

TRANSFORMATION OF THE AQUACULTURE VALUE CHAIN IN KENYA

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ABSTRACT

The Kenyan aquaculture sector has undergone a profound structural transformation over the last decade, evolving from a subsistence-based activity into a sophisticated commercial ecosystem. This growth is most evident in the cage-based segment of Lake Victoria, which saw an explosive 1,300-fold increase in production volume between 2014 and 2024. While the sector has successfully "democratized participation" by attracting thousands of small-scale farmers, the "industrialization of volume" has led to a concentration where few large-scale, vertically integrated firms now control most of the production. Pond-based aquaculture has also experienced significant expansion over the decade with the number of farmers more than doubling and small-scale operators continuing to dominate, representing over 89% of all producers. While total production volume surged nearly five-fold to 1,789.7 metric tons, the industry is witnessing a gradual structural shift toward commercial diversification as medium and large-scale operations increase their collective share of total output.

This transformation has been mirrored by the rapid maturation of the "hidden middle," characterized by a professionalized workforce of cage fabricators, specialized managers, and a transport network increasingly dominated by micro-enterprises. To sustain this momentum and ensure inclusive agricultural transformation, future policy must bridge the productivity gap for smallholders through Public-Private-Producer Partnerships (4P), strengthen environmental governance to prevent mass fish kills, and provide targeted credit and infrastructure for the micro, small, and medium enterprises (MSMEs) that provide critical logistics and inputs.

Key words: Cage-based aquaculture, Pond-based aquaculture, Kenya, Aquaculture value chain transformation, Hidden middle, MSMEs (micro, small, and medium enterprises), Vertical integration, Public-Private-Producer Partnerships (4P).

RESUMEN EJECUTIVO

El sector acuícola de Kenia ha experimentado una profunda transformación estructural durante la última década, pasando de una actividad de subsistencia a un ecosistema comercial sofisticado. Este crecimiento es más evidente en el segmento de jaulas del lago Victoria, que registró un aumento explosivo de 1.300 veces en el volumen de producción entre 2014 y 2024. Si bien el sector ha logrado "democratizar la participación" al atraer a miles de pequeños productores, la "industrialización del volumen" ha dado lugar a una concentración en la que unas pocas empresas de gran escala, verticalmente integradas, controlan hoy la mayor parte de la producción. La acuicultura en estanques también se expandió de manera importante durante la década, con más del doble de productores, y con el predominio continuo de operadores de pequeña escala, que representan más del 89% de todos los productores. Aunque el volumen total de producción aumentó casi cinco veces hasta alcanzar 1.789,7 toneladas métricas, la industria está mostrando un cambio estructural gradual hacia una mayor diversificación comercial, a medida que las operaciones medianas y grandes incrementan su participación conjunta en la producción total. Esta transformación también se ha reflejado en la rápida maduración del "medio oculto", caracterizado por una fuerza laboral profesionalizada de fabricantes de jaulas, gerentes

especializados y una red de transporte cada vez más dominada por microempresas. Para sostener este impulso y asegurar una transformación agrícola inclusiva, la política futura debe cerrar la brecha de productividad de los pequeños productores mediante Alianzas Público-Privadas-Productores (4P), fortalecer la gobernanza ambiental para prevenir mortandades masivas de peces, y proporcionar crédito e infraestructura focalizados para las micro, pequeñas y medianas empresas (MIPYMES) que aportan logística e insumos críticos.

Palabras clave: Acuicultura en jaulas, Acuicultura en estanques, Kenia, Transformación de la cadena de valor acuícola, Medio oculto, MIPYMES (micro, pequeñas y medianas empresas), Integración vertical, Alianzas Público-Privadas-Productores (4P).

1. INTRODUCTION

1.1 Purpose of INCATA Project

The INCATA: Linked Farms and Enterprises for Inclusive Agricultural Transformation in Africa and Asia project aims to understand the relationship between commercial small-scale producers (cSSPs) and micro, small, and medium enterprises (MSMEs) in the hidden middle of the agrifood value chain. It examines how these actors contribute to inclusive agricultural transformation through the following questions:

1. What kickstarts the dynamic of commercialization of SSP and engagement with MSME in the hidden middle? How do some SSP become commercial, how do some MSME get started, and how these two actors co-develop and nurture each other?
2. Which, how and why some cSSP and some MSME move along in the transformation process, while others don't?
3. To what degree does increasing commercialization and development of MSME translate into poverty reduction and women's economic empowerment? Who is included, and who doesn't or gets stuck at low levels of inclusion? How does inclusion accelerate the transformation?
4. What investments and policies have the potential to accelerate the symbiotic co-development of cSSP and MSME and the inclusion effects of that dynamic?

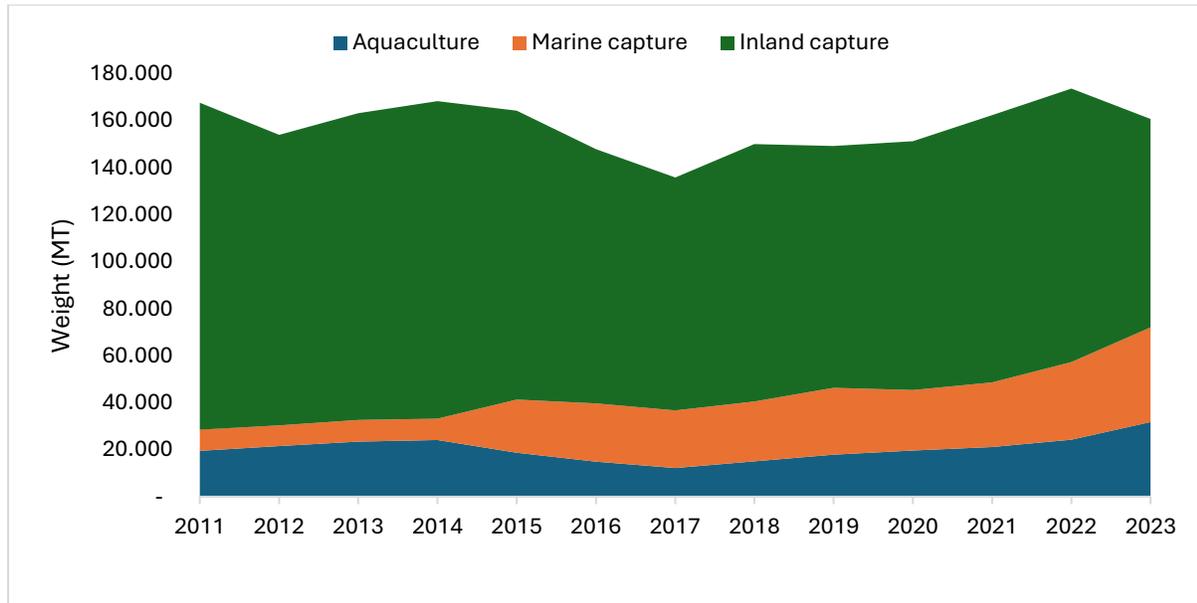
While this VC study was designed under the INCATA project, its scope is narrower and so it cannot address the questions raised. Instead, it is a meso level-inventory of the spatial and size distribution and hence concentration of actors in the key segments of the fish value chain. It assesses the transformation of the VC over a 10-year period focusing on its structure---the structure and growth of the VC (and its segments), how this varies over different production areas, and what drives the observed changes.

1.2 Overview of Aquaculture in Kenya

Kenya ranks as the seventh most populous country in Africa, with a population of 53 million by the end of 2024. The annual fish production in 2023 was about 161,307 metric tons (Figure1). Fish in Kenya primarily come from capture fisheries in rivers, large lakes, coastal systems, and aquaculture. Inland capture constitutes 55% of the production followed by marine sources and aquaculture with 25% and 20%, respectively (KNBS, 2024). This production level is relatively low compared to Egypt, Nigeria, South Africa, Morocco and Ghana indicating potential for growth in the sector.

The main cultured species are Nile tilapia and African catfish, with Lake Victoria being the primary source of capture fisheries, including Nile perch, Nile tilapia, and silver cyprinid (Omena). Kenya's per capita fish consumption is approximately 4.5 kilograms per year, significantly lower than Uganda's 10kg, Tanzania's 8.5 kg and the African average of 10 kg (KeFS, 2023). To match the continental average, Kenya would need to increase its fish production by 113%, thereby positioning capture fisheries and aquaculture to drive transformative and inclusive economic growth in the country.

