FOOD SYSTEMS TRANSFORMATION AND ONE HEALTH IN SOUTHERN AFRICA

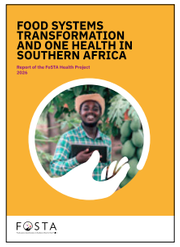
Report of the FoSTA Health Project
2026

FOSTA

Food systems transformation in Southern Africa for One Health

Contents

Executive Summary



The Food Systems Transformation in Southern Africa for One Health (FoSTA-Health) project is a multi-country, transdisciplinary initiative implemented across Malawi, South Africa, Tanzania, and Zambia. It investigates how major food system transformation pathways affect the interconnected domains of human, animal, plant, and environmental health. The project integrates high-level policy analysis with grounded community research and uses advanced modelling (iFEED) to assess potential futures up to 2050.

Representative Transformation Pathways (RTPs)—co-created with stakeholders through national dialogues (2023–2025) and refined through modelling and iterative engagement—serve as the core analytical framework for assessing future impacts.

Southern African food systems are shaped by environmental degradation, climate variability, rapid urbanisation, market integration, and demographic growth. Diets are transforming, with rising consumption of ultra-processed foods alongside persistent undernutrition and micronutrient deficiencies. Inequalities in land, finance, and market access reinforce gendered and socio-economic disparities. Exposure to transboundary pests, zoonoses, agrochemical risks, and climate-related shocks pose ongoing One Health challenges.

Policy responses across the Southern African Development Community increasingly frame food systems transformation and One Health as cross-cutting priorities. However, implementation remains uneven, fragmented, and constrained by political instability and capacity gaps. National One Health strategies exist in all four countries but vary in scope and effectiveness.

We present our analysis of four main pathways of food system change:

1. Market-oriented pathways – focused on export growth, value chain integration, and commercialisation.
2. Diet and demand-oriented pathways – addressing dietary transitions, consumer education, and nutrition-driven diversification.
3. Farming system and landscape-oriented pathways – emphasising agroecology, irrigation expansion, and sustainable land and water management.
4. Equity and local aspirations-oriented pathways – grounded in farmers' lived experiences, community governance, and inclusive development.

Each of these RTP families involves trade-offs across nutrition, livelihoods, environmental sustainability, and health outcomes. FoSTA-Health combines qualitative research with iFEED modelling to identify these synergies and risks.

1. Market-Oriented Pathways

Commercialisation—exemplified by Tanzania's horticulture sector, Zambia's soybean expansion, and South Africa's export-led agriculture—offers opportunities for income growth and dietary improvement. However, benefits are unevenly distributed. Smallholders, especially women, face barriers to market entry, and intensified production increases reliance on agrochemicals and exposure to zoonotic and food safety risks. Compliance with international standards adds further challenges, particularly for resource poor farmers.

2. Diet and Demand-Oriented Pathways

Urbanisation and rising incomes are driving rapid dietary transitions. While some consumers gain access to more diverse diets, unhealthy and ultra-processed foods are proliferating, exacerbating obesity and non-communicable diseases NDCs. Policy responses remain fragmented and often fail to address negative food environment drivers. Cultural norms, gendered household dynamics, and limited food literacy shape consumer behaviour and limit uptake of healthier diets.

3. Farming System and Landscape-Oriented Pathways

Maize-dominated systems are vulnerable to climate change and nutrition constraints. Landscape degradation, pesticide reliance, woodland conversion, and expansion of irrigation pose significant One Health risks. Agroecology and diversified cropping show promise but require supportive policies, improved extension, investment in water infrastructure, and gender-responsive resource access. Climate modelling reveals escalating water stress and drought-related risks for irrigation systems.

4. Equity and Local Aspirations-Oriented Pathways

Farmers' aspirations—centered on stability, education for children, diversified livelihoods, and autonomy—do not always align with technocratic policy visions. Gender norms constrain women's empowerment and household nutrition outcomes, even when technical training is provided. Community-level priorities highlight the need for cooperative structures, inclusive governance, secure land rights, and tailored finance.

Across all of these pathways, FoSTA-Health identifies several strategic priorities:

- Invest in inclusive, climate-resilient value chains, with co-financing mechanisms that benefit smallholders.
- Strengthen regulatory systems, including SPS measures, food safety governance, and agrochemical controls.
- Promote healthy food environments, using labelling, marketing regulations, school food policies, and nutrition literacy programmes.
- Advance agroecology and sustainable land management, supported by nexus-aligned policies integrating water, energy, agriculture, and conservation.
- Centre equity and local aspirations, ensuring women and youth have access to land, finance, leadership roles, and decision-making power.

1 Introduction

Food Systems Transformation in Southern Africa for One Health (FoSTA-Health) is a multi-country, transdisciplinary project examining major trajectories of change in food systems across Malawi, South Africa, Tanzania, and Zambia.

Transformation in African agriculture and food systems is driven by a variety of activities, institutions and stakeholders, and can take a variety of forms. Key transformation agendas in the region include (1) maize system diversification and improved soil management; (2) irrigation and land investments for large scale agricultural production; (3) increased engagement in commodity export markets; and (4) dietary change and diversification.

While these trajectories are often associated with growing economies, they can carry potential trade-offs and risks for human, animal and environmental health and these impacts may be unevenly distributed across society.

FoSTA-Health's work pays close attention to both high-level policy framings and the lived experiences and aspirations of rural communities in its analysis of the interlinked human, environmental and animal health impacts of representative food system transformation pathways (RTPs).

The FoSTA Health project is organised around five interlinked objectives.

1. To strengthen transdisciplinary and contextual understandings of the interactions between human, animal and environmental health at multiple food systems scales.
2. To parameterise and simulate these interactions, within a novel integrated and participatory modelling framework, to explore pathways of food system transformation across time (including against a context of changing climates) and space.
3. To co-develop and collectively evaluate promising and novel management strategies, policies, and governance approaches that have the potential to catalyse transformative food systems change.
4. To collaborate with a diverse range of stakeholders to understand varied experiences of, and priorities for, transformation and how it can equitably be brought about in different contexts.
5. To establish and strengthen long term, transdisciplinary communities of learning to take forward evidence-based, sustainable and equitable transformative food systems change for One Health outcomes across southern Africa.

In consultation with stakeholders, Representative Transformation Pathways (RTPs), which describe ongoing and plausible future food system changes, up to 2050, in the region have been developed.

The implications of these RTPs have been explored through a combination of grounded primary research across diverse food system topics (Table 1), and the iFEED (integrated Future Estimator for Emissions and Diets) modelling framework.

	Malawi	South Africa	Tanzania	Zambia
Transitions in and out of maize	Women's empowerment and maize-pigeon pea transitions Agriculture innovation, water resource use and resilience to shocks Gender integration in Farmer Field Business Schools and One Health outcomes		Women's empowerment, engagement in markets, and agricultural change Gender integration in Farmer Field Business Schools and One Health outcomes	Organic agriculture, bacterial uptake in crops and food safety
Land and water management	Environmental sustainability and livelihoods under crop diversification-borne disease risks	Pork and beef value chain dynamics and implications for land use Gender integration in Farmer Field Business Schools and One Health outcomes		Farm management practices, landscape structure and species interactions, disease vector distribution and associated health risks-borne disease risks
Export markets for fruit and vegetables	Seasonal and gender dynamics in household dietary decisions and nutritional outcomes	Comparing food safety and food quality regulation governing trade in across southern Africa	Governance, Value Chains and Emergent Export Commodities The role of collective action and middlemen in horticulture value chains transformation	
Dietary transitions		Dietary health implications of livestock consumption Food safety and regulation	Food safety and regulation	Socially differentiated dietary transitions, food safety and regulation Seasonal and gender dynamics in household dietary decisions and nutritional outcomes

Table 1:
Summary of the research topics that have been pursued by country

This report summarises the RTPs that have been co-developed through FoSTA-Health, highlighting the potential trade-offs and actions for different actors if each pathway is to be realised.

Section two summarises the state of knowledge on food systems, with particular reference to southern Africa. Section three gives an overview of the history of One Health and relevance to food systems. Section four summarises the participatory approach taken to developing the Representative Transformation Pathways (RTPs). Section five summarises the RTP families, highlighting what those pathways look like and summarising the recommendations that are necessary for those pathways to be sustainable.

2

Background to food systems

Within FoSTA Health we adopt a food systems approach, which recognises the complex interconnections that exist between actors and processes across food supply chains, from production to disposal, as well as the complexity of human, animal and environmental health drivers and impacts of food system change (FAO, 2018).

Systems approaches arose from critiques of productionist-oriented approaches to agriculture and supply chain development, which have failed to address hunger and malnutrition and caused environmental degradation. This has led to greater attention on how core food systems activities are influenced by and affect various other factors (such as climate and environmental degradation) and together gives rise to outcomes of food and nutrition (in)security, livelihoods, and environmental (un) sustainability (Friedland, 1984; Eriksen, 2008; Ingram, 2011).

2.1 Food systems in southern Africa

Southern African food systems are shaped by a variety of drivers which gives rise to particular characteristics. Drivers of change include environmental degradation, climate variability, market integration, urbanisation and population growth, which create unique challenges for from a One Health perspective (Swinburn et al., 2019; IPCC, 2022). Food systems in the region are increasingly characterised by a coexistence of smallholder and pastoral production with commercial export-oriented agriculture, expanding agro-processing, and dense informal and formal retail networks that connect rural producers to urban and peri-urban consumers (Ericksen, 2008; FAO, 2024a).

Various changes have been observed within southern African food systems in the past two decades. Diets are shifting as a result of rising urban incomes, supermarket expansion and trade liberalisation, with growing consumption of ultra-processed foods alongside persistent undernutrition, micronutrient deficiencies and diet-related noncommunicable diseases (Popkin & Reardon, 2018; Global Nutrition Report, 2020). Climatic shocks, including from droughts, floods and heat have become common, and other environmental changes include soil degradation, agrobiodiversity loss and water changes also interact with political conflict and economic shocks (IPCC, 2022; FAO, 2024b). The recent occurrence of COVID-19 exposed supply-chain vulnerabilities and affected food prices and availability, which occurred with concurrent pressures on social protection systems (Devereux et al., 2020; SADC, 2020). Inequalities in access to land, inputs, infrastructure and finance amplify risks along gender/age/rural-urban lines (Southern Africa Labour and Development Research Unit, 2018; Pereira & Drimie, 2016). Regional food systems are also affected by transboundary diseases, pests, vector-borne and/or zoonotic infections from land-use/intensification, and hazards from agrochemicals and antibiotic use (FAO, 2022; Nabarro & Wannous, 2014; Grace, 2015).

