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Rapid Review of Kenyan Alternative Proteins Sector

2025

Foreign, Commonwealth & Development Office

Executive Summary

Kenya's food system is under increasing pressure from climate change, population growth, and economic volatility, exacerbating food insecurity, malnutrition, and resource scarcity.

Protein consumption in Kenya falls significantly below recommended levels, with rural areas experiencing up to an 80% protein gap. Addressing these challenges requires urgent innovation to provide affordable, high-quality, accessible protein sources to meet growing demand and reduce dependence on resource-intensive, inefficient animal-sourced foods (ASF).

Innovate UK Global Alliance Africa[1] commissioned Agri Frontier to undertake this study to provide a rapid review of the Kenyan alternative protein sector for human consumption. It summarises current trends, opportunities, and gaps in the alternative protein industry in Kenya. It also highlights collaboration and technology commercialisation opportunities for UK and Kenyan businesses. The review focuses on three key categories of alternative proteins considered feasible in Kenya: plant-based, fermentation-derived (including traditional and biomass fermentation), and edible insects.

The benefits of including alternative proteins in diets would have far-reaching positive impacts. These include improved soil health and biodiversity, reduced greenhouse gas emissions, and reduced spread of zoonotic diseases while enabling adaptive, climate-resilient agricultural practices. Increasingly, leading global institutions such as FAO, CGIAR and the World Bank, are recognising the potential of alternative proteins to transform our food system and provide nutrient-dense solutions to malnutrition and food insecurity. However, scaling these industries faces cultural, structural, and economic challenges.

[1] The Global Alliance Africa programme is funded by the UK Foreign, Commonwealth and Development Office (FCDO) working in partnership with Kenya, Nigeria and South Africa. Further details on ***iuk-business-connect.org.uk/programme/africa.***

Challenges

Kenya's alternative protein sector faces multifaceted barriers that impede its development and market penetration across supply and demand dimensions.

On the supply side, critical constraints include insufficient pilot infrastructure, limited access to high-quality inputs, a shortage of technical expertise, and prohibitive capital costs. Research shows:

- The study found only one protein extrusion facility. While there may be more, they are exclusively used by millers or private companies and are unavailable for co-manufacturing.
- Only one company operates food-grade biomass fermentation, with all other fermentation facilities being pharma-grade – unsuitable for food production.
- All interviewees mentioned access to affordable capital and technical capacity as key.

On the demand side, meat is culturally symbolic of wealth, and consumers have low nutritional literacy, resistance to novel food, and are highly price sensitive. Research shows:

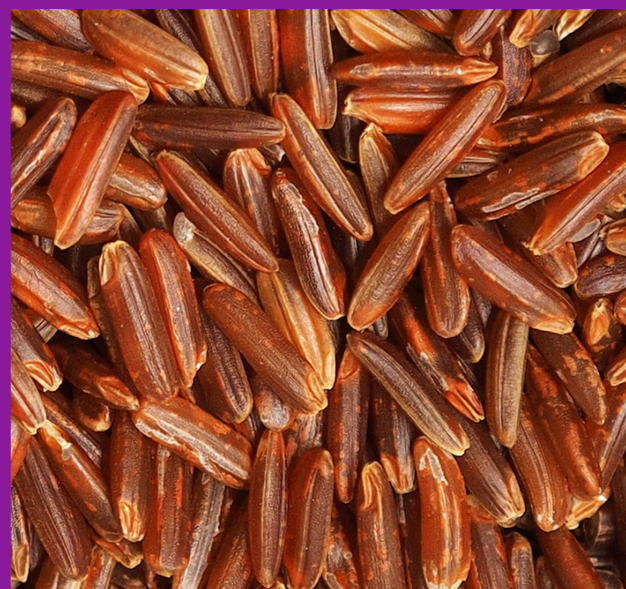
- Beef and milk consumption is predicted to increase by over 170% between 2010 and 2050.
- Beans and pulses are a primary source of protein for the rural population but contribute less than 10% of diets despite being affordable compared with ASF.
- Kenya faces a double burden of malnutrition: Overnutrition (obesity and overweight) in some areas and undernutrition (stunting and wasting) in others.
- Existing alternative protein products predominantly target high-income urban consumers, rendering them economically inaccessible to broader market segments.

170% predicted increase of beef and milk consumption between 2010 and 2015.

These challenges restrict operational scaling and competitive positioning against ASF and imports.

In the broader ecosystem, with over 22 legislative bodies, the regulatory landscape is fragmented, creating inefficiencies, ambiguous standards, and substantial complexity for potential market entrants. In addition, investors, whether philanthropic, donor, or venture capital, lack in-depth knowledge of alternative proteins, inflating perceived risks and constraining early-stage capital deployment.

These interconnected barriers underscore the need for a comprehensive, coordinated approach to developing Kenya's alternative protein ecosystem, requiring strategic interventions across technological, economic, and regulatory domains.



Opportunities

Alternative proteins offer a significant opportunity to address the country's protein and nutritional deficits through innovation and locally adapted solutions.

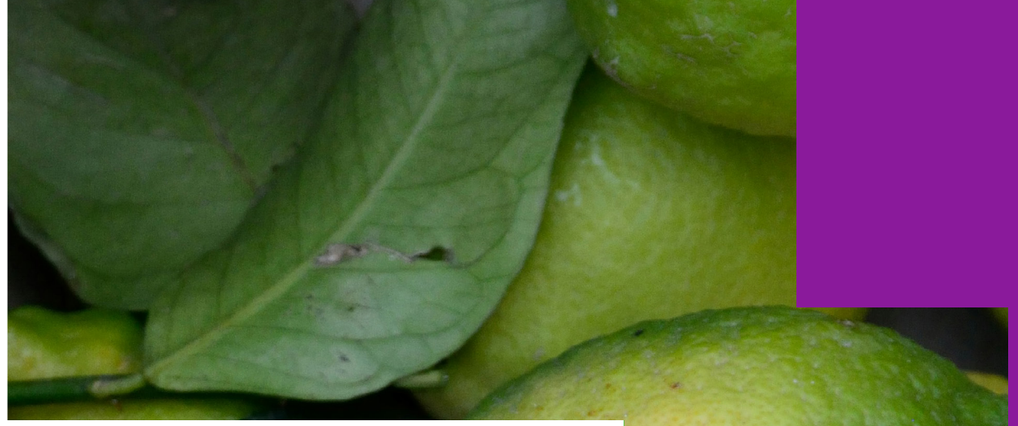
At the production level, Kenya's diverse agroecological conditions provide a natural advantage for cultivating protein-rich crops and insects. The wide variety of indigenous crops, such as Bambara nuts, cassava, coconuts, jackfruit, nuts, and various legumes, offer untapped functionality for plant-based meats. They can be cost-effectively produced while regenerating soil health and diversifying incomes.

At the processing level, food and beverage account for 55% of Kenya's manufacturing industry yet also up 40% post-harvest losses and 20% processing byproducts, offering a significant opportunity for upcycling and side-stream valorisation. With sufficient technology transfer support and capital, there are opportunities to utilise, integrate, and enhance local processing capacity to produce high-quality, low-cost protein. For instance, expanding agribusinesses' capacity to extract and extrude protein from protein-rich crops or on-site fermentation to valorise agri-processing side streams.

At the market level, opportunities exist to integrate with fast-moving consumer goods (FMCGs) like flour, biscuits, and porridges. In a highly competitive landscape, food manufacturers are eager to innovate and improve product nutrition. Alternative proteins can fortify FMCGs, rapidly accessing large markets through established brands and reducing barriers to novel foods. The humanitarian sector's therapeutic foods also present a promising avenue for proteins with complete amino profiles to access large markets and impact nutrition deficiencies at scale.

At the consumer level, large-scale institutional feeding programmes for schools and hospitals offer significant market access and opportunities to normalise novel ingredients. These well-established mass-market entry points provide opportunities to scale production and tackle malnutrition.

Urban and peri-urban areas such as Nairobi are experiencing a cultural revolution characterised by higher purchasing power and greater openness to innovative food experiences. This creates an ideal setting for introducing and normalising new foods. Culinary professionals—including chefs, restaurants, and food influencers—offer a powerful mechanism for shifting consumer perceptions and expectations.



The broader ecosystem level presents opportunities to collaborate and tackle research, regulatory, and investment challenges.

- The state of regulation opens the door for improvements that accelerate quality and consistency, enabling premium pricing and access to international markets.
- Kenya boasts a diverse research ecosystem of national and international centres, including KIRDI, JKUAT, ICIPE, KALRO, ICRISAT, and CGIAR. The research ecosystem, particularly when paired with leading centres in the UK, creates opportunities for innovation in seed development, processing facilities, microorganism and feedstock optimisation, and product design.

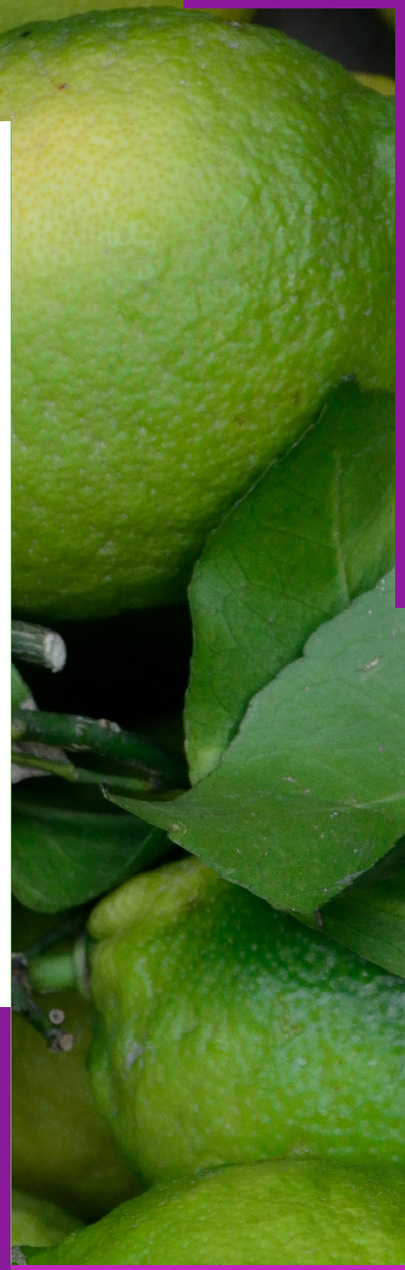
Innovative financing models such as coalition-financed projects can de-risk essential infrastructure to pilot and scale production. Strong examples exist, such as the fortified grain alliance, to build and operate pilot commercial scale facilities needed to meet economies of scale.

With investments in innovation, strategic partnerships, and affordability-focused approaches, alternative proteins can meet Kenya's protein needs, drive economic growth, and build a sustainable and inclusive food system.

"Cycling crops through animals to make meat jeopardises climate & biodiversity, hunger, and global health goals. There is a better way: using plants and cellular agriculture to create precisely the same meat experience but with far fewer harms. Powerful reports from the World Bank and IIASA make clear alternative proteins' tremendous potential.

Just as we are changing how energy is produced, and vehicles are powered (with renewable energy and electric vehicles), so too must we reimagine how meat is made."

FAO & CGIAR,
(2024), COP29[2]



[2] ***events.cgiar.org/alternativeproteinsforclimateh***

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The Case for Alternative Proteins in Kenya

1.1 Introduction

Sub-Saharan Africa (SSA) is set to experience the world's fastest and largest surge in protein demand. Driven by rapid population growth, urbanisation, and economic expansion, the continent's protein needs are expected to double by 2050. In Kenya alone, urbanisation will see 40 million people—up from 16 million currently—living in cities by mid-century. Compounding these challenges, macroeconomic disruptions, geopolitical instability, and climatic shocks have reversed poverty reduction progress since 2020, leaving many Kenyans unable to afford a healthy diet.[5,6,7]

Kenya's average calorie consumption gap is 22.5% compared to the EAT-Lancet recommended diet.[8] Looking specifically at protein intake, this increases to an average of 67.2%, while the poorest quintile has a gap of 80.5%.[9] Recent research also showed that a lack of high-quality protein is responsible for 30-40% of stunting.[10] Against this backdrop, the question of how to sustainably feed the country has emerged as one of the most urgent challenges for Kenya today.

Alternative proteins - sourced from plants, animal cells, insects, or through fermentation - have a significant potential to help meet growing protein needs, enable environmental restoration, increase food security, and address malnutrition.[11] They offer a scalable and regionally adaptable food solution that is adoptable by small and large-scale producers. They offer income diversification, bolster climate resilience, improve soil health, and provide access to essential nutrition. With increasingly volatile economic and climatic environments, solutions that help us adapt will be the key to sustainable food security.

This report aims to accelerate the introduction of innovative food solutions in Kenya by providing a rapid review of the alternative protein sector.

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[4] UNDESA (United Nations Department of Economic and Social Affairs). 2018. World Urbanization Prospects: The 2018 Revision. New York

[5] Breisinger, Clemens, Xinshen Diao, Paul A. Dorosh, Juneweenex Mbuthia, Lensa Omune, Edwin Ombui Oseko, Angga Pradesha, Jenny Smart, and James Thurlow. 2022. "Kenya: Impacts of the Ukraine and Global Crises on Poverty and Food Security," June. ***hdl.handle.net/10568/125311***.

[6] Nafula, N., D. Kyalo, B. Munga, and R. Ngugi. 2020. "Poverty and Distributional Effects of COVID-19 on Households in Kenya." AERC Working Paper. African Economic Research Consortium, Nairobi.

[7] UNICEF. 2022. Kenya Drought Situation. New York

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[10] Manary M. 2013. Inadequate dietary protein intake: when does it occur and what are the consequences? Food Nutr Bull.34:247–248.

[11] Innovation Commission Secretariat. (2023). Priority Innovations and Investment Recommendations for COP28. Innovation Commission. The University of Chicago.

1.2 Kenya's Food System

Kenya's food system is diverse and complex, reflecting the country's varied geography, population distribution, and economic structure. Most diets are predominantly plant-based, supplemented with animal-source foods (ASF), but dietary patterns vary significantly between rural, peri-urban, and urban areas.[12] Over 70% of rural diets, and their primary protein intake, is derived from beans, pulses, and starchy staples like maize, rice, sorghum, millet, wheat, and roots. These foods form a larger-than-recommended daily intake, see ***Figure 1*** below.

Rural households experience up to an 80% protein gap compared to the EAT-Lancet diet. High prices restrict access to balanced diets and ASF.[13] Meanwhile, urban households increasingly consume more ASF and processed foods, contributing to a rise in overweight, obesity, and related non-communicable diseases as modern food retailers expand.[14,15]

Agriculture is a cornerstone of Kenya's food system, providing over 80% of livelihoods and 65% of export earnings.[16] Including wider ecosystem services – from food supply, consumption, and institutional services - it accounts for 33.8% of the economy.[17] Smallholder farming (SHF) dominates Kenya's food system, producing approximately 66% of the food consumed.[18] Despite agriculture's importance, there are significant inefficiencies and challenges, see ***Figure 2***.

The consumption of beef and milk will increase by over 170% between 2010 and 2050 – by 0.81 and 8.5 million tonnes respectively.[19] Meat is a status symbol of wealth, and consumption is expected to rise as incomes increase in line with trends from other emerging economies.

While industrial farming is increasing in Kenya, particularly in the poultry and egg sectors, this growth comes with significant risks. Industrial farming practices contribute substantially to greenhouse gas emissions, biodiversity loss, and desertification.[20] They also heighten the risk of zoonotic diseases and antibiotic resistance.[21] These factors underscore the urgent need for innovative solutions to ensure sustainable and resilient food systems in Kenya.

Decreasing Crop Yields

- Crop yields have stagnated over the last 30yrs.[i]
- Yields for wheat & maize expected to drop a further 20% by end of century.[i]

Post-Harvest Losses

- Post-harvest losses account for 12-20% of total production.[ii]
- Agro-processing losses are also significant, maize is 18-20%.[iii]
- This results in heavy reliance on imports for staple commodities

Climate Vulnerability

- 98% rain-fed agriculture, yet only 17% is suitable to this mode of production.[ix, x]
- 80% of the land is degraded.[xi]
- Estimated 20-60% of livestock die during droughts in the horn of africa.[xii]

Figure 1 – Kenya's Food System Challenges

1.3 What Are Alternative Proteins

Alternative proteins are any protein-rich ingredient sourced from plants, fungi, algae, or cultured proteins intended to remove the need for conventional livestock products.[22,23] In addition, for this review, insects, although technically farmed livestock, have been included as they provide an alternative source of protein to conventional animal-based sources. As such, for this review, the following three categories are used: plant-based, fermentation-derived, and edible insects, definitions are provided in ***Figure 3***.

Note also that cultivated meat is an alternative protein source and has been defined below for completeness. However, it has been excluded from the review's scope due to the industry's technology readiness level (TRL) and the implications of introducing the technology in an LMIC context.

[12] Breisinger, C., Keenan, M., Mbuthia, J., & Njuki, J. (2023). Food systems transformation in Kenya: Lessons from the past and policy options for the future (0 ed.). International Food Policy Research Institute. ***doi.org/10.2499/9780896294561***

[13] Food and Agricultural Organization. (2017). Africa Sustainable Livestock 2050: Kenya Country Brief. USAID.

[14] Ecker, O., & Pauw, K. (2024). Dairy consumption and household diet quality in East Africa: Evidence from survey-based simulation models. Food Policy, 122, 102562. ***doi.org/10.1016/j.foodpol.2023.102562***

[15] Gómez, M. I., & Ricketts, K. D. (ds.). (2013). Food value chain transformations in developing countries—Selected hypotheses on nutritional implications.