Figure 1: Quantity of fish produced in Kenya by source and year



Data source: Kenya Fisheries Services, 2023

Kenya faces a significant gap between fish supply and consumer demand, with output from capture fisheries and aquaculture being insufficient (Obiero et al., 2019). The development of aquaculture in Kenya has the potential to address gaps in fish supply and consumption and play a significant role in Kenya's food systems by providing an important source of protein and micronutrients, enhancing food security and offer significant income-generating opportunities, particularly for smallholder farmers, and at each node in the value chain, contributing to poverty alleviation and improving livelihoods in rural communities (Obiero et al., 2019). Furthermore, aquaculture has the potential to create avenues for local and regional trade in fish products, with increasing demand for fish in local markets and export opportunities for Kenya (Munguti et al., 2021).

As a key component of agricultural diversification recognized in the Agriculture Sector Transformation and Growth Strategy (2019-2029), aquaculture could help to reduce the risks associated with relying solely on crop farming. This is particularly important in regions affected by unpredictable weather patterns which can affect crop yields (FAO, 2022). With capture fisheries become more unpredictable, aquaculture offers a sustainable alternative to meet local demand (Munguti et al., 2021) and contribute to more resilient food systems that are less dependent on external supplies (FAO, 2022).

In 2009, the government launched the Economic Stimulus Program (ESP) to boost economic growth and job creation. One key component was the Fish Farming Enterprise Productivity Program (FFEPP), which aimed to increase fish production and consumption. Through this programme, the government invested heavily in constructing fishponds, particularly in arid and

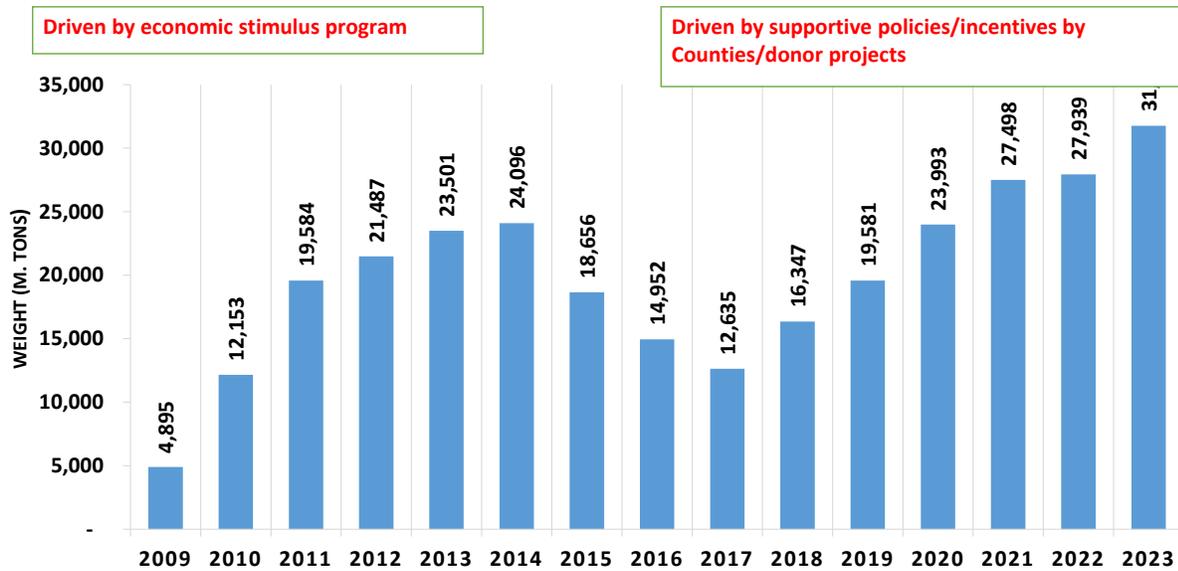
semi-arid areas and promoted aquaculture as an alternative livelihood, particularly in regions not traditionally known for fishing. Awareness campaigns promoted fish as a nutritious and affordable source of protein to increase demand from local production.

Aquaculture fish production has been on the rise since 2018, indicating a positive trend and greater potential in fish farming. The increase was mainly due to the cage farming in Lake Victoria and the uptake of fish farming in several counties. The growth during this period is attributed to government supportive policies and strategies¹, incentives by counties and donor funded interventions, including the Aquaculture Business Development Program (ABDP), Kenya Climate Smart Agriculture Project (KCSAP), Kenya Marine Fisheries and Socio-Economic Development (KEMSFED), and Blue Economy Strategic Resilience and Livelihood Project (Figure 2).

The Aquaculture Business Development Programme (ABDP), co-funded by IFAD and the Government of Kenya, was launched in June 2018 and is focusing on freshwater aquaculture systems to develop a vibrant aquaculture industry, with interventions on the policy and regulatory environment, support to farmer community production technologies, and upgrading strategic infrastructures such as markets, ice plants and processing plants through a Public-Private-Producer Partnership (4P) arrangement. As a result of the project, aquaculture currently contributes about 20% of total national production while capture fisheries has stagnated for the past 10 years.

¹ Kenya's Blue Economy Strategy which focus on strengthening governance and regulatory frameworks to promote responsible fishing and aquaculture; supporting fish farmers through access to quality feeds, fingerlings, and credit facilities and encourage private sector investment in aquaculture.

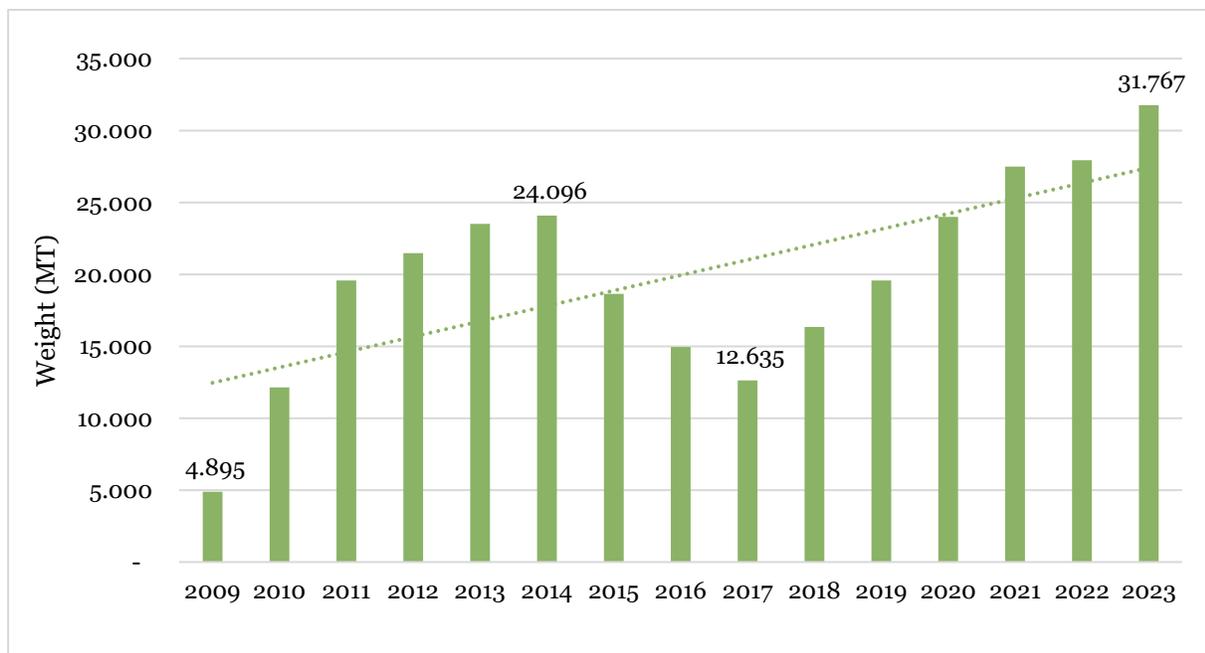
Figure 2: Trends in aquaculture production



Source: Fish Statistical Bulletin 2023 (KEFS).

Aquaculture production has increased more than six-fold from 4,895 metric tons to 31,767 in 2023 (Figure 3), with cage culture contributing over 20,000 metric tons. Despite recent growth in fish production, demand for fish still far exceeds domestic supply.