Political drivers

- Encouraging industrial agriculture (e.g. hybrid seeds, agrochemicals)
- Deprioritising other agri systems (e.g. organic)
- Controlled markets
- Policy incoherence
- Politicisation of agriculture
- Insufficient support for entering value chains

Environment & climate drivers

- Water availability
- Competition for land (crops, animals)
- Disease outbreak (associated with modern hybrid seeds & breeds)

Socio-economic drivers

- Opening up international & regional markets
- Farmer composition change (e.g. migration of commercial farmers), livestock growth & competition for animal feed crops

Figure 1:
Schematic of drivers of food system change in Zambia, summarising 33 interviews across government, NGOs and the private sector undertaken through the FoSTA Health project from 2024-25

2.2 Food systems-related policies in southern Africa

The Southern African Development Community (SADC) and its member states are increasingly articulating food systems transformation as a cross-cutting agenda that integrates agriculture, health, environment, trade and social protection, supported by emerging multistakeholder platforms, parliamentary alliances and regional programmes on resilient agrifood systems, nutrition and climate adaptation (FAO & SADC, 2025; SADC, 2023). Efforts to strengthen data systems, early warning, social protection and inclusive policy processes—alongside investments in climate smart and agroecological practices, sustainable land and water management, and diversified value chains—are central to current regional visions of transformation, even as political instability, fragmented governance and competing policy priorities continue to constrain progress (CST Stellenbosch University & GRP, 2022; Drimie & Pereira, 2020).

Key policy documents include the Regional Indicative Strategic Development Plan (RISDP) 2020-30, and the SADC Vision 2050, which aims for a region where food security and sustainable livelihoods are guaranteed (SADC, 2020a, b). National economic growth strategies often prioritise investments in export markets and recent SADC commitments under the Malabo Declaration and in the leadup to the African Continental Free Trade Area (AfCFTA) also seek to promote intra-African trade in food and agricultural products (AUC, 2014; Signé & van der Ven, 2021).

3

Background to One Health

One Health captures the interconnections between human, animal, and environmental health

One Health has historical roots in early zoonoses research and Calvin Schwabe's 1960s "One Medicine" concept, which highlighted parallels between human and veterinary medicine (Evans and Leighton, 2024; Paull, 2014).

The 2004 "One World, One Health" symposium, held by the Wildlife Conservation Society, produced the Manhattan Principles, advocating for integrated human-animal-environmental health strategies (WCS, n.d.). The WHO, FAO and the Office International des Épizooties (OIE, now named the World Organisation for Animal Health, WOAH) formed the Tripartite Alliance, with a remit for integrated regulation monitoring and surveillance of zoonoses and antimicrobial resistance (AMR) (FAO, OIE, WHO, 2010). However, there was limited environmental focus until UNEP's inclusion and the expansion to the Quadripartite Alliance, strengthening environmental and food safety dimensions.

The Quadripartite's One Health Joint Plan of Action (2022–2026), guided by the One Health High Level Expert Panel, prioritises zoonoses, food safety, environmental degradation, AMR, climate change, and governance (FAO, UNEP, WHO, OIE, 2022). It defines One Health as "an integrated, unifying approach that sustainably balances and optimises the health of humans, animals, plants and ecosystems." The explicit consideration of ecosystem health and climate change signalled a shift beyond outbreak response to disease prevention and systems transformation, with a recognition of the role of plants, ecosystems and biodiversity as well as animals and humans

3.1 Food systems and One Health

Although often driven by disease control, One Health increasingly addresses food system challenges (Ahmed et al, 2023). One Health-related issues in food systems include food safety, zoonoses, pathogen surveillance, antibiotic use, land/crop management, and nutrient-dense food production (Zhang et al, 2024). A One Health approach aligns with rising concerns about sustainability of healthy food production (Garcia et al, 2020). It supports sustainable transformation through nature-based and climate-smart options, such as locally adapted crops and reduced synthetic inputs (Ebenso et al, 2022).

One Health approaches align with others that have had prominence within food systems that have complementary goals, such as permaculture, organic farming and agroecology (Holmgren, 2002; Howard, 1940; Balfour, 1943: Paull, 2014; Altieri, 2002). These variously recognise system embeddedness, the role of healthy soil in healthy people, and environmentally friendly farming practices. eddedness, the role of healthy soil in healthy people, and environmentally friendly farming practices.

Figure 2 provides a schematic that shows how different components of food systems interact with One Health drivers and outcomes.

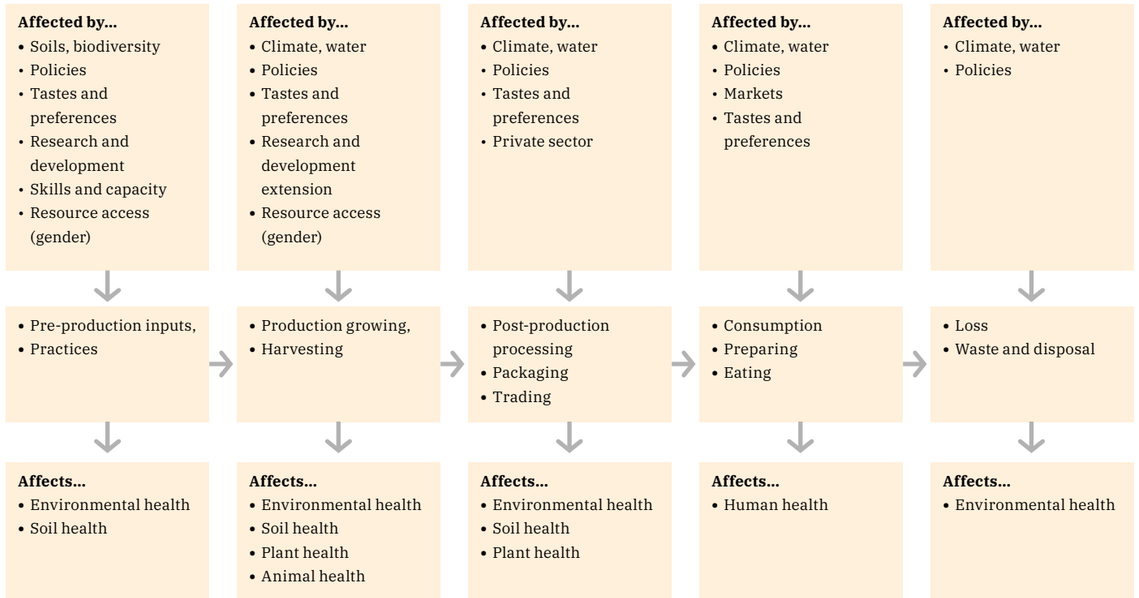


Figure 2:
Schematic of food systems and One Health showing how the various components of the systems are affected by One Health drivers (top row) and affect One Health outcomes (bottom row)

3.2 Policy responses to One Health in southern Africa

One Health approaches are increasingly adopted in governance and practice. Food is integrated into the One Health Joint Plan of Action (2022-26), which has a specific objective to: “Promote awareness, policy changes and action coordination among stakeholders to ensure that humans, animals and ecosystems achieve health and remain healthy in their interactions with and along the food supply chain” (FAO et al., 2022, page 16). Other key actors have also embraced One Health approaches that include food systems, for example ILRI, UK’s DEFRA and FAO (ILRI, 2025, Defra, 2025, FAO, 2025). However, this is not universal. Although food systems transformation needs are recognised, a One Health framing is not used by the Malabo Montpellier Panel (Malabo Montpellier Panel, 2021) and was only loosely used around the UN Food Systems Summit in 2021, appearing in one briefing paper (Bron et al, 2021).

Regional actors including SADC, FAO, WHO, WOAH and Africa CDC now explicitly frame One Health as a guiding approach for pandemic preparedness, antimicrobial resistance (AMR), transboundary animal diseases and food safety, with the SADC Action Plan for One Health (SAPOH) under development to steer country and partner programmes in the region (FAO, 2023). This regional framing is being operationalised through national policies, strategies and platforms in countries such as Malawi, South Africa, Tanzania and Zambia, albeit with differing scope, institutional anchoring and levels of implementation.:

- In Malawi, the Public Health Institute of Malawi and COHESA are formalising a national strategy with One Health focal points across ministries for zoonoses, AMR, and food safety (COHESA, 2023; PHIM, 2025; Mphande et al, 2024).
- South Africa’s National One Health Forum (established in 2014) coordinates sectors via an Implementation Framework and AMR Strategy, supported by CDC zoonoses programmes (CDC, 2019; Department of Health, 2018; OHHLWEP, 2022; Mhlanga et al, 2025).
- In Tanzania, the National One Health Strategic Plans (2015–2020, 2022–2027), prioritising surveillance, AMR, and safety (Ndimugala et al., 2020; Mtema et al., 2019; URT, 2015; URT, 2022), this falls under the coordination of the Prime Minister’s Office.
- Zambia’s National Public Health Institute coordinates a Multi-sectoral AMR Action Plan (2017–2027) through a One Health approach and zoonoses/food safety efforts (ZNPHI, 2017; AHO AFRO, 2020).

All four countries operationalise their policy commitments through various programmes supported by different donors.

