Social Consequences of Fish Scarcity

Fisherfolk—fishermen, fish traders, fish farmers— occupy the weak links of the fish value chain. They combat numerous obstacles and entrenched inefficiencies. Lake Victoria wild fish harvests peaked in 1994 and have been in steep decline (Ikiara, 1999, p. 24, Ogello *et al*, 2013, p. 103-104). Overfishing, silting, fertilizer runoff, and eutrophication have been the main contributors (Odada *et al*, 2004, p. 14, Ogello *et al*, 2013, p. 101). The households relying on the freshwater fishery for their livelihood are under threat (Obiero *et al*, 2015, p. 148).

Dwindling fish stocks exacerbate the transaction costs for traders. (Mojola, 2010, p. 153). Fish traders have difficulty securing reliable sources when they need to liaise with boats that arrive at different times of the day at different beaches (Fiorella *et al*, 2015, p. 329). Muddy, dirt roads and inadequate public transport hamper access to markets. Lack of cold chain storage also increases

the risk of spoilage significantly, and this can be more than 30% of harvests (Béné *et al*, 2010, p. 948).

Aquaculture has been floated as a solution, but fish farmers have struggling to have viable ventures. **This research will examine upgrading and inclusion pathways and how feasible they are under the circumstances for the given actors.**

1.3 Social Differentiation of Fisherfolk

Beginning in the 1980's, the Nile perch boom supercharged Lake Victoria into the world's largest inland freshwater fishery (Kimani, 2018 p. vii). Prior to the introduction of Nile perch, the lake was teeming with hundreds of cichlids and many other fish species that women traded in nearby markets nestled near the lake (Geheb, Binns 1997, p. 73). When 300 cichlid species became extinct after being decimated by the Nile perch, women were "...forced out of their fishing spaces" (Lwena *et al*, 2012, p. 204). Men moved in and became exclusive traders of Nile perch, and women were shunted into the less profitable *omona* (silver cyprinid, *Rastrineobola argentea*) (Medard *et al*, 1996, p. 6). By the mid-1990's, the fish factories had created 2.400 temporary job contracts, and had pilfered at least 15.000 jobs from the local economy, mostly from women (Abila, Jansen, 1997, p. 24).²

The emergence of fish factories in the 1980's along the shore of Lake Victoria ignited more intensive fishing (Ogello *et al*, 2013, p. 107). The fish become harder to find, and more capital was invested to travel farther, faster, to deeper waters (Mojola, 2010, p.152). This was reflected in the downward trajectory of the catch per unit effort (CPUE) for Nile perch (Ikiara, 1999, p. 52, Nyamweya *et al*, 2020, p. 1). Motorized boats, modern nets and hooks became necessary to catch the heavier Nile perch (Odada *et al*, 2004, p. 17). Local fishermen often did not have the funds to make these types of investments, and they lost status to those who did (Medard *et al*, 1996, p.7).

"The process of social differentiation was further pushed along by banks, who did not see fishermen as reliable and did not offer credit. This effectively left fishermen looking for who could, instigating the "mortgaging [of] the fishermen" to fish factories and were financially penalised if they tried to leave (McCormick, 2007, p. 227; Jentoft, 2010, p. 359). Their ranks were swelled by men migrating from other parts of the country and by struggling farmers who were faced with falling commodity prices' after neoliberal reforms hobbled their earning potential ³ (Mojola, 2011). Continued upgrades have resulted in

² Paragraph paraphrased from Ellingsen, C., 2022, p. 3. "Sustainable Rural Livelihoods Approach or Marxist Agrarian Political Economy: A Comparative Perspective to Probe Lake Victoria's Fishery." Politics of Agrarian Transformations.

³ Quoted from Ellingsen, C., 2022, p. 5. "Sustainable Rural Livelihoods Approach or Marxist Agrarian Political Economy."

Uganda and Kenya's fishing sector becoming eight times as effective since the year 2000, which has further strained the fishery (Nyamweya et al, 2020, p. 1).

Government Introduction of Aquaculture

Grappling with the aftershocks of the Great Recession and post-election violence, GoK launched the Economic Stimulus Programme (ESP) in 2009 for three years (Amankwah, 2018, p. 427). The overarching aim was to promote economic growth; investing in aquaculture was seen as a key avenue to bolster rural livelihoods (Omwoma *et al*, 2014, p. 209). The government dug 48,000 backyard fishponds (Obwanga *et al*, 2017). Pre-ESP, there were 4,742 fish farmers who harvested 4,452 mt (Obiero *et al*, 2019, p.1691, Abwao *et al*, 2021a, p. 3). In 2012, the number of farmers grew ten-fold to 49,050 (Obiero *et al*, 2019, p. 1691), and in 2014, harvests were 24,096 mt (Abwao *et al*, 2021a, p. 3). Following changes to the constitution, administration of ESP shifted from the national government to the municipality (Abwao *et al*, 2021a, p. 3), and subsidies for feed and fingerlings were withdrawn. Later studies (Jacobi, 2013, Farm Africa 2016, Obwanga *et al*, 2017) showed that most participating households had low or subsistence-level production. The sector has had sluggish growth since. Producers are beset with poor quality fish feed and fingerlings, low access to credit to afford the latest technology, and the ever-present risk of theft (Obiero *et al*, 2019, p. 1701).

1.4 Research Objectives

I see this as an opportunity to go beyond unpacking the struggles and marginalisation of fishing households (see Waiyaki, 2014), and look more closely at the available livelihood options offered by a strengthened aquaculture value chain. I am using a conceptual framework, developed by Riisgaard *et al* (2008), that is designed for smallholder upgrading in developing countries. They go beyond dynamics of and between value chains actors to incorporate "horizontal" elements: environment, poverty, labour, gender (Riisgaard *et al*, 2008). I look first at how upgrading by LakeFresh impacts income generation for fish farmers, and traders. To include poverty I look at risk and understand the environment as part of risk, with corresponding objectives. In light of increasing social differentiation and the possibilities for aquaculture's benefits to be inequitably distributed, I also investigate workers employed on fish farms.

Overall Objective:

Investigate upgrading pathways along the aquaculture value chain in Western Kenya.

Horizontal Objectives

1. Poverty:

1.1 Identify risk factors faced by different levels of fish farmers and fish traders from participating in the aquaculture value chain.

- 1.2. Investigate the two-way directional flow of risk posed by Lake Victoria.
 - 1.2.1. The risks to **fish farmers** by situating their cages on Lake Victoria, instead of backyard ponds.
 - 1.2.2 The risks to the **lake ecology** from the farming methods of fish cages.

2. Labour

- 2.1. Articulate the possibilities for social upgrading for workers on fish farms.

Research Question

To what extent does Kenya's aquaculture value chain offer feasible upgrading pathways?

Sub Questions

1. To what degree is social upgrading a consequence of economic upgrading? When and Why?
2. How can small scale fisherfolk socially upgrade?
3. How does participating in aquaculture expose fisherfolk to risk?

Chapter 2 Literature Review

Global Value Chains

The Global Value Chain framework was developed in the early 1990's (Gereffi, 2018). It is a multi-disciplinary tool for analysing trade flows by making visible the flow of products and services from creation to disposal. There are two basic guides for analysis: the "top-down" and "bottom-up" perspectives (Gereffi, 2018, p. 347). Top-Down is the big picture view, taking into account the larger world the chain is operating in and how this inhibits or fosters growth (Gereffi, 2018, p. 347). Known as governance, it is constituted of legislation, the policy framework, global trade treaties, societal mores (Haggblade et al, 2012, p. 4). "Bottom-up" is looking at strategies employed by industries, organisations, and producers to move into more profitable sections of the chain, referred to as "upgrading" (Gereffi, Fernandez-Stark, 2018, p. 307).

Value Chain Upgrading

GVC scholarship was at first concerned with interactions between multinational corporations and global supply chains in manufacturing industries such as shoes and clothing (Kaplinsky, 2002, p. 78, Gereffi, 1999). As these chains gained traction and grew, this was called "Industrial Upgrading" (Barrientos et al, 2010, p. 6). As the GVC framework expanded, it was applied to other types of businesses: call centres, tourism, horticulture (Taylor, Bain, 2005, Bernhardt, Milberg, 2011). To include these diverse sectors, the more general "Economic Upgrading" was adopted (Barrientos et al, 2010, p. 6). Economic Upgrading is further broken down below, adapted from Humphrey and Schmitz (2002).

Process upgrading: Processes become more efficient and less time-consuming (Kaplinsky, 2002, p. 38). This can mean mechanisation, i.e., a tractor instead of manual labour (Barrientos *et al*, 2018, p. 232).

Product upgrading: Better, improved product lines that sell for higher value, that need more skilled workers (Barrientos *et al*, 2018, p. 232).

Functional upgrading: when companies outsource and/or enter a new segment of the chain to increase profits, i.e., change from growing oranges to transporting and distribution (Barrientos *et al*, 2018, p. 233).

Chain upgrading: when a company enters a value chain in a new sector or invests in technology that enables new market entry (Kaplinsky, 2002, p. 38, Barrientos *et al*, 2018, p. 33).

Social upgrading

A weakness of this framework is that labour was treated as an ancillary part of production (Barrientos et al, 2018, p. 233). Adding in labour to value chain studies mandated closer analysis of impacts, positive and negative, on workers themselves, not just as a variable affecting productivity (Newsome *et al*, 2015). How do chains affect the number of jobs available? How feasible is it for smallholders to gain skills to move up the chain? (Bolwig, 2010, p. 182). This spotlight on workers was later conceptualised as social upgrading, which can

broadly be understood as advancing working conditions and workers' rights. It can be viewed through quantitative metrics, such as the number of people employed and the change in income levels (Milburg, Winkler, 2012). Or the hours worked, skills acquired, ratio of formal and casual contracts, and availability of benefits such as maternity leave, freedom to join a union (Barrientos, Gereffi, Rossi, 2018, p. 233). Studying social upgrading qualitatively looks at harder to measure concepts: autonomy, "voice," security (Pegler, 2015, p. 929).

Economic Upgrading = Social Upgrading?

An underlying assumption in the mainstream upgrading literature and the development sector at large is social upgrading goes hand-in-hand with economic upgrading (cite). Ben Selwyn points out that this originates from neo-classical economics, not in verifiable studies (Selwyn, 2013, p. 79). Rather than steady gains, researchers have found that workers in the global south in supply chains experience less security and a slump in wages over time (Shaffer *et al*, 2019).

Despite this data, this assumption has persisted over time, finding new resurgence in the expansion of social entrepreneurship. The guiding ethos of social enterprise is that business is a force for social good, and the way to maximise impact is through scale (Acumen, 2022).

Scholars hailing from the more Marxist tradition offer a counter perspective. For Ben Selwyn, a glaring weak link is the refusal to consider the inherent exploitative relations at the heart of how businesses operate (2013, p. 76). This capitalist logic ensures the game is rigged at the outset. His research in grape value chains in Brazil shed light on how a firm upgrading led to downgrading of workers (Selwyn, 2013). He further argues that improvements come from worker agency and the ability to organise, not top-down reforms (Selwyn, 2013, p. 84).

Bridget O'Laughlin calls for development researchers to turn their gaze from documenting rural livelihood strategies (see Scoones, 2015), and unpack the structural causes of poverty and the role of class relations (2002, p. 527). In her analysis of farmers in Mozambique she found that the history of rural enslavement and the struggle to end it resulted in the commodification of 'labour-power,' and that households were forced to grow foodstuffs for the market (O'Laughlin, 2002, p. 516). For O'Laughlin, it is a missed opportunity when class struggle—defined as resistance to oppressive power structures—is replaced by surface-level analysis of a producer's capabilities (O'Laughlin, 2002, p. 515). It promotes band-aids as a poverty response, rather than highlighting the conditions that fomented the solidification of poverty in the first place (O'Laughlin, 2022, p. 527).⁴

⁴ Paraphrased from Ellingsen, C., 2022, p. 4. "Sustainable Rural Livelihoods Approach or Marxist Agrarian Political Economy: A Comparative Perspective to Probe Lake Victoria's Fishery." *Politics of Agrarian Transformations*.

Examples of the type of scholarship that heeds O’Laughlin’s call are from Ponte, 2008, du Toit, 2009, van der Heijden, Vink 2013. Researchers van der Heijden and Vink (2013) say that the typical conceptualisation of barriers facing smallholders in the Global South puts the responsibility on the smallholders themselves. If only smallholders had the “magic cure” the right technology, crop variety, fertilizer, they would successfully integrate modern value chains (van der Heijden, Vink, 2013, p.82). They re-frame the issue by asserting that the problem is the structure of the market, not how to access it. They detail how the interests of supermarkets are at odds with smallholders, and that this gap widens as supermarkets consolidate (van der Heijden, Vink, 2013, p. 82). To optimise their supply-chain management, supermarkets buy from ever-larger producers or wholesalers. Their requirements for suppliers keep increasing, such as pre-packing and labelling produce (van der Heijden, Vink, 2013, p.72).

But perhaps their strongest evidence comes from studies in the United States and the UK, with long histories of supermarkets who completely shut out smallholders in their procurement (van der Heijden, Vink, 2013, p. 82). And indeed—the survival of American small farms has been credited to the creation of alternative food and distribution networks such as farmer’s markets and community supported agriculture (Goodman et al, 2012). As more African countries see a rise in supermarkets, this study problematises the assumption that joining modern value chains should be the goal. Kenya has its own turbulent supermarket to be discussed later, but one detail epitomises the barriers put in place. When the French supermarket Carrefour first wanted to enter the Kenyan market, one of their terms for joining their supply chain was a non-refundable fee of Ksh 1.4 million (\$14,280 USD) (Business Daily Africa, 2015). Just this clause effectively excludes many smallholders. These are useful analyses to have in mind. This study provided empirical evidence that economic upgrading (by supermarkets) led to social downgrading (or outright exclusion) of smallholder suppliers. It makes a stronger case for alternative distribution channels for smallholders offered by aggregators such as LakeFresh.