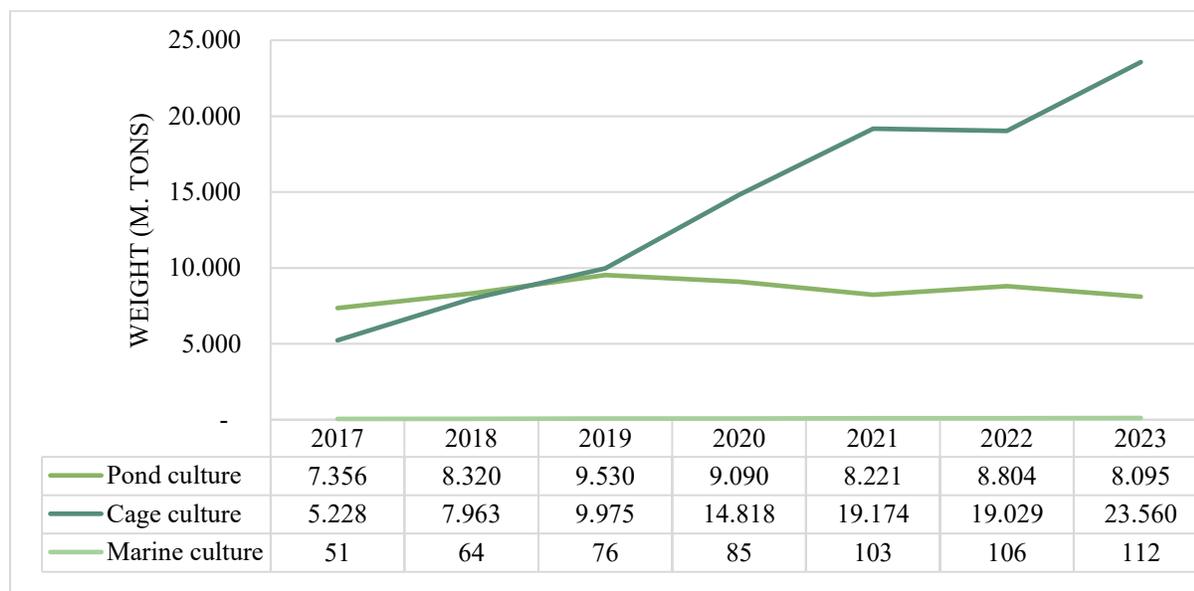
Figure 3: Trends in aquaculture production



Data source: Kenya Fisheries Services, 2023

The growth of the three segments that make up aquaculture (pond, cage and marine) is as shown in Figure 4, with cage culture registering the largest growth since 2019.

Figure 4: Trends of land based ponds, cage and marine culture 2017-2023



Source: Fish Statistical Bulletin, 2023 (KeFS).

This study presents the results from a meso-inventory conducted in various counties in Kenya, which represent the key production areas for cage and pond-based aquaculture, and the key consumption areas. We explore the extent to which the aquaculture value chain is transforming structurally and the roles of cage versus ponding farming, and the supporting services.

2. METHODS

This study is a meso level-inventory of the spatial and size distribution and thus concentration of actors in the key segments of the aquaculture value chain. We used a multistage approach to identify key areas for the meso study. First, a rapid reconnaissance survey was conducted and counties with the highest concentration of pond and cage aquaculture farming were identified. The importance of these areas was confirmed by crosschecks with official statistics and key informant interviews with County Fisheries Officers and an aquaculture expert from KEMFRI. The identified counties for cage farming are Busia, Homa Bay, Kisumu and Siaya, while those for pond farming are Kisii, Siaya, Migori, Bungoma, Kakamega, Busia and Kiambu. The County Fisheries Officers assisted in establishing the major production sub-counties and beaches. Key consumption counties were identified as Kisumu, Nairobi, Mombasa and Nakuru.

Next, during the field visit, a systematic snowballing was used to ensure the inclusion of all relevant beaches for cage farming. We started by assembling key informants at the main beach in each county for a group discussion. The key informants were carefully selected to include representation from each category of actors in the fish value chain (i.e. with beach management

unit (BMU) officials, feeders, security providers, farmers and cage managers). The group was asked to list all the beaches in the county where cage farming has taken place in the county at different points in time (*now, 5 years ago and 10 years ago*). After the listing of the beaches, the key informants were asked to provide for the main beach the number of various actors (input suppliers (feeds, cage nets, dam liners etc), farmers, cage makers, transporters, wholesalers and processors, now, 5 years ago and 10 years ago, by category of sizes where applicable and the reasons for the changes in the numbers.

After completing the group discussion in the main beach in the county, the research team visited all the other listed beaches in the county and engaged with the key informants to validate the list of beaches obtained from the main beach. This iterative process continued in each beach until no new beaches were identified. An inventory of actors was done in each beach. A similar approach was followed in all the counties identified as cage farming areas.

The inventory of pond farmers was done first through focus group discussions involving farmers and local/ward agriculture/fisheries officers. The data obtained from the wards was validated by the county directors of fisheries, who also assisted in filling any gaps.

The meso inventory was undertaken for most of the aquaculture VC actors as shown in Table 1.

Table 1: Definitions of actors and main characteristics

| Actor | Defining characteristic | Size category | Definition |
|------------------------------|--|---------------|--------------------------------------|
| Input supplier (fingerlings) | Number of fingerlings produced per month | Small | <200,000 |
| | | Medium | 200,000-700,000 |
| | | Large | >700,000 |
| Farmers (pond-based culture) | Total production area in square meters (standard pond is 300sqm) | | |
| Farmers (cage-based culture) | Total production per day | Small | <5 tonnes/day |
| | | Medium | 5-20 tonnes/day |
| | | Large | >20 tonnes/day |
| Wholesalers | Volume of fish consignment handled in market at a time | Small | Probox load or less/public transport |
| | | Medium | Canter load |
| | | Large | One lorry load and above |
| Transporters | Type/ number of transport vehicles | Micro | Bodaboda (motorcycle or bicycle) |
| | | Small | Probox |
| | | Medium | Canter or one lorry |
| | | Large | More than one lorry |

3. RESULTS

Results in this section show the structural change represented by changes over a decade (2014-2024) per value chain segment in the numbers and shares of actors by size strata. We present results separately for cage farming, pond farming, and support services.

3.1 Cage-based aquaculture production

Overall, the aquaculture shows huge expansion in number of farmers and volumes of fish (Table 2).

Table 2: Growth in aquaculture in Kenya (2014-2024)

| | |
|--|--|
| Dramatic expansion in participation | Total number of cage farmers rose from 39 operators in 2014 to 2,737 operators in 2024 |
| Exponential rise in production volume | Total volume surged from 24 metric tons (MT) in 2014 to 30,565 MT in 2024. The 2024 volume was 1,300 times that of 2014 |
| Rapid emergence in key counties | Ten years ago, cage aquaculture was either non-existent or negligible in three of the four counties surveyed Siaya County accounted for a large proportion of the total growth in farmer numbers The development of cage aquaculture has been rapid and widespread around Lake Victoria in the last decade |

Further results from Table 3 show the following:

1. An explosive growth in total number of cage farmers over the 10-year period, with Siaya county accounting for a large proportion of the total growth. The initial growth around Lake Victoria (Siaya, in particular) was likely driven by the ideal lacustrine conditions and early pilot projects that served as successful demonstrations. Siaya's long coastline on the lake provided a natural advantage. The success of early adopters created a powerful demonstration effect, encouraging a rapid influx of small-scale entrants. The proliferation of small-scale cages suggests low barriers to entry for this model, potentially supported by county government initiatives, NGO programs, or donor projects aimed at promoting aquaculture as a livelihood. The data on support services (Table A5) shows a concurrent rise in cage fabricators, indicating a local industry emerging to service this demand.

Despite this growth, the cage sector faces recurring challenges—including inadequate regulatory compliance, poor environmental management and frequent mass fish kills that threaten its long-term sustainability (Aura et al., 2025).

2. Emergence and rapid development in specific counties
While ten years ago, cage aquaculture was either non-existent or negligible in three of the four counties, we note a rapid and widespread adoption and expansion of cage-based aquaculture around Lake Victoria in the last decade.
3. Overwhelming dominance of small-scale operations

Throughout the decade, small-sized farms/operations have consistently dominated the cage-based production in terms of numbers, though their share has slightly decreased over

time. This is because they require minimal capital to set up and are within reach for many farmers. As a result, large numbers of small-scale cage farmers joined the sector, while a few well-resourced individuals and large-scale companies, are now producing most of the total volumes, mainly driven by economies of scale.

4. Emergence and gradual increase of medium and large-sized cage operations over time

There is a slow but steady diversification and scaling up within the sector, with some operations moving beyond the smallest scale. However, we note varied development of larger scale operations across counties. In Busia and Kisumu, large scale cage farms only appeared in 2024, reaching 2.1% and 2.3% of the total clusters in their respective counties. For Homa Bay large scale farms appeared earlier in 2019 (9.1%) but their share significantly dropped to 1.0% by 2024, while small scale operations increased their share. Despite its massive total growth, Siaya, still has a relatively small share of large operations (0.5% in 2024).