[16] Breisinger, C., Keenan, M., Mbuthia, J., & Njuki, J. (2023). Food systems transformation in Kenya: Lessons from the past and policy options for the future (0 ed.). International Food Policy Research Institute. ***doi.org/10.2499/9780896294561***

[17] Breisinger, C., Keenan, M., Mbuthia, J., & Njuki, J. (2023). Food systems transformation in Kenya: Lessons from the past and policy options for the future (0 ed.). International Food Policy Research Institute. ***doi.org/10.2499/9780896294561***

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[19] Food and Agricultural Organization. (2017). Africa Sustainable Livestock 2050: Kenya Country Brief. USAID.

[20] ***www.unep.org/news-and-stories/story/10-things-you-should-know-about-industrial-farming***

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[23] Herrick, T., S. Gannon, Katharine Kreis, S. Zobrist, Claudia Harner-Jay, J. Goldstein, S. Mason, et al. 2019. "Market Analysis for Cultured Proteins in Low- and Lower-Middle Income Countries." ***hdl.handle.net/10568/110685***.

1.4 The Role of Alternative Proteins in Creating a Sustainable Food System

Novel alternative proteins have been promoted in high-income countries (HICs) as a sustainable, high-quality source of protein. However, they have yet to be widely introduced to LMICs. It is essential to recognise that LMICs have distinct needs compared to HICs, so the introduction of novel and improved alternative proteins must be examined to minimise potential trade-offs. Specifically, many healthy reference diets are developed without accounting for LMIC settings where additional animal-sourced foods (ASF) could address food security and malnutrition challenges.[24] Despite this focus on ASF, there is a significant protein deficiency. The introduction and scaling of alternative proteins in LMIC food systems have the potential to fill this nutrient gap while improving livelihoods and broader economic growth.

Figure 4 highlights the advantages of alternative proteins using the FAO's high-level panel of experts (HLPE) and IFPRI's food system framework.

Figure 2 – Mean calorie consumption amounts per adult equivalent and reference intakes of the EAT-Lancet diets by major food group.

Figure 3 – Simplified Types of Alternative Proteins

Plant-based Protein

Traditional Plant Proteins

Legumes, Nuts, Cereals, and Algae.

Product Types: Whole food pulses, grains, and powders.

Novel Plant Proteins

Products designed to mimic animal meats' taste, texture, and appearance using plant ingredients.

Product Types: Plant-based burgers, sausages, nuggets, and texturised vegetable proteins (TVP), plant-based milk and cheese.

Edible Insects

Insect Varieties

The primary edible insects are crickets, grasshoppers, and mealworms, with crickets being the most commercialised species. Although there are over 2,000 known edible species.*

Crickets

Crickets are currently the only one being produced for human consumption in Kenya.

Product Types: Protein Powder and whole cricket snacks.

**Excluded from study*

Fermentation-Derived Proteins

Traditional Fermentation

Uses microorganisms to transform food substrates into products with enhanced nutritional, sensory, and preservation qualities.

Product Types: Tempeh and cheese

Biomass Fermentation

Feeding fast-growing microorganisms, such as fungi, yeast, or bacteria, to produce large quantities of microbial cells.

Product Types: Mycoprotein

*Precision Fermentation**

Engineering microorganisms to produce specific target proteins or molecules that are otherwise found in animals or plants.

Product Types: Animal free diary or egg proteins and fats.

Cultivated Meat

*Cultivated Meat**

Meat produced directly from animal cells. The final product is identical to conventional meat at the cellular level.

There are 174 cultivated meat companies globally but only three markets where it is approved for sale.

Product Types: Whole cuts of meat

[24] Kapur, M., Peña, A. N., Sreeram, N., Bloem, M. W., & Drewnowski, A. (2024). What Is the Likely Impact of Alternative Proteins on Diet Quality, Health, and the Environment in Low- and Middle-Income Countries. Current Developments in Nutrition, 8, 102064. ***doi.org/10.1016/j.cdnut.2023.102064***

Figure 4 – The Role of Alternative Proteins in Creating a Sustainable Food System

The potential contribution of alternative proteins expressed through the food system framework developed by the FAO's high-level panel of experts (HLPE) and adopted by IFPRI.

Inclusive

The ability of a system to provide all four dimensions to all communities and groups

Marginalised groups could significantly benefit from a diversification of food sources. At a global scale, diversifying protein supply could reduce crop food prices by 10-12%.[vi]

- Integration of more legumes into farming systems improves income and environmental resilience.
- There is also significant scope to explore the functionality of indigenous crops such as sorghum, millet, and Bambara nuts for use in novel alternative protein products.
- Better use of indigenous crops creates opportunities to increase the security and diversity of incomes for SHFS.
- The growing global population and food consumption, combined with changing dietary preferences, will lead to an increased demand for protein-rich plant crops, driving export markets which, can further support marginalised groups.[vii]

Sustainable

The ability of a system to function without ruining the environment for future generations

Alternative proteins repeatedly show a significantly less environmental impact than other food system interventions. On average they require up to 97% less land and water to produce, freeing up these resources for reforestation, ecosystem restoration, or other commercial purposes while producing up to 86% fewer GHG emissions.[viii]

- The World Bank examined 26 of the agrifood sector's most promising emissions mitigation interventions in which they ranked alternative proteins second for climate mitigation potential, at 6.1 GtCO2 eq. per year (the first being reforestation).[ix]
- The WB also found that alternative proteins have nine times more mitigation potential than the second most promising intervention to improve meat production (improved ruminant feed digestibility, at 680 MtCO2 eq/year).[x]

Productive

The ability of a system to efficiently produce enough food

Cycling crops through animals to make meat is incredibly inefficient. Alternative proteins are highly efficient protein sources:

- Fermentation-derived protein use up to 98% less land and 90% less water than conventional meat."
- 9 calories of feed are required to produce 1 calorie of chicken meat and 40 calories of feed for 1 calorie of beef.
- meat and 40 calories of feed for 1 calorie of beef. APs is close to a 1 to 1 calorie transfer.[iii,iv]
- APs would result in up to 75% reduction in land-use.[ix]
- The available land could be used to grow.[x]

Resilient

The ability of a system to withstand environmental and economic shocks

Alternative proteins are regenerative, contribute to a circular economy, and are less reliant on climatic systems reducing the impact of climate volatility.

- Insect-farming can utilise waste agricultural products and provide a natural source of fertiliser driving a circular system.
- Fermentation technology is produced in controlled environments. Detaching production from climate.
- Protein-rich plants, such as legumes fix nitrogen into the soil, contributing to a regenerative farming system.
- The diversity of usable legumes also facilitates crop rotations and mixed planting. This improves biodiversity, carbon sequestration, rainfall infiltration, and nutrient cycling while naturally reducing disease and pests.[xi,xii]

Nutritious

The ability of a system to provide a safe and balanced diet with sufficient micro and macronutrients

Animal sourced foods (ASF) are a great source of macro and micronutrients. As a result, the Kenya government and international agencies actively promote a protein transition from the majority of the population's current heavily plant-based diet to one with increased meats, eggs, and dairy.[xiii]

Despite this being part of a long-standing action on the food transformation agenda, there continues to be widespread food insecurity and malnutrition.

Alternative proteins can be an excellent tool to supplement existing practices and help close the nutrient gap in LMICs. Produced in the right way, they can provide the essential macro and micro nutrients required to help address malnutrition in Kenya.[xiv]

2

Rapid Review of the Kenyan Alternative Proteins Sector

The following section examines the challenges and opportunities of Kenya's alternative protein sector across four key stages of the food value chain: production, processing, retail, and consumer. It also considers the broader ecosystem context and the related challenges and opportunities for the sector. The section concludes with recommendations for Innovate UK.

2.1 Kenya's Alternative Protein Ecosystem

Figure 5 *provides a high-level ecosystem map for the alternative proteins for human consumption sector in Kenya*. The map is not designed to comprehensively represent the complete food system that contributes to alternative proteins, as this would include a substantial number of actors. Instead, it aims to provide an overview of the sector and the key players. For simplicity, actors have only been represented once, although some operate across multiple levels, i.e., AgVentures is a farming cooperative that primarily produces seed oils. However, they are experimenting with adding legumes to stimulate regenerative agriculture and diversify farmer incomes. Key actors in the ecosystem map are highlighted in yellow.

Table 1 – Key Alternative Protein Actors & IUKBC Opportunities

Actor	Interest/Activity	IUKBC Opportunity
Bezos Earth Fund (BEF)	BEF has a $1B commitment to tackling food system challenges 50% of which is allocated to alternative protein innovation. They have recently funded three alternative protein research centres to advance innovation across alternative protein technologies.	A BEF research centre has been established in Imperial Colleague London. IUKBC should identify research collaborations with Kenyan businesses and research institutions to adapt technology to local contexts.
CGIAR	CGIAR is a global research organisation that operates through 15 research centres. Its primary aim is to enhance food and nutrition security while improving natural resources and ecosystem services. The organisation has recently focused on alternative proteins as one of the key solutions to address climate, hunger, and global health. In September 2024, it released a flagship report, 2024 Breakthrough Agenda Report: Agriculture, in which a whole chapter was dedicated to the role of alternative proteins.	Collaborate research agenda for advancing SHFs by integrating protein-rich and indigenous crops with alternative protein functionalities.
The Food and Agriculture Organisation	FAO has previously been criticised for not including alternative proteins as a key solution in its climate roadmap released for COP28. However, its focus has increased, albeit marginally. They have worked with CGIAR on alternative proteins.	IUKBC should investigate further how to position with FAO. Coordinating with CGIAR and other actors would be a good starting point to drive FAO's inclusion in ecosystem activities.
ProVeg International	ProVeg is a food awareness NGO that promotes sustainable diets by adopting plant-based and cultivated foods. It has representation in South Africa and Nigeria and periodically runs accelerators for diet and food-system change start-ups.	They previously ran an accelerator in 2021 that included Ghana and Kenya. Exploring opportunities to collaborate on another accelerator in Kenya could provide essential support to early-stage organisations.
Tilt Collective	The Tilt Collective was launched in September 2024 and is still setting its agenda, particularly for its engagement in Africa.	Building relationships with the Tilt Collective would be an excellent avenue for technology transfer and promoting Kenya's successes to a global audience.
United Nations Environment Programme (UNEP)	UNEP authored the landmark 'What's Cooking: An Assessment of Potential Impacts of Selected Novel Alternatives to Conventional Animal Products' report in 2023. While the report demonstrates strong evidence in favour of alternative proteins, little progress has been made by UNEP to advance their integration into current modes of production.	Keep informed of developments.

2.2 Kenyan Alternative Protein Sector Challenges

Kenya's production, processing, and adoption of alternative proteins face various cultural, structural, and economic challenges. These barriers highlight the need for systemic changes across the value chain to unlock the sector's potential, see ***Figure 6***, and ***Table 2*** for summary of challenges by value chain stage.

The current range of alternative protein products available to consumers is expensive and accessible only in specialised retailers in large urban centres. The products follow a 'Western approach' in that they are designed for a niche market of urban high-income consumers who follow ethical, cultural, or health-focused diets. Given Kenya's current economic growth and widespread socio-economic challenges, this niche market is unlikely to grow in the short or medium term. Therefore, the mass-market adoption of 'Western-style' alternative protein products is unlikely - unless significant market and consumer education campaigns and substantial supply chain investments are made - to make products affordable and accessible.

Figure 5 – Kenya Alternative Protein Ecosystem Map (High-level)

Plant-Based

Plant-Based Products (Lab, Demo, & Pilot)

Grove Meadow Planta
OnlyPlants
mTofu
Vegany
Sydsel

Plant-Based Products (Commercial)

Promasidor
Qualipas Industries
Fry's Family Food
Alpro
Jetlak Foods
Brookside

Plant-Based Crops & Ingredients (Commercial)

Smallhold farmers
AgVentures
Unga Group
Victory Farms
Kisima Farm
Mlango
etc.

Fermentation

Fermentation-Derived Products (Lab, Demo, & Pilot)

Tempeh
Nairobi
Essential
Carbonovia

(Commercial Scale)

Novozymes

Fermentation Feedstock

Fermentation Feedstock
Agri-waste / byproducts
Dextrose importers
(Reucher Africa / Maya EA Ltd
Key Regulatory Bodies etc.)

Edible Insects

Edible insect products (Lab, Demo, & Pilot)

InsectiPro Zihanga Ltd

Edible Insect Feedstock

Agri-feed & crops producers

Processors & Equipment

Processors (Commercial)

Biofoods
Unga Group
Capwell Industries
Cargill
ADM
Syngenta
DuPont
CHS
Kitui Mills
Tate & Lyle
DSM Pembe mills
Mombasa mills

Equipment (Commercial)

Buhler
ADM/DSM Institute

Key Regulatory Bodies

KEBS
Kenya bureau of standards

PCPB
Pest Control Products Board

NBA
National Biosafety Authority

KEPHIS
Kenya Plant Health Inspectorate Service

DNPHL
Division of National Public Health Laboratory

AFA
Agriculture & Food Authority

Key Ecosystem Actors

Donors / Philanthropy

BEF
BMGFs
Rockefeller

CGIARILRI / IFPRI

GAIN

Global Alliance for Improved Nutrition

One Acre Fund

+ other outgrower extension services

UN Organisations

UNICEF
WHO
FAO
IFAD
UNEP

NFAL

Novel Fermentation Action Label

UK Research Centres

NAPIC etc.

NGOs & Think tanks

ProVeg
Tilt Collective
GFI
WWF
WRI

Key Research Centres

KMFRI
Kenya Marine and Fisheries Research

KIRDI
Kenya Industrial Research & Development Institute

KALRO
Kenya Agricultural & Livestock Research Organisation

ICIPE
International Centre of Insect Physiology and Ecology

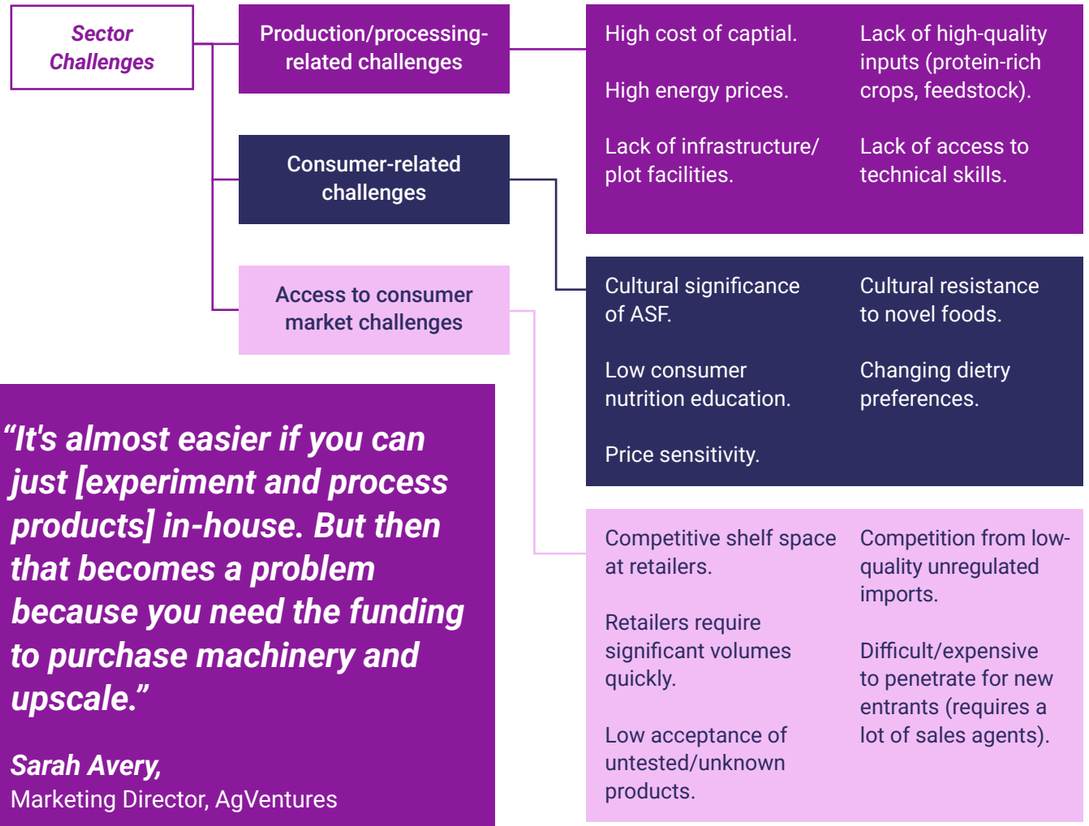
JKUAT
Jomo Kenyatta Uni' Agriculture & Technology

KALRO
Kenya Agricultural & Livestock Research Organisation

ICIRSAT
International Crops Research Institute for the Semi-arid Tropics services

ITA
Institute of Tropical Agriculture

Figure 6 – Alternative Protein Sector Challenge



"It's almost easier if you can just [experiment and process products] in-house. But then that becomes a problem because you need the funding to purchase machinery and upscale."