4

FoSTA-Health's approach to food system transformation

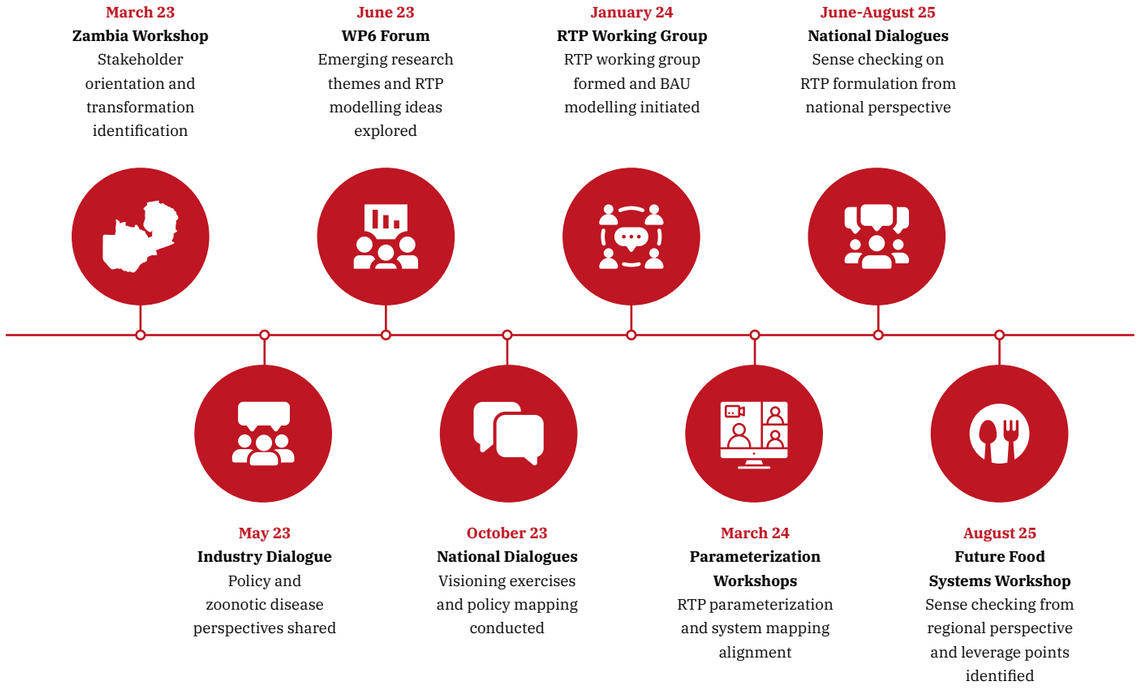


Figure 3:
Timeline of events informing RTP development

4.1 Development of Representative Transformation Pathways (RTPs)

Under the FoSTA Health project, RTPs were designed to summarise both "top-down" national policy visions and "bottom-up" food system transformations, including community aspirations and grass-roots initiatives.

A series of national dialogues held in Tanzania, Malawi, South Africa, and Zambia in both 2023 and 2025 informed the development of RTPs. During these dialogues, a diverse range of stakeholders—selected through mapping exercises to represent the various actors, processes, sites and scales of the food system—participated in exercises to identify desirable and plausible transformations for the year 2050.

Following the initial dialogues, RTPs were iteratively refined through targeted workshops and regular consultations between the modelling team, regional partners, and project researchers who themselves were regularly engaging with stakeholders. The final RTPs were also presented at the Future Food Systems Workshop in August 2025.

These interactions were essential for translating stakeholder input into the technical parameterizations used within the iFEED integrated model, ensuring that the values accurately reflected the changes described in the narratives. This collaborative framework ensured that the final narratives and parameter profiles were grounded in both stakeholder vision and scientific data. Figure presents a timeline of the events informing the RTP development process.

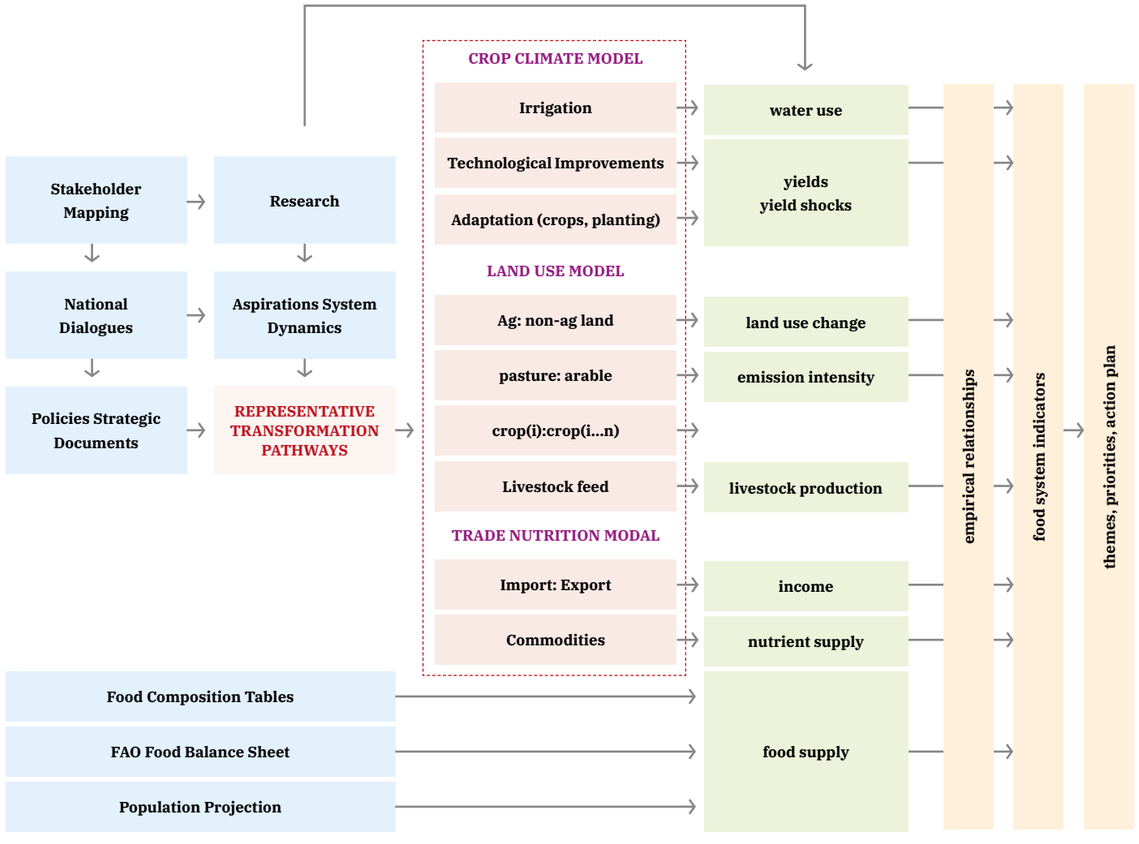


Figure 4:
Core modelling components and outputs of the iFEED model

4.2 Modelling approach

Each RTP was parameterized for assessment using iFEED, which evaluates food system outcomes under different scenarios. iFEED is an integrated modelling approach for outlining the risks and opportunities associated with food system pathways in the face of climate change. As well as looking at future food production, iFEED includes modelling of emissions, climate extremes and trade and nutrition analysis (Jennings et al., 2024)

Key modelling components include:

- The General Large Area Model for annual crops (GLAM; Challinor et al. 2004) is used to assess changes to average crop yields and crop failures in the future. The crops simulated are maize, soybean, potato and groundnut.
- There are approximately 432,000 simulations per crop and country (100 years, 10 productivity levels (YGP), 12 irrigation levels (from rainfed to fully irrigated), 18 climate models, 2 RCPs).
- Climate change impacts on a wider range of agricultural commodities are estimated using mean results from these simulated crops – the C3 photosynthetic pathway results (groundnut, soybean and potato) are used as average impacts for other C3 crops, and maize impacts are used for C4 photosynthetic pathway crops.
- Food production is assessed through a combination of yield change and stakeholder-driven land use allocation.
- Nutrition security outcomes are then assessed using future food production outcomes and across contrasting trade vignettes (business as usual; self-sufficiency; stakeholder expectations).
- The ECOSSE model (Estimating Carbon in Organic Soils – Sequestration and Emissions; Smith et al. 2010) is used to simulate changes to greenhouse gas emissions and soil organic carbon given changes to land use, yields and food production

4.3 Indicators and Heatmap

Despite extensive modelling work that focuses on optimising a single or few desirable outcomes, less attention has been paid to simulating the reality of how food system transformations perform across multiple interacting dimensions, particularly in data-constrained contexts. We address this by adopting an established and standardised set of food system health indicators as detailed in Schneider et al., 2023. In doing so, our approach provides a common evaluative language for assessing trade-offs across the food system, supporting deliberative policy analysis rather than somewhat prescriptive optimisation.

The indicators used were selected by an expert panel and split into modelled quantities and qualitative assessments made considering FoSTA work and findings.

Each indicator was then assigned a change of direction and magnitude according to whether that change was negligible/unknown, slight, significant, or great. These values were then used to create a heatmap where tiles were colour-coded to indicate how much a given dimension was improving (blue) or degrading (orange) and the level of certainty in the change. These form the basis of a high-level interactive map (https://fosta-health.shinyapps.io/Desktop/) through which stakeholders and others can appraise, across countries and RTPs, each of the indicators.

5 Findings

5.1 Summary RTP families

RTPs are country-specific, but there are significant commonalities across countries and, for the purposes of analysis and to ensure more regional relevance, it is possible to categorise RTP “families”. Table 3 categorises four families:

- **Market-oriented pathways**
- **Diet and demand-oriented pathways change**
- **Farming systems and landscapes-oriented pathways**
- **Equity and local aspirations-oriented pathways.**

Malawi	Business as usual	National Irrigation Master Plan	Women’s empowerment and agricultural diversification	Community aspirations of nutrition security, agricultural diversification, and hybridized management
South Africa	Business as usual	Educated consumers can afford to drive dietary changes	Educated consumers drive improved food safety	Increased exports
Tanzania	Business as usual	Tanzania’s Horticulture Exports Accelerator Programme	Nutrition-sensitive crop diversification	Community aspirations of organisation and market engagement
Zambia	Business as usual	Soybean intensification and expansion	Diverse diets drive agricultural change	Agroecology becomes common practice

Table 2:
Country-level RTPs and categorisation into families.