Overall, the findings indicate that the fish cage-based production has undergone dramatic expansion in terms of the number of operational cages over the last decade, particularly in counties like Siaya. While small-scale operations remain the cornerstone, signifying potential for upgrading or scaling in some counties, there is an identifiable shift towards the integration of medium and large-scale producers, indicating a dynamic and evolving industry structure.

Table 3: Structural change in number of farmers in cage-based production, 2014-2024

| County | Total number | | | Share of small in total number (%) | | | Share of medium in total number (%) | | | Share of large in total number (%) | | |
|--------------|--------------|------------|-----------|------------------------------------|-------------|--------------|-------------------------------------|------------|------------|------------------------------------|------------|------------|
| | 2024 | 2019 | 2014 | 2024 | 2019 | 2014 | 2024 | 2019 | 2014 | 2024 | 2019 | 2014 |
| Busia | 146 | 68 | 0 | 83.6 | 92.6 | 0.0 | 14.4 | 7.4 | 0.0 | 2.1 | 0.0 | 0.0 |
| Homa Bay | 103 | 11 | 0 | 93.2 | 81.8 | 0.0 | 5.8 | 9.1 | 0.0 | 1.0 | 9.1 | 0.0 |
| Kisumu | 311 | 79 | 12 | 89.4 | 100.0 | 100 | 8.4 | 0.0 | 0.0 | 2.3 | 0.0 | 0.0 |
| Siaya | 2177 | 622 | 27 | 96.9 | 99.7 | 100 | 2.6 | 0.2 | 0.0 | 0.5 | 0.2 | 0.0 |
| Total | 2737 | 780 | 39 | 95.2 | 98.8 | 100.0 | 4.0 | 0.9 | 0.0 | 0.8 | 0.3 | 0.0 |

Between 2014 and 2024, the volume of fish in cage-based production has also changed greatly (Table 4), and the following observations emerge:

1. Exponential expansion of cage-based aquaculture
The data clearly demonstrates that cage-based aquaculture has undergone a period of rapid and substantial expansion in terms of production volume over the last decade. The volume in 2024 was 1,300 times that in 2014.
2. Industrialization of production
The dramatic rise in the share of large-scale production, particularly in Homa Bay and overall, suggests a trend towards the industrialization and commercialization of cage-based fish farming. This shift from 100% small-scale contribution in 2014 to large-scale dominance by 2019 and 2024 indicates significant capital investment and scaling up of operations. Homa Bay County's transition toward industrialization has been driven by the entry of vertically integrated firms (e.g. Victory farms) investing in modern hatcheries, feed production and distribution logistics, fish processing infrastructure and community engagement. This expansion has been enabled by favourable site conditions

and a supportive policy environment that promote private sector investment at the county level. In contrast, Siaya's development appears to be driven by a decentralized, smallholder-led model supported by the demonstration effects mentioned earlier.

3. Varied development across counties
While the overall trend points to significant growth and large-scale dominance, the specific contributions of small, medium, and large operations vary by county. Some, like Homa Bay, are heavily driven by large-scale production, while others, like Siaya and Kisumu, still have substantial contributions from small-scale producers, even as larger operations emerge. Busia shows a more balanced growth across all scales by 2024.
4. Potential for continued growth
The continued increase in total volume and the diversification of contributions across different scales (small and medium shares increased relative to large between 2019 and 2024) suggest that the sector is still dynamic and evolving.

Table 4: Structural change in cage-based culture production volumes, 2014-2024

| Sub-county | Total volume (metric tons) | | | Share of small in total volume (%) | | | Share of medium in total volume (%) | | | Share of large in total volume (%) | | |
|--------------|----------------------------|---------------|-----------|------------------------------------|------------|--------------|-------------------------------------|------------|------------|------------------------------------|-------------|------------|
| | 2024 | 2019 | 2014 | 2024 | 2019 | 2014 | 2024 | 2019 | 2014 | 2024 | 2019 | 2014 |
| Busia | 930 | 175 | 0 | 47.2 | 86.3 | 0.0 | 33.4 | 13.7 | 0.0 | 19.4 | 0.0 | 0.0 |
| Homa Bay | 21065 | 11574 | 0 | 3.8 | 0.5 | 0.0 | 0.5 | 0.0 | 0.0 | 95.7 | 99.5 | 0.0 |
| Kisumu | 1652 | 244.2 | 8 | 63.2 | 100.0 | 100.0 | 20.4 | 0.0 | 0.0 | 16.3 | 0.0 | 0.0 |
| Siaya | 6917 | 792 | 16 | 85.9 | 100.0 | 100.0 | 11.1 | 0.0 | 0.0 | 2.9 | 0.0 | 0.0 |
| Total | 30,565 | 12,785 | 24 | 26.9 | 9.7 | 100.0 | 5.0 | 0.2 | 0.0 | 68.1 | 90.1 | 0.0 |

Comparing results in Table 3 (number of operators) and Table 4 (volume of production), several observations emerge regarding the structure and dynamics of cage-based aquaculture:

1. A highly concentrated sector characterized by many small-scale operators who dominate in terms of population (e.g. 95.2% in 2024), but have limited individual production capacity (accounting for only 26.9% of the total volume in 2024), and a very small number of large-scale operators (e.g., 0.8% in 2024) who, despite their minimal numerical presence, control most of the total production volume (68.1% of the total volume in 2024). Large farms achieve lower unit costs via scale (feed conversion, mechanised feeding, better survival) so they produce a disproportionate share of volume despite being few in number. Medium-scale operations show a less extreme, but still significant, productivity advantage. In 2024, they comprised 4.0% of total operators but contributed 5.0% of total volume.

This trend implies: (i) industrialization of production volume characterized by a significant shift towards large-scale production in terms of volume; and (ii) democratization of participation as shown by the massive increase in the total number of operators over the decade, with small-scale operators consistently forming the largest segment of this growth. The findings suggest a parallel trend of democratization of participation, where more small-scale producers are entering the sector, even if their collective output is outpaced by a few large players.

2. County-specific dynamics and specialization

- Homa Bay exemplifies the dominance of large-scale production. In 2024, only 1.0% of its operators were large-scale, but they accounted for an astounding 95.7% of its total production volume.
- Siaya presents a contrasting picture where small-scale operations contribute significantly to the county's total volume, despite the overall trend. In 2024, 96.9% of Siaya's operators were small-scale, and they contributed 85.9% of the county's total production volume.
- Busia and Kisumu show an emerging diversification in production scale. In 2024, Busia's small operators (83.6% of operators) produced 47.2% of the volume, while medium (14.4% of operators) and large (2.1% of operators) contributed 33.4% and 19.4% of the volume, respectively. Similarly, in 2024, small operators (89.4% of operators) in Kisumu produced 63.2% of the volume, with medium (8.4%) and large (2.3%) contributing 20.4% and 16.3%, respectively.
- Both Busia and Homa Bay show rapid emergence of production from zero in 2014, to larger volumes over time. explosive growth by 2019 and 2024. This rapid "from scratch" development, particularly in Homa Bay's case with such strong large-scale dominance, is a notable phenomenon, indicating significant and rapid investment or expansion in these areas.

Factors that have contributed to this trend include:

- i. Increased access to finance and credit facilities: Expansion, especially in Homa Bay County has been enabled by a blend of donor grants and loans, private-sector capital, and Government programmes supporting fingerlings, feeds, cages, R&D, and technical capacity (KCSAP and ABDP).
- ii. Increasing market demand: High consumer demand for farmed fish, combined with declining wild fish catches, continues to pull investment toward cage aquaculture.
- iii. Policy-driven incentives: The introduction of the 10% Government excise duty on imported fish from China encouraged domestic production and attracted new investors into the sector.
- iv. Natural advantages for aquaculture e.g. clear, hyacinth-free waters, deep water (>30 m), suitable for cage siting, and favourable environmental conditions that reduce operational risk
- v. Enabling policy environment for investment including streamlined licensing processes, supportive county leadership and availability of community land along the shoreline and a generally welcoming investment climate.
- vi. The national government's formal launch of the Blue Economy Department in 2016 sent a strong signal that aquatic resources were a priority for economic development. This created a more favorable regulatory and policy environment for investors.
- vii. Emerging opportunities for cage culture and enabling conditions are also observed in Lake Region Economic Block (LREB) counties, as part of a broader Western Kenya aquaculture growth corridor.
- viii. "Big Four Agenda" (2017-2022): Under Food Security and Manufacturing pillars explicitly prioritized aquaculture as a source of cheap protein and job creation, giving the sector high-level political backing.