Sarah Avery,
Marketing Director, AgVentures

2.2.1 — Summary of Challenges by Value Chain Stage

Table 2 – Summary Challenges by Value Chain Stage

Stage	Interest/Activity
Production Stage	• No off-take market results in high risk for SHFs. • Limited agricultural extension services and inadequate access to affordable quality inputs or seeds reduces farmers' ability to provide alternative protein inputs. • Low awareness of the benefits of protein-rich or novel crops and insects means limited farm uptake. • High insect-farm losses from disease and pests due to poor farm management. • Minimal or no large-scale fermentation infrastructure for local microbial production, forcing reliance on exports. • High cost of capital and scarce financing for early-stage firms and cooperatives attempting to build or upgrade production capacity.
Processing Stage	• High capital costs and limited financing options for installing, upgrading, or scaling processing facilities. • Inadequate specialised infrastructure (e.g., fractionation equipment, extruders, bioreactors, insect incubators and processing equipment). • Limited access to R&D laboratories for prototyping and testing new processing techniques or formulas. • Unreliable and expensive energy sources can account for up to 60% of total product costs in processing. • Frequent reliance on importing specialised machinery and inputs. • Restricted co-manufacturing opportunities, forcing early-stage firms to build facilities rather than rent existing capacity.
Retail Stage	• Fierce competition for shelf space in formal retail outlets, where securing placement often requires large volumes and consistent supply. • Penetration of informal markets requires high upfront costs and intensive on-the-ground presence. • Informal markets dominate mass-market rural and peri-urban food distribution. • Informal market competition from cheaper, low-quality, less-regulated imports. • Retailers hesitate to carry unfamiliar products (including insects, novel meat analogues, and fermentation-derived foods) without proven demand or marketing support.
Consumer Stage	• Meat is a status symbol that challenges alternative proteins' competitiveness. • The protein deficit is primarily driven by the inability of consumers to purchase ASF. Alternative proteins must at least match or undercut the cost of conventional meat to gain traction. • Consumers may not recognise the quality and importance of protein-rich foods and are unwilling to try new foods. However, urbanisation has seen an increased uptake in processed foods.
Wider Ecosystem	• Traditional attempts to improve the food system are narrow, production-centric interventions that pay limited attention to demand-side challenges (e.g., consumer education and preference), resulting in few demand-side interventions.[25] • A fractional, highly fragmented regulatory environment see ***section 1.4***. • Minimal investor knowledge inflates perceived risk and constrains capital inflows. • Limited public or philanthropic investment to de-risk capital expenditure and encourage private-sector investment in alternative proteins (e.g., co-manufacturing infrastructure, co-investment or credit guarantees). • Low policy support for R&D or facility build-outs (e.g., no statutory incentives, tax breaks, or grants explicitly designed for novel protein companies).

[25] Breisinger, C., Keenan, M., Mbuthia, J., & Njuki, J. (2023). Food systems transformation in Kenya: Lessons from the past and policy options for the future (0 ed.). International Food Policy Research Institute. ***doi.org/10.2499/9780896294561***

2.3 Regulatory and Policy Environment for the Alternative Protein Sector in Kenya

2.3.1 — Summary of Challenges by Value Chain Stage

Kenya's food regulatory framework is guided by the 2021 National Food Safety Policy and is built upon 19 Acts of Parliament that govern the food and agriculture sector. Oversight responsibilities are shared among 22 legislative bodies. However, particular agencies have more influence over food laws; see the ***Table 3*** below.

These national standards are further complemented by international guidelines from organisations such as the World Health Organization (WHO) and the World Trade Organisation (WTO). For example, Kenya's food safety regulations are generally consistent with the Sanitary and Phytosanitary (SPS) Agreement of the WTO, as well as standards set by Codex Alimentarius (Codex) and the International Plant Protection Convention (IPPC).

Despite this regulatory framework, the system is highly fragmented due to the many regulatory bodies involved in its implementation. This fragmentation can create inefficiencies, inconsistencies, and challenges in enforcement, particularly for emerging industries like alternative proteins that require precise and supportive regulatory pathways.

Table 3 – Kenya's Regulatory Framework

Regulatory Agency	Mandate
Kenya Bureau of Standards (KEBS)	KEBS plays the central role in regulating food products. Specifically: • Ensuring that imported and locally manufactured goods meet required quality standards. • Labelling requirements for consumer-ready food products. • Overseeing the certification of imported products through the CoC process.
Kenya Plant Health Inspectorate Services (KEPHIS)	Assures the quality of agricultural inputs and produce to prevent adverse impacts on the economy, the environment and human health. Monitors and analyses pesticide residues.
Pest Control Products Board (PCPB)	Regulates the importation, exportation, manufacture, distribution, and use of pest control products. Enforces pesticide and contaminant regulations.
Division of National Public Health Laboratory (DNPHL)	Examines microbial and chemical contamination of food.
National Biosafety Authority (NBA)	Exercises general supervision and control over the transfer, handling, and use of "genetically modified organisms" (GMOs), including importation of genetically engineered (GE) products.

While there are significant challenges, the early stage of regulation can also present opportunities (see ***Figure 6***). The status of category regulations is in ***Table 4***.

2.3.2 — Category Regulation

Table 4 – Category Regulation

Category	Regulation
Applies to all	• *Genetically engineered (GE) products*: Kenya's ban on genetically engineered (GE) products could impact importing more effective seed varieties. Despite this ban, imported consumer-ready food products containing GE ingredients must comply with strict labelling requirements under the Biosafety (Labelling) Regulations, 2012. For example, genetically modified ingredients must be explicitly labelled in the list of ingredients, e.g., "Soybean Meal (genetically modified)." Companies are advised to seek legal guidance to ensure compliance with these regulations. • *Certificate of Conformity (CoC)*: All food imports must secure a Certificate of Conformity (CoC) through KEBS inspection agents in the country of origin. This adds time, cost, and administrative complexity for businesses importing fermentation-derived protein ingredients or products into Kenya. • *Codex Alimentarius Commission*: The Codex Alimentarius Commission is working on creating standards for novel foods that will fast-track future regulatory developments in Kenya. However, most plant-based meat products and ingredients should fall under existing food standards.
Plant-Based	The regulatory framework for plant-based proteins in Kenya is primarily grounded in existing regulations for managing seed varieties with little to no specific regulation for further processed plant-based products. While guidelines for plant-based meat do not yet exist, a revised general food safety standard—including safety requirements for non-dairy products and beverages—will be finalised in 2025. • *Existing standards*: Traditional protein-rich crops, such as legumes and cereals, already have established standards, which provide clarity for producers working with these ingredients. However, there are no specific standards for plant-based meats. • *Collaboration with KEBS*: It is common practice for companies to work collaboratively with KEBS to develop specific standards if none exist.
Fermentation	The regulatory landscape for fermentation-derived proteins in Kenya is evolving, but there are existing avenues for these products to fit within established food safety standards. • *Existing standards*: Fermentation-derived proteins can often align with existing regulations, such as certain fungi strains already approved under food safety standards, i.e., for brewing and baking. Companies are encouraged to identify if their products can comply with current regulations. • *Collaboration with KEBS*: If aligning with existing regulations isn't feasible, organisations can collaborate with the KEBS to develop new standards. This is being made easier with international regulatory progress in the UK, US, EU, Israel, and Singapore, global leaders in alternative protein regulation. The Codex Alimentarius Commission is also working to create international standards for novel foods, which may further support regulatory clarity.

Table 4 – Category Regulation (continued)

Category	Regulation
Fermentation	• *Import regulations*: Companies importing fermentation-derived products must be cautious about the specific microbes used. Kenya has strict regulations to safeguard against biohazards and the ecosystem impact of gene pollution. Companies should verify import rules for the microbes they intend to use. • *Certificate of Conformity (CoC)*: All food imports must secure a Certificate of Conformity (CoC) through KEBS inspection agents in the country of origin. This adds time, cost, and administrative complexity for businesses importing fermentation-derived protein ingredients or products into Kenya.
Edible Insects	Kenya is one of the few countries with specific standards for edible insects, which provides a significant regulatory advantage compared to many other markets where insects lack formal approval for consumer sale. So areas to note: • *The standards do not currently differentiate insect quality*, which limits the ability of insect farmers to disaggregate quality and, therefore, charge premiums on high-quality insects. This significantly impacts the market's competitiveness and reduces the ability to export to high-quality markets in the US and EU. • *The Kenya Wildlife Service (KWS) requires additional approval for insect farming*, as insects are classified as wild animals under Kenyan law. This adds an extra regulatory step for producers. Four national standards regulate insects:

KS 2921: 2020	Production and handling of insects for food and feed - Code of practice	Mandates the minimum infrastructural and environmental requirements necessary for optimal production of edible insects.
KS2922–1:2022	Edible Insects – Specification. Part 1	Requirements of processed edible insects' products packaged and presented either as whole or ground form.
KS2922–2:2022	Edible Insects – Specification. Part 2	Requirements of processed edible insects' products such as biscuits or cookies (or any other product) where edible insects are used as ingredients.
KS2711: 2017	Dried insect products for compounding animal feeds – Specification	Specify the requirements for dried insect products that are intended to be used as protein sources in the formulation of animal feeds.

Figure 7 – Regulation - A challenge and an opportunity

Regulation:

A challenge and an opportunity

Dr. Wanjala, Senior Research Scientist at KIRDI, has dedicated the last 10 years to food regulation and is a member of the UN's Codex Alimentarius Commission. He highlighted that while working with the current food regulations presents challenges, there are also opportunities.

Kenya has a comprehensive food safety framework that includes specific regulations for various staple food products. Companies should review existing regulations to determine if their products are covered. If not, there is an opportunity to collaborate with standard-setting bodies, such as the KEBS. Dr Wanjala and others commented that developing new regulations when necessary is common practice as long as the overarching food safety regulation covers the product.

Companies should allocate appropriate time and budget for the regulation design process, which can take 3 to 6 months. This timeline may vary depending on the complexity of the regulation and whether similar regulations exist in other jurisdictions, such as the EU, which can serve as models for regulatory development.

2.4 Summary of Opportunities

There is significant market potential due to the country's protein gap and food insecurity for alternative protein manufacturers focusing on products that can achieve widespread adoption.

To successfully capture the market, products should follow the parameters set out in the ***Table 5*** below. Sector opportunities are summarised in ***Figure 9***. ***Table 6*** summarises opportunities by value chain stage.

Table 5 – Kenya Alternative Protein Product Development Parameter

Product Parameter	Kenya context	Opportunity
Affordable	Poverty is the primary cause of the protein gap, where households cannot afford sufficient quality protein.	Alternative proteins, if cheaper than ASF, have an opportunity to fill a market need, providing low-cost, high-quality protein to consumers.
Accessible	To enable consumption, products must be available for purchase, including in remote and hard-to-reach places.	Many types of Alternative proteins products, such as TVP and protein powder, can be made shelf stable. Thus, they can be easily stored and incorporated into existing meals. Existing distribution networks can facilitate remote customers' access to a wide range of products.
Functional	There is resistance to new food types and limited access to cooking equipment for lower socio-economic consumers. Traditional equipment is single cooking stoves.	Products should be designed so they can be prepared using similar equipment and methods. They should also aim to integrate easily into existing recipes/diets.
Taste	Meat is a status symbol for wealth and success. Traditional legumes and cereals are widely consumed, but demand is stagnant.	For consumer-facing goods, replicating the taste and functionality of meat could drive interest and replace more expensive, low-quality ASF. For ingredients such as protein powders, creating a tasteless product will allow for wider application into existing products, such as porridges, biscuits, etc.
Nutrition	Kenya faces the double burden of malnutrition – the coexistence of obesity and stunting/wasting.	Products should be fortified to provide enhanced micronutrient profiles. They should also be low in salt, saturated fats, and trans fats and aim for complete amino acid profiles.

Figure 8 – Technology transfer to valorise agro-processor waste streams

Case study:

Technology transfer to valorise agro-processor waste streams

The Novel Fermentation Action Lab (NFAL) established by Resourced recently launched the Euglena Fortified Cassava (EFC) project to trial the cultivation of Euglena gracilis (a microorganism) into existing cassava processing operations in Nigeria to enhance the nutritional value and valorise cassava waste streams. The project focused on fortifying staple foods like garri and cassava flour with euglena flour (EF), a high-protein ingredient derived from the microorganism. To achieve this, the project engaged two cassava processing companies, Psaltry, a large-scale processor, and Eagleson, a medium-scale processor, to assess the viability of local euglena production.

The project team found they could produce significantly enhanced cassava flour with a capital investment of between $88,000 and $115,000 for a 5,000L processing facility. By including 7.5% Euglena, the flour's protein content increased by 250%, as did its iron, zinc, iodine, and vitamin A levels. Market research also found that consumers were willing to pay up to 2-3x more per kg for the premium product.

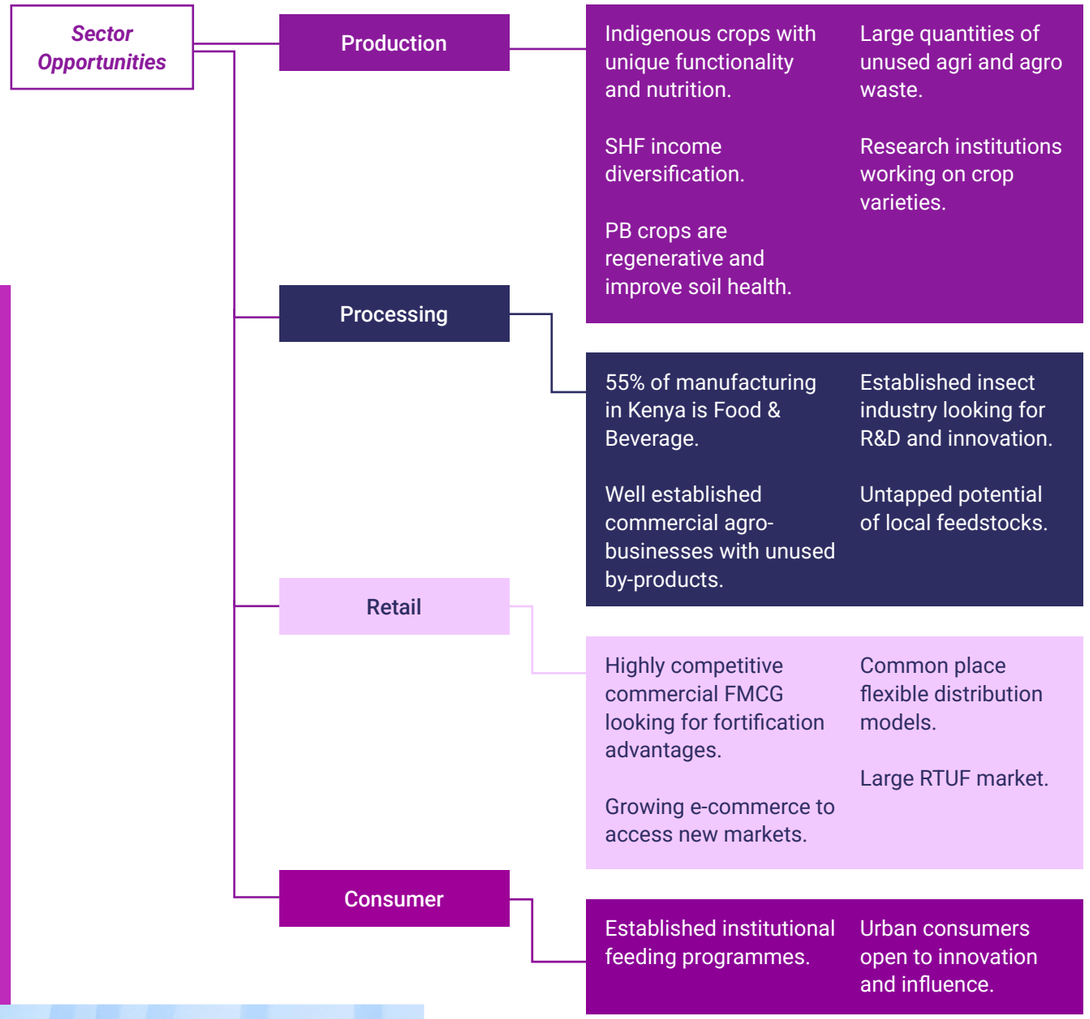
The EFC project aimed to develop a sustainable and cost-effective model for local production of euglena-fortified foods by leveraging the existing infrastructure and resources of agro-processors to address food insecurity and nutritional deficiencies in Nigeria.

The project's key findings showed that euglena-fortified cassava foods offered significantly more protein and micronutrients while localising production reduced raw material costs and enhanced market opportunities for processors.

"For the mass market, it's got to look, feel, and seem familiar and have only subtle differences."