2.2 Conceptual Framework

Riisgaard and Bolwig built on the upgrading strategies formulated by Humphrey and Schmitz (2002) for a framework specific to small scale farmers in agri-food production in the Global South (2008, 2010). Instead of treating value chains as “stand alone” they incorporated “horizontal” and “vertical” elements (Riisgaard et al, 2008, p. 3) They are looking to form a bridge between a knowledge of local realities, to the wider political forces, and the nexus between value chain actors (Riisgaard et al, 2008, p. 3). They have further strengthened the framework by looking at “gender, poverty, environment” (Riisgaard et al, 2008, p. 3). They see discussions centred on upgrading as rigid and ignore the conditions shaping producer’s participation in chains (Riisgaard, et al, 2008, p. 4). They emphasise that many aspects of improvement need to be done by actors located far away from the producers (2008, p. 4).

3.1 “Improve process, product or volume” Internal Company

The first set of practises is about having smoother, more efficient operations and production, through financial investment and hiring more skilled workers.

- “**Process**” Adopting practises that make the farm or cooperative run better, updated marketing plan, better record-keeping of expenses.
- “**Product**” more valuable product lines, adding eco-labels like Fair Trade, organic.
- “**Volume**”: expanding sales of crops by intensification or putting more land under cultivation, or higher amounts of lower priced goods (Riisgaard *et al*, 2010, p. 198)

3.2 “Change or add functions” Multiple Business Activities

“**Functional upgrading**” Farmers move beyond direct production to either “downstream” marketing, aggregating, value-addition, or “upstream,” selling of inputs, e.g. chicken farmers switch to sell feed, chicks, or services like insurance. coordination (Riisgaard *et al*, 2010, p. 198)

3.3 Improve value-chain co-ordination

Given the very real constraints facing smallholders, enhancing the network and coordinating abilities between actors is of paramount importance (Riisgaard *et al*, 2010, p. 198). Given the propensity for smallholders to endure high transaction costs in local markets, common issues are: high fragmentation, opaque markets, little enforcement of quality control, reducing incentives to improve, revolving door of purchasers, unstable prices. To combat this, they suggest a shift from completely market-based to tighter “vertical” coordination with producers adopting contracts, engendering longer term relationships (Riisgaard *et al*, 2010, p. 199). “Horizontal” coordination is setting up contracts with other smallholders. Pooling resources and lowering transaction costs, reducing risk, buying and sharing of assets, forming associations (Riisgaard *et*

al, 2010, p. 199). This is also known as “collective action” (Markelova, 2009

Figure 1: Types of upgrading strategies for small producers

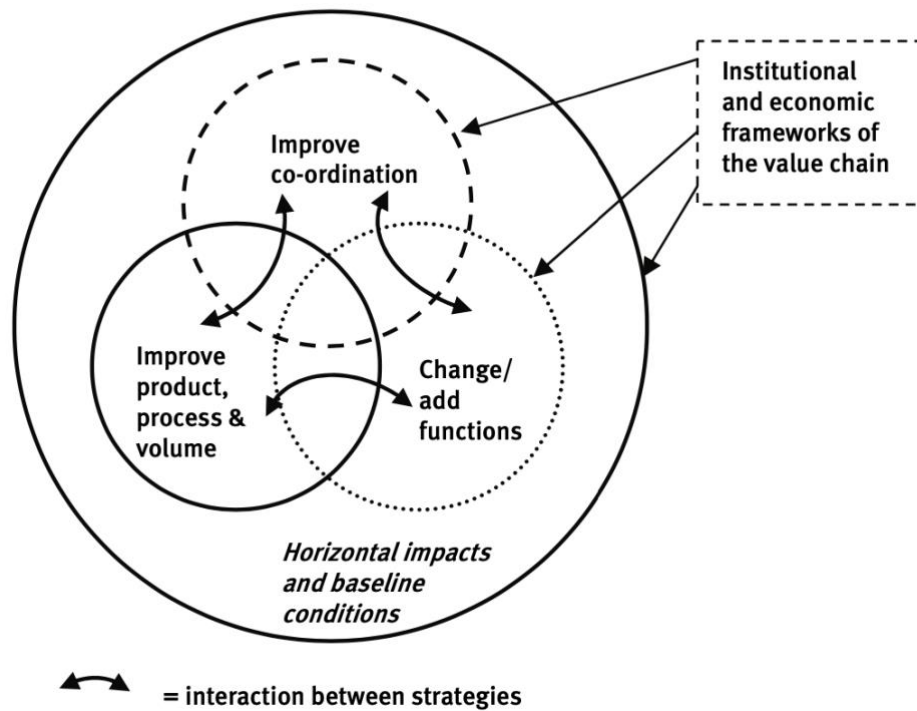


Figure 1 Visualisation of framework (Riisgaard et al, 2010, p. 201)

Chapter 3 Methodology and Methods

3.1 Methodology

This study utilized qualitative methods to examine upgrading trajectories for an SME aggregator and fisherfolk in Kenya. The aim was to “understand (not measure) people’s experiences with the idea of providing careful descriptions of life as it is lived and experienced (Yin, 1994),” cited by Manyungwa (2019, p. 277).

The first phase of research was writing several essays on Kenya’s fishing sector for ISS courses January – June 2022. I read grey literature from the Government of Kenya (GoK), KMFRI, aquaculture-related NGOs (Farm Africa), Wageningen University, FAO, UN, and other institutes. Most of the studies I read were focused on Kenya, ranging from cage fish farming, backyard fishponds, environmental issues in Lake Victoria, female fish traders, food security, rise and fall of Lake Victoria fishery, small scale fishers, supermarkets in Kenya and South Africa. Studies on horticulture smallholders, inclusive smallholder value chains, small scale fishers, were more broad, covering sub-Saharan Africa and Asia. I also read studies on Lake Victoria 20 years ago to have a historical perspective and compare challenges written about then to see if they were present today. I tried to prioritise reading African scholars, or scholars who had multiple studies on fisheries. I did initial searches but found many studies through cited references of published articles.

Research was undertaken 29 July – 29 August 2022 and 13 – 30 September 2022. Data was collected by Key Informant Semi-Structured Interviews, in-depth individual interviews, group interviews, focus group discussions, direct observation, participant observation, ethnographic field notes and daily reflections.

Semi-Structured Qualitative Interviews were chosen because I wanted to gain insights from people directly. If I came with my own set of questions or a survey, I am coming with my particular epistemology. The semi-structured format allows for the respondent to adapt the direction as necessary.

Key Informants are people with a specific set of knowledge (Sage Research Methods). A value chain framework guided me on finding different actors to speak to. These interviews were more loosely structured, as each person was at a different organization or in a different node of the value chain.

Structured Qualitative Interviews: I used the same set of questions when I interviewed the employees of Aquarech, in order to have a similar data set and cross compare answers better. As an act of reciprocity, I also asked questions relating to their own personal goals and what existing resources they have to achieve them.

In Siaya a few interviews with BMU chairmen, a fish trader, and a fish farm manager, Sara assisted with translation. For the larger focus group discussion with fisherfolk, a Luo translator was used for some of the participants. Interview Notes were taken during the interviews.

3.2 Research Sites



© WorldAtlas.com
Lake Victoria, in East Africa with the nations bordering it. Kenya was the country
Figure 2 Map of Lake Victoria, East Africa

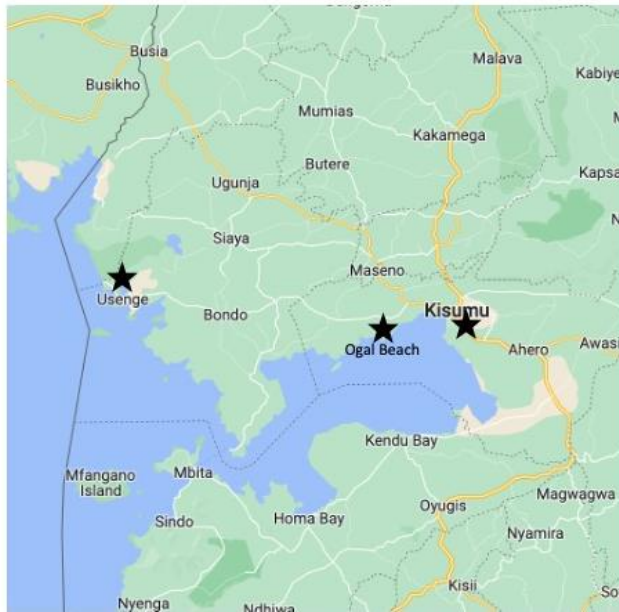


Figure 3 Kenya -- Lake Victoria

The black stars represent where my research was. The city of Kisumu, Ogal Beach in Kisumu County, and beaches near Usenge in Siaya County

3.3 Location

Kisumu is Kenya's second largest city. It was a natural place to situate the study as it was the beating heart of the Nile perch fishing 'boom,' where 80% of the fish filleting factories were built (Béné *et al*, 2010). Caged-fish farming was first attempted at the Lake in 2008, and is now widespread in the five counties that border the Lake (Abwao, 2021b, p. 534). I needed gatekeepers to facilitate my research, provide me with local credibility and help coordinate interviews. I conducted research at Ogal Beach, Kisumu County as they are within the supplier network for LakeFresh, making it easier to speak with people. Instead of being an unknown person I could be introduced as a student associated with LakeFresh. I first visited with LakeFresh staff and then I came back to stay for a couple of days with a farmer I had met.

I was able to visit Siaya County with the help of Dr. Otieno Ong'ayo, a faculty member at ISS. He connected me to his sister, Sara. She hosted me in her home and helped me visit several beaches in the area, and a day trip to Uharia Beach where there was a big cluster of fish farms.

3.4 Triangulation

Similar to how fishermen cast their nets and remember their location by triangulating their positions with two objects on shore, data triangulation was one of methods employed in my research (Yin, 1994, p. 121). I had an initial understanding of the context from the research and grey literature I had read. After attending various gatherings of value chain stakeholders, such as a presentation to a Bank, IDH aquaculture conference, and meetings with INTELLECAP, a donor funding gender interventions, similar issues were brought up. Speaking with fish farmers, LakeFresh employees, fish traders, also brought up the same issues. It felt like each research method added nuance to

the issues (Yin, 1994, p. 121). I was open to the idea of “multiple realities” but I just found that issues raised became more clear, not contradictory (Yin, 1994, p. 122).

I also employed triangulation through verification. For Luke Okech I had multiple interviews with him, and was also present when he was interviewed by donors on six occasions. I visited Ogal Beach four different times when the fish market was active. I spent two days with Farmer Bacchus at Ogal Beach and have had several conversations since then to confirm details. I spoke with some key informants multiple times. As I worked on the manuscript I checked in with some key informants about details.

3.5 Ethics & Positionality

My research was informed by my experience from eight years of involvement in social enterprise world, with building startups in Uganda, Kenya, Malawi, Thailand. This research allowed me to return to a context I know well, but now with an perspective informed by Marxian agrarian political economy from my AFES courses. Coming in as a researcher, not a co-worker, helped me to see things from a new angle and go to the field in a way I had not done before when I was mostly confined to office work.

Due to my positionality of being an American and an outsider to the study locations, I had to leverage the networks that I had. It would have been much more difficult to cold approach people at beaches, and harder to verify if people were who they said they were. Having someone accompany me facilitated conversations, established credibility and also added an element of safety. With presidential elections occurring there was an atmosphere of heightened tension. For this and other reasons I made the choice to not record interviews. Compensation of Ksh 200 (€1,57) the country standard, was given to interviewees when this was deemed appropriate. This was given to a farm manager in Oharia Beach, and for the participants in the focus groups. Before each interview I clearly described that I was a master’s student from Erasmus University conducting research on the aquaculture value chain in Kenya. I would ask for their consent before proceeding. To protect identities, individual names are aliases and the main company’s name was changed.

3.6 Limitations of the study

One of the largest biases pervading the study is that I mostly interacted with people who were broadly supportive of Kenya’s aquaculture sector. In one way or another they were directly involved, either farming fish, selling fish, investing in aquaculture companies, or supplying inputs. I did not encounter opposition to cage farming with the respondents, or much attention to potential negative externalities for the environment, or potential conflicts between cage fish farmers and others who access the Lake. The purpose of this study was not to question the validity of the sector, but to understand how aquaculture could offer income (or not) for current and aspiring fish farmers. To critique the whole enterprise would have been a different paper entirely. In retrospect, to have a stronger analysis it would have been better to speak with non-participants, and with ex-fish farmers who had left the sector for various reasons. Limitations of the framework were from my own accord, as I did not

have more time to utilise other indicators from environmental, gender or more deeply examine poverty.

Chapter 4 Data Collection

4.1 Direct Observation

I attended several key events. My first day in Kisumu I attended a meeting between members of a fish cooperative and Equity Bank agriculture finance officers. They were pitching for aquaculture financing. I went to an all-day conference for the project launch of an IDH aquaculture project. Attendees were a couple dozen fish farmers from across the country, fisheries officers, fingerling sellers, NGO staff, fish feed manufacturers. I was introduced to the who's who of Kenya's emerging aquaculture sector.

I wrote daily journal entries, 16 in total. Most days I worked in LakeFresh's office, giving me chance to see hiccups and growing pains, such as when a farmer who had already been paid delivered a huge order of low-quality fish, putting LakeFresh into the position of compromising on their usual product quality standards and selling it at a discount.

4.2 Participant-Observation

I employed the method of Participant-Observation to get a deeper understanding of aquaculture (Yin, 1994, p. 115). I found that shifting from reading about fish farming abroad in The Netherlands and physically visiting farms did elevate my perspective.