Generally, these results reveal a dynamic and evolving cage-based aquaculture sector, characterized by a high degree of participation from small-scale operators, yet the lion's share of production volume is increasingly driven by a very small number of highly productive large-scale operations, with county-specific variations in these trends.

3.2 Pond-based aquaculture production

The number of producers under pond-based aquaculture has also shown tremendous growth over the last 10 years (Table 5).

Table 5: Structural change in number of farmers in pond-based aquaculture production, 2014-2024

| County | Total number of farmers | | | Share of small in total number (%) | | | Share of medium in total number (%) | | | Share of large in total number (%) | | |
|------------|-------------------------|---------------|--------------|------------------------------------|-------------|-------------|-------------------------------------|------------|-------------|------------------------------------|------------|------------|
| | 2024 | 2019 | 2014 | 2024 | 2019 | 2014 | 2024 | 2019 | 2014 | 2024 | 2019 | 2014 |
| Siaya | 1403 | 1117 | 324 | 94.1 | 92.2 | 96.6 | 5.6 | 7.8 | 3.4 | 0.3 | 0.0 | 0.0 |
| Kisumu | 74 | 34 | 13 | 81.1 | 88.2 | 100.0 | 18.9 | 11.8 | 0.0 | 0.0 | 0.0 | 0.0 |
| Kisii | 2250 | 2159 | 2809 | 89.7 | 89.8 | 92.3 | 10.3 | 10.2 | 7.7 | 0.0 | 0.0 | 0.0 |
| Busia | 1795 | 1612 | 448 | 94.1 | 92.2 | 96.6 | 5.6 | 7.8 | 3.4 | 0.3 | 0.0 | 0.0 |
| Bungoma | 2,951 | 3,057 | 582 | 93.6 | 95.8 | 94.2 | 6.3 | 4.1 | 5.7 | 0.0 | 0.0 | 0.0 |
| Kakamega | 8,999 | 9,027 | 4,425 | 85.4 | 85.9 | 84.4 | 12.2 | 12.5 | 14.0 | 2.4 | 1.6 | 1.6 |
| Migori | 599 | 322 | 329 | 99.7 | 100.0 | 100.0 | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Kiambu | 886 | 1196 | 75 | 96.0 | 94.7 | 100.0 | 4.0 | 5.3 | 0.0 | 0.0 | 0.0 | 0.0 |
| All | 18,957 | 18,524 | 9,005 | 89.4 | 90.0 | 89.2 | 9.4 | 9.2 | 10.0 | 1.2 | 0.8 | 0.8 |

These findings show the following changes over the 10-year period:

1. Substantial overall growth in the number of pond-based farmers; it more than doubled during this period.
2. Persistent dominance of small-scale farmers, representing over 89% of all producers across the years.
3. Modest emergence and growth of medium-scale farming, coupled with a small but growing presence of large-scale farmers, indicating a nascent development towards larger commercial pond-based operations.
 - Notably, Kakamega consistently had large farmers, and their share increased slightly from 1.6% in 2014 to 2.4% in 2024. KMFRI and ABDP reports indicate that Kakamega has historically benefited from stronger extension services, higher pond densities, and better access to commercial feeds and quality fingerlings than neighbouring counties (Aura et al., 2020; IFAD/ABDP, 2024). The modest increase in large-scale farmers between 2014 and 2024 is linked to rising demand from nearby urban centres such as Kakamega Town and Mumias, which created reliable markets for higher-volume producers. The improved availability of commercial feeds and hatchery services in the region also enabled some medium-scale farmers to grow into larger enterprises (Obiero et al., 2019).

- Furthermore, the adoption rate of the GoK’s Economic Stimulus Program (ESP) in Kakamega County was notably high, creating a solid foundation for growth into the coming decade. In 2024, the county government took proactive steps to further strengthen the sector, including constructing new ponds, rehabilitating older ones, supplying fingerlings and feed, and enhancing market access through initiatives like the Fresh Fish Friday’s campaign, which successfully increased local fish consumption.
4. Diverse county-level growth and structural shifts, with most counties showing fluctuations in the number of farmers and notably:
- A shift towards medium-sized farms in Kisumu (from 100% small farmers in 2014 to 18.9% share of medium farmers by 2024)
 - Late emergence of medium farms in Migori; it had exclusively small farmers (100%) in 2014 and 2019, but by 2024, a small share of medium farmers (0.3%) emerged.
 - Late emergence of large farms in Siaya (0.3%) and Busia (0.3%) by 2024, where they had none in the previous years.
 - In other counties like Kisumu, Kisii, Bungoma, Migori, and Kiambu, large pond-based farmers were either absent or did not emerge by 2024.

The changes in volume of production from 2014-2024 are as shown in Table 6.

Table 6: Structural change in pond-based aquaculture production volumes, 2014-2024

| County | Total volume (metric tons) | | | Share of small in total volume (%) | | | Share of medium in total volume (%) | | | Share of large in total volume (%) | | |
|------------|----------------------------|----------------|--------------|------------------------------------|-------------|-------------|-------------------------------------|-------------|------------|------------------------------------|------------|------------|
| | 2024 | 2019 | 2014 | 2024 | 2019 | 2014 | 2024 | 2019 | 2014 | 2024 | 2019 | 2014 |
| Siaya | 406.6 | 308.1 | 44.1 | 79.9 | 76.3 | 88.8 | 17.5 | 23.7 | 11.2 | 2.6 | 0.0 | 0.0 |
| Kisumu | 17.2 | 4.4 | 0.0 | 65.1 | 54.5 | 0.0 | 34.9 | 45.5 | 0.0 | 0.0 | 0.0 | 0.0 |
| Kisii | 57.7 | 51.6 | 53.7 | 69.2 | 71.6 | 75.5 | 30.8 | 28.4 | 24.5 | 0.0 | 0.0 | 0.0 |
| Busia | 323.6 | 378.0 | 108.0 | 90.9 | 96.1 | 96.4 | 8.7 | 3.8 | 3.6 | 0.4 | 0.0 | 0.0 |
| Bungoma | 469.8 | 425.0 | 26.0 | 82.6 | 88.3 | 84.6 | 17.4 | 11.7 | 15.4 | 0.0 | 0.0 | 0.0 |
| Kiambu | 136.0 | 241.1 | 14.8 | 96.0 | 100.0 | 100.0 | 4.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Kakamega | 257.7 | 213.6 | 53.4 | 84.8 | 86.5 | 86.4 | 8.0 | 7.3 | 7.4 | 7.2 | 6.2 | 6.2 |
| Migori | 121.0 | 64.4 | 65.8 | 98.7 | 100.0 | 100.0 | 1.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| All | 1,789.7 | 1,686.1 | 365.7 | 84.9 | 88.2 | 90.7 | 13.4 | 11.0 | 8.4 | 1.7 | 0.8 | 0.9 |

These results indicate the following:

1. Significant overall growth in pond-based aquaculture production, with output increasing from 365.7 metric tons in 2014 to 1,789.7 metric tons in 2024.
2. Dominance of small-scale farmers in production volume, but with a declining trend.
 - Small-scale farmers consistently contribute the largest share to the total pond-based production volume. However, their share has shown a declining trend over the 10 years, from 90.7% in 2014 to 88.2% in 2019, and down to 84.9% in 2024. This suggests that while small farmers are still the backbone of production, their relative dominance is gradually decreasing as other scales of farming grow.

- Notable counties where small farmers still contribute a very high share include Migori (98.7% in 2024) and Kiambu (96% in 2024).
3. Increasing contribution from medium-sized farms
 - The share of medium-sized farmers in total pond-based production volume has shown a consistent increase, growing from 8.4% in 2014 to 11% in 2019, and significantly rising to 13.4% in 2024. Medium-sized farms are emerging in areas where access to credit, market linkages, seed and feed availability has improved overtime. In contrast, large pond farms are expanding more slowly, as they face higher barriers, including land acquisition, water access rights, and capital requirements, compared to cage systems, which can more easily utilize existing lake space.
 - Counties like Kisumu (34.9%), Kisii (30.8%), Siaya (17.5%) and Bungoma (17.4%) show strong contributions from medium-sized farmers in 2024.
 4. Emergence and growth of large-scale farming in production volume
 - The contribution of large-scale farmers to the total pond-based production volume increased, albeit from a low base, from 0.9% in 2014 to 1.7% in 2024.
 - Kakamega consistently had a share of large-scale production, increasing from 6.2% in 2014 and 2019 to 7.2% in 2024.
 - Siaya (2.6% in 2024) and Busia (0.4% in 2024) also showed the emergence of large-scale production volumes by the end of the decade, having none in previous years.