Juliet Agg-Manning,
Co-Founder Greenspoon (exited)

Figure 9 – Plant-based Protein: Market Access Playbook



2.4.1 – Summary of Opportunities by Value Chain Stage

There are myriad opportunities for alternative protein stakeholders, outlined in ***Table 6*** below:

Table 6 – Alternative Protein Opportunities by Value Chain Stage

Stage	Opportunity
Production Stage	• *Draw on Kenya's agroecological advantage*: Explore the functionality of indigenous and agroecologically well-suited crops such as Bambara nuts, jackfruit, coconut, legumes, algae (particularly Spirulina), cereals (wheat), and tubers such as cassava. ◦ They also produce a range of byproducts that could provide feedstock for fermentation and insect production systems. ◦ Kenya reduces the need for climate-controlled environments required for insects. • *Utilise alternative proteins to diversify farmer incomes*: ◦ Insect production produces frass, valuable as an organic fertiliser, reducing the need for expensive chemical inputs. ◦ Soy, lupin, and peas, among others, are regenerative crops that sequester nitrogen and improve soil health. • *Valorise byproducts and waste streams*: Assess large agricultural commodity producers' appetite and opportunity to valorise side streams and utilise post-harvest losses. ◦ Partnerships between fermentation and insect-focused start-ups, research institutions, and agri-food processors could unlock efficient circular practices. • *Technology and Knowledge Transfer*: ◦ The UK and EU research and technology companies can help identify efficient microbial strains suitable for biomass fermentation using local feedstocks. ◦ Research partnerships between the private sector, seed research centres, and plant-protein processing research centres to optimise seed varieties for extrusion functionality.
Processing Stage	• *Leverage Kenya's existing medium and large-scale agro-processors*: Kenya has one of sub-Saharan Africa's most developed agro-processing industries. There are opportunities to utilise, integrate and enhance local manufacturing, for instance: ◦ Integrate or enhance protein extrusion capacity for processing agricultural commodities such as peas, soy, wheat, and rice for medium and large agri-businesses to enable the manufacturing of higher-value products. ◦ Integrate value-added processes to valorise byproducts and waste streams, such as utilising waste as a feedstock for fermentation see ***Figure 8***. • *Technology and Knowledge Transfer*: ◦ Optimise insect processing techniques to maximise nutrient retention and digestibility while reducing microbial load and allergenic risks. ◦ Mapping optimal organisms and local feedstock availability, as well as assessing the feasibility of adapting existing local manufacturing for local processing. ◦ Explore indigenous and climate-suited crops' novel protein extraction techniques and plant-protein functionality for plant-based meats.

Table 6 – Alternative Protein Opportunities by Value Chain Stage (continued)

Stage	Opportunity

Retail Stage	• *Integrate with existing FMCGs*: Given the widespread fortification of products in Kenya,
	  ◦ Integrate alternative proteins with large-scale agri-food products such as flour and other Fast-Moving Consumer Goods (FMCG) products such as biscuits and other snacks.
	  ◦ Food manufacturers operate in a highly competitive environment and are eager to innovate and affordably improve the nutrition of their products.
	• *Leverage e-commerce*: For high—and medium-income consumers, e-commerce in urban and peri-urban areas is widely used and offers low-cost and effective distribution options. Supermarkets such as Greenspoon have cultivated a direct-to-market model that links consumers with a range of ethical and health-focused foods.
	• *Develop flexible distribution models*: New entrants may find supermarkets challenging, and navigating informal markets can be complex. To improve market access, seek to develop local networks with key market actors, offer training schemes, and generate buy-in with local community leaders.
	• *Reformulate ready-to-use-foods*: The approval process for reformulating ready-to-use-foods (RTUFs) is challenging. However, with fermentation-derived proteins offering a complete amino profile with increased micronutrient levels, there is an opportunity to investigate this humanitarian food security market.

Consumer Stage	• *Utilise existing consumer-facing entry points*: Institutional feeding programs, such as those in schools and hospitals, offer excellent mass-market entry points.
	• *Engage culinary enterprises, restaurants, hotels, and chefs to improve perceptions and the use of novel foods*: Chefs and food influencers significantly influence consumer food choices and dining trends, particularly in Nairobi, which is undergoing a cultural revolution where new foods, diets, and fashions are being explored by a growing middle-class.
	  ◦ Improve chef's ability to create delicious and nutritious plant-based or alternative protein recipes to shift consumer expectations of desirable food.
	  ◦ Urban and peri-urban areas in Kenya offer powerful levers for cultural change as residents have greater purchasing power and are increasingly receptive to new foods and experiences.

Wider Ecosystem	• *Enhancing regulation*: Developing and implementing more granular standards for insect farming and protein-rich crop cultivation and processing would accelerate quality consistency, enable premium pricing, and open access to international markets. • *Utilise innovative financing models to de-risk infrastructure investments*: Investor priorities focus on the dual motivations of impact and financial return. These priorities can be leveraged to form blended or coalition-financed projects, such as the Fortified Whole Grain Alliance highlighted in ***Figure 7***, to de-risk investment in pilot processing facilities.

Table 6 – Alternative Protein Opportunities by Value Chain Stage (continued)

Stage	Opportunity

Wider Ecosystem	• *Leverage Kenya's extensive research ecosystem*:
	  ◦ KIRDI and JKUAT can be key partners in scaling lab and pilot facilities.
	  ◦ ICIPE is a world-renowned insect research centre with strong connections globally.
	  ◦ KALRO and ICRISAT can help design improved seed varieties for plant-based products.
	• *Partner with international donor and research organisations*:
	  ◦ CGIAR, ILRI, FAO, and others have recently increased support and attention on alternative proteins as crucial solutions to driving nutritional, economic, and environmental improvements in LMIC food systems.
	  ◦ Global think tanks, such as the Good Food Institute, and philanthropies like the Bezos Earth Fund are also increasing their focus on alternative proteins in sub-Saharan Africa.

Figure 10 – Benefits, Challenges & Opportunities for Fermentation-Derived Proteins

Case study: Improving access to capital

Challenges

1. ***High capex:*** Building alternative protein processing facilities requires specialised equipment (protein extruders, insect incubators, and bioreactors). This present high-risk investments as products are largely untested.

2. ***Long timelines to revenue:*** Products have long development cycles and require intensive R&D. These timeframes often exceed the patience of traditional investors, who look for quick returns.

3. ***Investor knowledge gap:*** Investors are unfamiliar with the technologies involved. This makes assess deals challenging.

Opportunities

1. ***Asset-light approaches:*** Explore co-manufacturing before committing to building facilities.

2. ***Strategic partnerships:*** Large agricultural corporations are increasingly entering the Kenyan market. Partnerships could reduce capital needs for start-ups, provide technical assistance, and a route to market.

3. ***Educate investors:*** Increasing investor knowledge to improve risk assessment capacity and foster sector confidence. Workshops, industry reports, and case studies from more mature markets could play a key role in bridging the gap.

4. ***Entrepreneur capacity & networks:*** tailored pitches, improved processes, and marketing can drive investor confidence. Strong networks facilities access to diverse funding sources.

5. ***Blended finance:*** Grants and concessional loans from public and donor funding supports early-stage R&D, while guarantees, co-investment, or off-take agreements reduce CapEx risks.

6. ***Public financing and incentives:*** Kenya's incentive schemes such as the credit guarantee scheme offer potential financing solutions for MSMEs.

Case Study: De-risking infrastructure investment

The Fortified Whole Grain Alliance (FWG-Alliance) is a pioneering coalition addressing malnutrition through the advancement of fortified whole grain foods. The initiative builds a sustainable ecosystem by integrating key stakeholders throughout the value chain, from farmers and processors to manufacturers, governments, and NGOs.

The Alliance's business model rests on two fundamental pillars

1. Strategic corporate partnership, exemplified by the collaboration with Bühler, a global leader in food manufacturing equipment. This partnership strengthens technical capabilities and provides essential capital investment.

2. Diverse funding & research partnerships, from large corporations, donors, and research institutes. This diverse ecosystem ensures products are adapted to Kenyan market needs while providing robust access to technical expertise, raw materials, and established distribution channels.

For alternative proteins, this broad-spectrum partnership model offers opportunities for cross-sector collaboration improving facility utilisation.

Example

Extrusion equipment used for rice flour fortification shares similarities with plant-protein processing for plant-based meat products. Technological overlap creates the potential for facility sharing across industries, thereby reducing investment risks.

2.5 Summary of Recommendations for Innovate UK

Matchmaking and technology transfer: Expand the Global Alliance Africa multi-stakeholder platform to connect technology companies with large and small local food manufacturers. Building on the existing network created by IUK, the platform should be expanded to include local manufacturers with an interest in valorising waste streams, piloting innovative alternative protein extrusion, fermentation, and extraction technologies. Given the nature of the technologies, interest groups should specialise in particular technology applications.

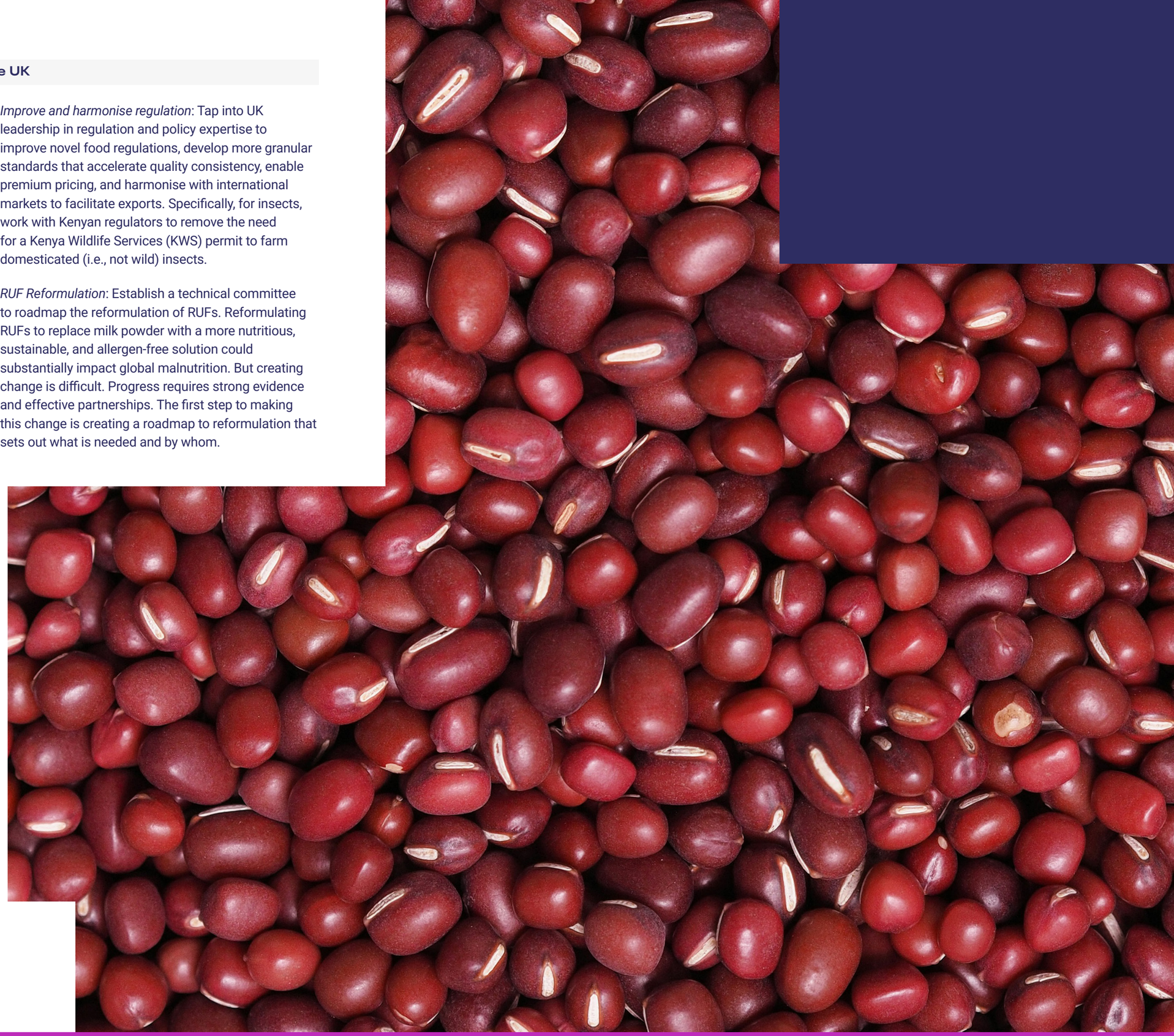
Reduce barriers for investment

- *Build investor capacity for deal sourcing and investment monitoring*. This would involve creating awareness of the alternative protein's potential and capacity building on sourcing deals, conducting due diligence, and effectively monitoring investments.
- *Facilitate broad-spectrum partnerships to mobilise capital for pilot facilities*. Facilitate partnerships with donors, large corporations, SMEs, and research institutes to fund pilot commercial facilities, similar to the FWGA model.

Leveraging UK alternative protein leadership: Strategic partnerships with UK-based institutions can significantly accelerate Kenya's alternative protein ecosystem. Potential initiatives encompass developing context-specific consumer preference studies, supporting research into novel protein extraction techniques, optimising microbiology strains, and establishing connections between Kenyan and UK educational institutions.

Improve and harmonise regulation: Tap into UK leadership in regulation and policy expertise to improve novel food regulations, develop more granular standards that accelerate quality consistency, enable premium pricing, and harmonise with international markets to facilitate exports. Specifically, for insects, work with Kenyan regulators to remove the need for a Kenya Wildlife Services (KWS) permit to farm domesticated (i.e., not wild) insects.

RUF Reformulation: Establish a technical committee to roadmap the reformulation of RUFs. Reformulating RUFs to replace milk powder with a more nutritious, sustainable, and allergen-free solution could substantially impact global malnutrition. But creating change is difficult. Progress requires strong evidence and effective partnerships. The first step to making this change is creating a roadmap to reformulation that sets out what is needed and by whom.



3

Category Deep Dives

3.1 Plant-based Proteins

Plant-based proteins and meat substitutes could facilitate a transformative shift in the global food system. By leveraging plants as the primary source of protein, these products deliver a sustainable alternative to conventional meat, addressing critical environmental, health, and food security challenges.

Table 7 – Benefits, Challenges & Opportunities for Plant-based Proteins

Benefits

Studies show plant-based meats can be produced uses 72-99% less water, 47-99% less land, and emits 30-90% fewer greenhouse gases than conventional meat production.[26] Additionally, it causes 51-91% less water pollution, allowing ecosystems and biodiversity to recover and thrive.

Processing protein-rich crops into plant-based meat can significantly improve traditional staple foods' nutritional profile and bioavailability. By supplementing diets, plant-based meat can play a pivotal role addressing food insecurity, ensuring communities meet their nutritional needs where access to diverse and sufficient protein sources is limited.

Challenges

In Kenya, plant-based meat products are 84% - 98% more expensive than locally manufactured burgers, mince, and sausages.[27] The products primarily target the wealthiest consumer segment, and the price point and unsatisfactory sensory appeal reduce consumer acceptance.

Little to no effort creating a plant-based meat product for low-income consumers. This review found two plant-based products for the mass market (Promasidor's Sossi Soy, and NatureLock Food's Stewday). The lack of industry means there's little known on consumer preferences and demand. Plus, limited infrastructure for manufacturing.

Opportunities

Kenya's agricultural economy, established agri-processing industry, entrepreneurial environment, and increasing urbanisation provide a strong opportunity for innovation and market growth. The opportunity is amplified with increasing technological innovation driven by Western markets which unlocks great price cuts and improved functionality of novel proteins.

Changing Western diets offers a sizable export market opportunity for high-quality protein-rich crops and plant-based meat ingredients. Increasing food commodity processing for export is a key focus of Kenya's strategic Transformation and Growth Strategy and the Big Four Agenda.

Kenya's agroecological conditions and indigenous crops offers untapped plant-based input functionality innovation. Indigenous and climate suitable crops such as Bambara nuts, Jackfruit, Spirulina, Coconuts, among others have unique functionality that can improve the taste, texture, and nutritional properties of plant-based proteins.

[26] The Good Food Institute. (2019). Plant-based meat for a growing world.

[27] Ogutu, F. O., Okiko, G., Wanjala, G., Luvitaa, S., Obong'o, B. O., Vriesekoop, F., & Munialo, C. D. (2024). Unlocking the potential of plant-based foods in sub-Saharan Africa: A review of the opportunities and challenges. International Journal of Food Science & Technology, 59(8), 5326–5342. ***doi.org/10.1111/ijfs.17327***

3.1.1 — Plant-based proteins: What are they, and how are they made?

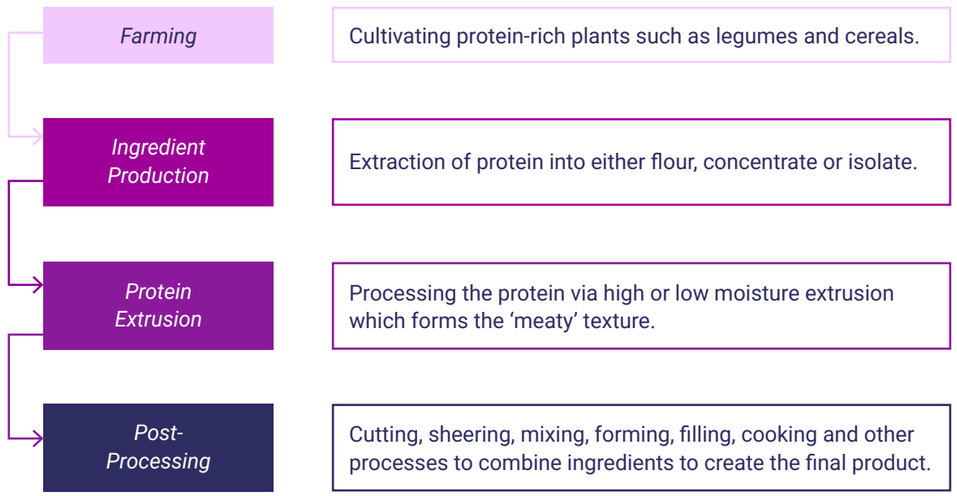
Plant-based proteins can be divided into two groups: traditional plant-based proteins and novel plant-based proteins, which are sometimes referred to as plant-based meat.