KEY
- Market-oriented pathways
- Diet and demand-oriented pathways change
- Equity and local aspirations-oriented pathways
- Farming systems and landscapes-oriented pathways

5.2 Market-oriented Pathways

Agricultural commercialisation in southern Africa is accelerating, driven by national development strategies, regional trade agreements, and global market demands. Tanzania, Zambia, and South Africa exemplify this transformation through targeted investments in high-value commodities such as fruits, vegetables, spices, and oilseeds. Tanzania's Vision 2025 and Agriculture Sector Development Programme II aim to shift from informal, small-scale farming toward semi-formal, export-oriented systems. This transition prioritises market integration and value chain development, positioning agriculture as a key driver of economic growth.

In Zambia, the Comprehensive Agriculture Transformation Support Program (CATSP) underscores a similar agenda, focusing on priority commodities including maize, wheat, soybeans, and horticultural crops. Soybean production is particularly significant, with plans to more than double output between 2022 and 2027. This expansion is largely export-driven, responding to growing demands, including from South Africa's growing feedlot industry, which supports intensive meat production. Such linkages illustrate how regional markets are becoming increasingly interconnected.

South Africa operates within a highly formalised export framework, supplying substantial volumes of fresh produce to European markets. However, compliance with stringent food quality regulations—including new organic and deforestation-free requirements—adds considerable costs for producers. Beyond Europe, emerging markets in China and the Middle East, alongside opportunities under the African Continental Free Trade Area (AfCFTA), are reshaping trade dynamics and creating new growth prospects.

5.2.1 Market-oriented Pathways and One Health

The commercialisation of agriculture in southern Africa presents a complex interplay of opportunities and risks for human, environmental, and animal health. Market integration is often promoted as a pathway to improved incomes and livelihoods for resource-poor farmers, with potential benefits for food security and nutrition. High-value crops such as fruits and vegetables can address widespread micronutrient deficiencies. However, these benefits are unevenly distributed: affordability and access to nutrient-rich produce remain limited for low-income households, reinforcing existing health disparities.

For small-scale farmers, entering formal markets entails significant challenges. Stringent export standards and traceability requirements often exclude resource-poor producers, while those who participate face financial and production risks. Women, who constitute the backbone of rural agriculture, experience systemic barriers—unequal land rights, limited access to credit and technology, and restrictive social norms—that marginalize them from lucrative value chains. Their exclusion not only reduces income but also undermines household food security, as women typically allocate resources toward family wellbeing. Informal trade channels, where women are more active, expose them to harassment and violence, further compromising health and safety.

Environmental and animal health outcomes are also affected. The pressure to maintain high yields for competitive markets drives unregulated use of agrochemicals, leading to pesticide resistance, soil degradation, and contamination of water sources. These practices pose risks to human health through exposure and residues, while complicating compliance with international food safety standards. Additionally, intensified production systems can increase vulnerability to zoonotic diseases, as ecological imbalances and poor biosecurity heighten disease transmission risks.

While agricultural commercialisation offers potential nutritional and economic gains, its uneven benefits and associated risks underscore the need for inclusive policies and sustainable practices that safeguard human, environmental, and animal health.

5.2.2 Market-oriented RTP Summaries

RTP	Narrative Scenario (2050)	Key Modelling Assumptions
Tanzania: Horticulture Exports Accelerator Programme	Collaboration between organisations such as TAHA, development partners, and the Ministry of Agriculture has formalised Tanzania's horticultural sector through initiatives like the Horticultural Exports Accelerator Programme (HEAP), which improves access to inputs and promotes gender inclusion. These efforts have driven historic yield growth, expanded annual horticulture production to 14.6 million tonnes, and strengthened compliance with global standards, while reducing post-harvest losses and improving water quality for irrigation. As a result, horticultural exports now account for $2 billion annually and are supported by fair contracts, transparent supply chains, and improved land tenure laws.	• Agricultural land weighted to reflect an increase in horticultural crops (citrus, avocado, cashews, spices, cabbages, carrots, pineapples) horticulture at 10% per annum • Priority crop production optimised and irrigated, with 30 % exported and post-harvest losses (PHL) reduced to 5% for those crops.
Zambia: Soybean intensification and expansion	Soybean production follows the pathway outlined by Zambia's Comprehensive Agriculture Transformation Support Programme (CATSP), reaching the target of 2 million tonnes per year by 2050. This is driven largely by the considered development of public-private partnerships, which provide a vehicle for improved funding and access to inputs across small-scale and commercial farmers, who consist of 60% and 40% of soybean farmers achieving yields of 1.5 and 3 tonnes per hectare, respectively.	• Soybean area increased by replacing up to 40% of maize, until production targets of 4 million tonnes per year are reached, given yields of 1.5 and 3 tonnes per hectare for 60% and 40% of national area totals, respectively. • Soybean crops will be irrigated and adapted to changing planting dates and growing seasons.
South Africa: Increased exports	Improvements in the ongoing formalisation and development of both the horticultural and livestock sector supports desirable increases in export levels. As a result, beef productivity increases by 35%, poultry productivity increases by 29%, and pork productivity increases by 110%. At least 20% of this production will be for high value export markets. Investment in disease control, through extension services and disease-free zones, is complemented and facilitated by digital information systems promoting traceability, comprehensive record keeping, and early warning systems. There is less need for antibiotic control of zoonoses and an increase in animal welfare.	• Maize used as animal feed increases by 18% and exports reduced by 10% • Horticultural area capped at 2023 extent and crop yields maximised. • Livestock area increases to include marginal lands – 1,500,000 ha. • Soybean production will be optimised to support intensified livestock production • Horticulture production will be optimised to represent intensification, and up to 60% of excess exported. • Culling numbers due to disease outbreaks such as FMD and Avian Flu will be reduced by 80%

Table 3: Summary descriptions of the Market-oriented RTPs and notes on assumptions that were made within iFEED when modelling these RTPs

5.2.3 iFEED Modelled Impacts of Market-oriented Pathways

Food System Indicator	RTP Tanzania Horticulture Exports Accelerator Programme	RTP Zambia Soybean intensification and expansion	RTP South Africa Increased exports
Vegetable yield (t ha-1)	51.9% (12.76)	-0.1% (5.4)	0% (20.98)
Vegetable availability (g day-1)	734% (64.39)	0.4% (8.39)	0% (35)
Tubers yieki (1 ha-13	149.6% (10.97)	-0.1% (8.1)	0% (31.43)
Total food (lannes)	77.3% (9.3K)	-4% (2.2K)	18.5% (12.2K)
Kcal capita-1 day-1	7.9% (1.8K)	-9.2% (2.3K)	13.2% (5K)
Total value agriculture (S)	90.8% (92.5B)	26.9% (22.4B)	57.3% (209.5B)
Agricultural export value (S)	364% (12:9B)	64.9% (1B)	77.7% (17.6B)
Women with no fruit intake (%)	-51.8% (0.47)	0% (1)	0% (0.92)
Children with no fruit intake (%)	-74.3% (0.21)	0% (0.99)	0% (0.82)
Population meeting kcal needs (%)	7.9% (0.84)	-2.3% (0.95)	0% (1)
Women meeting MDD (%)	46.9% (0.6)	13.2% (0.46)	0.2% (0.47)
Children meeting MDD (%)	59.2% (0.45)	12.7% (0.38)	0.5% (0.41)
Nul yield (1 ha-1)	0% (0.7)	-0.1% (0.36)	0% (1.39
Legume yield (tha-1)	0% (1.32)	16.5% (0.73)	0% (1.73)
Kg capita -1 year-1	104.1% (57.46)	5.7% (37.83)	25.5% (101.15)
Cost of a healthy diet ($, total)	52.6% (21.8B)	-2.3% (15.2B)	0% (23.8B)
Fruit yield (tha-1)	48.1% (11.81)	0% (4.66)	0% (17.52)
Ecosystem function (-)	10.8% (0.57)	5.6% (1.35)	87.3% (0.27)
Crop shock icsses (S)	82.9% (962.5K)	37.6% (457.8K)	72.8% (5.9M)
Cereal yield (tha-1)	0% (2.49)	-1.9% (5.55)	0% (6.95)
Agriculturel water withdrawal (m³)	575% (2781.6B)	1169.8% (530.58)	0% (13888.1B)
Agricultural land expansion (ha)	0% (2.25)	0% (225)	0% (1.05)

Figure 5: Heatmap output of the iFEED integrated modelling approach for the Market-oriented RTPs, against 22 food system indicators, for 2050. Each column represents one RTP. Outcomes are expressed as an absolute measure (in brackets) in the relevant unit for each indicator, and also as a percentage change relative to a business-as-usual model run for the relevant country in 2050. Orange colour represents that the RTP is desirable with regards to the given indicator, and blue represents undesirable. Grey represents that the indicator was fixed as a modelling assumption for that RTP. The shading is a composite indicator of the magnitude and the certainty (i.e. the strength of the signal relative to the uncertainty associated with it) of the result, with darker shading representing greater combined magnitude and certainty.

5.2.4 Grounded Research on Market-oriented Pathways in FoSTA Health

FoSTA Health research highlights the uneven impacts of agricultural commercialisation across Tanzania, Zambia, and South Africa, revealing both opportunities and systemic challenges for livelihood and health outcomes.

In Tanzania, ethnographic and supply chain research reveals that the transformation of horticultural value chains from domestic to export markets has reshaped household dynamics, gender roles, and resource access. Initiatives promoting fruits, vegetables, and spices have increased incomes—avocado farmers, for instance, earn up to $1,700 per acre annually. However, governance structures vary widely: spot markets for oranges, modular systems for avocados, and hierarchical models for snow peas create different risk profiles. Farmers often bear the brunt of market volatility, as seen when snow pea production in Tanga collapsed following the exit of its sole buyer in 2021. Middlemen remain central to market engagement, providing credit and transport through informal systems like kalaza loans, which lack transparency and reinforce gender inequalities. While cooperatives are promoted as empowerment tools, FoSTA research finds they often suffer from weak governance and elite capture, limiting their transformative potential.