At several points I was able to participate in some of the activities. My second trip to Ogal Beach I went out in the boat at 4:30 am to see the fish being harvested, and then the marketplace. Later in the afternoon I went out in the boat again and helped feed the fish, and got a sense of the record keeping and measurements involved. I was able to taste wild fish and farmed fish on multiple occasions. I learned how Lake-side people like their fish fresh, and generally do not eat fish more than a day old. In Siaya County, I was shown the tell-tale sign of how fresh a fish is: their luges should still be red.

	Semi-Structured Interviews with Key Informants	No. Respondants
Aquaculture: Sector	LakeFresh Employees	14
	Fish Trader	2
	Fish Feed Manufacturer	2
	Commercial Cage Operator	1
	Lolwe Social Enterprise	4
	Fisherman	1
	Fish Trader, Siaya	2
	Fish farmers	3
	Fish farm workers, Siaya	2
Donors	LakeFresh External Investor	1
	IDH	3
	Equity Bank	3
	INTELLECAP	4
Researchers	Retired GoKagriculture researchers	2
	ISS Faculty Member	1
Govt	Beach Management Unit Chairmen - 3 beaches	6
	County politician	2
Total Respondents Interviewed		53

Focus Groups	
Fish Traders, Kisumu	5
Fish Farmers	
Ogal Beach, Kisumu	44
Udum Beach, Siaya	25
Total Focus Group Participants	74

Group Interviews	
Aquarech staff	16
Lolwe Social Enterprise	4
Total Interviewed	20

In-depth Interviews	No.
Luke Okech	5
Farmer Bacchus	4

4.3 Focus Groups

Three focus groups were held. The first was with a spectrum of fish traders. Wholesaler, Hotel Trader, and three small scale traders who sold fried fish at markets. The second and third were with fish farmer groups, and the discussion centred mostly on women's roles. The second focus group was at Ogal Beach: who have been working with LakeFresh for a couple of years. They are looking to solidify their relationship with LakeFresh and expand their operations. The third was at Udum Beach: This cooperative had recently joined LakeFresh's network. They manage two backyard ponds with meagre harvests.

Chapter 5 Nuts and Bolts of a Successful Fish Farm

Before upgrading strategies for the firm and smallholders are further elaborated, variables that are integral to the overall viability of fish farming are introduced and their importance explained. These include the size of operation, type of fish feed, access and distributors of feed, fingerlings.

5.1 Cage Size and Location

The shift from poorly performing to commercially viable begins with cage size. There is a minimum threshold that needs to be met to earn meaningful returns in aquaculture. Unlike cashews, where more trees can be planted as a farmer earns income, cage fish farming needs a considerable up-front investment. Some are under the mistaken impression they can start small, such as a few 2x2 meter squared cages, and add more later. Simply put, the math does not work, and these farmers will generate losses. Cages need to be placed in suitable location. Many of the fishponds built in the ESP programme had poor performance due to unfavourable conditions such as the water temperature being too cold (Obwanga, 2017, p. 53).

5.2 Fish Feed

Fish feed can be the make-or break factor for aquaculture, as feed can be 60% of a farm's overhead in Kenya (Abwao et al, 2021b, p. 541). There are several aspects to consider: traditional versus improved feed, accessibility, authorised distribution, and feeding regimen. There are two categories of traditional feed: homemade and locally manufactured.

5.2.1 Homemade Feed

Inexperienced or new fish farmers with backyard ponds will initially feed fish with what they have at home, such as maize flour, rice bran, vegetables, freshwater shrimp, expired bread. For an organisation looking to establish an outgrower network, a certain level of standardisation is needed. Attempting to ensure quality control across thousands of farmers making their own concoctions is a formidable task.

Experienced fish farmers are the exception. I visited a retired KMFRI aquaculture scientist in Siaya county who was experimenting with fish farming and was making his own feed. He had extensive qualifications, and would

know when something is amiss, as when fish are not meeting their growth targets, whereas new farmers will not be less knowledgeable.

5.2.2 Local Feed

Another issue is the quality of the commercial feed manufactured in Kenya. Farmers do not grow soybeans, a key ingredient. No firm has imported the machinery needed to make floating pellets, resulting in the ubiquity of sinking mash feed. Using this feed is problematic, as 40% sinks to the bottom, contributing to the decomposing organic matter in the lake that exacerbates eutrophication. Sinking mash lengthens the production cycle to 13-16 months, with lower unit weight and poor tasting fish. The farmer will have overspent on feed at this point.

5.3. Accessibility of Improved Feed

Once learning that improved feed cannot be found locally and needs to be imported, this does not fix the issue of finding it. An agriculture extension officer relayed a conversation with farmers in Kakamega who travel 32 kilometres by motorbike to try to buy it. Feed comes in 25 kg bags so carrying it is also a problem. Even if they are able to find it, they are not able to verify the ingredients, leading to the next problem.

5.4 Vetted Distribution Network of Fish Feed Retailers

A vexing issue is finding trusted sources to purchase feed from. It can be common practise for fish feed to have less nutrients than advertised. Studies have found a huge disparity between the label and the actual contents, especially for protein, and a major reduction in nutrition content was observed once feed left the site of production to downstream retailers due to the addition of filler ingredients like sand (Obwanga *et al*, 2017, p. 25). The combination of unscrupulous sellers looking to increase profit margins, and inadequate inspections by KEBS (Kenya Bureau of Standards) lead to this practise continuing unabated. This is a problem across East Africa (Obwanga *et al*, 2017, p. 25).

5.5 Feeding Regimen

The next step after securing a consistent, reliable supply of feed is learning how to implement a feeding regimen. Key informants said fish need to be fed 2-4 times per day, depending on their size. Other variables such as water temperature, depth, and current will also affect how much to feed. Keeping detailed records is important for the farmer to calculate their FCR.

5.5 Fingerlings

Quality fingerling seed is the second biggest issue facing the aquaculture sector in Kenya (after fish feed) (Obwanga *et al*, 2017, p. 16). Many respondents voiced this concern. Problems that were raised at the IDH Aquaculture Conference were the following: farmers have been sold fingerlings that are the wrong species, mixed gender, stunted, in-bred fish, and receiving less than paid for. One solution on the horizon is the Tilapia Excellence Centre in Kisumu. A commercial fish farm operator said Israel and another donor country are funding the centre, where a selective breeding program will be launched to

create more robust, locally-sourced strains of Tilapia strains, a key driver to advance the sector.

5.8 Conclusion

With the right guidance and resources, these are upgrades that are within the control of the farmer. The discussion emphasises the importance of joining a trusted network. Midstream actors can steer farmers to authorised distributors of feed and fingerlings. Now that “what” farms need has been explained, we will shift to see “how” businesses can mediate farmers positioning in the value chain.

Chapter 6

Kenya’s Aquaculture Value Chain

6.1 Three Business Models

This section considers three different business models for aquaculture. The following discussion will show how the possibilities for economic and social upgrading partly depend on how the business is structured and the stage of growth. Each business highlighted is guided by a different philosophy and outline opportunities for bigger downstream actors.

6.1.1 The Dreamers

Lolwe Social Enterprise is at the seed stage. Founded by a cooperative of late-career, prominent Kenyan businessmen and professionals, they have a big vision. Their *raison d’être* is to improve the economic opportunity for small-scale fish farmers. They are looking to lease an abandoned 500-ton fish factory in Kisumu. They had the FAO conduct a feasibility assessment to estimate the amount needed to fully repair and operationalise the factory. The investment needed is an amount they can raise among themselves.

They have analysed the value chain to see other barriers deterring fish farmers. Establishing a market with the factory is one thing, but getting to it is another. They have approached a transport company that ferries passengers to Lake Victoria’s islands. Lolwe has asked them to expand their services and build a refrigerated boat to transport fish from cages to factory. The company has satellite images of all the cages on the Lake. They are calculating the expected volume of rides and routes to determine how much farmers would pay.

Lolwe is also looking at how to encourage Kenyan farmers to adopt soy as a crop, as this is a key ingredient for fish feed. While Lolwe is still at the seed stage, their plans and work so far illustrate how a larger actor is able to reshape the value chain by creating opportunity (fish factory) and increasing accessibility (fish taxis).

6.1.2 The Pragmatists

LakeFresh was founded by Luke Okech and his father in 2019 and is at the start-up stage. Their chief concern is getting a functional value chain for aquaculture up and running as soon as possible. Rather than exploring how to

promote planting of soybeans, LakeFresh imports soy fish feed. This meets a critical gap and increases the demand for feed. As more farmers take up fish farming, the case for manufacturing feed in-country gains traction. The foundation of LakeFresh's business model is the provision of quality farm inputs. As their network of farmers grow, they plan to aggregate fish. To do this they are building a decentralised hub and spokes model that links outgrowers with bulking centres. This model creates pockets of distribution and production, a very different structure than the next model, Victoria Farms.

6.1.3 The Leader

Victoria Farms is positioning for market dominance. Founded in 2016, they run their own commercial cage operation in Homa Bay, with annual production of 8.000 metric tons (Omollo, 2022). They service 56 company branches on a daily basis with refrigerated trucks (Collins, 2022). They have considered contract farming with fishermen, but they have not seen a project plan that looked sustainable enough. However, they have had success with small scale female fish traders. As part of a GIZ-funded initiative, they sell fish at Ksh 325 (~€ 2,5) to 15.000 women in 12 counties. Women fry the fish and sell at Ksh 625 (~€ 5) The price paid is transparent and publicly posted. There are no middlemen. Victoria Farms has recently expanded to Rwanda, Democratic Republic of Congo, and Tanzania (Kene-Okafor, 2022). Victoria Farms is also marketing themselves as a leader in 'sustainable' aquaculture. While Victoria Farms does not source from smallholder farmers, their economies of scale (choice of business practices) can positively or adversely shape the value chain. They have demonstrated impact on female fish farmer livelihoods, drastically reducing their transaction costs and uncertainty. If they truly are adopting greener farming methods, this has the potential to percolate through the sector. Less damage to the Lake ecology also lowers the environmental risk for fish cages near them. Their market share also adds to the demand for fish feed.

6.1.4 Reappraising the Effect of a Business

The business models highlighted are at different stages of growth, their impact ranges from the potential to the verifiable. Lolwe shows us what could be, Lakefresh shows us what can be done now, and Victoria Farms shows how they, for better or worse, influence the sector as a whole. Some needed upgrades to improve the outlook for fisherfolk, such as paved roads or subsidised power to make cold chain affordable, would appear at first glance to be beyond the scope of the value chain. As these improvements require government intervention. Yet companies have demonstrated adaptations that circumvent these obstacles. If Lolwe's proposal for fish taxis comes through, the lack of a suitable road network becomes less of an issue. Victoria Farms has overcome the lack of cold chain by using technology to optimise their supply chain. By tracking daily sales of each of their 15.000 traders, they can predict how much fish to deliver to each of their 50+ branches. These both reflect tighter coordination, of which will be discussed later.

An important characteristic of both Lolwe and LakeFresh's business model is that it relies on high productivity of fish farmers, so there is built-in incentive

to assist farmers. LakeFresh’s aquaculturalist said GoK aquaculture projects have a poor track record, as they tend to provide cheaper, inferior inputs to farmers. The difference is that the government has no stake in farm yields and are not incentivised to offer more expensive inputs.

6.2 A Tale of Two Beaches

Now that the essential components for profitable ventures have been covered, and the implications different business models can have on fisherfolk, the focus shifts to the value chain. Value Chains are useful for visualising “the structural connective tissue linking small farmers with input suppliers, processors, traders and final consumers,” and amplifying voices from below, especially rural producers (Haggblade *et al*, 2012, p. 2). Two beaches with cage fish farming were selected for analysis. One is more local, smaller-scale and the second is regional.

6.3 Local Fish Value Chain

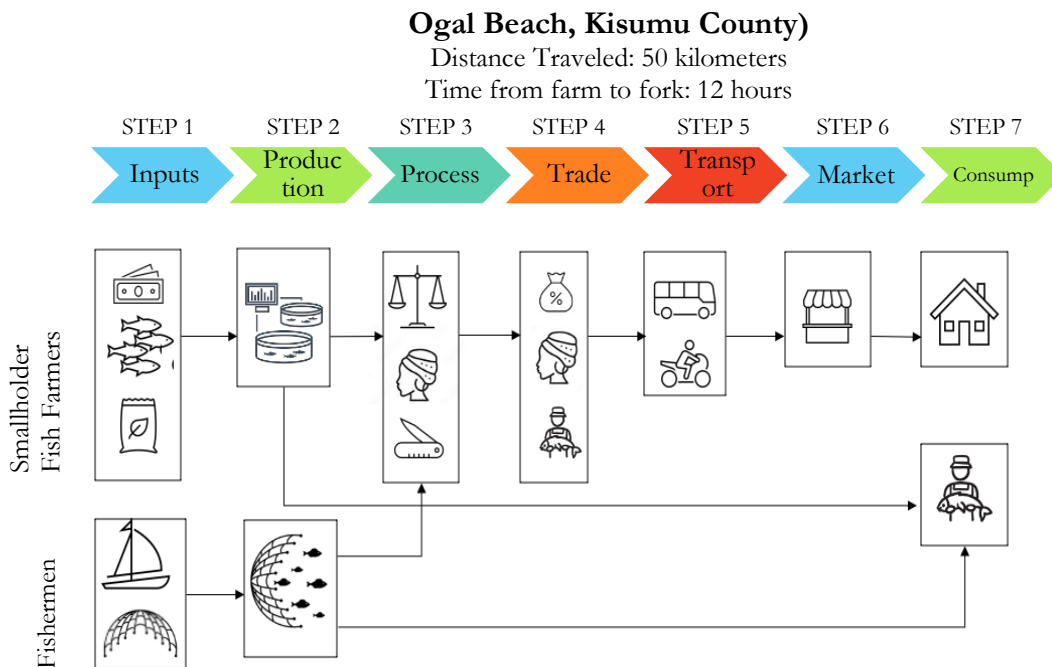


Figure 4 Local Fish Value Chain

Ogal Beach is located in Kisumu County, about an hour’s drive from the city centre over increasingly rough terrain. I made a total of four trips to Ogal Beach, including a two-day visit.