Traditional plant-based proteins include legumes, cereals, and nuts. Specifically,

- Legumes are a family of plants known for their nutrient density and high protein and fibre content. They also fix nitrogen, so they can significantly improve soil health. Examples include soybeans, chickpeas, mung beans, lentils, black beans, and peas.
- Cereals are grasses cultivated for their edible grains. While primarily a source of carbohydrates, some grains can provide significant protein. Examples include wheat, barley, millet, oats, and sorghum.
- Nuts are energy-dense foods rich in healthy fats, proteins, vitamins, and minerals. Examples include cashews, walnuts, almonds, pistachios, etc.
- Algae and aquatic plants include micro and macroalgae and aquatic plants. Microalgae are microscopic, photosynthetic organisms found in freshwater and marine systems. They have diverse nutritional profiles, bioactive compounds, and essential amino acids. Examples of microalgae include spirulina and chlorella, and macroalgae include kelp, nori, and wakame. Aquatic plants include duckweed (Lemna minor), among others.

Novel plant-based proteins or plant-based meat are products designed to mimic animal meats' taste, texture, and appearance using plant ingredients. They often combine plant proteins, fats, and flavourings to replicate meat properties. The new generation of products also looks, cooks, and tastes like conventional meat. Products include plant-based burgers, sausages, nuggets, and texturised vegetable proteins (TVP). The figure below outlines a simplified production process.

Figure 11 – Simplified plant-based meat production process



3.1.2 — Regulatory Overview

The regulatory framework for plant-based proteins in Kenya is still evolving and no specific guidelines currently exist for plant-based meat. However, a revised general food safety standard—including safety requirements for non-dairy products and beverages—will be finalised in 2025. The standards that currently apply include:

- *There are established standards for traditional protein-rich crops*, such as legumes and cereals.
- *Kenya has a ban on genetically engineered (GE) products* which could impact importing more effective seed varieties. Despite this ban, consumer-ready food products containing GE ingredients can be imported but must comply with strict labelling requirements under the Biosafety (Labelling) Regulations, 2012. For example, genetically modified ingredients must be explicitly labelled in the list of ingredients, e.g., "Soybean Meal (genetically modified)."
- *All imported food products, including plant-based alternatives, must secure a Certificate of Conformity (CoC)* through inspection by an agent contracted by the Kenya Bureau of Standards (KEBS) in the country of origin. This process adds time, cost, and administrative complexity for businesses seeking to enter the Kenyan market.
- *It is common practice for companies to work collaboratively with KEBS to develop specific standards if none exist*. In addition, the Codex Alimentarius Commission is working on creating standards for novel foods that will fast-track future regulatory developments in Kenya. However, most plant-based meat products and ingredients should fall under existing food standards.

Figure 12 – Tackling misinformation on Ultra Processed Foods (UPFs)

Tackling misinformation on Ultra Processed Foods (UPFs)

A major driver of the global debate around UPFs is the improper application of the NOVA classification system. NOVA was designed to classify the level of processing of a product. As such, the system categorises foods solely based on the level of processing without effectively considering ingredients or nutritional content. This system, therefore, results in plant-based meat being "grouped with notoriously unhealthy products such as chocolate snacks, fast foods and sugary drinks". Emerging research has shown that the level of processing alone does not determine the nutritional quality of food, and classifying foods based on processing is not a scientifically sound approach. While processing should not be ignored, products 'healthiness' should be evaluated on their ingredients and the health benefits they provide.

When applied to plant-based proteins, processing enhances their nutrient density and bioavailability. Traditional plant-based proteins, while healthy, have a lower protein content and bioavailability than ASF. Processing these crops can increase protein ratios, improve the bioavailability of macro- and micronutrients, and replicate the sensory experience of ASF. Many studies have shown that, on average, plant-based meat has better nutritional profiles than comparable animal products. As a result, plant-based meat should be seen as an essential part of building sustainable and resilient food systems.

Figure 13 – Unlocking the full potential of indigenous crops

Unlocking the Potential of Indigenous Crops for Plant-Based Proteins

The majority of plant-based products today rely on a narrow range of protein combinations, such as pea and potato, soy and wheat, or chickpea and rice. Each combination provides different protein concentrations, nutrient bioavailability, functionality, cost, sourcing ease, or allergen risks. This presents a significant opportunity to explore the untapped potential of indigenous crops, which often offer unique functional properties and are well suited to local growing conditions.

Each protein source—legume, oilseed, vegetable, fruit, nut, or cereal—differs in its performance characteristics, such as flavour, functionality, and nutrient density. Indigenous crops like Bambara nuts, jackfruit, cassava, cowpea, coconut among others hold promise as alternative protein sources that can support the development of plant-based products tailored to local markets. For example, OnlyPlants is creating plant-based spreads using Bambara nuts, while Sydsel is exploring the functional properties of jackfruit. However, to unlock the full potential of indigenous crops for mass-market plant-based products, further research is needed to understand their nutritional profiles, functional properties, and scalability. By investing in research and innovation, Kenya could lead the way in developing plant-based alternatives that are both culturally relevant and environmentally sustainable.

3.1.3 — Gap analysis & Opportunity Mapping

This review identified a small number of early-stage companies specialising in alternative proteins, primarily producing products aimed at higher socioeconomic consumers in urban areas, particularly Nairobi. These include several small—to medium-batch tofu producers, a plant-based meat producer, and a non-dairy producer. This review found only two domestic commercial-scale company (Promasidor, NatureLock Foods) manufacturing plant-based products for lower socio-economic consumers. A small number of commercial plant-based protein product manufacturers, either domestic or international, serve middle-class and more wealthy market segments, such as Fry's Family Food, Qualipas Industries, and Alpro (a brand of Danone). There are also diversified (producing a range of plant-based and animal-sourced foods) commercial-scale non-dairy milk producers: Jetlak Foods and Brookside.

Table 7 provides the key gaps and opportunities across the value chain—production, processing, trade, retail, and consumption—and highlights actionable strategies to build a resilient and inclusive plant-based protein sector.

3.1.4 — Market Access Playbook

The nascent plant-based protein sector in Kenya presents challenges and opportunities for new entrants. While the market faces gaps across production, processing, trade, retail, and consumption, careful planning and strategic action can position new businesses to succeed.

The market access playbook outlines key steps for new entrants to establish and grow their operations. It highlights key learnings from the review and their relevance to plant-based protein businesses entering the Kenyan market. The playbook focuses on five key principles:

Based on these principles, the playbook (***Table 8***) is broken into intervention and strategic partner recommendations for the private sector for each stage and the wider ecosystem. Recommendations have also been included for Innovate UK to accelerate private sector progress in growing the industry.

Setting up right	Setting enterprises up to deliver quality and grow sustainably.
Research & Development	Innovation to achieve price competitiveness and optimise sensory and use functionality.
Understanding local consumer preferences	Ensuring that product development is rooted in understanding Kenyan consumers' needs and tastes to meet them where they are and bring them along the journey.
Enhancing market awareness & trust	Educating consumers about new products and ensuring high safety standards.
Building strategic partnerships	Working with existing institutions and partners to build and leverage local expertise and develop synergies amongst actors to facilitate the smooth development and adoption of new products.

Table 8 – Plant-Based Protein: Gap Analysis & Opportunity Mapping

Stage	Challenges	Opportunities
Production	• Limited protein-rich crops grown domestically. • SHFs produce 66% of food but lack technical expertise and resources to diversify into protein-rich crops like legumes or soy. • Only 17% of arable land is suitable for rain-fed farming, yet 98% depends on rain. • Lack of offtake agreements discourages SHFs investing in productivity and diversification.	• Leverage agricultural cooperatives, like AgVentures, to experiment with protein-rich legumes, which have wide-reaching benefits (e.g., nitrogen fixation to improve soil health, diversify SHF incomes, and improve nutrient availability). • Partner with seed research centres to optimise varieties for extrusion functionality. • Partner with research institutions like KALRO to explore indigenous, drought-resistant, protein-rich crops adapted to Kenya's climate. • Map agroecological zone specializations for protein-rich crop cultivation.
Processing	• High post-harvest losses (12-20%) and an unreliable ingredient supply (poor quality, SHF side-selling, and unpredictable yields), reduce availability of raw materials for processing. • Limited processing facilities plant-based protein.[28] • Agricultural cooperatives lack capacity to innovate. • Plant-based meat prices 84-98% higher than ASF.[29]	• Expand R&D facilities for plant-based protein processing innovation. E.g., expand KIRDI or JKUAT lab-scale equipment for developing new formulations. • Partner with commercial agro-processors to establish co-man processing facilities, including protein extraction, isolation, and extrusion. • Assess products like Promasidor's Sossi Soy to identify practices for scaling production and aligning with local consumer preferences.
Trade	• Kenya is a net import of staple crops. • Low levels of African-origin plant-based alternative protein foods in the EU or other global markets. • Regulations do not meet export quality standards.	• Increasing food commodity processing for export is a key focus of Kenya's strategic Transformation and Growth Strategy and the Big Four Agenda.[30] • Export opportunity for high-value protein-rich crops, inputs to alternative proteins. • Leverage large agribusiness existing distribution networks. • Work with regulators to create export quality standards.

Retail/ Consumer	• Low cultural adoption of new foods, especially in rural areas.
	• Highly price sensitive market, consumers have a protein gap partially due to affordability of ASF.
	• Plant-based nutrition concerns reduce government and stakeholder acceptance.
	• Limited access to techniques (biofortification, autoclaving), reduces ability to improve nutrition.
	• Informal markets can be challenging to penetrate, given informal supply chain structures.
		• Nutritional parity or superiority compared to ASF essential.
		• Develop products to ensure they:
		  ◦ Fortified with additional micronutrients during processing.
		  ◦ Low calories, sugars, fats, and sodium, creating healthier alternatives that address Kenya's rising urban prevalence of non-communicable diseases.
		  ◦ Option to integrate with existing products (flour, biscuits, etc.,)
		  ◦ Fit within existing cultural food expectations: similar functional use in diets, preparation methods, cooking equipment, etc.
		• Leverage expansive e-commerce and flexible distribution channels to reach consumers in informal markets and traditional retailers.
		• Educate SHF and local community leaders about the benefits of growing protein-rich legumes for SHF and the nutritional value of plant-based meat.
		• Introduce plant-based proteins into institutional feeding programmes.

[28] The review found only one domestically produced commercial extruded product – Sossi Soy, produced by Promasidor.

[29] Ogutu, Fredrick O., Gertrude Okiko, George Wanjala, Susan Luvitaa, Boniface O. Obong'o, Frank Vriesekoop, and Claire D. Munialo. 2024. "Unlocking the Potential of Plant-based Foods in sub-Saharan Africa: A Review of the Opportunities and Challenges." International Journal of Food Science & Technology 59 (8): 5326–42. ***doi.org/10.1111/ijfs.17327.***

[30] FAO, European Union and CIRAD (2023). Food Systems Profile – Kenya. Catalysing the sustainable and inclusive transformation of food systems. Rome, Brussels, Montpellier, France. ***doi.org/10.4060/cc6056en.***

Stage/Component	Intervention	Strategic Partners	Innovate UK Recommendations
Production & Consumption System			
Production	*Explore Indigenous Protein Sources:* • Unlock the potential of indigenous crops like Bambara nuts, jackfruit, and drought-resistant legumes. • Crops are well-suited to local growing conditions, offer unique functional properties, and can reduce dependency on imported raw materials. Promote Sustainability: Highlight the environmental and economic benefits of using locally grown crops, particularly those that enhance soil health and require less water, such as legumes.	*Collaborate with Research Institutions:* KALRO, KIRDI, CGIAR, and FAO to test and validate the functionality and scalability of indigenous crops. *Engage Agricultural Cooperatives:* Such as AgVentures or other aggregators / collectives / processors to diversify into protein-rich crops and provide SHFs with training and resources.	*Indigenous and diversified crop pilot projects:* • Indigenous and legume crop cultivation with off-take agreements. • Improve seed varieties and micronutrient content by connecting farming cooperatives with research institutes (e.g., KALRO and ICRISAT). • Coalition funding of small-scale facilities. • Map agroecological zones to understand ideal growing areas for protein-rich crops in Kenya.
Processing	*Build for quality and scale:* Research shows high-quality (product and efficiency) Kenya agribusiness successfully access formal retail.[31]	*Grow existing lab-scale facilities to stimulate innovation:* KIRDI or JKUAT expand lab-scale equipment designed to test and develop new formulations.	*De-risk investment for processing facilities:* • Conduct techno-economic analyse and feasibility study for processing facilities. • Facilitate context adapted technology transfer. • Upgrade existing lab processing facilities.
Product development	• *Affordability matters:* Plant-based options must be cheaper than ASF for less affluent consumers and at least match ASF pricing for wealthier segments. • *Nutritional profile:* Tailor products to local needs—rural, peri-urban, or urban. Improve protein content and nutrient bioavailability through optimised formulations. • *Sensory Appeal:* Deliver taste and texture that matches or exceeds ASF, or enhances existing staples, to increase acceptance. • *Functional & user-friendly:* Align with common cooking methods, address cold chain limits by maximising shelf life, and minimise waste for retailers. • *Nutritional Parity:* Equal or better nutrition compared to ASF. Highlight benefits: clean labels, fibre, pre-/probiotics, and added vitamins.	*Market Research:* Understand consumer preferences, motivations, nutritional awareness, and misconceptions.	*Research partnerships on consumer demand:* Assess universities/research Institutions/private sector partnerships to conduct consumer research. The private sector must be included in any research to ensure it is practical and usable.

Table 9 – Plant-based Protein: Market Access Playbook

[31] De Jong, M. V., Selten, M. P. H., Gitata-Kiriga, W., Peters, B., & Dengerink, J. D. (2024). An overview of the Kenyan food system: Outcomes, drivers and activities. Wageningen Centre for Development Innovation. ***doi.org/10.18174/658586***

Table 9 – Plant-based Protein: Market Access Playbook (continued)

Stage/Component	Intervention	Strategic Partners	Innovate UK Recommendations
Production & Consumption System			
Consumer demand/market access	• *Local Alignment:* Develop products that fit Kenya's traditional diets and cooking methods. Incorporating plant-based proteins into familiar staples (e.g., fortified flours or protein-enriched snacks) keeps costs down and ensures cultural relevance. • *Flexible distribution:* Supermarket entry can be hard for newcomers and informal markets are fragmented. To reach higher-income consumers, use e-commerce; for lower-income segments, leverage mobile tech and community partnerships. • *Consumer Education:* Grow supply and demand together by highlighting nutritional, ecological, and cost benefits of plant-based proteins. Tailor messages to urban families, rural communities, and health-focused buyers.	• *Leverage institutional feeding programmes:* School feeding, hospital etc to *deliver products and raise awareness.* • *Joint ventures:* Partner with agri-food companies to leverage their distribution networks and by-products • *Culinary training:* Train hotels, restaurants, and culinary schools to make plant-based recipes. Chefs are key food culture influencers and can change food expectations.	*Explore consumer preferences and demand drivers:* Assessment local consumer food preferences. For example, Nectar's Taste of Industry Report.[32]
Ecosystem			
Access to finance	• *Measuring Impact:* Attract philanthropic, donor, and impact investment funding, by collecting social and environmental impact data from the outset. • *Research funding sources:* Work with Kenyan government agencies, trade organisations, and NGOs to align with national food security objectives.	*Commercial partners:* Companies such as Buhler, Cargill, and others are increasing their presence in Kenya. Co-manufacturing (CMO) or joint ventures with commercial-scale agri-food producers reduce the cost of market entry. Collaborate with government bodies, NGOs, and donors to access financing	*De-risk capital investments:* i.e., Manufacturing Africa or the Sustainable Urban Economic Development (SUED) programme. Improve programme staff awareness to enable deal sourcing, due diligence, and decision-making. *Raise Awareness:* Showcase alternative protein's potential to investors. *Networking events:* stimulate CMO or joint operations with commercial agri-business.
Access to skills	• *Staff capacity building:* through innovation, joint ventures, or other education-focused partnerships.	*Innovation partnerships:* Partner with UK and/ or Kenya universities to create innovation co-ventures/partnerships. *CMO and joint ventures:* with established agri-food companies to share knowledge, technology, and access to skilled labour.	*Strengthen education and industry links:* Improve connections between industry in Kenya and the UK with education centres/universities. *University and Research Institution connections:* Connect UK alternative protein research centres and universities/ training colleges in Kenya, i.e., JKUAT and NAPIC.
Regulatory environment	• *Collaborative regulatory development:* Work with regulators to design fit-for-purpose regulation.	KEBS, NGOs, and donors to guide policy.	*Leverage UK regulation leadership:* UK policy sandbox as example of improved novel food regulations.

[32] ***www.nectar.org/***

3.2 Fermentation-Derived Proteins

Fermentation has been used for centuries to preserve and enhance foods and is now evolving into a cutting-edge technology that can play a pivotal role in enabling sustainable diets. Biomass fermentation—cultivating microorganisms such as fungi, yeast, or algae to produce high-protein biomass—offers immense potential for Kenya's food system. This technology can be a scalable, sustainable solution to meet the country's growing demand for affordable and nutritious proteins and enable Kenya to address protein deficiencies in rural and urban populations.

Table 10 – Benefits, Challenges & Opportunities for Fermentation-Derived Proteins

Benefits

Fermentation-derived protein is nutritionally rich, offering high protein concentrations that meet conventional animal proteins. It has high digestibility, bioavailable nutrients, and complete amino-acid profiles.

Fermentation-derived protein is highly sustainable: When produced at scale, it requires 98% less land and 90% less water than traditional animal agriculture, making it ideal for Kenya's resource-constrained environment.[33]

Fermentation technology can upcycle food waste, harvest protein every 92 hours, and grow anywhere, regardless of climate. This promotes a circular economy, reduces food insecurity and food production climate vulnerabilities.