In Zambia, farm surveys and pesticide residue analysis, reveals that soybean commercialisation has driven significant agrochemical use, with 90% of registered highly hazardous pesticides found in soybean systems. Application rates frequently exceed manufacturer recommendations due to retailer influence, limited farmer knowledge, and fear of yield loss. These practices are found to be particularly prevalent among commercial soybean producers, and evidence was found within commercial systems of malpractices such as the use of paraquat to accelerate soybean drying. These practices pose ecological and health risks, including pesticide resistance and contamination of household environments. Residues detected in house dust highlight indoor exposure risks, which may undermine malaria control strategies reliant on insecticide-treated nets and indoor spraying. Livestock disease management faces similar challenges, with acaricide resistance and reliance on unregistered chemicals.

Regulation document analysis reveals complex and fragmented regulatory frameworks across the region. South Africa has the most sophisticated regulatory system, but local, regional and international demands may create barriers for the exporters. The South African meat export market has transformed over the past 50 years with the main export countries for beef being focused, in the Middle East and China, with plans to broaden the market into Europe. However, this remains a challenge due Foot and Mouth Disease (FMD) outbreaks, the latest still ongoing. The main trade partners regarding pork are focused on Africa, with the main export locations being Mozambique and Namibia. The beef and pork industries are aiming for the inclusion and growth of more smallholder farmers with the goal to enter the commercial sector and thus the export market however FMD and African Swine Fever (ASF) remain a pertinent challenge in the South African beef and pork sectors respectively, in both the commercial and smallholder sectors.

Along with the transformation of the meat sector, the South African fruit and vegetable industry has also evolved over the past 50 years. FoSTA Health has collected and evaluated both the key industry and support stakeholders along the value chain. One of the reasons for South Africa's successful fruit and vegetable export market is due to the well organized and structured food safety and quality frameworks, which are enforced and monitored by key regulatory bodies with their own specific roles in the value chain. The success of these regulatory bodies has been made possible due to the support functions available to them, in the form of financial or extension services, infrastructure as well as research and development. FoSTA-Health also collected data showing that the key bottlenecks in the South African industry have arisen from on-farm challenges, barriers to the market, inefficiencies in the supply chain and constraints regarding regulation and policy.

Across the region, FoSTA research underscores that while commercialisation can enhance incomes and improve dietary diversity, it also introduces vulnerabilities—market shocks, environmental degradation, and health risks, which are unevenly distributed and can act to exacerbate socio-economic and gender inequalities.

5.2.5 Recommendations for Actions under Market-oriented Pathways

Recommendations for actions under market-oriented pathways have been distilled from across FoSTA-Health outputs. For a fully referenced list of recommendations categorised by the responsible actor see Table B1 in Appendix B.

A first priority is to **mobilise sustained public and private investment to expand productive capacity and market infrastructure across the region.** This includes channelling government and private sector funds into production, storage, transport, cold chains and processing facilities, and aligning these investments with nutrition and trade goals rather than short-term gains. Realising this will require ministries of finance and agriculture, regional economic communities (RECs) and national planning bodies to operationalise investment frameworks, while commercial banks, agribusinesses and logistics firms co-invest in value chains with clear incentives and risk-sharing arrangements.

A second cluster of recommendations centres on **strengthening public–private partnerships (PPPs) and improving the enabling environment for value addition and trade.** The evidence points to the need for structured PPP platforms that bring together government agencies, farmers' organisations,

processors and exporters to co-design investments in input and output markets, as well as measures such as tax relief on processing equipment and streamlined export procedures. Key actors here are trade and industry ministries, investment promotion agencies and standards bureaus working with processors, exporters and producer organisations to negotiate fair terms, reduce regulatory bottlenecks and scale commercially viable models. To ensure a gender-equitable enabling environment, it would be important to consider adequate representation of women in the platforms.

A third theme is **upgrading quality, standards and compliance systems to support competitive regional and international trade.** Recommendations highlight harmonising and enforcing sanitary and phytosanitary (SPS) and other standards (e.g. ZABS in Zambia, regional EAC/SADC/AfCFTA frameworks), introducing grading and measurement norms at farmgate and markets, and strengthening food safety and certification systems. Acting on this requires national standards authorities, food safety regulators, customs and trade ministries, together with exporters, packhouses and certification bodies, to invest in testing capacity, clarify regulatory mandates and support smallholders to meet demanding export and higher-end domestic market requirements. Particular consideration can be given to ensure support to smallholders is gender equitable.

The market-oriented pathway also emphasises **research, development and innovation to drive productivity and commercial growth.** This includes prioritising agricultural R&D, using tools such as iFEED modelling to inform long-term planning, and investing in technologies such as improved varieties, biotechnology, digital tools and AI that can enhance productivity and resilience. Research institutes, universities and CGIAR centres need to work with line ministries, extension services, private input suppliers and development partners to co-finance and co-produce applied research that responds to market opportunities, while ensuring regulatory bodies oversee responsible use of biotechnology and data.

Another set of recommendations focuses on **strengthening extension, farmer capability and producer organisations to connect smallholders to higher-value markets.** Improving extension services, reskilling agents, establishing communities of practice and using social media and other digital channels are all seen as critical to translating scientific and policy advances into on-farm practice and commercially viable production. Here, agricultural ministries and extension departments, NGOs, producer cooperatives and private buyers need to invest jointly in training, farmer field schools, digital advisory services and organisational support so that smallholders can meet quality, volume and reliability requirements in emerging value chains. Since there are often barriers to women's participation in value chains, extension service providers should have more women agents, and target women directly, rather than heads of households, and ensure gender-sensitive training provision.

Finally, the pathway calls for **targeted financial and risk-management instruments to unlock diversified, market-oriented production.** Recommendations include tailored microfinance and insurance products, incentives for crop diversification and direct markets, and financial mechanisms that make irrigation, improved inputs and post-harvest technologies affordable for smallholders. Financial sector regulators, commercial banks, microfinance institutions and insurance companies, in partnership with agriculture and finance ministries and development partners, need to design and deploy products that fit smallholder realities, while farmer organisations and civil society support uptake and ensure instruments remain accessible and equitable for both men and women and marginalised communities.

5.3 Diet and Demand-oriented Pathways

Southern Africa is experiencing profound changes in dietary patterns and food environments, driven by urbanisation, economic development, agricultural transformation, and shifting cultural norms.

Current policies across agriculture, health, trade, education, and infrastructure are fragmented, largely focused on food security and undernutrition, and oriented towards economic growth, with limited attention to the food environment drivers of obesity and NCDs, slowing progress towards healthier, more sustainable food environments.

5.3.1 Diet and Demand-oriented Pathways and One Health

The double burden of malnutrition is an increasingly important challenge in southern Africa particularly in urban centres where economic inequalities are high. In Zambia, metrics of chronic undernutrition, such as stunting, have remained at approximately 50% for the lowest wealth quintile, over the past two decades (Mwanamwenge and Harris, 2017). At the same time, economic development and urbanisation are contributing to nutrition transitions towards more refined maize, less diet diversity and more unhealthy western dietary patterns. In some contexts, this is contributing to improved intake of protein and micro-nutrients and helping to address protein deficiencies, but it is also contributing to the increased consumption of processed oils, fats and red meat, which can be associated with diet-related diseases.

23% of women in Zambia are overweight or obese, and rates of hypertension and diabetes are rising (Mwanamwenge and Harris, 2017). Red meat consumption has increased by almost 40% in southern Africa since the early 1990s, which together with low fruit and vegetable intake contributes to the increasing burden of diet-related disease in southern Africa (Gebremedhin and Bekele, 2021). Dietary transitions also contribute to new societal exposure to new food safety-related health risks, for example antibiotics, hormones, disinfectants and pathogens, which have been less well studied in the context of African dietary transitions. In urban contexts, there is heterogeneity in food distribution and access dynamics and complex relationships between food surplus, waste and access to nutrition (Jensen and Orfila, 2021, Sibanda and Mwamakamba, 2021).

5.3.2 Diet and Demand-oriented RTP Summaries

Table 4: Summary descriptions of the Diet and Demand-oriented RTPs and notes on assumptions that were made within iFEED when modelling these

RTP	Narrative Scenario (2050)	Key Modelling Assumptions
South Africa: Educated consumers can afford to drive dietary changes	Food labelling regulations and restrictions on the marketing of ultra-processed food are commonplace. There are many awareness campaigns promoting balanced diets. Local agriculture is supported to help cater to consumer demand for healthy, nutritious food. Approximately 50% of consumers choose diets that broadly align with food group-based dietary recommendations, with a significant shift towards whole grains, lean meats, fruit and vegetables. Agriculture diversifies to broadly align with half of South Africa's population meeting food based dietary guidelines.	• Agricultural production is diversified to reflect South Africa's food group based dietary guidelines (FGBDs). • Proportions of maize and soybean animal feed altered to support protein targets in accordance with FBDGs. • Palm oil imports capped at 2033 projections.
South Africa: Educated consumers drive improved food safety	Educated and affluent consumers demand safer foods. South African livestock producers address challenges related to disease control and regulation, making livestock exports from South Africa more competitive. Investment in disease control, through extension services and disease-free zones, is complemented and facilitated by digital information systems promoting traceability, comprehensive record keeping, and early warning systems. There is less need for antibiotic control of zoonoses and an increase in animal welfare. Horticultural producers continue to reinvest profits in new seed and production technologies, ensuring export compliance and a continuation of historical export increases.	• Beef productivity increases by 35% • Poultry productivity increases by 29%, and imports halved. • Pork productivity increases by 110%. • Horticultural area capped at 2023 extent and crop yields maximised. • Livestock culls reduced by 80% • Livestock area increases to include marginal lands – 1,500,000 ha.
Zambia: Diverse diets drive agricultural change	Zambia's National Food and Nutrition Commission drives education and incentivisation around the benefits of a balanced and healthy diet. The Zambian Ministry of Agriculture ensures that there is a step change in the demand for diverse and nutritious foods and crops. There is a focus on nutrition independence driven by agriculture. Imports do not increase. Targeted irrigation supercharges nutrition and resilience in the fruit and vegetable sector, whilst more crops are dedicated to livestock to support increased protein production and consumption.	• Agricultural production is diversified to reflect Zambia's FBDGs. • Proportions of maize and soybean animal feed altered to support protein targets in accordance with FBDGs. • Indigenous food crop yields adjusted to reflect optimal agroecological practices and uplifts, with PHL reduced by 50%.
Tanzania Nutrition-sensitive crop diversification	Improved integration of the Tanzanian Ministry of Agriculture and the Ministry of Nutrition help drive nutrition-oriented crop production throughout Tanzania. This is orchestrated through improved access to indigenous, nutrient-focussed, crop seeds and their inputs, and includes climate-resilient crops such as sorghum, millet, and cassava. Education and marketing around healthy diets, nutritious, and climate-resilient food systems is countrywide. There is a shift in demand for animal protein, indigenous grains, and more fruit and vegetables. Maize, whilst still the dominant staple, is reduced by 20% nationwide to facilitate this agricultural diversification.	• Crop areas altered to achieve nutrition targets set out by Tanzania's FBDGs. • Indigenous food crop yields adjusted to reflect irrigation and other agroecological practices with PHL reduced by 50%. • Proportions of maize and soybean animal feed altered to support protein targets in accordance with FBDGs. • 50% of maize and beans are fortified with vitamin A and iron, respectively • 50% of sweet potatoes are orange-fleshed.