6.3.1 Smallholder Fish Farmers

Farmer Bacchus is based in Nairobi, and visits his farm once a month. In this local value chain, step 1 is sourcing inputs from fish feed, fingerlings, and having the finances necessary to fund the business until the next harvest cycle. Step 2 is production, where fish grow to market weight. The night before harvest, Bacchus receives orders from fish traders. The next morning before dawn, 8 men go in a wooden canoe with an outboard motor. Fish for the orders are hauled into the boat. Once on shore the fish are carried in 30 kg

plastic buckets. At the market, a man weighs and sorts each individual fish by 5 grades, separated by weight. In step 4, women gut and scale the fish if requested by traders, and the traders pay the BMU Ksh10 (€0,08) per kilogram. Fish is transported by taxi vans or motorcycle taxis. The traders sell their fish at the market in step 6. Customers buy at the market and eat fish for dinner. Traders who have unsold fish may also eat it for dinner. Total distance travelled will be not more than 50 kilometres and the time will be 12 hours.

6.3.2 Small Scale Fishermen

The original value chain was powered by fishermen. Their inputs are their boats, maybe a motor, and nets. At 7:00, dhow sail boats appear along the shoreline to retrieve nets laid the night before. They use two land-based landmarks to triangulate their position on the water. They will keep prized fish for themselves and their households; these are not sold to the market or the boat owner. The other fish will go through the same 3-7 steps.

6.3.3 Features of Ogal Beach

Ogal Beach has 46 cage farmers, with approximately 400 cages sized 6 x 6 meters squared. There is a range in ownership, from individuals, welfare groups, friends and registered companies. Some fishing boat owners have cages, while some friends jointly invested in cages. A woman's group has several cages.

This is a local chain that is more informal, with **spot markets**. Bacchus does not have contracts with the traders, and there can be different ones each time. The biggest constraint is lack of cold chain, which compresses the timeline. Traders will only purchase from Bacchus what they expect to sell that day. They prefer smaller fish. They also split the fish in half and sell in pieces. After seeing fish stands in more rural locations, the demand for smaller fish makes sense, as they are easier to preserve and more affordable. In this area there is perceived scarcity on both sides. Ogal Beach has more fish than they can sell, but traders have difficulty finding fish.

6.4 Regional Fish Value Chain

Oharia Beach (Siaya County)

Distance Traveled: 450 kilometers

Time from farm to fork: 1-5 days

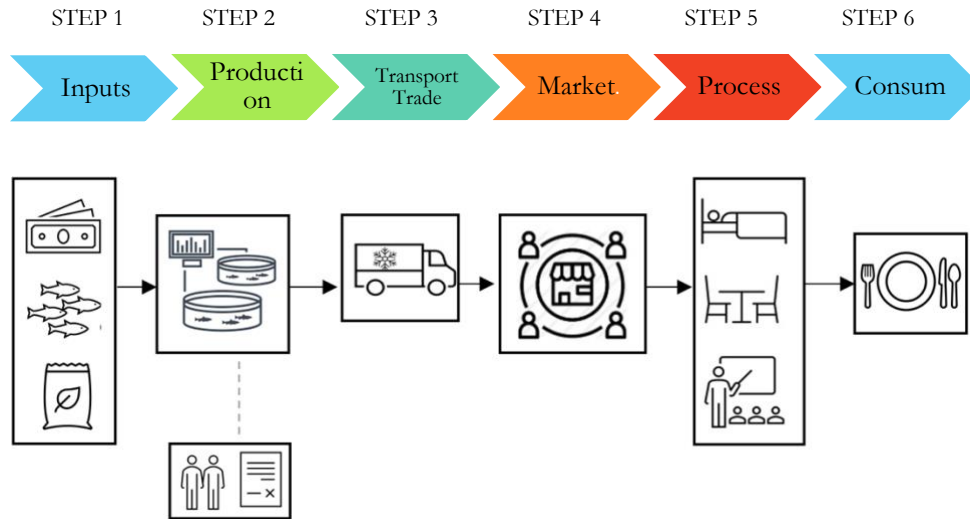


Figure 5 Regional Fish Value Chain

6.4.1 Oharia Beach Value Chain

Like Bacchus, Farmer Hermes also lives in Nairobi. His farm at Oharia Beach participates in a regional value chain. During Step 2 production he liaises with a wholesale trader using a contract. Step 3 is harvest time, where 500 kgs to 1 ton of fish are transported via refrigerated truck to Gikomba, the large fish market in Nairobi. From here the wholesaler sells to other businesses he has contracts with, usually primary and secondary boarding schools, hotels, and restaurants. The businesses will then prepare the fish for their customer. Due to the addition of cold chain, this process can take anywhere from 24 hours to a few days, and the fish travel 450 kilometers.

6.4.2 Features of Oharia Beach

Oharia Beach in Siaya was one of the earliest beaches to start cage fish farming and are still going strong (Abwao, 2021b, p. 534). They have 5,000 cages, with an estimated 300-500 farmers, as some cages are managed collectively. Out of this figure there are 2 women, both of whom are wives of fishermen. There are a few fingerling farms adjacent to the lake. Farmers have their cages locally welded.

6.6 Conclusion

The local Ogal Beach and the more regional Oharia Beach value chains were mapped out. These simplified versions provide a snapshot, a “day-in-the-life” of a fish farmer to contextualise the constraints and opportunities.

A question to ask about other actors in the mix. Are they adding to the local economy, cannibalising or weakening it? Ogal Beach reveals a variety of competing actors. A more well-off businessman installed cages at Ogal Beach. Instead of selling his fish at the BMU Trading Centre on the beach he set up a store and freezer in town. He courted larger scale traders and diverted them from Ogal Beach. This is an example of a farmer upgrading, at the expense of other fish farmers, and downgrading the BMU. Farmers at Ogal Beach need to find more buyers, as they are not able to sell all that they can produce and so are forced to sell at lower prices to clear stock.

Chapter 7 Economic Upgrading for LakeFresh

In order to investigate how (or if) economic upgrading can be linked with social upgrading, the expansion of LakeFresh will be outlined and followed with the relevance for fish farmers. Firm Upgrades are broken down into three categories, Business Improvement, Functional Upgrading, and Vertical Cooperation.

1 Business Improvement

The first section is general business improvement relating to processes, product lines and volume (Bolwig *et al*, 2010)

1.1 Process Improvement

1.1.1 Human Resources

A key part of improving processes is having the human resources. In August 2022 a Sales Manager and an accountant were hired bringing the total staff to 19. The key hires are expected to improve internal sales, finance, and accounting processes, and add Point-of-Sale software. In 2023 LakeFresh is expected to hire an additional 25 staff.

1.1.2 Capital

LakeFresh is in the midst of negotiating a \$3 million USD seed funding round with impact investors. If successful, the infusion of capital will go a long way towards improving processes. The top priority will be maintaining inventory of fish feed. They are not able to fulfil current demand, which employees said was their biggest challenge. NUTRECO, a Dutch commercial fish feed manufacturer signed on as an investor in October 2022. This is an opportunity to forge a close connection with a global fish feed supplier, as sustained supply is critical to growth. IDH a Dutch global NGO visited LakeFresh in Aug 2022. Based on the information collected they are building a business model for LakeFresh, which will aid them in making strategic decisions as they expand.

Impact on smallholders: reliable, consistent access to improved fish feed is important to their success. IDH business model will guide them on what investments will be viable (for ex buying a refrigerated truck).

1.2 Better Product Lines

1.2.1 Feed

LakeFresh's competitive advantage is that they sell imported fish feed from Egypt and Mauritius. They sell 25 kg sacks of extruded soy pellets in mash, 2mm, 3mm, 4mm, 4.5mm for Ksh 3.600 (€28,50) each. Traditional feed made in Kenya sells for Ksh 3.000 (€23,74). The extruded pellets have a high protein content. The pellets float, more efficient than the local sinking mash of which 40% sinks.

1.2.2 Farmed Tilapia

Through the addition of four aggregating centres, LakeFresh is planning to aggregate and sell more tilapia. LakeFresh only purchases tilapia from their network of farmers they sell fish feed to. Compared to wild fish, farmed fish are fleshier, bigger, and are uniform in size, simplifying grading and sorting. Choosing to buy fish from farmers who utilise verified feeds aids the company with quality assurance.

1.2.3 Future Product Upgrading

Future product upgrading will be aligning products at their retail outlets with particular customer segments. Their Manyatta location in Kisumu is in a low-income neighbourhood. Consumers are very price conscious and prefer smaller fish. For retail outlets in wealthier areas, consumers prefer fillets from larger fish, and they pay more attention to packaging. Serving these diverse markets will give LakeFresh the opportunity to fine tune their product lines.

1.2.4 Fingerlings

In 2023, LakeFresh plans on expanding their product line and sell fingerlings. They have secured a 10-year lease on a property that was formerly under the Ministry of Fisheries. It has the necessary infrastructure, with multiple ponds to begin fingerling production.

Impact on Smallholders: Farmers have quality assurance of fish feed, and they will be able to buy fingerlings in the future.

1.3 Higher Volumes

Increasing volumes is LakeFresh's primary upgrading strategy. As of August 2022, they had imported 1.000 metric tons of fish feed. They had 2.000 farmers registered, with 500 active purchasers. Operations have scaled rapidly since founding. In 2019, their revenue was \$10.000 USD; 2020 was \$320.000, 2021 was \$400.000. Many businesses went under in 2020, while LakeFresh expanded ten-fold, despite the constraints brought on by COVID-19. In 2022, projected revenue is \$1.2 million USD. Their operations volume will increase with four new aggregating centres coming on board in 2022-2023. The higher fish volume will supply LakeFresh retail franchise outlets in Nairobi. Through grants from INTELLECAP and GSMA Fund for Climate Resilience, they are planning to add 3.000 and 5.000 farmers, respectively.

Impact on smallholders: A wider geography of farmers will have more opportunity to sell fish back to Lakefresh, and more people will become fish farmers.

2 Functional Upgrading

2.1 Downstream Activities

In 2019, LakeFresh built their office in Kisumu, that also acts as their bulk aggregating centre. They are now able to accept bulk fish orders, process (gutting and scaling) and re-sell fish. They opened four retail outlets, in Kakamega, Homa Bay, Kisii, Kisumu counties. Kisii and Manyatta are both directly overseen by LakeFresh while Kakamega and Homa Bay, are franchises. Future outlets will also be franchises. The outlets sell fish directly to consumers, who purchase raw whole fish, fillets, or fried fish.

Impact on smallholders: Farmers have a bigger market for their fish.

2.2 Upstream Activities

2.2.1 Outsourcing

Luke Okech, in an earlier business, was making his own fish feed. To manufacture extruded pellets, he needed €100K of machinery. He chose to upgrade by founding a new company and outsourcing. Importing fish feed from Egypt he was able to offer a higher quality product than what he could produce within Kenya.

2.2.2 Feed

LakeFresh has built up its own network of farmers to sell feed to. They have several services to make fish feed more accessible to farmers. They have a last mile distribution system that delivers to rural areas. They also offer a credit financing option called “Buy Now Pay Later.”

Impact on smallholders: Rural farmers can have feed delivered. Qualified farmers 90 days away from harvest can receive feed on credit and pay after harvest.

2.2.3 Aquaculture Extension

LakeFresh organises trainings with county governments to teach farmers a feeding regimen. Their staff monitor farmers through phone calls and in-person visits to record fish growth and advise on feeding.

Impact on smallholders: farmers learn how to better utilise their feed for better growth.

2.2.5 Planned Upstream Activities

LakeFresh is planning to grow fingerlings in 2023. They are the technical lead in an IDH aquaculture project, and provided IoT water sensors to the farmers.

Impact on smallholders: A degree change of 1 degree Celsius impacts the amount of feed that should be given, so IoT sensors can help further finetuning of feeding.

2.2.6 Future Upstream Improvements

On the basis of INTELLECAP recommendations, LakeFresh will be implementing gender-specific interventions. This will facilitate the participation of female fish farmers and prepare LakeFresh to become “investment ready” for gender lens impact investors. They may be adding a contract model of farming to reach lower-income groups.

Impact on smallholders: More women are able to take up fish farming.

3 Closer Value Chain Cooperation

3.1 Vertical Cooperation

LakeFresh’s building of four more aggregator centres is a shift to more vertical coordination. Their centres connect producers with consumers and strengthen linkages along the chain. LakeFresh’s retail outlets connect customers to processed fish. In the future they are exploring partnerships with insurance and financial institutions to offer more wrap-around services to farmers.

Impact on smallholders: Fish farmers have access to bulk aggregation points with processing facilities, this is currently lacking in the Kenyan market.

3.2 Horizontal Cooperation

LakeFresh works with other farmers, and Luke is a chairman of the Kenyan Cage Fish Farmer’s Association, this further spreads awareness of farming knowledge. LakeFresh encourages farmer groups to join savings groups.

3.3 Summary: Economic Upgrading

Most of LakeFresh’s upgrading have clear links to more beneficial outcomes for fish farmers. Their activities address all the success factors for aquaculture outlined in Chapter 5. Opportunities for social upgrading will be discussed explicitly in the next section.