Challenges

The lack of commercial-scale food-grade fermentation facilities restrict the economies of scale needed to compete with conventional proteins. In Kenya, there is one pilot-scale food-grade fermentation bioreactor. High energy prices and inconsistent power supply compound costs. The significant capital investment required for research, development, and production facilities creates substantial barriers to entry.

There's a shortage of skilled biotechnology workers and difficulties securing consistent, high-quality feedstock supplies from agricultural by-products. While there is a growing body of skilled workers, there is still a significant lack of in-country capacity across the production process. In addition, while post-harvest losses are substantial, there is a lack of waste processing, transport, and management to ensure a consistent supply of feedstocks.

Opportunities

Fermentation-derived products can be readily integrated into staple and therapeutic foods, providing an effective route to market through familiar products. There is a strong cultural acceptance and expectation around food fortification, which reduces barriers to market entry for new products.

Increasingly volatile climates offer an opportunity to expedite the production and sale of climate-resilient protein. Grown in bioreactors and harvested every 92 hours, this protein offers rapid production that can meet the needs of a growing country.

Substantial post-harvest losses can be transformed into high-quality, affordable protein, increasing agribusiness revenues while improving food security. Kenya's agricultural resources and existing food processing infrastructure create a strong opportunity to transform waste streams into valuable protein products.

[33] ***gfi.org/fermentation/***

3.2.1 — Fermentation-derived proteins: What are they, and how are they made?

Fermentation-derived proteins can be broken down into three distinct types.

- *Traditional fermentation:* involves using microorganisms to transform food substrates into products with enhanced nutritional, sensory, and preservation qualities. This type of fermentation has been practised for centuries to create various food products. Examples of products include tempeh and cheese.[34,35]
- *Biomass fermentation:* utilises fast-growing microorganisms, such as fungi, yeast, or bacteria, to produce large quantities of microbial cells (biomass). This biomass is rich in protein and can be harvested and processed into food products. Examples of products include mycoprotein derived from filamentous fungus.[36]
- *Precision fermentation:* involves engineering microorganisms to produce specific target proteins or molecules that are otherwise found in animals or plants. This technology produces complex proteins with desired functionalities without relying on traditional animal-sourced foods. Examples of products include animal-free dairy proteins and egg proteins.[37]

The review primarily focuses on biomass fermentation because of its significant impact potential. Biomass fermentation also has significant innovation potential compared to traditional fermentation, which, although it provides nutritious products, is less easy to adapt and scale for the local market. Precision fermentation is excluded from the review due to its current technology readiness level (TLR), which makes it less suitable for entering an LMIC such as Kenya.

3.2.2 — Regulatory Overview

There is no specific regulatory framework for biomass-fermentation-derived food products; however, the existing food safety framework covers most aspects of the inputs for fermentation-derived foods. The following summarises the regulatory landscape in Kenya:

- *Existing Frameworks*: Kenya's regulatory framework allows input for fermentation-derived proteins to align with current food safety standards. For instance, approved fungi strains under existing regulations provide a pathway for compliance. Companies should assess how their products fit these regulations or collaborate with KEBS to establish new standards if necessary.
- *Global & International Support*: For unregulated products, the regulatory progress in countries like the UK, US, EU, and others, alongside efforts by the Codex Alimentarius Commission to develop novel food standards, can serve as a guide for Kenyan regulators and businesses (***Figure 14***). CAC is a specifically helpful framework currently being applied to understand how regulations can be created for Kenyan-made biomass fermentation-derived proteins.
- *Import and Genetically engineered Product Compliance*: Stricter rules apply to products with biohazard and gene pollution risks. Fermentation-derived products are naturally low risk due to controlled environments. Nonetheless, market entrants can expect scrutiny. Genetically engineered (GE) products face labelling requirements under the 2012 Biosafety Regulations.
- *Companies must secure a Certificate of Conformity (CoC)* for all imports and consult legal experts to ensure compliance with labelling, safety, and regulatory protocols.

3.2.3 — Gap Analysis & Opportunity Mapping

The Kenya fermentation-derived protein industry remains nascent and under-resourced. The review found one micro-enterprise producing small batch tempeh and one early-stage biomass fermentation company (Essential), notably the only one in sub-Saharan Africa except South Africa (MycoSure). Given the potential for biomass fermentation to impact nutrition at scale, there is a significant market opportunity if production can be scaled and costs reduced.

Historically, fermentation has relied on purified sugars as feedstocks, but there is immense potential to utilise lower-cost alternatives, including agricultural by-products and side streams from other industries.

Table 9 provides key gaps and opportunities across the value chain and highlights actionable strategies to build a resilient and inclusive plant-based protein sector, specifically:

- The analysis starts at the processing stage (the stage at which microbes are cultivated to form protein-rich biomass).
- Excludes microbial selection and production as Kenya currently has limited opportunity to grow and experiment with various microbial strains.
- The waste stage has been included in the analysis. The choice of feedstock is critical as it impacts not only the cost and sustainability of the process but also the growth, composition, and flavour profiles of the microbes.

[34] "What Is Fermentation for Alternative Proteins? | Resource Guide | GFI." 2021. January 4, 2021. ***gfi.org/fermentation/.***

[35] Bedsaul-Fryer, Jacquelyn R., Jimena Monroy-Gomez, Kesso G. Van Zutphen-Küffer, and Klaus Kraemer. 2024. "An Introduction to Traditional and Novel Alternative Proteins for Low- and Middle-Income Countries." Current Developments in Nutrition 8 (February):102014. ***doi.org/10.1016/j.cdnut.2023.102014.***

[36] "What Is Fermentation for Alternative Proteins? | Resource Guide | GFI." 2021. January 4, 2021. ***gfi.org/fermentation/.***

[37] "What Is Fermentation for Alternative Proteins? | Resource Guide | GFI." 2021. January 4, 2021. ***gfi.org/fermentation/.***

Figure 14 – Codex Alimentarius Commission

Codex Alimentarius Commission

The Codex Alimentarius Commission (CAC) is the preeminent international food standards body, established in 1963 through collaboration between the UN Food and Agriculture Organisation (FAO) and World Health Organisation (WHO). With 189 members, including 188 countries and the European Union, the CAC develops globally recognised standards, guidelines, and codes of practice for food safety and trade.

The Commission is the primary architect of international food regulations, focusing on critical areas such as food additives, contaminants, and pesticide residues. Through its comprehensive framework, the CAC coordinates standards across international organisations, conducts scientific risk assessments, and develops risk management protocols. This standardisation creates a foundation for harmonised food safety practices while facilitating international trade through consistent regulatory approaches.

The CAC's role has become increasingly vital in regulating novel foods, particularly as innovations in food technology accelerate. Its adaptive framework provides essential guidance for evaluating new food products and technologies that lack established safety histories. Many nations now base their novel food regulations on CAC standards, creating a unified global approach that balances innovation with consumer protection. This harmonisation is particularly crucial for alternative proteins and other emerging food categories, where the CAC's science-based standards help navigate complex safety and regulatory challenges while reducing barriers to international trade.

Figure 15 – Developments in UK Alternative Protein Research Centres

Developments in UK Alternative Protein Research Centres

The UK and EU are accelerating global efforts to advance alternative proteins by significantly investing in research and innovation. Since 2010, the UK has published 255 research papers on plant-based foods, cultivated meat, and fermentation, making it a regional leader. It also accounts for 14% of the EU's research on new fermentation methods for food innovation. Recently, the UK has, via UK Research and Innovation (UKRI), among others, funded key research centres:

- ***University of Bath's Cellular Agriculture Research Manufacturing Hub (CARMA):*** Focused on scaling cellular agriculture technologies.
- ***Imperial College London's Microbial Foods Hub:*** Advancing microbial fermentation for alternative protein production.
- ***National Alternative Protein Innovation Centre (NAPIC) at the University of Leeds:*** Aims to drive innovation across the production, processing, and commercialisation of alternative proteins.
- ***The Bezos Centre for Sustainable Proteins:*** Funded by the Bezos Earth Fund, this centre focuses on advancing cultivated meat and other sustainable protein solutions.

NAPIC and the Microbial Food Hubs are particularly relevant to fermentation companies looking to launch in Kenya. NAPIC focuses on producing high-quality alternative proteins, scaling cultivated meat and fermentation with AI models, and supporting a just transition for producers. Meanwhile, the Microbial Foods Hub spans six universities and explores the potential of engineering biology to optimise fermentation and microbial food production. Germany and Spain complement the UK's leadership by advancing plant-based meat, seafood, and dairy innovation, making the EU a global powerhouse for alternative proteins.

Stage	Challenge	Opportunity
Processing	• Lack of commercial-scale food-grade fermentation bioreactors. • Co-manufacturing is restrained by the high cost of repurposing existing facilities. • High energy costs (majority of production costs) and inconsistent energy increase cost of production. • Shortage of skilled professionals in biotechnological operations. • Investors will be resistant to funding high-capital cost, low margin and market-untested products.	• *Funding:* Strategic partnerships with FDIs, government, and the private sector could help fund facility installation and operation. Reduce cost of production by: • Utilising agro-processors' byproducts and waste streams for feedstock and researching viable Agri-waste to reduce the cost of feedstock. • R&D to optimise extraction methods and prevent fungi colonial mutants that interfere with meat texture and fermentation effectiveness. • Partner with the UK's leading alternative protein research centres • Explore on-site renewable energy solutions (geothermal, solar, etc.) or partner with commercial agri-processors that have on-site energy. Pathways to accessing skilled workforce • Technology and skills transfer through global fermentation company partnerships and UK alternative protein research • Explore long-term training programmes and biotechnology curricula with universities, technical institutes, and industry players.
Trade	• Short-to-medium-term export of mycoprotein is unlikely due to current manufacturing capacity. • No well-established regional distribution networks and trade partnerships for fermentation-derived protein products. • Not price competitive with imports. • Limited consumer and business awareness slows market acceptance and trade growth.	• If domestic capacity is scaled, neighbouring countries could be viable markets for affordable, quality products.
Retail/ Consumer	• Limited consumer familiarity and a lack of awareness among retailers. • Sensory properties may limit consumer acceptance.	• Powdered proteins can readily integrate into existing products (e.g., fortified flours, biscuits) and bypass cold chain challenges. Nutritional benefits make products competitive with conventional proteins. • Well suited for integration into ready-to-use foods (***Figure 16***). There is also strong consumer acceptance of food fortification. Plus, fermented foods are culturally ingrained in diets.[38] • Institutional feeding programmes, e.g., school feeding programs offer access to large markets.
Waste	• Agri-waste presents a cost-effective and environmental solution for fermentation feedstock. However, its fragmented supply chain poses challenges in securing consistent quality and quantity which may hinder production.	• Conduct R&D to identify suitable agri-waste for use as feedstock in fermentation. • Partner agricultural stakeholders and fermentation companies to create efficient supply chains for agri-waste feedstocks.

Table 11 – Fermentation-Derived Protein: Gap Analysis & Opportunity Mapping

[38] Habtamu Hawaz, Benedetta Bottari, Francesca Scazzina, and Eleonora Carini. 2025. "Eastern African Traditional Fermented Foods and Beverages: Advancements, Challenges, and Perspectives on Food Technology, Nutrition, and Safety." PubMed 24 (2): e70137–37. ***doi.org/10.1111/1541-4337.70137.***

The Long, Windy, but Worthy Path to Reformulating Ready-to-Use Foods

Ready-to-use foods (RUFs) are critical in the fight against malnutrition, falling into three categories:

- *Ready-to-Use Therapeutic Food (RUTF):* Treats severe acute malnutrition in children and adults.
- *Ready-to-Use Supplementary Food (RUSF):* Treats moderate acute malnutrition.
- *Ready-to-Use Complementary Food (RUCF):* Prevents chronic malnutrition in children aged 6 to 24 months.

The greatest challenge in scaling RUFs is the high cost, primarily driven by milk powder, which accounts for over 50% of the cost but only 25-30% of the content. This cost barrier limits access, with only 15% of children with severe acute malnutrition receiving RUTFs. Reformulating RUFs with fermentation-derived proteins offers a significant opportunity to reduce costs while maintaining high nutritional value, enabling access to millions more people in need.

However, reformulation faces significant hurdles. Due to their life-saving role, RUTFs, rightly so, have stringent regulations, making them difficult to change. Institutional resistance and slow regulatory approvals further complicate reformulation efforts. RUSF and RUCF, which address less severe conditions, present a clearer pathway for introducing fermentation-derived proteins. Success in these categories could ultimately pave the way for reformulating RUTFs, unlocking a more affordable and sustainable solution to malnutrition worldwide.

To make change happen, strong evidence of nutritional comparability is required via clinical trials and coordination across several key players, such as WHO and UNICEF. In parallel, fermentation costs need to be reduced, and awareness built of the capability of fermentation-derived proteins.

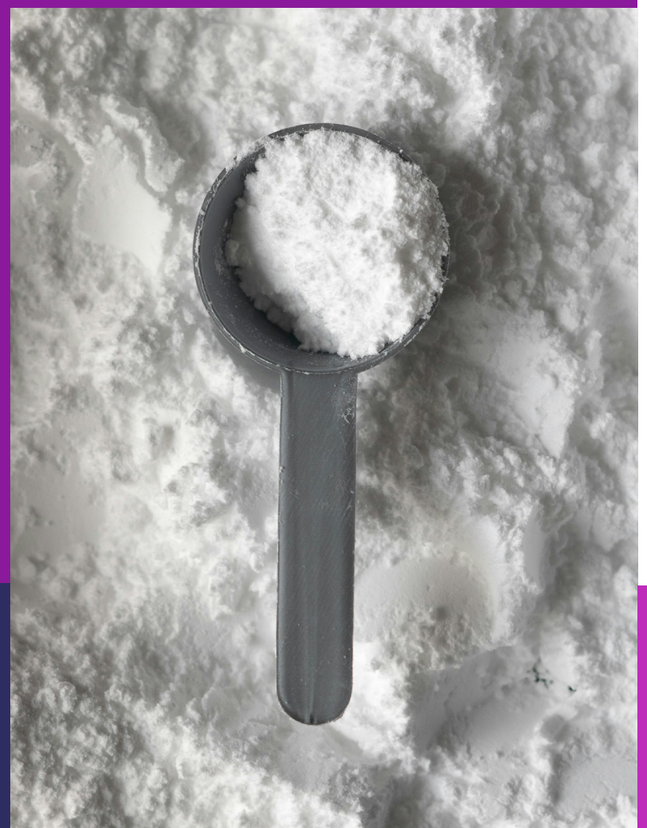


Figure 16 *sources:*

1. Bahwere, P., Balaluka, B., Wells, J. C. K., Mbiribindi, C. N., Sadler, K., Akomo, P., Dramaix-Wilmet, M., & Collins, S. (2016). Cereals and pulse-based ready-to-use therapeutic food as an alternative to the standard milk- and peanut paste-based formulation for treating severe acute malnutrition: A noninferiority, individually randomized controlled efficacy clinical trial. American Journal of Clinical Nutrition, 103(4), 1145–1161. ***doi.org/10.3945/ajcn.115.119537***

2. ***www.businessresearchinsights.com/market-reports/ready-to-use-therapeutic-food-market-111146***

3.2.4 — Market Access Playbook

Kenya's nascent fermentation sector has challenges and opportunities for new entrants. While the market faces gaps across production, processing, trade, retail, and consumption, careful planning and strategic action can position new businesses to succeed.

*The market access playbook (**Table 10**) outlines key steps for new entrants to establish and grow their operations*. It highlights key learnings from the review and their relevance to fermentation-focused businesses entering the Kenyan market. The playbook focuses on five key principles:

Setting up right	Setting enterprises up to deliver quality and grow sustainably.
Research & Development	Innovation to achieve price competitiveness and optimise sensory and use functionality.
Understanding local consumer preferences	Ensuring that product development is rooted in understanding Kenyan consumers' needs and tastes to meet them where they are and bring them along the journey.
Enhancing market awareness & trust	Educating consumers about new products and ensuring high safety standards.
Building strategic partnerships	Working with existing institutions and partners to build and leverage local expertise and develop synergies amongst actors to facilitate the smooth development and adoption of new products.

Table 12 – Fermentation-Derived Protein: Market Access Playbook

Stage/Component	Intervention	Strategic Partners	Innovate UK Recommendations
Production & Consumption System			

Processing	• *Mapping innovation pathways:* Explore how to achieve price and sensory competitiveness.
	  • Research optimal Agri-waste feedstock formula.
	  • Optimise production process using low-cost adaptation (industry standard inputs – such as cleaning agents, may be prohibitively expensive).
	  • Energy efficiency and access to renewable energy.
	• *Assess facility options:* Understand the manufacturing landscape:
	  • Local bioreactor capacity is limited, and co-manufacturing (CMO) or renovating existing facilities involves significant costs.
	  • Consider access to affordable energy or the feasibility of on-site renewable energy.
		• *Commercial-scale:* Companies like Buhler, Cargill, and Novozymes are expanding in Kenya. They offer potential partnerships for joint ventures.
		• *Feedstock supply:* Agricultural cooperatives & Agri-processors can provide feedstock.
			De-risk investment for processing facilities:
			• Conduct techno-economic analyses (TEA) to assess facility opportunities.
			• Technology transfer/ learnings from UK research centres and assess modifications to suit local context.
			• Establish lab-scale facilities at key institutions and universities (KIRDI and JKUAT).
			• Assess existing fermentation capacity, i.e., pharmaceuticals, and feasibility of food-grade renovations.
			Research partnerships between UK research centres and Kenya businesses to:
			• Identify microbial strains suitable for biomass fermentation using local feedstocks.
			• Utilisation of local agricultural by-products and waste streams as feedstocks.