Overall, results from Table 6 reveal that while small-scale farmers still produce the majority of pond-based aquaculture, there is a clear and growing trend of diversification in production scale, with medium-sized farmers increasing their output share and large-scale operations emerging and contributing more significantly to the total volume, particularly in specific counties like Kisumu and Kakamega.

Support services in aquaculture sector

Just like in the case of production, the aquaculture has registered huge growth and maturation of support services over the last decade (Table 7).

Table 7: Structural change in number of feeders, security guards, cage managers and cage fabricators, 2014-2024

| County | Actor | Number | | |
|----------|------------------|--------|------|------|
| | | 2024 | 2019 | 2014 |
| Busia | Feeders | 130 | 22 | 1 |
| | Security guards | 27 | 12 | 2 |
| | Managers | 71 | 7 | 1 |
| | Cage fabricators | 3 | 2 | 0 |
| Homa Bay | Feeders | 293 | 36 | 0 |
| | Security guards | 66 | 27 | 0 |
| | Managers | 13 | 1 | 0 |
| | Cage fabricators | 9 | 2 | 0 |
| Kisumu | Feeders | 266 | 47 | 6 |
| | Security guards | 52 | 23 | 5 |
| | Managers | 90 | 13 | 4 |

| | | | | |
|--------------|-------------------------|------------|------------|-----------|
| | Cage fabricators | 32 | 16 | 2 |
| Siaya | Feeders | 263 | 104 | 28 |
| | Security guards | 100 | 34 | 5 |
| | Managers | 128 | 49 | 15 |
| | Cage fabricators | 63 | 18 | 0 |
| Total | Feeders | 952 | 209 | 35 |
| | Security guards | 245 | 96 | 12 |
| | Managers | 302 | 70 | 20 |
| | Cage fabricators | 107 | 38 | 2 |

A detailed look at the structural change in the number of key supporting actors in aquaculture cage farming across four counties (Busia, Homa Bay, Kisumu, and Siaya) over a 10-year period, reveals the following:

- Overall rapid and accelerating growth, characterized by a massive increase in the number of all four actor categories between 2014 and 2024, reflecting the expansion of cage aquaculture activity. The Economic Survey 2025 report confirms that fish production from cage culture continues to increase steadily, accounting for 76.4% i.e., 25,547 metric tonnes (out of 33,767 MT valued at Ksh 10 billion in 2024) compared to land-based freshwater and mariculture producing 7,742 MT and 134 MT respectively (KNBS, 2025).
 - Feeders: The total number of feeders grew from 35 in 2014 to 952 in 2024, representing the largest numerical increase among all listed actors.
 - Security guards: The total number of security personnel increased more than twentyfold, rising from 12 in 2014 to 245 in 2024.
 - Managers: The total number of cage managers increased from 20 in 2014 to 302 in 2024.
 - Cage fabricators: This category experienced tremendous proportional growth, increasing from only 2 individuals in 2014 to 107 in 2024, indicating the increasing demand for specialized cage construction and maintenance services.

The data strongly suggests that the supporting ecosystem for cage culture matured rapidly, especially in the last 5 years (2019-2024), across the documented counties. The massive growth in support services (e.g., a 50-fold increase in cage fabricators) is a direct response to the sector's expansion. It signals a transition from a subsistence to a market-oriented economy. As the number of cages and volume of production grows, it becomes viable for individuals and businesses to specialize in providing essential inputs and services, a key indicator of a maturing value chain.

This growth is mainly attributed to more investor farmers going into cage farming and an increasing number of large companies investing in cage-based aquaculture. Additionally, there has been a strong government and development partner policy push for aquaculture development through the Kenya Climate Smart Agriculture Project (KCSAP) that provided subsidies, credit guarantee and grants specifically for aquaculture inputs, including cages, fingerlings, and feed, dramatically lowering the entry cost for thousands of new farmers and the Aquaculture Business Development Programme (ABDP) an initiative to transform aquaculture from subsistence to a business-oriented sector, offering training, infrastructure (hatcheries), and market linkages. Other factors include

willingness from investors and lending organisations who now put their money in fish farming; fish feed companies opening distribution centres near the farmers; fingerling availability from authenticated hatcheries (Kenya Fisheries Service has been conducting hatchery visits to authenticate and ensure compliance to regulatory requirements since 2020); ease of acquiring the licenses; and, fish farming has now been realized as an agribusiness venture (commercialization of the venture instead of subsistence nature of pond-based operations).

2. Regional concentration and dominance

Specific counties dominate the concentration of these supporting actors:

- Siaya County generally exhibits the highest numbers for essential infrastructure and management roles in 2024 i.e. security personnel (100), cage managers (128) and cage fabricators (63), accounting for more than half of the total fabricators (107) across all four counties in 2024.
- Homa Bay County leads in the number of feeders (293) in 2024, closely followed by Kisumu (266) and Siaya (263).

3. Emergence of the aquaculture workforce in Homa Bay

- Homa Bay County showed a complete absence (zero actors) across all four categories (feeders, security, managers, and cage fabricators) in 2014. However, by 2024, the county had developed a significant workforce, hosting the largest number of feeders (293) and substantial security personnel (66), demonstrating a rapid establishment of the necessary support structure within the 10-year window.

4. Feeders vs. managers ratio

- The ratio of feeders to managers in 2024 is approximately 3:1, suggesting that management roles are fewer and potentially oversee multiple feeder operations. Cage managers in Lake Victoria typically supervise multiple cages and, in some cases, entire cage clusters. However, published data rarely specifies the number of farms per cage manager because the management structures are usually organized at the level of cage units within a given enterprise. The standard practice is that managers are assigned to multi-cage clusters within the same farm, not multiple farms. A manager may oversee multiple cage clusters/lines belonging to the same owner, especially in large commercial companies. The 3:1 feeder-to-manager ratio observed in 2024 therefore aligns with documented labour organization in cage aquaculture, where managers coordinate feeding schedules, water-quality monitoring, net maintenance, and harvest planning across multiple cages and several feeders.

The input supplier segment has also undergone changes, and results in Table 7 indicate:

1. Exponential overall growth in supplier base

- The data reveals a dramatic expansion and professionalization of the overall input supply market, shown by an increase in the total number of all input suppliers across the nine counties----- increased nearly tenfold over the decade---- demonstrating the expanding market demand for inputs.

2. Dominance of feed distribution

- Fish feed distribution (feed stockists) represents the most significant structural component of the supply chain in 2024, accounting for nearly half of the total input suppliers.
- Hatcheries also saw strong growth, increasing from 14 in 2014 to 62 in 2024, reflecting the rising need for commercially supplied fingerlings. Growth of hatcheries and feed stockists parallels commercial demand; IFAD/ABDP support plus private feed entrants expanded local supply, reducing transport costs and enabling higher stocking densities.

Table 8: Structural change in number of fish input suppliers, 2014-2024

| County | Hatcheries | | | Feed stockists | | | Feed millers | | | Providers of nets/dam liners/floaters | | | All input suppliers | | |
|------------|------------|-----------|-----------|----------------|-----------|----------|--------------|----------|----------|---------------------------------------|----------|----------|---------------------|-----------|-----------|
| | 2024 | 2019 | 2014 | 2024 | 2019 | 2014 | 2024 | 2019 | 2014 | 2024 | 2019 | 2014 | 2024 | 2019 | 2014 |
| Bungoma | 5 | 2 | 1 | 8 | 3 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 14 | 6 | 2 |
| Kakamega | 8 | 4 | 2 | 30 | 7 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 40 | 11 | 3 |
| Busia | 8 | 5 | 2 | 7 | 2 | 1 | 0 | 0 | 0 | 4 | 0 | 0 | 19 | 7 | 3 |
| Siaya | 11 | 9 | 2 | 32 | 6 | 1 | 2 | 2 | 0 | 15 | 0 | 0 | 60 | 17 | 3 |
| Kisumu | 8 | 4 | 2 | 14 | 5 | 2 | 3 | 1 | 0 | 12 | 4 | 2 | 37 | 14 | 6 |
| Homa Bay | 7 | 3 | 1 | 4 | 1 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 13 | 4 | 1 |
| Kiambu | 4 | 2 | 1 | 5 | 2 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 11 | 4 | 1 |
| Kisii | 6 | 3 | 3 | 4 | 1 | 1 | 1 | 0 | 0 | 4 | 0 | 0 | 15 | 4 | 4 |
| Migori | 5 | 2 | 0 | 3 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 9 | 3 | 1 |
| All | 62 | 34 | 14 | 107 | 28 | 8 | 9 | 4 | 0 | 40 | 4 | 2 | 218 | 70 | 22 |

3. Emergence of localized manufacturing and infrastructure supply

The data shows the shift from purely retail/distribution to localized production and specialized equipment supply:

- Feed millers: These were absent in 2014 but grew to 4 suppliers in 2019 and reached 9 suppliers in 2024.
- Specialized equipment: Suppliers of nets/dam liners/floaters increased twentyfold, over ten years. This growth is likely linked to the explosion in cage culture, which requires this specialized infrastructure.