ECONOMIC UPGRADING STRATEGIES LAKEFRESH

	Accomplished as of Oct 2022	Confirmed 2022- 2023 Plans	Future
1. Business Improvement			
1.1 Process	<ul style="list-style-type: none"> 1. Recruitment of Chief Technology Officer (2021) 2. Key Hires: Sales Manager, Accountant (Aug 2022) 3. NUTRECO, a Dutch Fish Feed Company awarded \$250,000 and joined as investor (Oct 2022) 	<ul style="list-style-type: none"> 1. Track impact on farmers 2. Adopt Point-of-Sale system 2. Clear financial policies 3. Close \$3 million funding round 4. Improve ordering w/ NUTRECO 5. Receive business model analysis from IDH 6. Hire 25 more staff 	
1.2 Product	Sell improved fish feed: Extruded soy pellets in mash, 2mm, 3mm, 4mm, 4.5 mm	<ul style="list-style-type: none"> 1. Resell fish from farmers who bought LakeFresh feed 2. Sell fingerlings 	Retail outlets: fine tune products for different market segments
1.3 Volume	<p>Increasing volumes is primary upgrading strategy</p> <ul style="list-style-type: none"> 1. Imported 1,000 mt of fish feed 2. Expanded to 1,200 farmers 3. Revenue: 2019 (\$10k), 2020 (\$320k), 2021(\$400k) 4. 2019-2021 hired 16 staff 	<ul style="list-style-type: none"> 1. INTELLECAP add 3k farmers 2. GSMA add 5k farmers 3. Order more fish feed 4. Increase customers 5. Projected 2022 revenue \$1,2 m 5. Hire 25 more staff 6. Increase fish bought (currently 10% of revenue) 	Expand to more counties in Kenya
2. Functional Upgrading			
2.1 Downstream	<ul style="list-style-type: none"> 1. Built fish aggregating center in Kisumu (2019) where fish are processed for added value then resold to outlets, traders 3. Opened 2 retail outlets for B2C 4. Launched franchise model with 2 more outlets 5. Farmers who buy feed can sell their fish back to LakeFresh 	<ul style="list-style-type: none"> 1. \$80,000 from KESAP to fund aggregating centers to 4 counties 2. Once supply chain is adequate will rent warehouse in Nairobi, have bigger operation there. 	Transport - purchase of refrigerated truck could enable farm gate purchase and transport of fish
2.2 Upstream	<ul style="list-style-type: none"> 1. Founder pivoted from making fish feed, to a commercial cage farm to supply inputs to fish farmers. 2. Fish Feed Sales 90% of revenue 3. Last Mile Distribution system for feed 4. Credit scheme for feed 5. Aquaculture Extension 6. Built app to sell fish feed 	<ul style="list-style-type: none"> 1. Adopt Trainer of Trainers model for aquaculture extension 2. Add INTELLECAP's gender interventions to policies, programs to build network of female farmers 3. Technical Support - IoT Sensors 4. Expand app to include fish sales 	<ul style="list-style-type: none"> 1. Add Artificial Intelligence to technical support 2. Link with financial institutions, insurance 3. Add contract farming model
3. Enhanced Value Chain Cooperation			
3.1 Vertical	<ul style="list-style-type: none"> 1. Secured 10 yr lease from government for fingerling production 2. IDH Aquaculture project 	LakeFresh will work with NUTRECO to expand market for fish feed	Create linkages with insurance and finance institutions
3.2 Horiz.	<ul style="list-style-type: none"> 1. CEO is chairman of Kenya Cage Fish Farmer's Association 2. Partner with pre-existing cooperatives. 	Cooperatives join savings groups	

Table 1 Summary of LakeFresh Upgrading

Chapter 8 Social Upgrading for Farmer-Owners

When understanding when and why social upgrading is a consequence of economic upgrading, its important to be specific. This section addresses potential upgrading for small-scale fish farmer owners who have multiple income streams.

8.1. Better Farm Management and Practises

(Bolwig et al, 2010)

8.1.1 Improving Processes

The bulk of upgrading opportunities for smallholder fish farmers relate to process improvement, greater efficiency, and judicious use of resources. The first is taking out the guesswork. Farmers exposure to technologies can introduce useful improvements. Proper record keeping enhances farmer's ability to track costs and calculate their Feed Conversion Ratio. Armed with evidence, they are better placed to make informed decisions.

8.1.2 Feeding Regimen

A key process is the farmer's feeding regimen, of which LakeFresh can play a pivotal role. LakeFresh recommends higher amounts of feed than Kenya's government, which is still reflecting 2009 recommendations for backyard ponds. An aquaculturalist shows how to adjust feed based on fish size, water temperature. Following this advice, farmers are expected to shorten their production cycles from 12-16 months to 8-10 months, a significant difference.

8.2 Improved Products

8.2.1 Fish Feed

There is a marked, depreciable quality with farmed fish that are fed home-made inputs, in taste, size and flesh-to-bone ratios. By upgrading to improved, soy fish feed, farmers have a competitive product, whose taste and size rival wild-caught fish. Farmers learn counter intuitively they need to spend more on inputs to earn more. A study found that when fish farmers used improved fish feed, their incomes rose 67% (Amankwah, 2018).

8.3 Higher Volume

Farmers reported that the sale of Tilapia has not increased in 15 years, so producing higher volumes is a key contributor to higher incomes. This is done by adopting more intensive farming methods (Rothuis, 2011).

8.4 Function Upgrades: Upstream & Downstream

Smallholders have limited ability to add upstream functions. One potential upstream activity is growing fingerlings, but respondents said this is too complicated for entry level farmers. Another obstacle is sourcing quality fish brood stock. Fish farmers generally add fish trading, a downstream functions, to their household. It is common for the wives of fishermen and farmers to trade fish.

Interchain Upgrading is a feasible option, where fish farmers use profits to invest in other business ventures. Farmer Bacchus in Ogal Beach had 50

beehives, a grove of mango trees on his property and planned to convert a guesthouse for Air Bnb. I found that fish farmers were also owners of fishing boats at beaches in Siaya and Kisumu. A study on Kenyan aquaculture found that from a survey of 331 fish farmers, 91% had other income streams (Obiero *et al*, 2019, p. 1696).

8.5 Enhanced Value Chain Cooperation

8.5.1 Vertical Cooperation

Fish farmers have more security in value chains with tighter coordination. Established relationships build social capital. Everyone I spoke to cited lack of trust as an issue. It is harder to dump low quality fish or fingerlings with someone you need to keep doing business with. Farmers may also have the opportunity to access other service-providers such as financial institutions and insurance schemes.

8.5.2 Horizontal Cooperation

The above upgrades involved interventions by larger companies, but smallholders can access secondary benefits through BMU's and joining a cooperative. BMU's purchase assets such as boats, nets, and motor engines that members can rent for daily or monthly use. Farmer Bacchus formed a cooperative at Ogal Beach. It has not been as successful as he would like due to lack of trust and investment by other members. They have lobbied the BMU for better services, and standardised trading terms. This included time slots to sell fish, consistent pricing, and established rates for paying casual laborers. Cooperatives can help sustain local markets. If a fish farmer is only coming to a market to sell fish sporadically, it is more difficult to find and retain wholesale fish traders. A cooperative could work together and have staggered harvest days.

8.6 When is social upgrading a consequence of economic upgrading?

Through a network provided by LakeFresh, fish farmers have access to "power/knowledge" in a Foucauldian sense (Mills, 2003, p. 69). They join a trusted network that recommends cage suppliers, fingerling producers, fish feed sellers, and are connected to other markets. They gain new knowledge, such as how to finetune their feeding regimen, that differs from the official government recommendations. For some farmers, they can realise profits for the first time and are re-oriented from subsistence to commercial production.

In Summary: Three Ways To Facilitate Social Upgrading

1. Being Set Up for Success.

Before they embark on aquaculture, fish farmers need a clear-eyed understanding of the startup costs for cages that are large enough to recoup their investment. They also need to know where is best to put their cages. A politician at Ogal Beach drove this point home when she spoke of farmers who invested in poor quality, small cages, and who have just been operating at a loss. She said for those with the financial means to properly invest they have

been successful. She felt there was a clear delineation between the successful cage operators and poorly performing farmers.

2. High productivity + more markets

Higher yields need coincides with greater market access for sustained impact (Haggblade, 2012, p. 2). As LakeFresh scales, fish farmers will have a reliable market to sell their products. For farmers who live near the four new aggregating sectors, links will be built that did not exist before. Enhanced market opportunities is an important aspect of encouraging adoption of new methods (Amankwah, 2018, p. 42).

3. Vertical Coordination

When fish farmers are connected to value chain actors that have a vested interest in their productivity, they have greater security.

Social Upgrading possibilities for other shades of fisherfolk will be examined in the next section.

8.7 Social Upgrading for Whom?

I show in this section how one's opportunity to upgrade is heavily influenced by one's position in the hierarchy. Lower-income farmer cooperatives, farm workers, fish traders offer different comparisons.

8.6.1 Contract Farming : A Way In or a Trap?

For those interested in aquaculture but do not have the upfront capital required, donors have proposed various iterations of a contract farming model. After reviewing the different factors, contract farming as an upgrading trajectory sounds questionable. The cooperatives would be leased cages, pay instalments over time, with eventual transfer of ownership. Fish feed already comprise 60% of the farm's overhead (Abwao et al, 2021a), and payments for cages cut further into that margin. Added risks are low productivity, theft and the complication of group politics. It is also difficult to ensure that cooperatives would honour their payments, as there are no real enforcement mechanisms in Kenya. Farmers can always side-sell. A partnership where cages and the first few months of inputs are covered by grant funding is a more plausible scenario. The groups would need to be highly vetted, with strong commitment by members to work in aquaculture and vouched for by a community leader.

8.6.1 Labour: Farmer Workers

Another group to consider are farm workers. The cage fish farms I visited in Ogal and Oharia Beach had a full time general manager and an extra worker. At harvest time in Ogal Beach, a crew of 8 casual laborers were needed to harvest the fish. Once on shore, a man weighs and sorts each fish, while a couple of women gut and scale the fish. According to the BMU chairman at Ogal Beach, these casual workers are paid a flat rate of Ksh 9.000 (€ 71) monthly, which is far lower than the minimum wage of Ksh 12.000-15.000 (€94 - €118). These jobs have "low value capture within the chain," and workers face "lack of social protection, lack of rights" (Barrientos *et al*, 2018, p. 241). They are paid in cash or mobile money and no employer is making payments to the national social security fund or the national health insurance scheme on their behalf. Unions are quite scarce in Kenya so farm workers do not have representation. Their jobs are not very secure, but neither do the other types of employment in this area: fishing boat crew member, motorcycle mechanic, small retail shops.

On the other hand, fish farm workers are being exposed to new skills, which has been noted as part of social upgrading (Barrientos *et al*, 2018, p. 241). Working on a successful fish farm gives someone a front row seat to the nuts and bolts of production. The manager at Oharia Beach said he had attended trainings organised by NGO's and KESAP, on fish farming methods. Although farmer training is not necessarily connected to higher incomes (Guarin *et al*, 2022, p. 18). It needs to be targeted training, and ideally run by the buyers, so farmers learn what exactly the market demand is and adjust accordingly. However, the ability of farmer-workers to functionally upgrade by

shifting from waged work to operating their own farm remains insurmountable without significant finances.

The amount needed to launch a farm ranges from Ksh 500.000 (€3.930) if using locally welded cages to Ksh 2 million (€15.731). Putting this into wider context, studies found that informal micro-entrepreneurs invested up to Ksh 200.000 / €1.570); 57 percent invested Ksh 30.000 and 10% Ksh 100.000 /€787 (FKE, 2021 p. 25). This shows how uncommon an investment upwards of Ksh 500.000 is.

Furthermore, 67% of founders used their own savings to start informal businesses, as accessing formal credit is not possible in the informal economy (FKE, 2021 p. 25). For farm workers to save enough from their meagre pay checks is highly unlikely, without significant external or donor support. A study found the average age of fish farmers to be 50 (Obiero et al, 2019, p. 1696). The amount of capital required may be a reason for why the age of fish farmers trends upwards. Given this reality, possibilities for farmer workers to socially upgrade is very slim. Their position is more akin to treading water. They are not drowning, but not very well placed for emergencies. Their situation recalls James Scott's (1976) words "the position of the rural population is that of a man standing permanently up to the neck in water so that even a ripple is sufficient to drown him."

8.6.3 Fish Traders

In Kenya's gendered fish economy, the vast majority of fish traders are women; studies have put the figure at 90 percent (Mojola, 2011). Most operate at a small scale, typically selling fried fish at the roadside or informal markets (Fiorella *et al*, 2015. A politician at Ogal Beach noted that women fish traders had precarious livelihoods. They are given fish on credit and fall into debt, at which point they migrate to another beach.

Male fish traders, though they are few, punch far above their weight class. They tend to be wholesale traders, selling large volumes to hotels, restaurants, or other businesses. Though making up a smaller share, In a group interview with INTELLECAP researchers, Luke Okech spoke of this dichotomy: "*You will never see Moses being Agnes, or an Agnes being Moses.*" When the focus group and staff of LakeFresh were asked why there was such an absence of large scale female fish traders, they did not have definitive answers. A commonly held sentiment was that women were more risk-averse and less likely to use credit for a larger purchase. Being more assertive and willing to take the risk were seen as more masculine characteristics. Ashley, a trader said she sensed there were some barriers from accessing that kind of network. She, however, was very open to expanding her business and was working with LakeFresh on a joint venture. A discussion of upgrading possibilities, regardless of one's positioning would be incomplete without an appraisal of the risks involved.

Chapter 9 Thieves, Spoiled fish, Cashflow: Risks of Business

9.1 Risks

While companies can enhance the value chain by strengthening market linkages and making quality inputs more available, this could all be upended by unforeseen risks. The next line of inquiry investigates the effect of risk/uncertainty on upgrading for fish farmers/traders. One's exposure to risk is a feature of poverty, one of the components for horizontal analysis of value chain. Some risks have to do with business operations: maintaining cash solvency, safeguarding against theft, selling to a variety of buyers. While other risk factors are based on the ecology of Lake Victoria.