Product development	• *Integrate into existing products:* Fortify widely consumed staples like flour, biscuits, and complementary foods. • *Highlight nutrition over sustainability:* Market the health benefits, such as addressing micronutrient deficiencies and providing complete protein. • *Local consumer preferences:* Test product formulations with the target market as preferences are largely unresearched.	• Nectar has run two *consumer taste preference studies* in the US and would have strong learnings that could be applied.[39]	• *Research consumer demand:* Conduct consumer research to inform commercial product development. Involve the private sector so research is practical and usable. • *Optimised integration:* Consumer research on best product integrations. • *RUF Reformulation:* Establish a technical committee to explore reformulating RUFs.
Consumer demand/ market access	• *Research Food Culture and Consumption Habits:* Tailor product development to align with traditional diets and cooking methods. • *Educate Consumers:* Tailor messaging to different market segments (e.g., urban households, rural communities, and health-conscious consumers), as their needs and uses differ significantly.	• *Leverage institutional feeding programmes:* such as school feeding programmes, to deliver products, raise awareness and improve nutrition. • *Commercial Food & Beverage:* There are well-established brands (which dominate Kenya's FMCG market) that offer routes to market.	• *Explore consumer preferences and demand drivers:* Nectar's Taste of Industry Report provides an example study, and the approach could be adapted to the local context.[40]

[39] www.nectar.org/
[40] www.nectar.org/

Table 12 – Fermentation-Derived Protein: Market Access Playbook (continued)

Stage/Component	Intervention	Strategic Partners	Innovate UK Recommendations
Ecosystem			
Access to finance	• *Measuring Impact:* To secure philanthropic, donor, and impact investment funding, companies should collect social and environmental impact data from the start. Demonstrating both direct and indirect impact as investors seek broad and deep outcomes. • *Research funding sources:* Work with Kenyan government agencies, trade organisations, and NGOs to align with national food security objectives. Leverage incentives and policies supporting industrialisation, sustainability, and addressing malnutrition (Big Four Agenda etc.)	• *Commercial partners:* Companies such as Buhler, Cargill, and others are increasing their presence in Kenya. Co-manufacturing (CMO) or joint ventures with commercial-scale agri-food producers reduce the cost of market entry.	• *De-risk private capital investments:* Leverage grants and public-private financing programs such as FCDO's Manufacturing Africa or the Sustainable Urban Economic Development programme to derisk investments. • *Raise Alternative Protein market awareness:* Raise awareness of alternative protein's potential with private capital investors. • *Networking events* to encourage strategic partnerships between commercial-scale agri-food producers and alternative protein start-ups for co-manufacturing or joint operations.
Access to skills	• *Staff capacity building* through innovation, joint ventures, or other education-focused partnerships.	• *Innovation partnerships:* Partner with UK and/or Kenya universities to create innovation co-ventures/partnerships. • *CMO and joint ventures* with established agri-food companies to share knowledge, technology, and access to skilled labour.	• *Strengthen education and industry links:* Improve connections between industry in Kenya and the UK with education centres/ universities to encourage introducing biotechnology and fermentation-focused training programmes at universities or research centres. • *University and Research Institution connections:* Connect UK alternative protein research centres and universities/ training colleges in Kenya, i.e., JKUAT, NAPIC, and microbial hubs.
Regulatory environment	• *Engage regulators early:* Work closely with standards advisors to assess the application of existing standards to current products. Engage with regulatory bodies like KEBS to align on safety and efficacy requirements.	• Collaborate with government bodies, NGOs, and donors for policy guidance. First movers can also help shape regulations in Kenya.	• *Leverage UK leadership in Alternative Protein regulation:* Tap into UK policy expertise to improve novel food regulations and facilitate learning workshops with Kenyan regulators.

3.3 Edible Insects

Edible insects, or entomophagy, have been consumed by humans for centuries and remain deeply rooted in the cultures of many regions, including Africa, Asia, and Latin America. Globally, over 2,000 edible insect species have been documented, with more than 2 billion people incorporating them into their diets.[41]

In Kenya, insects such as grasshoppers, termites, lake flies, and crickets have traditionally been consumed, particularly in the Western provinces.[42]

Table 13 – Benefits, Challenges & Opportunities for Edible Insects

Benefits

Culturally significant and exceptionally nutritious: They offer complete proteins, healthy fats, vitamins, and minerals essential for human health.

A sustainable and scalable solution to the growing global demand for protein. Insect farming requires significantly fewer resources—such as land, water, and feed—than traditional livestock farming while generating fewer greenhouse gas emissions.

Produce diverse high-value products, such as protein-rich flours, oils, fertilisers, and biodiesel feedstock. Farming insects can diversify farmer income due to the extensive range of products and contribute to a circular economy by utilising waste and providing organic fertiliser.

Challenges

Despite sustained investment, they have experienced low uptake in Kenya and international markets such as the EU, UK, and US. Many large and well-funded companies, such as Ynsect, have recently changed their strategy to produce animal feed after failing to establish a food market.

Cricket protein is not competitive with traditional proteins because of inefficiencies in production and high-cost inputs. Cricket feedstock can be expensive, and incubation to maturation is complex, leading to yield losses. This is compounded by the high cost of energy.

Opportunities

Black Solider Fly larvae (BSF) offer a price-competitive protein but are not currently deemed safe for human consumption. If safety issues can be solved, the BSF larvae's ability to convert organic waste into high-protein biomass provides a sustainable solution to waste management and protein production challenges.

Farmers can diversify their income through insect production and selling valuable by-products like frass, an organic fertiliser that can reduce dependency on chemical alternatives. Frass can be a low-cost, high-quality fertiliser that stimulates regenerative farming practices.

Integrating insect protein into institutional feeding programs and ready-to-use foods provides a clear route to market, while improved regulation could open up regional trade opportunities.

[41] Huis, Arnold van. 2013. "Potential of Insects as Food and Feed in Assuring Food Security." Annual Review of Entomology 58 (Volume 58, 2013): 563–83. ***doi.org/10.1146/annurev-ento-120811-153704***.

[42] Ayieko, Monica, John Kinyuru, Harinder Makkar, and Christopher Munke-Svendsen. 2016. "Technical Brief #1: Insects as Food and Feed in Kenya – Past, Current and Future Perspectives." 1. GREENiNSECT.

3.3.1 — Edible Insects: What are they, and how are they made?

In Kenya, edible insects primarily include crickets, grasshoppers, and mealworms, with crickets being the most commercialised species. These insects are valued for their high nutritional content, particularly their protein levels, reaching up to 77% of dry matter.[43]

Most farmed insects require less than two months to mature to a marketable size, making them efficient to produce. However, crickets take longer, typically five to six weeks, and are farmed in semi-managed and controlled environments.[44,45] This means farms can achieve 8-10 cycles per year for crickets.

Crickets, while an excellent source of nutrients, are more successful with specialised feeds similar in composition to chicken feed.[46,47] This presents cost challenges, as chickens have a more established market. Cricket farming presents further challenges such as susceptibility to diseases, pests, and environmental fluctuations, which can lead to significant yield losses. This also presents challenges concerning safety (see ***Figure 17***).

Edible insects can be consumed whole, but their appearance often discourages consumers. To address this, insects are commonly processed into powders or other forms to disassociate their origin. Processing methods vary and include lipid extraction, enzymatic proteolysis, thermal treatments like blanching and pasteurisation, low-temperature techniques such as refrigeration and freezing, dehydration, and fermentation. Each method has distinct advantages and disadvantages; not all techniques suit every insect or insect-based product. Careful consideration of the processing approach is essential to ensure product safety, quality, and consumer acceptance.[48]

Figure 17 – Edible Insect Food Safety Concerns

Edible Insect Food Safety Concerns

Food safety concerns remain a significant barrier to the widespread adoption of insects for human consumption. Studies have highlighted the potential risks of contamination, including parasites, bacteria, and other harmful pathogens, raising questions about the safety and reliability of insect-based foods.

One major concern is the prevalence of parasites in edible insects. A study investigating 300 insect farms found that 81.33% were contaminated with parasites (30% of which were harmful to humans), emphasising that "edible insects are an underestimated reservoir of human and animal parasites." These parasites could pose risks to both consumers and livestock if not properly addressed during farming and processing. In addition, shelf-stable insect products have been found to harbour harmful bacteria such as Salmonella and Bacillus cereus, which can cause foodborne illnesses.

Inadequate hygiene practices, poor processing standards, and insufficient regulatory oversight exacerbate these risks, making food safety a critical challenge for the industry.

To overcome these concerns, stricter regulations and standards are needed across the edible insect supply chain, from farming to processing and retail. Improved hygiene practices at insect farms, rigorous quality control during processing, and enhanced storage and packaging solutions can reduce contamination risks. Additionally, more research is needed to understand and mitigate the transmission of parasites and bacteria in insect farming. By addressing these safety challenges, the edible insect industry can build consumer trust and unlock its potential as a sustainable and nutritious protein source for the future.

[43] Montowska, Magdalena, Przemysław Łukasz Kowalczewski, Iga Rybicka, and Emilia Fornal. 2019. "Nutritional Value, Protein and Peptide Composition of Edible Cricket Powders." Food Chemistry 289 (August): 130–38. ***doi.org/10.1016/j.foodchem.2019.03.062***.

[44] Tanga, C. M., & Kababu, M. O. (2023). New insights into the emerging edible insect industry in Africa. Animal Frontiers, 13(4), 26–40. ***https://doi.org/10.1093/af/vfad039***

[45] Kimani, M., (2024), Rapid Review of Kenya's Alternative Protein Sector, Interview by Tom Chapman, 29 November.

[46] Fernandez-Cassi, X., Supeanu, A., Vaga, M., Jansson, A., Boqvist, S., & Vagsholm, I. (2019). The house cricket (Acheta domesticus) as a novel food: A risk profile. ***https://doi.org/10.3920/JIFF2018.0021***

[47] Kimani, M., (2024), Rapid Review of Kenya's Alternative Protein Sector, Interview by Tom Chapman, 29 November.

[48] Liceaga, Andrea M. 2021. "Processing Insects for Use in the Food and Feed Industry." Current Opinion in Insect Science 48 (December): 32–36. ***https://doi.org/10.1016/j.cois.2021.08.002***.

3.3.2 — Regulatory Overview

Kenya is one of the few countries with specific standards for edible insects – see ***Table 14*** below. This provides a significant regulatory advantage compared to many other markets where insects lack formal approval for consumer sales. While the existence of a standard represents meaningful progress, there are gaps.

The standards do not currently differentiate insect quality; an issue explored further in the gap analysis section. For insect farming, additional approval is required from the Kenya Wildlife Service (KWS), as insects are classified as wild animals under Kenyan law.

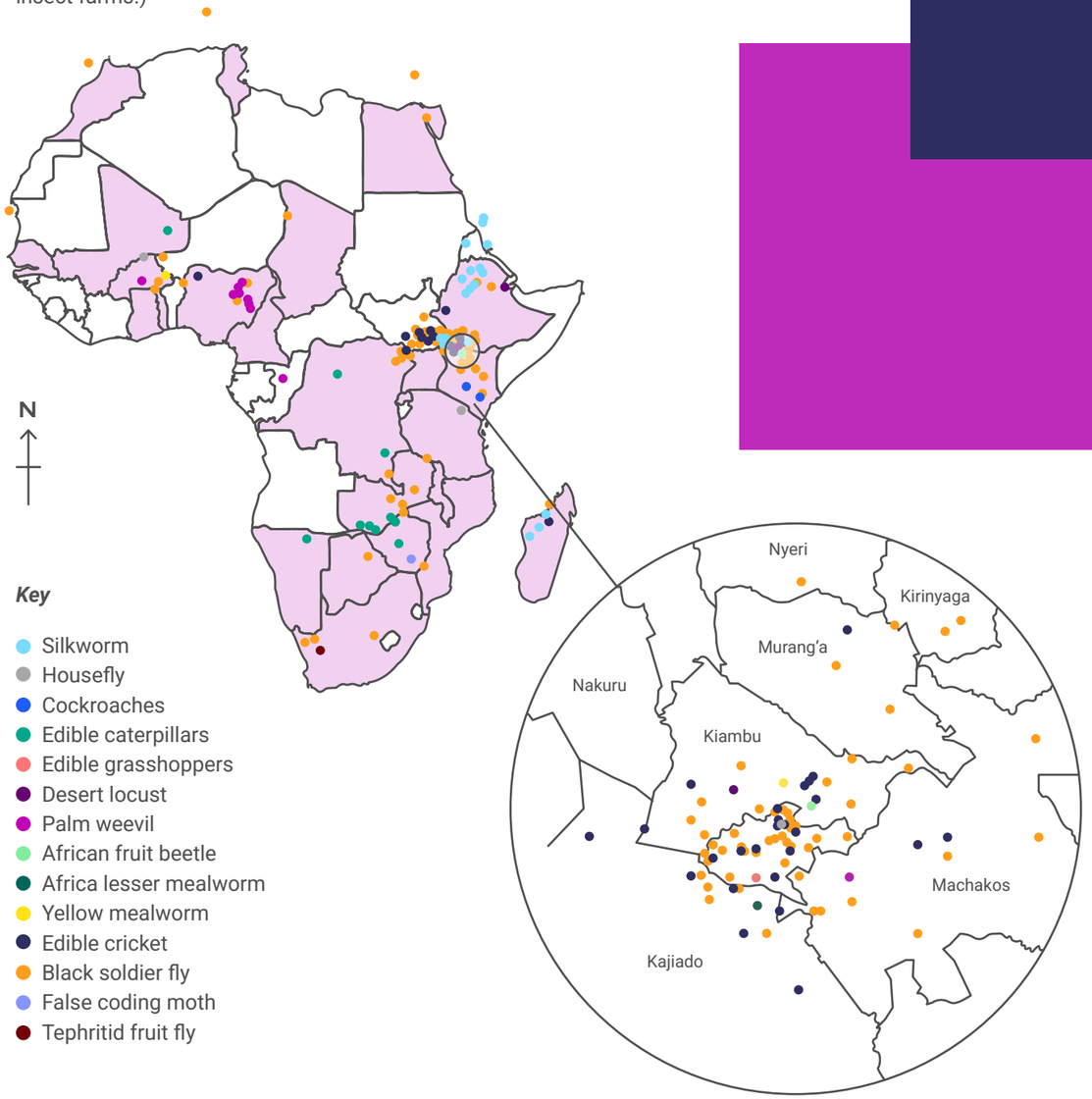
Table 14 – Summary of KEBS Current Insect Standards

Standard	Title	Mandate
KS 2921:2020	Production and handling of insects for food and feed - Code of practice	Mandates the minimum infrastructural and environmental requirements necessary for optimal production of edible insects.
KS2922–1:2022	Edible Insects – Specification. Part 1	Requirements of processed edible insects' products packaged and presented either as whole or ground form.
KS2922–2:2022	Edible Insects – Specification. Part 2	Requirements of processed edible insects' products such as biscuits or cookies (or any other product) where edible insects are used as ingredients.
KS2711:2017	Dried insect products for compounding animal feeds - Specification	Specify the requirements for dried insect products that are intended to be used as protein sources in the formulation of animal feeds

3.3.3 — Gap Analysis & Opportunity Mapping

Insect farming (primarily for animal feed) has seen a "massive and continuous expansion of enterprises in Africa."[49] As such, more granular data on current operations across Africa is available. ***Figure 18*** shows the distribution of insect farming operations across Africa. Note that this includes edible insects and insects for use as animal feed.

Figure 18 – Distrobution of insect farms for food and feed in Africa (Highlighted countries have operational insect farms.)



Despite this growth in the number of farms, the industrialisation of insect production, commercial processing, and product development remains limited. A mix of SHFs and SMEs conducts insect farming in Kenya, farming ten species (either for food or feed). BSF used for animal feed are the most farmed (>80%) species, and insects for animal feed represent between 80-95% of the market in Kenya.[50,51] The industry, and specifically BSF, was promoted in 2013 by FAO as a viable alternative soy animal feed source and a waste management solution.[52] This has led to a consolidation of funding and farming efforts around BSF.

BSF is not used for food due to several potential risks; however, significant market opportunities exist if a solution is found, as ***Figure 19*** explores. In Kenya, insects used for food are limited to crickets, grasshoppers, and mealworms.

- *Crickets*: The primary insect farmed for food in Kenya is Crickets via InsectiPro. They have developed a tested production process and have two products on the market: a snack and protein powder. Both products are expensive compared to conventional proteins such as poultry. Thus, it is marketed towards high-income consumers in urban areas. InsectiPro has also successfully launched school feeding programmes in collaboration with UNICEF using cricket protein; however, the protein is not price competitive with alternatives at the current production scale.[53]
- *Mealworms*: Despite their approval for inclusion in human food, this review found no scaled farming of these insects or products incorporating them in the market in Kenya for food. However, they are being produced for animal feed. Commentators mentioned that production costs more than crickets, but protein yield is less efficient.

The review did not find any other edible insect products available in Kenya. ***Table 12*** provides key gaps and opportunities across the value chain—production, processing, trade, retail, consumption, and waste—and highlights actionable strategies to build a resilient and inclusive edible insect sector.

[49] Tanga, C. M., & Kababu, M. O. (2023). New insights into the emerging edible insect industry in Africa. Animal Frontiers, 13(4), 26–40. ***https://doi.org/10.1093/af/vfad039***

[50] Tanga, C. M., & Kababu, M. O. (2023). New insights into the emerging edible insect industry in Africa. Animal Frontiers, 13(4), 26–40. ***https://doi.org/10.1093/af/vfad039***

[51] Kimani, M., (2024), Rapid Review of Kenya's Alternative Protein Sector, Interview by Tom Chapman, 29 November.