Table 4: Summary descriptions of the Diet and Demand-oriented RTPs and notes on assumptions that were made within iFEED when modelling these RTPs

5.3.3 iFEED Modelled Impacts of Diet and Demand-oriented Pathways

Food System Indicator	RTP Zambia: Diets drive agricultural change	RTP South Africa: Educated consumers drive improved food safety	RTP South Africa: Educated consumers drive dietary change	RTP Tanzania: Nutrition-sensitive crop diversification
Vegetable yield (t ha-1)	-0.1% (6.4)	0% (20.98)	0.3% (21.05)	0.2% (8.41)
Vegetable availability (g day-1)	76.4% (14.75)	0% (35)	53.8% (53.83)	14.2% (8.82)
Tubers yieki (1 ha-13	8.6% (8.8)	0% (31.43)	0.5% (31.58)	10.7% (4.87)
Total food (lannes)	12.5% (2.6K)	19.6% (12.3K)	9% (11.2K)	10.8% (5.8K)
Kcal capita-1 day-1	-21% (2K)	14.6% (5.1K)	-2.2% (4.4K)	11.8% (1.8K)
Total value agriculture (S)	12.9% (20B)	56.8% (208.9B)	3.2% (137.58)	15.2% (55.8B)
Agricultural export value (S)	5.9% (663.9M)	32.2% (13.18)	21.4% (128)	18.7% (3.3B)
Women with no fruit intake (%)	-0.1% (1)	0% (0.92)	-10.5% (0.82)	-0.8% (0.97)
Children with no fruit intake (%)	-0.5% (0.99)	0% (0.82)	-9.8% (0.74)	-6.1% (0.75)
Population meeting kcal needs (%)	-7% (0.91)	0% (1)	0% (1)	11.8% (0.87)
Women meeting MDD (%)	21.3% (0.49)	0.2% (0.47)	16.5% (0.55)	24.5% (0.51)
Children meeting MDD (%)	12.8% (0.38)	0.5% (0.41)	17.6% (0.48)	28.4% (0.36)
Nul yield (1 ha-1)	-0.1% (0.36)	0% (1.39)	-0.3% (1.38)	0% (0.7)
Legume yield (tha-1)	-9% (0.57)	0% (1.73)	20.9% (2.1)	56.7% (2.07)
Kg capita -1 year-1	-4.7% (38.22)	27.1% (102.39)	0.7% (81.14)	14.8% (32.32)
Cost of a healthy diet ($, total)	-4.6% (14.8B)	0% (23.8B)	-16.4% (19.98)	-10.3% (41.3B)
Fruit yield (tha-1)	0% (4.66)	0% (17.52)	-4.8% (16.69)	1.4% (8.08)
Ecosystem function (-)	25.1% (1.6)	87.3% (0.27)	154.7% (0.37)	9.4% (0.56)
Crop shock icsses (S)	-24.2% (252K)	76.7% (6M)	-29.1% (2.4M)	18.8% (624.9K)
Cereal yield (tha-1)	-9.4% (5.12)	0% (6.95)	8.1% (7.52)	15.5% (2.88)
Agriculturel water withdrawal (m³)	2308.3% (1006.2B)	0% (13888.1B)	-10.2% (124698)	1161.9% (5200.2B)
Agricultural land expansion (ha)	0% (2.25)	0% (1.05)	0% (1.05)	0% (2.25)

Figure 6: Heatmap output of the iFEED integrated modelling approach for the Diet and demand-oriented RTPs, against 22 food system indicators, for 2050. Each column represents one RTP. Outcomes are expressed as an absolute measure (in brackets) in the relevant unit for each indicator, and also as a percentage change relative to a business-as-usual model run for the relevant country in 2050. Orange colour represents that the RTP is desirable with regards to the given indicator, and blue represents undesirable. Grey represents that the indicator was fixed as a modelling assumption for that RTP. The shading is a composite indicator of the magnitude and the certainty (i.e. the strength of the signal relative to the uncertainty associated with it) of the result, with darker shading representing greater combined magnitude and certainty.

5.3.4 Grounded Research on Diet and Demand-oriented Pathways in FoSTA Health

FoSTA Health research across Zambia, Malawi, South Africa, and Tanzania has supported understanding of how dietary transitions and food environment changes affect nutrition, health, and social dynamics.

For example, our findings in Zambia show obesogenic transitions including decreasing diversity of healthy foods, alongside increasing availability, unregulated marketing and desirability of inexpensive unhealthy foods. While most Southern African countries prioritise their policies addressing undernutrition, progress toward creating healthier, sustainable food environments to prevent obesity remains slow. The policies may not holistically address the food environment drivers of the ongoing obesogenic dietary transitions and attendant double burden of malnutrition (Government of Zambia, 2020; Harris et al., 2019; NFNC, 2019). Some policies such as the vitamin A fortification of sugar in Zambia may instead unintentionally contribute to an obesogenic food environment. Recognising the gap, discussions on potential double duty, do no harm policies strategies have started gathering pace over the last decade. Accordingly, southern African governments have initiated several strategies to tackle dietary transitions including development of food-based dietary guidelines (FBDG), front of pack labelling, and tax on sugar sweetened beverages and public education campaigns (Ministry of Agriculture Zambia, 2021; Mukanu, 2021). While in South Africa implementation of tax on sugar sweetened beverages and front of pack labelling is already underway, in Zambia these policies are still in discussion phase. The rolled-out policy strategies particularly in Zambia are faced with policy contextualisation and implementation gaps due to data limitations (Mukanu et al., 2023).

Additionally, our research in Zambia highlights fragmented and uncoordinated government actions resulting in contradictory policies which underpin obesogenic transitions. Such contradictory policies include monocultural agriculture, economic-driven investment policies without explicit public health safeguards, and lower investments in wet markets amidst supermarket growth. The urban food systems modernisation agenda in southern Africa has been reported to favour a super-marketisation trend over wet market infrastructure improvements, despite the importance of wet markets for food access for low income households (Battersby, 2018; Hannah, 2022). Overall, Zambian nutrition policy places emphasis on improving public awareness, but implementation is slow due to inadequacies in educational strategies and local government's capacity.

In Zambia, FGD and photovoice studies have shown that refined maize meal, cooking oil, sugary beverages, and processed foods dominate the urban diet, while access to diverse, healthy foods remains limited. In Malawi, studies show that rural households produce what they consume and compliment their diets through markets. Hence the targeted interventions that encourage diversified crop and animal production within the rural farming households directly improves consumption of diverse diets beyond maize as the staple food. Without diversification of cropland toward micronutrient-rich commodities such as pulses, green vegetables, fruits, and millet, nutrient deficiencies will persist. Animal-sourced foods offer benefits by improving the bioavailability of nutrients, but overconsumption of meat is linked to obesity and non-communicable diseases, as well as increased environmental impacts.

Gender dynamics are central to food and nutrition security. Women are key actors in crop production and food purchasing and preparation, yet their decision-making is constrained by cultural norms, resource limitations, and labour burdens. FoSTA Health findings underscore the importance of approaches that are gender-sensitive (at a minimum) or ideally gender-responsive, that promote shared responsibility for household nutrition and food safety. In urban Zambia, wet markets are particularly important for women, offering affordable access to indigenous foods. However, underinvestment in these markets undermines food safety and quality, pushing consumers toward supermarkets and fast-food outlets.

In Malawi, crop and animal diversification practices were found to improve women's access to diverse diets such as pumpkins, sweet potatoes and legumes beyond just maize. Women were found to rely on harvested legumes and vegetables for consumptions as well as for the market to acquire other food items that they do not produce such as fish and meat. Farmer Field Business Schools market interventions strengthened women's business skills enabling profitable engagement with agricultural markets and created access to capital through Village savings and Loans to generate capital. Titukulane activity interventions also equipped the households with nutritional knowledge on how they can prepare and meet their dietary goals by preparing a balanced meal using locally grown and sourced food commodities.

The participatory dietary budgeting and negotiations (PaD-Ban) study conducted in rural Malawi and urban Zambia explored how men and women navigate dietary decisions based on knowledge, resources, and cultural norms. Preliminary findings in both rural Malawi and peri-urban Zambia show that lean seasons result in monotonous maize-based diets, while resource-abundant periods do not necessarily lead to improved nutrition. Food status, cost and preferences often outweigh nutritional considerations, and indigenous foods are less preferred despite their health benefits. In both Malawi and Zambia, gender roles were found to complicate decision-making, with men often retaining control over food choices particularly during resource abundant periods despite women possessing greater food literacy. In low-income urban areas, food literacy is generally lower, especially in older adults, and food safety concerns are more pronounced during lean periods, leading to compromised dietary practices. Rural households interviewed in Malawi showed more awareness/knowledge and considerations of food nutritional values when deciding their meals compared to peri-urban participants in Zambia.