9.2 Theft

To illustrate how risk can punctuate someone's livelihood, we will revisit the story of Ashley, the fish trader. When we first met, she and LakeFresh were setting up a retail shop near her home. Seeing a mutually beneficial opportunity, LakeFresh invested more than a \$1,000 USD on the shop's construction, purchased necessary assets and loaned 60 kilograms of fish. When I came back for fieldwork, I was updated on what had transpired. Her first day was a resounding success, and she placed another order for fish. Unfortunately, that same night, the shop was broken into and everything was stolen. Ashley went from starting a promising, new venture to becoming bankrupt overnight. She was not held liable for the investment that was lost, but LakeFresh, for the time being, was not going to invest again. She lives in a slum and does not have the security features other households have, such as a security guard or fencing. Her painful arc illustrates the dichotomic upgrading/downgrading trajectories of fish traders. It should be noted that the risk of theft extends far beyond aquaculture; combating thieves is one of the costs of doing business, and remains a chronic issue across Kenyan life.

Theft is a perennial challenge for fish farmers. In a context where many houses have a gated compound with security guards, fishing cages on the lake are quite vulnerable to theft. Farmer Bacchus, said a friend invested in cages at Dunga Beach in Kisumu. His harvests were a quarter to a half of what they should have been, and he ended up writing off his investment and abandoning his cages. The main strategy employed to mitigate theft is through horizontal cooperation. The Ogal Beach BMU provides security. Guards work in night and day shifts, patrolling the cages in a boat.

9.3 Cash is King

One of the draws to fishing was the potential for daily wages. With dwindling fish stocks, this has become less and less possible (Obiero *et al*, 2019). But with aquaculture, a farmer adopting best practises (cage size, improved fish feed, fingerlings, feeding regimen etc) has to be cash positive for least eight months. Compared to fishing that has immediate results, successful aquaculture requires planning and foresight, and the ability to survive multiple contingencies (Amankwah, 2018). Farm assets can degrade. Cheap cages rust and need

replacement (after 3 years). Nets need to be checked frequently, as they can break without warning and drift away, freeing the fish. If they run out of money, how possible is accessing credit? Obiero found that the number one reason fish farmers exited the value chain was their inability to afford improved feed and sustain operations (2019). If they run out of money, how possible is accessing credit and is this even advisable? Gerber (2014) notes how “credit/debt” is a double edged sword; what could be once seen as “formidable potential” can morph into a crushing force (p. 729).

A potential mitigation strategy is savings groups, as members can apply for loans. If they default, their membership status is revoked. They lose access to future opportunity, but they are not further impoverished. This is different than in the case if an individual had put up land as collateral that was later confiscated.

9.4 Lack of Cold Chain

Fish is highly perishable, and Kenya lacks cold chain infrastructure. Farmers and traders do not have much flexibility, and must sell their catch within one day of harvest. Bad weather also affects sales. Local traders do not buy fish when it rains, as they will not be able to smoke or sun dry their fish in wet conditions. Aquaculture mitigates this somewhat, as fish farmers can hold off harvesting if they know a storm is coming, but at the same time, storms can damage their inventory and assets.

9.5 Too Big To Fail (So They Said)

It is imperative that fish farmers can sell to a number of different buyers. One would assume that supermarkets would be the preferred buyers with lucrative contracts. Recent events in Kenya show the opposite to be true. Nakumatt, Tusky’s, and Naivas were the largest supermarkets in Kenya and were contracted to pay suppliers 30-120 days post-delivery. By 2015 they had unpaid debts to suppliers of a reported Ksh 8 billion (\$81 million USD) (Business Daily Africa, 2015). In 2018 Nakumatt went under, and was liquidated in Jan 2021 with a debt of Ksh 30 billion (\$296 million), with Ksh 18 billion unpaid to suppliers (Miriri, 2021). Tusky’s Supermarkets shut its doors in 2021 (Shiundu, 2021). The supermarkets had used money towards expansion and delayed supplier payments. These supermarket titans closed without paying arrears, forcing many of their suppliers into bankruptcy. Uchumi’s has closed down, and Shoprite, a South African brand has exited the country (Shiundu, 2021)). There is a lack of federal regulation that did not protect suppliers or compel supermarkets to make payments, revealing vulnerabilities in the system. Viewed from this perspective, spot markets where farmers are paid immediately for their goods seem much more secure than working with supermarkets.

9.6 Environmental Risk

When considering the environment, there are two aspects: the first is the Lake itself, and the inherent risks to production. The second aspect is the effect of the practises adopted by farmers (Riisgaard, Bolwig, 2008, p. 3). Missing from

the IDH Aquaculture conference, and most conversations I was privy to, was a real acknowledgement of the environmental risks. After a seven-hour briefing with IDH consultants, one of them as an after-thought asked about the environmental effects of aquaculture. To which Luke Okech said the greatest risk was not from aquaculture but other land-based industries near the lake. A recent World Bank study from 2020 reiterated this. They found that conventional, chemically-laden agricultural methods, dumping of urban sewage and industrial waste were the primary drivers of ecological change on the lake (Varughese, 2022). Eutrophication is driven by decomposing organic matter, which can be sewage, algae, water hyacinth, fish feed or fish waste (Odada *et al*, 2004).

9.6.1 Pollutants

Fisherfolk also face environmental risks from land use that are far outside of their control (Odada *et al*, 2004). The farm manager at Oharia Beach reported that the year before there had been a massive fish kill. This was corroborated by news articles that reported 100 tonnes of dead Nile perch piled up on the shores of Uganda, Kenya, Tanzania within two months (Guyson, 2022). At the time of the fish kill, an interview with a fisherman said *omena* and smaller tilapia were not dying, and that Nile perch sized 5 to 10 kilograms, were the most affected as they need more oxygen. (Ssenkabirwa *et al*, 2021).

One of the contributing factors has been worsening ecology of the Lake: algae blooms have grown five times since the 1960s, and about half of the Lake's depths have no oxygen for months at a time (Odada *et al*, 2004, p. 621). When pollutants are dumped in the water, oxygen levels become even more depleted and then fish suffocate.

As I am writing this, a massive fish kill is ongoing in Lake Victoria Farmers started reporting total losses in October 2022 (personal comms, 2022). KMFRI was attributing fish deaths to an influx of polluting chemicals and raw sewage (Ochieng, 2022). Pollutants contribute to eutrophication which causes a surge in algae and water hyacinth. The vegetation removes oxygen, and when this cold, de-oxygenated water from the lake floor surges to the lake's surface, fish suffocate. Caged fish in shallow areas are most susceptible, while wild fish are less vulnerable as they can swim away. This is a devastating loss for any farmer, but for those who have taken out loans, it's even more heart-breaking. Media reports of massive fish kills can also erode consumer confidence in farmed fish.

9.6.2 Tainted Genes, Lowered Fish Immunity: Effects of Farm Practises

The methods adopted by fish farmers should also be assessed on their environmental impact. With the majority of Kenyan fish farmers on the Lake using sinking mash feed, they are contributing to eutrophication and further erosion of the ecosystem. Cages with lead paint raise possible health and safety concerns for the people who eat fish from these cages. Fish would need to be tested to check for lead residue or any other pollutants.

9.6.3 Biodiversity

A key part of tilapia intensification globally is to use all male tilapia fingerlings. Males and females grow to be different sizes, and they will breed, interrupting production. Female fish are treated with hormones to change to male fish. Males grow in a uniform way, easing production. Using hormones in a contained RAS system on land is one thing, but hormone-treated fish in lake cages can escape and mix with the wild fish, and hormones could impact water quality (Obiero, 2019, p. 1703). Studies in Ghana have evidence of GIFT mixing with wild Tilapia, threatening biodiversity (Anane-Taabeah et al, 2019, p. 1). Most worryingly the addition of hormones in the lake has possibility to affect other aquatic species and lower disease resilience in tilapia (Obiero, 2019, p. 1703). Alternatives to produce male fish could be further explored, such as high temperatures or adopting male breeders with YY chromosomes (Obiero, 2019, p. 1703).

9.6.4 The Unfolding Disaster of G.I.F.T.

A product upgrade often mentioned in the literature, with environmental implications, is genetically improved farm tilapia (GIFT). It is widely promoted by industry. World Fish Center credits GIFT with improved food security and farmer production (2022). It is cited as an important factor in the intensification of aquaculture across Asia (Ponte, 2008), and Zambia (Kaminski, 2018).

However, GIFT is illegal in Kenya. GoK is attempting to preserve the genetic diversity of the wild Tilapia species found in Lake Victoria. Despite the restriction, there are reportedly farmers surreptitiously using GIFT. A respondent said that one of the co-founders of Victoria Farms originally worked for an aquaculture company in Ghana. In Lake Volta in 2017 and 2018 there was a huge spike in fish deaths from bacterial infections of *Streptococcus* and *Necrosis Virus* in spleen and kidneys (Ragasa et al, 2020). This is theorised to be from a combination of widespread poor farming practises and the illegal importation of GIFT Tilapia that were susceptible to disease (Ragasa, 2020, p. 1). Rampant fish disease is being further exacerbated by growing antibiotic resistance in farmed tilapia and catfish, with high levels of e-coli bacteria found in fishponds (Agbeko, 2020). After the collapse of the industry, the co-founder re-located to Kenya to start anew.

In light of the damage, the Ghanaian government has forced the Chinese fish farm importing GIFT to close and is encouraging efforts to develop the Tilapia strain indigenous to Ghana, the Akosombo (Okai, 2019). However, the sector as a whole is more vulnerable: the cross-contamination has led to fish with weaker immune systems, who are more susceptible to disease. Farmers are now encouraged to vaccinate their tilapia against disease (Okai, 2019).

Poor hygiene with fish handling can have devastating ripple effects on public health. Malawi is experiencing its largest Cholera outbreak, in 27 out of 29 districts (WHO, 2022). An informant from the Ministry of Health said cholera was first reported in a fishing settlement, and that the bacteria has been traced to fish being sold at urban markets.

When assessing the risks faced by farmers, they represent the whole spectrum of easily adoptable by the farmer (change feeds, don't use GIFT) to much larger, complex issues that require multi-country agreements such as reducing pollutants. Utilising the natural diversity from the Lake to continually breed more robust varieties is seen as a safer strategy.

Chapter 10 Final Thoughts

In order to investigate upgrading pathways along Kenya's aquaculture value chain, I navigated between two approaches: the ethos of social enterprise and class-based Marxist agrarian political economy. A business case for cage fish farming first needed to be established. If a farmer-owner purchases large enough cages (minimum 5 x 5 sq m), places them in a conducive part of the Lake, sources high quality inputs, outmanoeuvres thieves, storms, and is downriver of considerate businesses who properly dispose of their toxic waste, then yes, aquaculture can be an avenue for generating income, provided that they

liaise with buyers who pay at the time of delivery or shortly thereafter. It requires significant capital investment, from Ksh 500.000/€3.930) to Ksh 2 m/ (€15.731), and the means to finance a production cycle for 8 to 13 months. Preferably this is money that comes from personal savings, to avoid high interest payments. No insurance product exists yet for aquaculture in Kenya, so the farmer should hedge their bet, by running a joint venture and/or multiple income streams. This would spread out the risk and enable the farmer to offset losses and avoid financial ruin.

A Marxist lens reveals how social differentiation is a key component of defining the feasibility of upgrading pathways. Inversely, aquaculture reinforces social differentiation, as one's position at the starting line heavily determines the outcome. There are high barriers to entry, and those who can invest enough have an opportunity for greater accumulation. The ones unable to join stay marginalised. Farmer-workers, small scale fish traders, and farmers who invest in shoddy cages and inputs are not able to move up. Farmers reliant on only aquaculture can fare worse than those with a diversified portfolio. They are more vulnerable if they had to take out a loan to finance the farm as they could end up worse than where they started.

Models that propose contract farming with vulnerable groups should proceed with caution. Consequences need to be fully thought through, and worst-case scenarios woven into program design, in order to blunt the effects of social differentiation. Can an insurance product be offered? What happens if people default on their loans or if all their assets are stolen or lost in a storm? The goal should be to prevent the further impoverishment of marginalised participants. Black swan events⁵ (terrorist attacks, crippling drought, currency devaluations) occur here with somewhat regularity.

⁵ "Rare and unpredictable events that have severe consequences as a result of the event" (Leonard, 2022).

Further Research

Continued population growth and urbanisation in Kenya assure vibrant demand for fresh fish. With several supermarket giants going bust in Kenya in the last two years – Nakumatt, Shoprite, Tusky's, Uchumi, more research needs to go into what a farmer-centred supply chain would look like, echoing van der Heijden and Vink (2013). This research would have benefited from seeking out the voices of those not part of the value chain and ex-farmers who have exited the chain to learn more about what went wrong.

Two other avenues for future research into more equitable forms of aquaculture could examine the role of savings groups and cooperatives. To what extent do savings groups offer a bridge for financially-excluded people to start and manage businesses? How do different types of cooperatives facilitate entry into aquaculture? How successful are these enterprises?