4. Regional concentration of supply services

Input supply services are highly concentrated in specific counties, reflecting where aquaculture activities are most intensive:

- Siaya County acts as the primary input supply hub, possessing the highest number of all input suppliers (60) in 2024, and specifically leads in the number of hatcheries, feed stockists and providers of nets/dam liners/floaters.
- Kakamega County is another significant hub, with 40 total suppliers in 2024, driven primarily by its high number of feed stockists.

Overall, the aquaculture value chain has structurally progressed from a rudimentary, small-scale system in 2014 to a developed commercial ecosystem in 2024 that is highly dependent on dedicated commercial input suppliers, with clear regional centers specializing in feed distribution, hatchery operations, and equipment manufacturing.

Table 9 shows a rapid growth in the total number of wholesalers, alongside a shift toward larger, more professional enterprises across the counties over the ten-year period.

Table 9: Structural change in fish wholesalers, 2014-2024

| County | Total number of fish wholesalers | | | Share of small in total number (%) | | | Share of medium in total number (%) | | | Share of large in total number (%) | | |
|--------------|----------------------------------|------------|------------|------------------------------------|-------------|-------------|-------------------------------------|------------|------------|------------------------------------|------------|------------|
| | 2024 | 2019 | 2014 | 2024 | 2019 | 2014 | 2024 | 2019 | 2014 | 2024 | 2019 | 2014 |
| Bungoma | 91 | 82 | 72 | 100.0 | 100.0 | 100.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Busia | 112 | 75 | 68 | 81.2 | 97.3 | 100.0 | 17.9 | 2.7 | 0.0 | 0.9 | 0.0 | 0.0 |
| Homa Bay | 78 | 62 | 45 | 89.7 | 96.8 | 100.0 | 9.0 | 3.2 | 0.0 | 1.3 | 0.0 | 0.0 |
| Kakamega | 68 | 47 | 34 | 94.2 | 100.0 | 100.0 | 2.9 | 0.0 | 0.0 | 2.9 | 0.0 | 0.0 |
| Kisii | 45 | 20 | 15 | 80.0 | 90.0 | 100.0 | 11.1 | 10 | 0.0 | 8.9 | 0.0 | 0.0 |
| Kisumu | 65 | 54 | 57 | 86.1 | 88.9 | 94.7 | 6.2 | 7.4 | 5.3 | 7.7 | 3.7 | 0.0 |
| Migori | 61 | 40 | 18 | 80.3 | 90.0 | 94.4 | 14.8 | 10 | 5.6 | 4.9 | 0.0 | 0.0 |
| Nandi | 5 | 5 | 3 | 80 | 100.0 | 100.0 | 20 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Siaya | 77 | 76 | 99 | 92.2 | 100.0 | 79.8 | 5.2 | 0.0 | 10.1 | 2.6 | 0.0 | 10.1 |
| Trans Nzoia | 9 | 7 | 4 | 100.0 | 100.0 | 100.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Uasin Gishu | 7 | 5 | 5 | 100.0 | 100.0 | 100.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Vihiga | 19 | 9 | 7 | 100.0 | 100.0 | 100.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Nairobi | 92 | 67 | 42 | 70.6 | 74.6 | 88.1 | 17.4 | 14.9 | 0.0 | 12 | 10.5 | 11.9 |
| Mombasa | 20 | 11 | 14 | 50.0 | 63.6 | 14.3 | 50 | 36.4 | 85.7 | 0.0 | 0.0 | 0.0 |
| Total | 749 | 560 | 483 | 85.7 | 93.4 | 91.5 | 10.4 | 5.0 | 5.4 | 3.9 | 1.6 | 3.1 |

Specifically, the results highlight the following trends:

1. Overall market expansion and growth

- The total number of fish wholesalers across all surveyed counties grew significantly, rising by about 1.6 times between 2014 and 2024.
- In 2024, Busia led the counties with the highest number of wholesalers (112), followed closely by Nairobi (92) and Bungoma (91).
- There is a substantial increase in the capacity of the wholesale sector, necessary to handle the growing volume of aquaculture production:

2. Structural shift towards commercialization

- While small wholesalers still dominate the market numerically, the relative share of medium and large enterprises increased significantly, indicating a gradual process of commercial consolidation
- Persistence of small wholesaling: several counties, including Bungoma, Trans Nzoia, Uasin Gishu, and Vihiga, remained entirely composed of 100% small wholesalers in 2024,

indicating that the transition to medium/large enterprises is not uniform across all regions.

- This could suggest that while entry barriers remain low for small players, a growing portion of the market volume is likely to be handled by larger, more formalized medium and large entities.

3. Regional concentration of large-scale wholesaling

- The structure of the wholesale clusters varies significantly by region, indicating specialized market roles for urban and production-adjacent counties:
 - i. In 2024, Nairobi (the urban hub) has a relatively lower share of small wholesalers (70.6%) and the highest share of large wholesalers (12.0%), likely handling large volumes for distribution in its high-consumption areas.
 - ii. Mombasa has a distinctive structure in 2024, split evenly between 50% small and 50% medium wholesalers. This is notable, given that in 2014, medium wholesalers made up an overwhelming 85.7%. The shift from medium-dominated wholesalers in 2014 to a 50–50 distribution by 2024 largely reflects the rapid entry of small wholesalers driven by the growing urban demand for fresh, chilled, and aquaculture-sourced fish in Mombasa. As inland aquaculture production expanded, especially from Lake Victoria and central Kenya, more small traders began supplying segmented retail outlets, supermarkets, and neighbourhood markets, lowering the dominance of traditional medium wholesalers (Obiero et al., 2019). An improved cold-chain distribution and increased availability of fish from aquaculture reduced reliance on a few medium-scale operators handling marine landings, enabling many smaller traders to operate profitably with lower volumes (FAO, 2020).
 - iii. Emergence of large wholesalers in production regions: Counties near production centers also showed growth in large businesses. For example, Kisii had 8.9% large wholesalers in 2024 (up from 0% in 2014)---it is a key consumption center due to its high population. Urban hubs (Nairobi, Kisumu, Nakuru, and Kisii) attract medium/large wholesalers to supply supermarkets and hotels, while rural counties retained many small wholesalers; coastal changes (Mombasa) reflect increased inland aquaculture supply and more retail outlets.

As shown in Table 10, logistics support from market loaders has also grown over time, with the results revealing the following:

1. Significant overall growth in

- Number of market-based loaders nearly tripled over the 10 years, rising from 77 in 2014 to 229 in 2024.
- The most significant period of growth occurred between 2019 and 2024

2. Nairobi and Migori as key labor hubs: the workforce is highly concentrated in specific regions, which serve as either major consumption centers or critical transit points:

- Nairobi is the single largest hub for loaders, increasing from 17 in 2014 to 54 in 2024. As a major urban market, this concentration reflects the high volume of fish being handled for final distribution and sale in the capital region.

- Migori County shows a very high number of loaders, which could suggest its growing importance as a transit or aggregation point in the fish trade.
3. Rapid expansion in production-adjacent counties
- Counties historically linked to aquaculture production or local trade also saw considerable growth in loading capacity i.e. Kisii, Kisumu, Homa Bay, Bungoma and Busia

Overall, the distribution of market-based loaders reflects the geography of fish consumption and trade, with the largest contingents found in the capital city (Nairobi) and in major regional trade and distribution centers (Migori, Kisii, and Kisumu). This growth confirms the necessity of physical labor to manage the increased volume of fish moving through the value chain.