FoSTA Health's photovoice study in Zambia adds depth to these findings by capturing lived experiences of food environment transitions. Participants reported dwindling diversity of healthy foods and increased marketing of unhealthy options through billboards, social media, and in-store promotions. Supermarkets and home gardens emerged as trusted food sources, but wet markets remained essential for fresh produce. The study revealed that consumers desire more detailed food labelling and risk information, highlighting a disconnect between policy and public understanding.

In Malawi, the FoSTA health photovoice study highlighted how women's knowledge in crop diversification and decision-making participation on what crops to grow complimented their household diets. Choices of crops were driven by women's desire to achieve their daily household nutritional goals. Hence, women narratives from the photovoice showed stronger links between women empowerment in decision making, crop diversification and household nutritional goals.

In South Africa, dietary transformations – specifically regarding meat – have led to a transformation of the meat value chains over the last 50 years. As with the South African agricultural sector, the meat sector is complex and dualistic in nature whereby a modern, regulated, highly evolved, large-scale commercial system coexists with a subsistence-oriented informal sector, with limited access to capital and technology, and is unregulated. Despite the significant increases in overall meat consumption in South Africa, the per capita consumption of beef has decreased whereas per capita pork consumption is increasing.

Furthermore, data was collected investigating livestock movement from rural to urban areas, with provinces such as Gauteng province slaughtering far more animals than their local populations suggest. This movement supports high urban dietary demand. The movement of pigs in the commercial pork industry is limited which aligns with the high level of vertical integration of the industry. However, the movement of pigs in the smallholder industry is not well understood or documented. As with all movement of livestock, in both commercial and smallholder industries, there is an increased risk related to animal disease transmission, such as Foot and Mouth Disease (FMD) and African Swine Fever (ASF). As smallholder farmers shift toward market-oriented production, the potential for disease spread increases, posing threats to food security and public health.

5.3.5 Recommendations for Actions under Diet and Demand-oriented Pathways

Recommendations for actions under diet and demand-oriented pathways have been distilled from across FoSTA-Health outputs. For a fully referenced list of recommendations categorised by the responsible actor see Table B2 in Appendix B.

A first priority is to **build nutrition literacy and shift social norms around diets, especially among young people.** Regional dialogue recommendations emphasise sustained public education campaigns that target children, adolescents and urban consumers to raise awareness of healthy, diverse diets and the risks of ultra processed foods and sugar-sweetened beverages. Realising this requires ministries of health and education, broadcasting and communications regulators, municipal authorities and civil society partners to design and fund multi-year communication strategies, integrate food based dietary guidelines into school curricula and teacher training, use social and mass media in ways that reach both urban and rural youth, and address gender dynamics in household food decisions to promote shared responsibility for family nutrition.

A closely related cluster calls for **reshaping food environments through regulation and standards that favour healthier choices.** Recommendations include improving school food environments by restricting advertising and sales of high sugar, high salt and high fat products around schools, phasing out unhealthy items from tuckshops, and subsidising or prioritising healthy options in these spaces. These actions depend on education ministries, local governments, school governing bodies and health authorities working together to set binding standards for what can be sold in and around schools, monitor compliance and support small vendors to transition towards healthier offerings rather than simply losing livelihoods. In practice, this is likely to require integrated policy bundles that align economic incentives across agricultural, trade and processed food value chains with nutrition guidelines. There is a particular role for the private sector through well-crafted regulations and incentive structures. South Africa has recently introduced some of these policies, for example around aligning input subsidies and public expenditure to food-based dietary guidelines, and other countries could draw from this

A third set of recommendations centres on **nutrition-sensitive food labelling and consumer information systems.** The urban food systems work proposes context-appropriate front-of-pack labelling schemes—such as warning logos or positive endorsement logos—to help consumers quickly identify healthier and less healthy options, alongside efforts to evaluate which formats are most understandable and effective in Southern African contexts. Implementing these measures requires food safety and standards agencies, health ministries and consumer protection bodies to develop and adopt labelling regulations, while food manufacturers and retailers reformulate products and update packaging, and research and civil society organisations generate evidence on consumer understanding and industry responses.

Another important recommendation area is **retail and marketing practices that "nudge" consumers toward nutritious and indigenous foods.** Suggested measures include issuing guidelines for retailers to prioritise indigenous and nutrient-rich foods at eye-level and at check-out points, rebranding traditional or under-utilised foods, and limiting the most aggressive promotion of ultra-processed products in key spaces. Here, large supermarket chains, wholesalers and independent retailers are central actors, working in partnership with trade and industry ministries, competition authorities and public health agencies, while producer groups and marketers help position indigenous foods as attractive, convenient and aspirational rather than "poor people's food". Governments can also support this through promoting healthier foods in public institutions.

Finally, the pathway stresses **strengthening food safety governance and domestic standards and improving market infrastructure as a foundation for healthier demand and trusted markets.** Regional food standards recommendations call for setting and enforcing clear limits for key food safety hazards, prioritising domestic standards that protect local consumers, and making sure these do not simply mirror external regulations in ways that exclude smallholders or informal actors. National standards authorities, food safety regulators, health ministries and municipal inspectors need to coordinate with producers, processors, informal vendors and consumer organisations to codesign realistic standards, invest in laboratory and point of care testing capacity, and communicate risks and responsibilities clearly so that safer food becomes both expected and achievable across domestic markets.

5.4 Farming System and Landscape-oriented Pathways

Maize dominates agriculture in southern Africa. In Malawi, it accounts for 50% of planted area and 60% of calorie intake, while in Tanzania it provides 45% of caloric intake and is grown by 85% of rural households. In Zambia, 90% of smallholders grow maize, which occupies 57% of arable land. Despite its importance, maize is highly vulnerable to droughts and delayed rains, and its limited micronutrient profile has prompted diversification strategies. Although government subsidies often reinforce maize monoculture, Malawi's National Resilience Strategy and Tanzania's Second Agricultural Sector Development Programme ASDP II promote drought-tolerant cereals like sorghum and millet, along with legumes and root crops for nutrition.

The vision of the Zambian government, as set out in CATSP, is to improve food and nutrition security, create jobs and increase export revenue by increasing agricultural productivity, through investment in sustainable technologies and irrigation (towards a potential 2.75 million hectares of irrigatable agricultural land, compared with current area of 200,000ha). The CATSP refers to the extent of land under cultivation relative to the available arable land as a constraint on total production, although agricultural policy does not set explicit targets for agricultural expansion. In 2004, 100,000-hectare Farm Blocks were identified for expansion in each Province.

Malawi's Agriculture Land Resources Management Policy supports sustainable commercial agriculture and resilience, aligning with Vision 2063 and other national plans. Irrigation development is central to Malawi's growth plans. As of 2024, 148,850 hectares were irrigated, representing 36% of potential irrigable area and 6% of arable land. Under the National Irrigation Master Plan and Investment Framework, the target is to have 220,000 hectares of irrigated agriculture by 2035.

5.4.1 Farming System and Landscape-oriented Pathways and One Health

Ongoing changes in agriculture and land use in southern Africa pose significant One Health risks by disrupting ecological balances and increasing exposure to pests, pathogens, and zoonotic diseases. Large-scale conversion of woodlands into cropland for maize and soybeans reduces biodiversity and eliminates habitats for natural pest predators. This loss of ecological regulation leads to higher pest pressures, including outbreaks of fall armyworm, grasshoppers, and stem borers, which drive increased pesticide use. Heavy pesticide reliance introduces chemical residues into soil and water systems, affecting human and animal health while degrading ecosystems.

Fragmented landscapes also heighten the risk of vector-borne diseases. Clearing woodlands diminishes populations of predators that control mosquitoes and ticks, increasing transmission of malaria and livestock diseases. Livestock kept in intensified systems or near fragmented habitats face greater exposure to pathogens, while disease vectors thrive in disturbed environments. These dynamics create feedback loops where agricultural intensification amplifies disease risks for humans, animals, and crops.

Water resource pressures compound these risks. Expanding irrigation to counter climate variability increases water abstraction from rivers and lakes, threatening aquatic ecosystems and livelihoods dependent on fisheries. Reduced water quality and altered hydrological cycles can foster conditions for waterborne diseases and compromise food safety. In Malawi's Lake Chilwa basin, for example, irrigation expansion without ecological safeguards could destabilize a critical wetland ecosystem, undermine biodiversity and increase vulnerability to disease outbreaks.

Gendered inequalities exacerbate health risks by limiting women farmers' access to resources for pest management, irrigation, and diversified

cropping. This perpetuates reliance on maize monocultures, which are nutritionally poor and vulnerable to climate shocks, increasing malnutrition and food insecurity. Gender disparities remain pervasive. Women farmers face structural barriers in land, finance, technology, and market access. In South Africa, women own only 18% of private land and 13% of agricultural land. In Zambia and Tanzania, women receive smaller, less fertile plots for subsistence crops. Even in Malawi, where women hold 58% of agricultural land, they manage only 5% of cultivated plots and lack decision-making authority. Limited access to credit and extension services compounds these inequalities.