References Cited

- Abila, R.O., Jansen, E.G. (1997). "From Local To Global Markets: The Fish Exporting And Fishmeal Industries Of Lake Victoria- Structure, Strategies And Socio-economic Impact In Kenya." *Socio-economics of Lake Victoria Fisheries: IUCN East African Program*. 2, September, pp.1-38. Available:(<https://portals.iucn.org/library/sites/library/files/documents/1997-082.pdf>). Accessed: 20 March 2022.
- Abwao, J. et al. (2021a). "Selective Breeding Of Nile tilapia, *Oreochromis niloticus*: A Strategy For Increased Genetic Diversity And Sustainable Development Of Aquaculture In Kenya." *Journal Of Applied Aquaculture*, DOI: 10.1080/10454438.2021.1958728
- Abwao, J. et al. (2021b). "Socioeconomic Dynamics And Characterization Of Land-Based Aquaculture In Western Kenya," *Aquatic Ecosystem Health and Management*, 24(1), pp. 64–72. DOI: 10.14321/aehm.024.01.10.
- Acumen Fund (2022). "About." Available: (<https://acumen.org/>). Accessed 10 November, 2022.
- Agbeko, R. (2020). Isolation And Characterization Of Antibiotic Resistant Bacteria From Selected Fish Farms In The Central And Western Regions Of Ghana. Master in Philosophy Thesis. University of Cape Coast. Available (<https://ir.ucc.edu.gh/xmlui/handle/123456789/6480>). Accessed 10 November 2022.
- Amankwah, A., Quagraine, K.K., and Preckel, P.V. (2018). "Impact Of Aquaculture Feed Technology On Fish Income And Poverty In Kenya." *Aquaculture Economics & Management*, 22,4, pp. 410-430, DOI: 10.1080/13657305.2017.1413689
- Anane-Taabeah, G, Frimpong, E.A., Hallerman, E. (2019). "Aquaculture Mediated Invasion Of The Genetically Improved Farmed Tilapia (Gift) Into The Lower Volta Basin Of Ghana" *Diversity* 11,10 (188). <https://doi.org/10.3390/d11100188>
- Aquarech. (2021). "Farmer Agency for Rural Empowerment: The FARE Approach," pp. 1-80.
- Balirwa, J.S. (2007). "Ecological, Environmental And Socioeconomic Aspects Of The Lake Victoria's Introduced Nile Perch Fishery In Relation To The Native Fisheries And The Species Culture Potential: Lessons To Learn." *African Journal of Ecology*, 45(2), pp. 120-129.
- Barrientos, S., Gereffi, G., Rossi, A. (2010). "Economic and Social Upgrading In Global Production Networks: Developing A Framework For Analysis." *Capturing The Gains*, pp. 1-25. Available: (www.capturingthegains.org/publications/workingpapers/index.htm.) Accessed 12 March 2022.

- Barrientos, S., Gereffi, G., Rossi, A. (2018). Economic And Social Upgrading In Global Production Networks: A New Paradigm For A Changing World In (ed.), Gereffi, G., *Global Value Chains And Development Redefining The Contours Of 21st Century Capitalism*. Cambridge: Cambridge University Press.
- Béné, C., Lawton, R., Allison, E.H. (2010). “‘Trade Matters In The Fight Against Poverty:’ Narratives, Perceptions, And (Lack Of) Evidence In The Case Of Fish Trade In Africa.” *World Development*. 38(7), pp. 933–954. DOI: 10.1016/j.worlddev.2009.12.010
- Béné C., Steel, E., Kambala Luadia, B., and Gordon, A. (2009). “Fish As The ‘Bank In The Water’ – Evidence From Chronic-Poor Communities In Congo.” *Food Policy*, 34, pp. 104–118.
- Bernhardt, T., Milberg, W. (2011). “Economic And Social Upgrading In Global Value Chains: Analysis Of Horticulture, Apparel, Tourism And Mobile Telephones.” Capturing the Gains Working Paper. June. Available:(http://www.capturingthegains.org/publications/workingpapers/wp_201106.html). Accessed 10 June 2022.
- Bolwig, S., Ponte, S., du Toit, A., Riisgaard, L., and Halberg, N. (2008) “Integrating Poverty and Environmental Concerns into Value-chain Analysis: A Conceptual Framework And Lessons For Action Research.” DIIS Working Paper, 2008,16, pp. 1-70. Copenhagen: Danish Institute of International Studies, pp. 1-70.
- Bolwig, S., Ponte, S., du Toit, A., Riisgaard, L., and Halberg, N. (2010) “Integrating Poverty and Environmental Concerns into Value-chain Analysis: A Conceptual Framework.” *Development Policy Review*, 28 (2), pp. 173-194.
- Business Daily Africa (2015). “Nakumatt, Naivas, And Tusky’s In Debt Row With Suppliers.” 29 September. Available: (<https://www.businessdailyafrica.com/bd/corporate/companies/nakumatt-naivas-and-tuskys-in-debt-row-with-suppliers-2097594>). Accessed: 17 November 2022.
- Carswell, G., de Neve, G. 2013. “Labouring For Global Markets: Conceptualising Labour Agency In Global Production Networks.” *Geoforum*. 44, pp. 62-70. Available: <http://dx.doi.org/10.1016/j.geoforum.2012.06.008> Accessed 25 June 2022.
- Collins, T. (2022). “Kenyan Company Tapping Into ‘Multibillion-Dollar’ Fish Farming Opportunity.” *How We Made It In Africa*. 1 July 2022. Available: (<https://www.howwemadeitinafrica.com/kenyan-company-tapping-into-multibillion-dollar-fish-farming-opportunity/144914/>). Accessed: 10 November 2022.
- Dolan, C., Humphrey, J. 2004. “Changing Governance Patterns In The Trade

In Fresh Vegetables Between Africa And The United Kingdom.” *Environment and Planning A*. 36,3, pp. 491–509.

du Toit, A. (2009). “Adverse Incorporation And Agrarian Policy In South Africa. Or How Not To Connect The Rural Poor To Growth.” *Institute for Poverty, Land And Agrarian Studies*. Pp. 1-27. Available: (https://repository.uwc.ac.za/bitstream/handle/10566/65/duToit_Adverse2009.pdf?sequence=3). Accessed 25 June 2022.

Echoing Green, (2022). “About Us.” Available: (<https://echoinggreen.org/about/>). Accessed 10 November 2022.

Ethical Trading Initiative (ETI). (2005). *Recommendations For Working With Smallholders. ETI Smallholder Guidelines*. ETI Reports. London: Ethical Trading Initiative, pp. 1-111.

Farm Africa. (2016). “Gender Impact Study Of The Kenya Market-Led Aquaculture Program.” Nairobi: Farm Africa, pp. (1-182).

FKE. (2021). “Informal Economy In Kenya..” *Federation Of Kenya Employers*. March. Pp. (1-85).

Fiorella, K.J., Camlin C.S., Salmen, C.R., Omondi, R., Hickey, M.D., Omollo, D.O., Milner, E.M., Bukusi, E.A., Fernald, L.C.H., Brashares, J.S. (2015). “Transactional Fish-For-Sex Relationships Amid Declining Fish Access In Kenya.” *World Development*, 74, pp. 323- 332. doi: <http://dx.doi.org/10.1016/j.worlddev.2015.05.015>

Gerber, J.-F. (2014). “The Role Of Rural Indebtedness In The Evolution Of Capitalism.” *The Journal of Peasant Studies*, 41(5), pp. 729–747, <http://dx.doi.org/10.1080/03066150.2014.921618>

Gerber, J.-F., Raina, R.S. (2018). “Post Growth In The Global South? Some Reflections From India and Bhutan.” *Ecological Economics*. 150. Pp. 353-358. <https://doi.org/10.1016/j.ecolecon.2018.02.020>

Gibbon, P. (1997). *Of Savour and Punks: The Political Economy Of The Nile Perch Marketing Chain In Tanzania*. CRD Working Paper 97.3. Copenhagen: Center for Development Research.

Goodman, D., DuPuis, E.M., Goodman, M. (2012) *Alternative Food Networks Knowledge, Practice, And Politics*. New York: Routledge. Pp. 1-298.

Guarin, A., Nicolini, G., Vorley, B., Blackmore, E., and Kelly, L. (2022). *Taking Stock Of Smallholder Inclusion In Modern Value Chains: Ambitions, Reality And Signs Of Change*. London: IIED.

Guyson, N. (2022). “Lake Victoria Locals Blame Companies For Mysterious Mass Fish Die-Offs.” *African Arguments*. 11 May. Accessed: 1 November 2022. Available: (<https://africanarguments.org/2022/05/lake-victoria-locals-blame-companies-for-mysterious-mass-fish-die-offs/>).

- Haggblade, S., Theriault, V., Staatz, J., Dembele, N., Diallo, B. (2012) “A Conceptual Framework For Promoting Inclusive Agricultural Value Chains.” *IFAD*. Pp. 1- 38).
- Jacobi, N. (2013). *Examining The Potential Of Fish Farming To Improve The Livelihoods Of Farmers In The Lake Victoria Region, Kenya Assessing Impacts of Governmental Support*. Master’s Thesis. University of Akureyri. (Pp. 1-103).
- Jansen, E. G. (1997) “Rich Fisheries – Poor Fisherfolk: Some Preliminary Observations About The Effects Of Trade And Aid In The Lake Victoria Fisheries.” *Socio-economics Of The Nile Perch Fishery Of Lake Victoria Project Report, 1*, Nairobi: IUCN-EARO, pp. 1-17.
- Jentoft, S., Onyango, P., and Islam, M.M. (2010). “Freedom And Poverty In The Fishery Commons.” *International Journal of the Commons*, February, 4 (1), pp. 345-366. Available: <https://www.jstor.org/stable/26523026>. Accessed: 25 March 2022.
- Kaminski, A.M., Genschick, S., Kefi A.S., Kruijssen, F. (2018). “Commercialisation And Upgrading In The Aquaculture Value Chain In Zambia.” *Aquaculture*. 493, pp. 355–364. <https://doi.org/10.1016/j.aquaculture.2017.12.010>
- Kaminski, A.M. (2020). “A Review Of Inclusive Business Models And Their Application In Aquaculture Development.” *Reviews In Aquaculture*. 12, pp. 1881–1902. DOI: 10.1111/raq.12415
- Kene-Okafor, T. (2022). “Kenya-Based Aquaculture Tech Victory Farms Nets \$5M Funding To Expand Into New Markets.” *Tech Crunch*. 19 May. Available: (<https://techcrunch.com/2022/05/19/kenya-based-aquaculture-tech-victory-farms-nets-5m-funding-to-expand-into-new-markets/>). Accessed: 8 November 2022.
- Kimani E.N., Aura M.C., Okemwa, G.M. (eds.) (2018) “The Status Of Kenya Fisheries: Towards The Sustainable Exploitation Of Fisheries Resources For Food Security And Economic Development.” *Kenya Marine and Fisheries Research Institute (KMFRI)*, Mombasa pp. 1-135
- Knorringa, P., Pegler, L. (2006). “Globalization, Firm Upgrading And Impacts On Labour.” The Hague: Institute of Social Studies.
- Kruijssen, F., McDougall, C.L., van Asseldonk., I.J.M. (2018). “Gender And Aquaculture Value Chains: A Review Of Key Issues And Implications For Research.” *Aquaculture*, 493, pp. 328–337.
- Ikiara, M. M. (1999) Sustainability, Livelihoods, Production And Effort Supply In A Declining Fishery: The Case of Kenya’s Lake Victoria Fisheries. D. Phil Thesis. University of Amsterdam, The Netherlands.
- Leonard, K. (2022). “What is a Black Swan Event?” *Seeking Alpha*. Available:

(<https://seekingalpha.com/article/4489012-black-swan-event>).
Accessed: 20 November 2022.

- Lwenya, C., Yongo, E., Nunan, F., Onyango, L.J.. (2012). "Finding Space for Participation: Fisherfolk Mobility and Co-Management of Lake Victoria Fisheries." *Environmental Management*, pp. 204-216. DOI: DOI:10.1007/s00267-012-9881-y
- March, A., Failer, P. (2022). "Small-Scale Fisheries Development In Africa: Lessons Learned And Best Practices For Enhancing Food Security And Livelihoods," *Marine Policy*, 136, pp. 1-12.
- Mayer, F., Pickles, J. 2011. Re-embedding Governance: Global Apparel Value Chains and Decent Work. 'Capturing the Gains' Working Paper 01, *University of Manchester*.
- McCormick, D., Mitullah, W.V., (2007). 'Global Markets And Local Responses: The Changing Institutions In The Lake Victoria Fish Cluster' In Oyelaran-Oyeyinka and McCormick (eds), *Industrial Clusters And Innovation Systems In Africa: Institutions, Markets And Policy*, United Nations University Press.
- Medard, M., Wilson, D.C. (1996). "Changing Economic Problems For Women In The Nile Perch Fishing Communities On Lake Victoria." *Anthropologica*, 38(2) 149, pp. 1-25. Available: (<https://www.proquest.com/docview/214174247?accountid=13598&orcedol=true>) Accessed: 14 April 2022.
- Mena Report, (2018) "Italy, Kenya: Development Of Kenya's Aquaculture Sector Could Reduce Rural Poverty And Tackle Chronic Malnutrition And Food Insecurity." 25 June. Gale Academic OneFile, Available: (link.gale.com/apps/doc/A544294397/AONE?u=erasmus&sid=oclc&xid=e59f6f03). Accessed 4 Jan. 2022.
- Milberg, W., Winkler, D. (2012). "Economic and Social Upgrading in Global Production Networks: Problems of Theory and Measurement," Global Development Institute Working Paper Series ctg-2010-04, GDI, *The University of Manchester*. Available: (<https://ideas.repec.org/p/bwp/bwppap/ctg-2010-04.html>). Accessed 10 November 2022.
- Mills, S. (2003). Power/Knowledge in *Michel Foucault* (pp. 67-79). Routledge: London.
- Molony, T., Richey, L. A., Ponte, S. (2007). "'Darwin's Nightmare': A Critical Assessment." *Review Of African Political Economy*, 113, pp. 598-608.
- Mojola, S.A. (2011) "Fishing In Dangerous Waters: Ecology, Gender and Economy In HIV Risk." *Social Science and Medicine*, 72, pp. 149-156.
- Moreau, M.A., Garaway, C.J. (2018) "'Fish Rescue Us from Hunger' the

Contribution of Aquatic Resources to Household Food Security on the Rufiji River Floodplain, Tanzania, East Africa.” *Human Ecology*, 46, pp. 831–848 <https://doi.org/10.1007/s10745-018-0030-y>