Table 10: Number of market-based loaders, 2014-2024

| County | Number of loaders | | |
|------------|-------------------|------------|-----------|
| | 2024 | 2019 | 2014 |
| Homa Bay | 20 | 13 | 7 |
| Kisii | 25 | 14 | 11 |
| Kisumu | 25 | 12 | 6 |
| Migori | 48 | 19 | 11 |
| Mombasa | 6 | 4 | 4 |
| Nairobi | 54 | 30 | 17 |
| Kakamega | 17 | 12 | 8 |
| Bungoma | 19 | 13 | 7 |
| Busia | 15 | 9 | 6 |
| All | 229 | 126 | 77 |

The transport network has equally expanded to support the growing aquaculture value chain (Table 11).

Table 11: Structural change in fish transporters, 2014-2024

| County | Number of transporters | | | Share of micro in total number (motorbikes including tuk tuks) (%) | | | Share of small in total number (Public transport and probox) (%) | | | Share of large in total number (lorries > 3.5 tons) (%) | | |
|----------|------------------------|------|------|--|------|------|--|-------|-------|---|------|------|
| | 2024 | 2019 | 2014 | 2024 | 2019 | 2014 | 2024 | 2019 | 2014 | 2024 | 2019 | 2014 |
| Homa Bay | 18 | 10 | 4 | 55.6 | 60.0 | 50.0 | 27.8 | 30.0 | 50.0 | 16.7 | 10.0 | 0.0 |
| Kisii | 110 | 49 | 15 | 58.2 | 53.1 | 46.7 | 40.0 | 46.9 | 53.3 | 1.8 | 0.0 | 0.0 |
| Kisumu | 122 | 89 | 51 | 24.6 | 28.1 | 9.8 | 73.0 | 70.8 | 90.2 | 2.5 | 1.1 | 0.0 |
| Migori | 92 | 48 | 30 | 47.8 | 58.3 | 80.0 | 48.9 | 41.7 | 20.0 | 3.3 | 0.0 | 0.0 |
| Mombasa | 29 | 14 | 4 | 51.7 | 71.4 | 75.0 | 41.4 | 28.6 | 25.0 | 6.9 | 0.0 | 0.0 |
| Nairobi | 210 | 85 | 12 | 71.4 | 52.9 | 0.0 | 16.7 | 23.5 | 41.7 | 11.9 | 23.5 | 58.3 |
| Kakamega | 10 | 5 | 1 | 0.0 | 0.0 | 0.0 | 100.0 | 100.0 | 100.0 | 0.0 | 0.0 | 0.0 |
| Bungoma | 20 | 7 | 1 | 0.0 | 0.0 | 0.0 | 100.0 | 100.0 | 100.0 | 0.0 | 0.0 | 0.0 |
| Busia | 133 | 61 | 17 | 78.2 | 77.0 | 58.8 | 18.0 | 19.7 | 41.2 | 3.8 | 3.3 | 0.0 |
| Vihiga | 15 | 7 | 3 | 0.0 | 0.0 | 0.0 | 100.0 | 100.0 | 100.0 | 0.0 | 0.0 | 0.0 |
| Nandi | 2 | 1 | 1 | 0.0 | 0.0 | 0.0 | 50.0 | 100.0 | 100.0 | 50.0 | 0.0 | 0.0 |

| | | | | | | | | | | | | |
|-------------|------------|------------|------------|-------------|-------------|-------------|-------------|-------------|-------------|------------|------------|------------|
| Uasin Gishu | 1 | 1 | 1 | 0.0 | 0.0 | 0.0 | 100.0 | 100.0 | 100.0 | 0.0 | 0.0 | 0.0 |
| Trans Nzoia | 5 | 3 | 1 | 0.0 | 0.0 | 0.0 | 100.0 | 100.0 | 100.0 | 0.0 | 0.0 | 0.0 |
| Siaya | 156 | 73 | 11 | 65.4 | 64.4 | 9.1 | 34.6 | 35.6 | 90.9 | 0.0 | 0.0 | 0.0 |
| All | 923 | 453 | 152 | 56.2 | 51.7 | 34.2 | 39.0 | 43.0 | 61.2 | 4.8 | 5.3 | 4.6 |

Overall, the transport sector has been characterized by the following changes:

1. Massive expansion of the transport workforce

- Total number of fish transporters increased sixfold, rising from 2014 to 2024, and doubled between 2019 and 2024.
- This growth is necessary to support the substantial increase in aquaculture production volume.

2. Structural shift towards micro-enterprises

- There is a shift towards smaller operators, perhaps indicating ease of entry and potential fragmentation of the transport service
- Micro-transporters, mainly motorbikes, now represent the largest proportional share of the market, growing from 34% in 2014 to 56% in 2024. The rise of motorbike and tuk-tuks as micro-transporters and localized loaders reflects last-mile demand growth and faster distribution models; improvements in cold-chain/ice services and distribution innovations made small-volume, high-frequency deliveries viable.
- Conversely, the share of small transporters decreased significantly, dropping from 61.2% in 2014 to 39.0% in 2024.
- The share of large transporters remained relatively small and stable.
- Some counties (Kakamega, Bungoma, Vihiga, Uasin Gishu, and Trans Nzoia) are dominated by small transporters. This suggests that these regions have not yet seen the proliferation of micro-operators common elsewhere, or that their transport needs require a slightly larger capacity.

3. Regional concentration and specialization

Specific counties dominate the transport sector, reflecting major production and consumption hubs:

- Nairobi has the highest total number of transporters, nearly doubling the number in 2019
- Nairobi also displays a highly micro-focused structure in 2024, with 71.4% being micro-transporters. This is a sharp reversal of its 2014 structure, where micro-transporters were non-existent and large transporters dominated at 58.3%. This signals a fundamental shift in how transport operates in the capital, possibly due to a shift toward localized delivery networks.
- Siaya, Busia, Kisumu and Kisii are also major transport hubs.
- Busia shows a high concentration of micro-transporters (78.2% in 2024), reflecting its potential role as a key border or aggregation point. Busia hosts a Fish Market Transshipment and Auction Centre to facilitate cross-border trade in fresh and dried

fish products imported and/or exported to Uganda and Democratic Republic of Congo (DRC).

- Large transporters are rare but concentrated in key trade locations, with Nairobi (11.9%) and Homa Bay (16.7%) having the highest shares in 2024. These are insulated/refrigerated lorries.
- Kisumu County has the largest share of small transporters (73.0% in 2024) and a comparatively low share of micro-transporters (24.6%).

Another support function for the aquaculture VC is the fish cutters (specialized actors involved in preparing fish for market or processing), whose growth has been characterized by (Table 12):

1. Tripling of specialized labor for fish cutting

- This reflects the overall increase in fish production requiring preparation services.

2. High concentration in urban and consumption hubs

- Nairobi and Mombasa have the highest number of fish cutting services,
- This could suggest that much of the fish processing or preparation for end consumers takes place away from the primary production areas
- Further, it suggests that a large portion of fish is transported whole or minimally processed before final preparation at the point of sale or secondary processing.

3. Emergence of cutting services in production regions

- While urban centers dominate, certain production-adjacent counties also developed specialized cutting capacity, particularly Homa Bay---This could indicate the development of processing activities closer to the source of fish production.

Table 12: Number of fish cutters (fileters), 2014-2024

| County | Number of fish cutters | | |
|------------|------------------------|-----------|-----------|
| | 2024 | 2019 | 2014 |
| Migori | 3 | 1 | 0 |
| Homabay | 10 | 6 | 0 |
| Kisumu | 3 | 2 | 2 |
| Nairobi | 51 | 32 | 20 |
| Mombasa | 23 | 15 | 5 |
| All | 90 | 56 | 27 |

CONCLUSION

This study shows a massive structural transformation of Kenya's aquaculture sector between 2014 and 2024. This growth is characterized by an exponential rise in fish production, particularly through a shift toward cage-based farming in Lake Victoria. While small-scale producers constitute most participants, results indicate that a few large-scale commercial operations now control most of the production volume. The study also highlights a maturing support ecosystem, noting a rapid increase in input suppliers, specialized technicians, and transport networks. Driven by government initiatives and private investment, the industry has evolved from a subsistence model into a sophisticated commercial value chain. This expansion serves to address local fish supply deficits while fostering economic opportunities across various Kenyan counties.

The structural shift toward large-scale industrial dominance in production volume is explained by several key factors including; (i) economies of scale; (ii) ability to control the value chain through vertical integration with investments in modern hatcheries, feed production, and distribution logistics; (iii) access to finance and capital investment by a blend of private-sector capital and government programs; (iv) supportive policy environment such as market protection, political backing, streamlined licensing processes; (v) market demand and environmental suitability for large-scale operations; and, (vi) maturation of support services.

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