[52] Fernandez-Cassi, X., Supeanu, A., Vaga, M., Jansson, A., Boqvist, S., & Vagsholm, I. (2019). The house cricket (Acheta domesticus) as a novel food: A risk profile. ***https://doi.org/10.3920/JIFF2018.0021***

[53] Kimani, M., (2024), Rapid Review of Kenya's Alternative Protein Sector, Interview by Tom Chapman, 29 November.

Figure 19 – Black Soldier Fly - Unlocking the Potential of Sustainable Protein from Waste

Black Soldier Fly: Unlocking the Potential of Sustainable Protein from Waste

Black Soldier Fly (BSF) larvae present a promising opportunity as a sustainable and efficient source of protein, mainly because they can convert organic waste into high-protein biomass. However, their potential has yet to be unlocked for human food because of safety concerns and a lack of regulatory approval for BSF protein for human consumption – BSF is regulated for inclusion in livestock and pet foods in the EU and USA. Despite a growing body of research, there are still gaps in the research for the full bioconversion of toxins in waste, raising concerns about microbial, heavy metal, and allergen risks. Without sufficient evidence to address these risks, BSF as a protein remains unregulated for human consumption globally, including in the EU and the UK.

Additionally, post-consumer waste can be included in BSF feedstock in Kenya. This creates a challenge of inconsistent quality and supply of feed-grade waste for larvae production. Decentralised waste collection often requires long-distance transportation to centralised facilities, driving up costs.

High production costs, particularly for energy-intensive drying processes, limit the scalability of BSF protein at current prices for the livestock feed industry. If regulation supported BSF for human consumption, current prices would make BSF an affordable protein source.

If the challenges identified can be overcome, BSF has immense potential as an affordable and sustainable protein source for both food and feed.

"If we solve BSF for human food, we could end malnutrition."

Laura Stanford, Founder of
Bug Picture & Loop Pet Food

Figure 20 – Consumer Acceptance of Edible Insects

Consumer Acceptance of Edible Insects

There is significant industry hype that consumers in Kenya and, more broadly, SSA accept insects as part of traditional diets. ICIPE, Kenya's insect research centre, has conducted several studies and found relatively high consumer acceptance of insect-based foods such as bread baked with cricket powder. Acceptance is higher when insects are processed and combined with existing products rather than eaten whole.

Despite these trials, however, Kenyan insect businesses report a high say-do gap. While insects have been part of traditional diets in some regions and for some cultures, the reality is that the consumption of insects in Kenya is far from normalised, particularly in urban areas. While the evidence is anecdotal, even for those from cultures where this is the usual practice, the transition to urban life includes a shift away from insects.

"People have moved on from insects, so their reintroduction requires heavy marketing."

Laura Stanford, Founder of
Bug Picture & Loop Pet Food

Table 15 – Edible Insect: Gap Analysis & Opportunity Mapping

Stage	Challenge	Opportunity
Production	• Insects are highly susceptible to disease and environmental changes, causing production losses and increasing costs. • High contamination risks as insects can serve as reservoirs for human and animal parasites. • Long maturation times and fresh feed requirements reduce the competitiveness of crickets. • Difficult to export as standards do not recognise quality improvements (consistency in weight and nutritional profile). • Accessing sufficient feedstock can be difficult (primarily for insects used as animal feed).	• Climate-controlled environments ensure consistent and safe food production. • Exploring the use of BSF for food. • Granular standards for insect farming and processing to meet quality consistency and enable premium pricing. • Partner with waste management and Agribusinesses to provide a steady, cost-effective feedstock supply. • Collaborate with the Kenyan government to subsidise organic fertiliser to accelerate the adoption of insect farming by-products.
Processing	• Safety remains a concern. Studies have found Salmonella and Bacillus cereus in processed, shelf-stable insect products. • 60% of total production costs is energy. • Limited off-take demand for insects. • Vertically integrated companies limit innovation and scaling. Scaling requires expanding the entire supply chain (e.g., eggs, feedstock, facilities), which adds significant costs and complexity.	• Partner with ICIPE (globally recognised) and other European research institutions to reduce microbial contamination and allergenicity. • Research maximised nutrient retention and digestibility by reducing microbial load and allergenic risks • FMCG companies are looking for fortification advantages in highly competitive market – offers market entry point. • Outsourcing (e.g., feedstock or egg production) to reduce costs and complexity, allowing companies to focus on core areas such as processing and product development.
Trade	• Limited grading and quality criteria limit EU, UK, or US trade. • The production scale in Kenya is too small to meet the export-ready volumes required for markets like the EU, UK, or US.	• Harmonising regulations with international standards. • The UK private sector could foster investments through off-take agreements.
Retail/Consumer	• Expensive products do not serve the mass market or address malnutrition. For instance, 1kg of cricket protein powder costs around KShs 2,000. • While insects are part of traditional diets in some Kenyan regions, consumption is far from normalised, especially in urban areas. Substantial marketing is still needed to raise awareness and overcome stigma. • ICIPE has conducted several studies and found relatively high consumer acceptance of insect-based foods such as bread baked with cricket powder. Acceptance is higher when insects are processed and combined with existing products rather than eating insects whole.[55] • Despite this, businesses report a large "say-do gap," where interest does not translate into sustained purchases.	• Scale production to improve economies of scale. Some companies have also been experimenting with out-grower schemes, which have the double benefit of diversifying SHF incomes while reducing production costs for insect companies. • Focus on producing insect powder, which can be integrated with existing mainstream products to improve consumer acceptance. See ***Figure 20***. • Explore the potential of using insect powder to replace whey protein in RUFs, see ***Figure 16***.

[54] Frentzel, H., Kelner-Burgos, Y., Fischer, J., Heise, J., Göhler, A., & Wichmann-Schauer, H. (2022). Occurrence of selected bacterial pathogens in insect-based food products and in-depth characterisation of detected Bacillus cereus group isolates. International Journal of Food Microbiology, 379, 109860. ***https://doi.org/10.1016/j.ijfoodmicro.2022.109860***

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3.3.4 — Market Access Playbook

The market access playbook outlines key steps for new entrants in the mealworm and cricket sectors to establish and scale operations in Kenya's early-stage edible insect sector. This playbook is not designed to be comprehensive.

It highlights key learnings from the review and how they apply to food-edible insect businesses looking to enter and succeed in the Kenya market.

The playbook focuses on five key principles:

Setting up right	Setting enterprises up to deliver quality and grow sustainably.
Research & Development	Innovation to achieve price competitiveness and optimise sensory and use functionality.
Understanding local consumer preferences	Ensuring that product development is rooted in understanding Kenyan consumers' needs and tastes to meet them where they are and bring them along the journey.
Enhancing market awareness & trust	Educating consumers about new products and ensuring high safety standards.
Building strategic partnerships	Working with existing institutions and partners to build and leverage local expertise and develop synergies amongst actors to facilitate the smooth development and adoption of new products.

Table 13 is divided into intervention and strategic partner recommendations for the private sector at each stage of the production and consumption system and the wider ecosystem. Recommendations have also been included for Innovate UK to accelerate private sector progress in growing the industry.

Table 16 – Edible Insects: Market Access Playbook

Stage/Component	Intervention	Strategic Partners	Innovate UK Recommendations
Production & Consumption System			
Production (primary)	• *Develop farming protocols:* Controlled environments and disease management protocols are essential for consistent and safe yields. • *Ensure food safety:* Invest in research to reduce contamination risks from parasites and diseases.	• *ICIPE:* R&D into resilient farming systems minimising losses from disease, pests, and environmental changes. • *Farming Co-operatives:* Disseminate out-grower initiatives via cooperatives as an efficient information & training mechanism	*Research centres: ICIPE is a world-renowned insect research centre with strong connections to leading centres globally. Specifically:* • Identify resilient and high-nutrient insect species that can be farmed. E.g., Safe BSF could unlock a price-competitive insect protein. • Improve farming systems to increase yield, reduce disease susceptibility, and enhance scalability.
Processing	• *Optimise Processing Techniques:* Refine methods (e.g., blanching, dehydration, fermentation) to improve nutrient retention and digestibility and reduce processing cost, microbial load, and allergenicity. • *Capitalise by-product revenues:* Maximising income from by-products like frass, oil, or other products to improve sustainability and reduce production costs. • *Utilise regional markets as stepping stones:* Exporting to African markets with fewer regulatory barriers to build capacity, scale, and experience before expanding to stricter markets like the EU or US. • *Mapping innovation pathways:* Innovation is needed to achieve price competitiveness and optimise sensory and use functionality. Including utilising Agri-waste as feedstock. • *Capitalise on EU market shift:* Edible insect production in the EU has faced significant headwinds, with many companies closing or shifting focus to insects for animal feed. This creates an opportunity to fill the supply gap.	• *Commercial Partners:* Companies like Buhler, Cargill, and others are expanding in Kenya. Forming strategic partnerships for co-manufacturing (CMO) or joint ventures with commercial-scale agri-food producers reduces market entry costs. • *Agri-business:* Agricultural cooperatives & Agri-processors for feedstock supply.	• *De-risk investment for processing facilities:* In partnership with the private sector, conduct techno-economic analyses and feasibility studies to determine challenges and opportunities for constructing processing facilities.

Product development	• *Integrate with existing products:* Consumers are more likely to accept insect-based products when integrated into familiar foods, such as bread, porridge, or protein snacks. Focus on creating products that "disassociate" the insect origin.
	• *Focus on product development:* Innovate new formulations/flavours tailored to local diets and consumer preferences.
	• *Address price sensitivity*: Edible insect products are too expensive for the mass market.
		• Nectar has run *two consumer taste preference studies* in the US and would have strong learnings that could be applied.	• *Research partnerships on consumer demand:* Assess viable partnerships between universities/ research institutions / private sector for:
			  • Consumer research to support product development.
			  • Optimised flavours and concentrations with existing mass-market products.
			  • The private sector must be included in any research to ensure it is practical and usable.[40]
			• *RUF Reformulation:* Create a technical committee to develop a roadmap for reformulating RUFs, replacing milk powder with a nutritious, sustainable, and allergen-free solution that can substantially impact global malnutrition.

Stage/Component	Intervention	Strategic Partners	Innovate UK Recommendations
Production & Consumption System			
Consumer demand/market access	• *Educate Consumers:* Launch awareness campaigns highlighting proteins' nutritional, environmental, and affordability benefits. Tailor messaging to different market segments (e.g., urban households, rural communities, and health-conscious consumers).	• *Leverage institutional feeding programmes:* such as school feeding programmes, to deliver products, raise awareness and improve nutrition. • *FMCGs:* Partner with large FMCGs to leverage their distribution networks and brand awareness.	• *Explore consumer preferences and demand drivers:* assess local consumer sensory, functionality, and uses preferences. For example, an adapted version of Nectar's Taste of Industry Report provides an example study that considers the product requirements of the LMIC context.[56]
Ecosystem			
Access to finance	• *Measuring Impact:* To secure philanthropic, donor, and impact investment funding, companies should collect social and environmental impact data from the start. Demonstrating both direct and indirect impact as investors seek broad and deep outcomes. • *Research funding sources:* Work with Kenyan government agencies, trade organisations, and NGOs to align with national food security objectives. Leverage incentives and policies supporting industrialisation, sustainability, and addressing malnutrition. • *Value chain disaggregation:* Understand where you can add value and specialise. This will help drive value chain efficiency.	• *Commercial Partners:* CMO or joint ventures with commercial-scale agri-food producers could reduce the cost of market entry.	*De-risk private capital investments:* • Through grants and public-private financing, i.e., through programmes such as Manufacturing Africa or the Sustainable Urban Economic Development programme. • Create awareness of the alternative protein's potential with programme staff to improve deal source, due diligence, and decision-making. • Networking events to encourage partnerships for CMO or joint operations with commercial-scale agri-food producers and alternative protein start-ups and technology transfer opportunities.
Consumer demand/market access	• *Educate Consumers:* Launch awareness campaigns highlighting proteins' nutritional, environmental, and affordability benefits. Tailor messaging to different market segments (e.g., urban households, rural communities, and health-conscious consumers).	• *Leverage institutional feeding programmes:* such as school feeding programmes, to deliver products, raise awareness and improve nutrition. • *FMCGs:* Partner with large FMCGs to leverage their distribution networks and brand awareness.	• *Explore consumer preferences and demand drivers:* assess local consumer sensory, functionality, and uses preferences. For example, an adapted version of Nectar's Taste of Industry Report provides an example study that considers the product requirements of the LMIC context.[56]

[56] ***https://www.nectar.org/***

Table 16 – Edible Insects: Market Access Playbook

4 Annexes

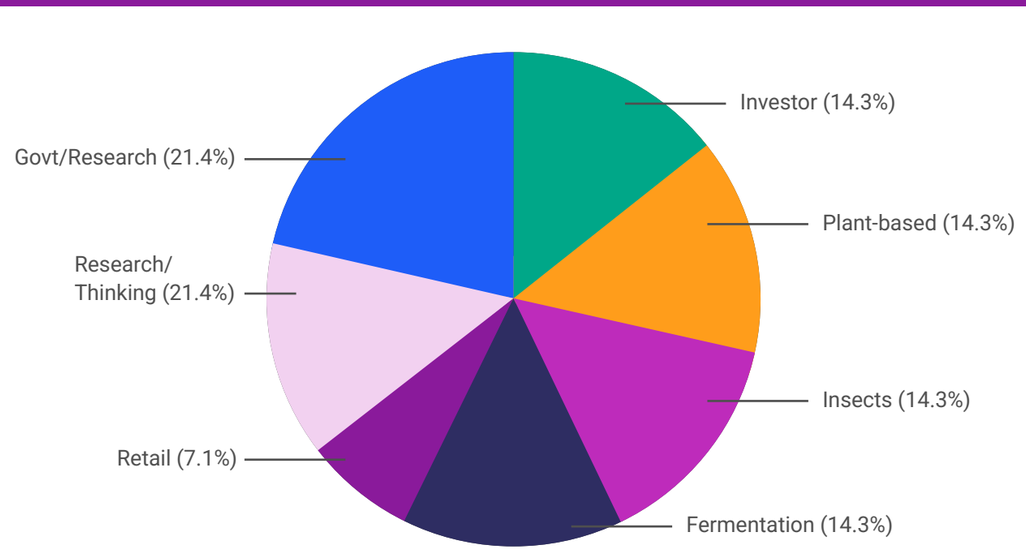
4.1 Methodology

The research used a mixed methods approach to collect data, including both qualitative primary data and qualitative and quantitative secondary data. Primary data was collected through key informant interviews (KIIs), while secondary data was collected through online academic, business, and research institute data sources. A full bibliography has been provided in Annex B.

For the primary data, 14 stakeholder interviews were conducted. Interviewees were selected to ensure representation of the private sector within each of the three technologies and from government and research institutions. A semi-structured interview guide was used as an aide memoir and general discussion framework. This ensured all themes were covered while simultaneously allowing for spontaneous, flexible, and responsive discussion of any points of interest.

The figure below illustrates the distribution of interviews conducted, segmented by organization type:

Figure 21: Interview by Organisation Type



4.2 Bibliography

4.2.1 — Diagram References

Figure 1 – Kenya Food System Challenges

i United Nations Environment Programme (2023). Adaptation Gap Report 2023: Underfinanced. Underprepared. Inadequate investment and planning on climate adaptation leaves world exposed. Nairobi. ***https://doi. org/10.59117/20.500.11822/43796***

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ix Kalele, Dorcas N, William O Ogara, Christopher Oludhe, and Joshua O Onono. 2021. "Climate Change Impacts and Relevance of Smallholder Farmers' Response in Arid and Semi-Arid Lands in Kenya." Scientific African 12 (June): e00814–14. ***https://doi.org/10.1016/j.sciaf.2021.e00814***.

x De Jong, M. V., Selten, M. P. H., Gitata-Kiriga, W., Peters, B., & Dengerink, J. D. (2024). An overview of the Kenyan food system: Outcomes, drivers and activities. Wageningen Centre for Development Innovation. ***https://doi.org/10.18174/658586***

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xii Fanzo, J.C., Downs, S.M. 2021. Climate change and nutriAon-associated diseases. Nat Rev Dis Primers. 7, 90.

Figure 2 - Types of Alternative Protein

i Tanga, Chrysantus M, and Margaret O Kababu. 2023. "New Insights into the Emerging Edible Insect Industry in Africa." Animal Frontiers 13 (4): 26–40. ***https://doi.org/10.1093/af/vfad039***.

Figure 3 – The Role of Alternative Proteins in Creating a Sustainable Food System

i ***https://www.unep.org/news-and-stories/story/what-you-need-know-about-new-animal-source-food-alternatives***

ii ***https://gfi.org/fermentation/#:~:text=Fermentation's%20efficiency%20has%20many%20benefits&text=Mycelium%2C%20microalgae%2C%20microbes%2C%20and,cholesterol%2C%20a-ntibiotics%2C%20and%20hormones***.

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4.2.1 — Diagram References

Figure 1 – Kenya Food System Challenges

i United Nations Environment Programme (2023). Adaptation Gap Report 2023: Underfinanced. Underprepared. Inadequate investment and planning on climate adaptation leaves world exposed. Nairobi. ***https://doi. org/10.59117/20.500.11822/43796***

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Contact:
Michael Nzungi
michael.nzungi@iukbc.org.uk
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