- Ndanga, L.Z.B., Kwamena Quagraine, Ngugi, C.C., Amadiva, J. (2015). “Application Of Porter's Framework To Assess Aquaculture Value Chain In Kenya.” *African Journal of Food, Agriculture, Nutrition and Development*, 3,15, 3. June. pp. 10118+. Gale Academic OneFile. Available:(link.gale.com/apps/doc/A423048642/AONE?u=erasmus&sid=oclc&xid=db113b76). Accessed 16 Nov. 2022.
- Neiland, A.E. (2004). “Incorporating Fish Market and Trade Information Into Policy-Making For Sustainable Livelihoods And Poverty Reduction: Methods And Lessons From The Lake Chad Basin.” DFID/FAO Sustainable Fisheries Livelihoods Programme (SFLP).
- Newsome, K., Taylor, P., Bair, J., Rainnie, A. (eds). (2015). ‘Putting Labor In Its Place: Labour Process Analysis And Global Value Chains’ in Newsome, K. et al (eds) *Putting Labor In Its Place*. London: Macmillan, pp. 1-28.
- Nyamweya, C. S. et al. (2020) “A Century of Drastic Change: Human-Induced Changes of Lake Victoria Fisheries and Ecology,” *Fisheries Research*, 230. doi: 10.1016/j.fishres.2020.105564.
- Obiero, K.O., Abila, R.O., Njiru, M.J., Raburu, P.O., Achieng, A.O., Kundu, R., Ogello, E., Munguti, J.M., Lawrence, T. (2015). “The Challenges Of Management: Recent Experiences In Implementing Fisheries Co-Management In Lake Victoria, Kenya.” *Lakes and Reservoirs: Research and Management*, 20, pp. 139–154. Doi: 10.1111/lre.12095
- Obiero, K.O., Waidbacher, H., Nyawanda, B.O., Munguti, M., Manyala, J.O., Kaunda-Arara, B. (2019) “Predicting Uptake Of Aquaculture Technologies Among Smallholder Fish Farmers in Kenya.” *Aquaculture International*, 27, pp. 1689–1707 <https://doi.org/10.1007/s10499-019-00423-0>
- Obwanga, B., Lewo, M.R. (2017). “From Aid To Responsible Trade: Driving Competitive Aquaculture Sector Development In Kenya. Quick Scan Of Robustness, Reliability And Resilience Of The Aquaculture Sector. Wageningen, Wageningen University & Research, Report, Kenya. 68 pp. 1-68.
- Ochieng, A. (2022). “Pollution Blamed For Mass Fish Deaths in Lake Victoria.” *The Nation*. 23 Oct. Available:(<https://nation.africa/kenya/counties/kisumu/pollution-blamed-for-mass-fish-deaths-in-lake-victoria-3994978> Accessed (1 November 2022).
- Odada, E.O., Olago, D.O., Kulindwa, K., Ntiba, M. & Wandiga, S. (2004). “Mitigation Of Environmental Problems In Lake Victoria, East Africa: Causal Chain And Policy Option Analyses.” February. *Ambio*, 33,

- 1/2 Transboundary Issues in Shared Waters, pp. 617–627. Available: www.jstor.org/stable/4315451. (Accessed 10 January 2022.)
- Ogello, E.O., Obiero, K., Munguti, J.M. (2013). “Lake Victoria And The Common Property Debate: Is The Tragedy Of The Commons A Threat To It’s Future.” *Lakes, Reservoirs And Ponds*, 7(2), p.101-126.
- Okai, E.K. (2019). “Can Ghana’s Tilapia Sector Bounce Back?” 12 March. *The Fish Site*. Available: (<https://thefishsite.com/articles/can-ghanas-tilapia-sector-bounce-back>) Accessed: 15 November.
- O’Laughlin, B. (2002). “Proletarianisation, Agency And Changing Rural Livelihoods: Forced Labour And Resistance In Colonial Mozambique.” *Journal of Southern African Studies*, 28(3), pp. 511-530, DOI: 10.1080/0305707022000006495
- Omollo, R. (2022). “Firm Sets up 500 Cages in Lake Victoria To Boost Supply.” *The Star*. 2 June. Available: (<https://www.the-star.co.ke/counties/nyanza/2022-06-02-firm-sets-up-500-cages-in-lake-victoria-to-boost-fish-supply/>). Accessed: 10 November 2022.
- Omwoma, S., Owuor, P.O., Anger, D.M.K., Umami, M., Lalah, J.O., Schramm, K-W. (2014). “Declining Commercial Fish Catches in Lake Victoria’s Winam Gulf: The Importance of Restructuring Kenya’s Aquaculture Program.” *Lakes and Reservoirs: Research and Management*. 19, p. 206-210.
- Opondo, P. (2016). Fisheries As Heritage: Indigenous Methods Of Fishing And Conservation Among The Luo Fishers of Lake Victoria, Kenya. In A.-M. Deisser & M. Njuguna (Eds.), *Conservation of Natural and Cultural Heritage in Kenya: A Cross-Disciplinary Approach* (1st ed., pp. 200–211). UCL Press. <https://doi.org/10.2307/j.ctt1gxxpc6.20>
- Pegler, L. (2015) “Peasant Inclusion In Global Value Chains: Economic Upgrading But Social Downgrading In Labour Processes?” *The Journal of Peasant Studies*, 42(5), pp. 929–956. doi:10.1080/03066150.2014.992885
- Ponte, S. (2008). “Developing A ‘Vertical’ Dimension To Chronic Poverty Research: Some Lessons From Global Value Chain Analysis.” *Chronic Poverty Research Centre*. Working Paper, 111. Pp. 1-33. Available: <https://ssrn.com/abstract=11538946>
- Ragasa, C., Agyakwah, S.K., Asmah, R., Mensah, E.T-D., Amewu. (2020). “Characterisation Of Fish Farming Practices And Performance.” *IFPRI Discussion Paper 01937*, pp. 1-33. Available: (<https://books.google.nl/books?id=qyHtDwAAQBAJ&dlpg=PR5&ots=I5y0YLVRF0&dq=Domazoro%20Lake%20Volta%20fish%20health%20Journal%20of%20Fish%20Diseases%2C&lr&pg=PR5#v=onepage&q&f=false>). Accessed: 10 November 2022.

- Riisgaard, L., Bolwig, S., Ponte, S., du Toit, A., Halberg, N., and Matose, F. (2010). "Integrating Poverty And Environmental Concerns Into Value-Chain Analysis: A Strategic Framework And Practical Guide," *Development Policy Review*, 28, (2), pp. 195-216.
- Riisgaard, L., Hammer, N. (2011). "Prospects For Labour In Global Value Chains: Labour Standards In The Cut Flower And Banana Industries." *British Journal of Industrial Relations*, 49(1), pp. 168–190. Available at <http://onlinelibrary.wiley.com/doi/10.1111/j.1467-8543.2009.00744.x/abstract>.
- Rutasire, J., Kabonesa, C, Okechi, J.K., Boera, P. (2010). 'Gender Issues In Fish Farming In The Lake Victoria Basin: With A Focus On Development And Dissemination Of Wetland Clariid Fishes Breeding Technologies' In Flintan, F., Tedla, S. (eds.), *Natural Resource Management The Impact of Gender and Social Issues*. Kampala, Uganda: Foundation Publishers, pp. 157-183.
- Rothuis, A., van Duijn, A.P., van Rijsingen, J., van der Pijl, Rurangwa, E., (2011). *Business Opportunities For Aquaculture In Kenya: With Special Reference to Food Security*. LE Report. The Hague: Wageningen UR. November, pp. 1-132.
- Scoones, I. (2015). *Sustainable Livelihoods And Rural Development: Agrarian Change & Peasant Studies*. Warwickshire, UK: Fernwood Publishing, pp. 1-138.
- Scott, J. (1976). *The Moral Economy of the Peasant: Rebellion and Subsistence in Southeast Asia*. New Haven: Yale University.
- Selwyn, B. (2013). "Social Upgrading And Labour In Global Production Networks: A Critique And An Alternative Conception." *Competition And Change*. 17,1, February, pp. 75-90. DOI 10.1179/1024529412Z.00000000026
- Shaffer, P., Kanbur, S., Sandbrook, R. (eds) (2019) *Immiserizing Growth : When Growth Fails The Poor*. First edn. Oxford, United Kingdom: Oxford University Press. Available at: INSERT-MISSING-URL (Accessed: 20 November 2022).
- Shiundu, L. (2021). "Tuskys Collapse: Once Giant Supermarket Chain Closes Last Branch In Nakuru." *Tuko*. 30 Jan. Available: (<https://www.tuko.co.ke/400537-tuskys-collapse-once-giant-supermarket-chain-closes-branch-nakuru.html>). Accessed 16 November 2022.
- Ssenkibirwa, A., Edema, D., Muganga, M., Musasizi, A., Kutamba, W. (2021). "Tonnes of Nile Perch Rot As Fish Species Die En Masse." *The Uganda Daily Monitor*. 11 February. Accessed: 1 November 2022. Available: (<https://www.monitor.co.ug/uganda/news/national/tonnes-of-nile-perch-rot-as-fish-species-die-en-masse-3287650>)

- Taylor, P. and Bain, P. (2005). "India Calling To The Far Away Towns: The Call Centre Labour Process And Globalisation." *Work, Employment and Society*, 19(2), pp. 261–282
- UNEP (2016). "A New Shine To Gold: Reducing Health Hazards Of Artisanal And Small-Scale Gold Mining." *United Nations Environmental Programme*. 6 December. Available: (<https://www.unep.org/news-and-stories/story/new-shine-gold-reducing-health-hazards-artisanal-and-small-scale-gold-mining>). Accessed 10 November 2022.
- Varughese, M, KC, S. (2022). "Protecting Lake Victoria For A Green, Resilient, Inclusive Future." *World Bank Practice Group*. 15 March. Accessed: 1 November 2022. Available: (<https://blogs.worldbank.org/water/protecting-lake-victoria-green-resilient-and-inclusive-future>)
- van der Heijden, T., Vink, N. (2013) "Good For Whom? Supermarkets And Small Farmers In South Africa – A Critical Review Of Current Approaches To Increasing Access To Modern Markets." *Agrekon*, 52,1, pp. (68-86), DOI: 10.1080/03031853.2013.778466
- Waiyaki, E. (2014). *Coping Strategies Of Kenya's Coastal Artisanal Fishing Households Against Poverty: Do these strategies produce any sustained benefit? Master's Thesis*. International Institute of Social Studies, pp. 1-58.
- WHO. (2022). "Cholera-Malawi." Available: (<https://www.who.int/emergencies/disease-outbreak-news/item/2022-DON419>). Accessed: 10 November 2022.
- Will, M. (2011). "Integrating Smallholders Into Global Supply Chains." GTZ Division Economic Development and Employment and Division Agriculture, Fisheries and Food. April. Available at <http://www.giz.de/Themen/en/dokumente/gtz2010-en-globalgap-group-certification.pdf>
- World Bank. (2022). "Population Growth (Annual %)- Kenya." The World Bank Data Bank. Available: (<https://data.worldbank.org/indicator/SP.POP.GROW?locations=KE>). Accessed: 16 November 2022.
- World Fish Center. (2022). "The Gift That Keeps On Giving." Available: <https://www.worldfishcenter.org/pages/gift/> Accessed: 1 November 2022.

Appendices

Questions Posed in Interviews

Founder of Lolwe Social Enterprise

- Can he explain more about the work of his social enterprise?
- Who else is involved?
What is the potential?
- How to change the market to make it work better?
- I was at the meeting for equity bank, what other changes are they trying to make?
- How does aquaculture smallholding differ from horticulture?
- How does his business model work, how is he planning to make money?
- Where is he seeking funding?

Equity Bank Employees

Questions covered agriculture financing.

- What is their past experience with agriculture loans?
- Do they lend to individual farmers or cooperatives?
- What sectors or crops have they had success with?
- What are the interest rates?
- What are the barriers for credit provision?
- What is the rate of default?
- What are the types of products and services they offer?
- What are their perceptions of rural clients and farmer SME's?

Farmer Bacchus, Ogal Beach

- What are the risks, challenges of fish farming?
- What are the management challenges?
- How does he manage from a distance?
- How does he prevent theft?
- What has caused the decline of Lake Victoria fishery?
- Who has the most power in this value chain?
- Who are helpful and unhelpful actors
- How is the fish market regulated and structured?
- How does he see this can be improved?
- How does this compare to other crops in Kenya?
- How have farmer livelihoods changed over time, since his father?
- How does his cooperative work? What could be improved?
- How is this value chain structured? Who does he sell to and when? How does he find his traders?

Luke Okech, LakeFresh

- What are the income streams for LakeFresh?
- What are the current projects being funded by donors?
- How are you planning on expanding the business?

- What is holding back farmers from achieving commercial viability?
- How is LakeFresh supporting fish farmers?
- What is the history of your company since founding?

Farm Manager, Oharia Beach

- What are the problems facing fish farmers?
- What trainings have you attended?
- Describe your job
- Does aquaculture offer a decent way to earn a living?
- How much does it cost to start cage fish farms?
- What are the problems facing fishermen?
- Have wild fish harvests decline?
- What are the mitigation measures (if any)? How effective are these?
- Who are the buyers of fish? What is the size of harvest?
- What are environmental events that have occurred?

LakeFresh Employees

- What is your role?
- Describe in your own words the mission of LakeFresh
- How is knowledge managed in the company?
- What does your job entail?
- What are your challenges?
- What are the challenges facing LakeFresh?
- What are the challenges in the aquaculture value chain?
- How does your past experience inform your job?

LakeFresh Aquaculturalist - Additional Questions

- What are the options for upgrading and downgrading by cage fish farmers?
- How have fish farmers struggled ?
- How are farmer workers paid?
- How did the aquaculture project with Farm Africa go?
- What types of homemade feed did fish farmers use?
- What is the difference between backyard fish ponds and fish cages?
- What is the difference between peasant level and commercial level?

Focus Group Questions for Fish Farmers at Ogal Beach Udum Beach

- What are their options for social and economic upgrading?
- What is the risk of social downgrading?
- What do they see as risk?
- How do they manage risks?
- Can they describe what social support systems they have?
- Can they afford to buy fish?
- How often do they eat it?
- What are examples of collective action?
- What are the solutions to their challenges?