5.4.2 Farming System and Landscape-oriented RTP Summaries

RTP	Narrative Scenario (2050)	Key Modelling Assumptions
Zambia: Agroecology becomes common practice	Agroecology receives policy support with dedicated finance, and training and support programmes. Around 30% of Maize is intercropped or rotated with legumes, with climate smart practices (e.g. residue retention) being used on 80% of crops. Integrated pest management is practiced in 50 % of farms, which also demonstrate a 50% reduction in postharvest loss. Livestock intensification is seen in 50% of farms country wide. An emergent export market is created for high-income organic products, leading to 5% increase in soybean and beef being exported.	• 40% of Maize, and the same total area of soybeans, cowpeas, pigeon peas, and beans will have their yields increased to reflect intercropping or rotation. • Indigenous crops will have their yield increased to reflect agroecological uplifts • Post-harvest loss reduced by 50% across staple and indigenous crops • Agroforestry used to replace 16% of degraded miombo woodland to grow nitrogen rich fodder crops
Malawi: Irrigation Master Plan	Government subsidies and international donors help overcome prohibitively high costs associated with irrigation systems whilst addressing land rights and access issues, offering training programs to help communicate the benefits and promote use. Irrigation expands according to Water Resource Areas identified in Malawi's National Irrigation Master Plan and Investment Framework, in both state-led and farmer-led initiatives, covering approximately 200,000 ha of arable land. Soil and water management issues are addressed within irrigation systems and these practices are encouraged to be applied outside of irrigation as well.	• Malawi's irrigated area will be expanded to 200,000 ha to reflect irrigation expansion since the year 2000, with expansion focusing on high value horticultural crops
Malawi: Women's empowerment and agricultural diversification	Female and youth empowerment is promoted through initiatives across Malawi. Gender-sensitive farming schools such as integrated Farmer Field and Business School program are scaled out across the country. There is greatly improved and equitable access to education and training. Women and youth are involved throughout food and value chain systems as not only workers, but as innovators and leaders in agriculture. There is improved access to inputs for all farmers, such as seeds and fertilisers (indigenous, organic, and synthetic) and a change in mindset around diversifying away from maize as Malawi's sole staple crop. Indigenous, drought-resilient, and nitrogen fixing crops are subsidised and significant crop diversification takes place. Across Malawi, 40%.	• PHL reduced by 50% across intercropped legumes, beans and pulses. • 40% of maize will be intercropped or rotated with equal proportions of groundnuts, cowpeas, pigeon peas, and beans, having yields adjusted to reflect intercropping or rotation.

Table 5: Summary descriptions of the Farming System and Landscape-oriented RTPs and notes on assumptions that were made within iFEED when modelling these RTPs

5.4.3 iFEED Modelled Impacts of Farming System and Landscape-Oriented Pathways

Food System Indicator	RTP Zambia: Agroecology becomes widespread	RTP Malawi: Irrigation Master Plan	RTP Malawi: Women's empowerment, agricultural diversification and innovation
Vegetable yield (t ha-1)	71.1% (10.96)	0.1% (10)	0% (9.99)
Vegetable availability (g day-1)	219.4% (26.72)	0.1% (36.06)	0% (36.01)
Tubers yieki (1 ha-13	20.8% (9.79)	0% (18.18)	1.4% (18.44)
Total food (lannes)	128.1% (5.2K)	1.7% (3.6K)	19.6% 4.3K)
Kcal capita-1 day-1	75% (4.4K)	2% (2.8K)	33.4% (3.6K)
Total value agriculture (S)	473.4% (101.38)	8% (268)	35.5% (32.68)
Agricultural export value (S)	328.7% (2.78)	278.9% (1.18)	48.4% (435M)
Women with no fruit intake (%)	-0.4% (1)	-0.7% (0.82)	-0.2% (0.83)
Children with no fruit intake (%)	-0.7% (0.99)	-2.2% (0.61)	-0.7% (0.62)
Population meeting kcal needs (%)	2.4% (1)	0.4% (0.98)	2.5% (1)
Women meeting MDD (%)	56.3% (0.64)	2% (0.59)	15.9% (0.67)
Children meeting MDD (%)	68% (0.57)	2.1% (0.5)	16.9% (0.57)
Nul yield (1 ha-1)	673.3% (2.77)	50% (0.89)	338.9% (2.61)
Legume yield (tha-1)	350.7% (2.82)	1.2% (1)	149.6% (2.47)
Kg capita -1 year-1	147.7% (99.35)	1.3% (58.08)	17.9% (67.6)
Cost of a healthy diet ($, total)	-26.1% (11.58)	-3.6% (9.18)	-17.7% (7.78)
Fruit yield (tha-1)	10.8% (5.17)	3.6% (15.04)	1.2% (14.69)
Ecosystem function (-)	43.1% (1.83)	0% (0.22)	0% (0.22)
Crop shock icsses (S)	641.4% (2.5M)	-2.6% (413.3K)	12.3% (477K)
Cereal yield (tha-1)	18.1% (6.68)	0% (3.49)	28.3% (4.47)
Agriculturel water withdrawal (m^3)	6605.2% (2801.58)	924.7% (662.38)	5693.5% (3744.78)
Agricultural land expansion (ha)	0% (2.25)	0% (1.76)	0% (1.76)

Figure 7: Heatmap output of the iFEED integrated modelling approach for the Farming system and landscape-oriented RTPs, against 22 food system indicators, for 2050. Each column represents one RTP. Outcomes are expressed as an absolute measure (in brackets) in the relevant unit for each indicator, and also as a percentage change relative to a business-as-usual model run for the relevant country in 2050. Orange colour represents that the RTP is desirable with regards to the given indicator, and blue represents undesirable. Grey represents that the indicator was fixed as a modelling assumption for that RTP. The shading is a composite indicator of the magnitude and the certainty (i.e. the strength of the signal relative to the uncertainty associated with it) of the result, with darker shading representing greater combined magnitude and certainty.

5.4.4 Grounded Research on Farming System and Landscape-Oriented Pathways in FoSTA Health

Agroecological practices in southern Malawi were studied through household surveys and field visits in Zomba. Adoption was dynamic and non-linear, with farmers adapting or disadopting practices based on experimentation and changing needs. Key drivers included household size, number of cultivated plots, and farmer networks. Field observations revealed informal adaptations not captured in surveys, highlighting the need for nuanced understandings of technological change. A participatory farming system modelling tool was developed to facilitate stakeholder engagement and systems thinking.

Participatory field trials in Mangochi and Zomba assessed intercropping and fertilization impacts on yields, soil health, and nutrition. The 2023–2024 season was affected by El Niño-induced droughts, while 2024–2025 saw better rainfall. Intercropping consistently outperformed sole cropping in land efficiency, regardless of fertilizer response. Gendered preferences emerged: men favoured sole maize cropping, while women preferred intercropping for dietary diversity, especially for households with young children.

Climate model datasets were used to assess future water availability for irrigation. Projections indicate rising temperatures and declining rainfall over southern Malawi, especially under high-emission scenarios. These changes will increase evapotranspiration and crop water requirements, amplifying irrigation demand. Hydrological models using the Soil and Water Assessment Tool (SWAT) were developed for the Upper Shire River and Lake Chilwa basins, integrating topographical, soil, land use, and weather data. Initial simulations show irrigation water demand per unit area will rise due to higher temperatures and reduced rainfall. Both catchments are underlain by low-yielding aquifers that do not permit aquifer recharge and storage for dry season flows. As a result, there is a pronounced contrast between wet-season and dry-season flows across the country, with major rivers showing a tendency for streamflow to quickly subside in response to wet seasons with diminished rainfall. This relationship is central to governing the propagation of drought signals, and the coincidence of periods when irrigation water demand is pronounced with periods when there is a significant drop is streamflow to sustain water irrigation needs. More importantly, results show that droughts under future climatic conditions propagate much more quickly across different components of the hydrologic cycle, heightening the risk of irrigation system failure when spikes in irrigation water demand coincide with a hydrological drought.

Building on trends in irrigation landscape transformation, as well as farmer and stakeholder interviews on irrigation practices, scenarios for irrigation management have been developed and tested in the model. Such scenarios include the altering of practices such as planting dates and the growing of early maturing varieties. Such practices, however, happen in the context of upstream catchment degradation and competition for water resources between newly established (some informal) irrigation schemes and pre-existing ones. There is clear evidence that new irrigation landscapes have opened up along main rivers that supply water for irrigation at historically established irrigation schemes downstream. In contrast, the amount of land that is actually under irrigation during the dry season at such historical schemes shows a decreasing trend, with as little as 10% of a scheme being under irrigation in some seasons. Farmer testimonies reveal that such experiences have resulted from low water availability, tracing the cause to climatic changes, catchment degradation, and competition between users. Shifting practices at the farm or scheme level therefore stands to realise adaptation gains if efforts are coupled with systemic shifts in policy and practice.

Maintaining balance in water utilization is vital, given the scale of activities supported by surface water resources across the Shire River and Lake Chilwa basins. Lake Chilwa, a critical ecosystem supporting thousands of livelihoods, is highly vulnerable to climate change. Irrigation and other activities must avoid exacerbating these vulnerabilities. Studies highlight the need to optimize outcomes for irrigation, energy, and ecosystems in a changing climate.

Crop-climate modelling indicates maize yields are highly vulnerable to extreme climate events, with potential reductions of up to 30% by 2050. Meeting Zambia's projected 2050 nutritional requirements would require maize yields to increase by 192%, from 1.7 to 5 tonnes per hectare. Achieving this without major cropland expansion would require tripling crop yields, especially in extreme years. While CATSP aims to produce surplus for export, food imports may be necessary under climate extremes. Agricultural expansion could meet mid-century food needs without encroaching on protected areas, but achieving nutrition targets in extreme scenarios would require a 268%–370% increase in cropland, potentially exceeding 6 million hectares. Such expansion risks encroaching on densely populated or forested areas.

Remote sensing reveals significant woodland-to-agriculture conversion in Zambia's Central Province. In Mkushi, cropland expanded from 7% in 2003 to nearly 16% by 2022, while Chibombo lost an estimated 32% of woodland cover between 2000 and 2023. Drivers include agricultural expansion, charcoal production, and rising demand for maize and soybeans. Field surveys confirm a rapid transition from woodland to monocropped maize and soybean fields, with limited diversification. This shift reduces biodiversity, increases pest pressures, and heightens disease risks. Intact woodland blocks support higher natural enemy abundance and lower pest pressures, while cropland and grassland exhibit higher pest incidence and lower invertebrate diversity. Clearing woodlands disrupts predator populations that control mosquitoes and ticks, increasing risks of vector-borne diseases such as malaria and livestock illnesses. Fragmented landscapes undermine natural biocontrol services, exacerbating pest outbreaks and disease transmission. Indiscriminate use of pesticides and acaricides hasten the development of resistant mosquitoes and ticks to these chemicals, further affecting crop yields and the health of humans and their animals.

5.4.5 Recommendations for Actions under Farming System and Landscape-Oriented Pathways

Recommendations for actions under farming system and landscape-oriented pathways have been distilled from across FoSTA-Health outputs. For a fully referenced list of recommendations categorised by the responsible actor see Table B3 in Appendix B.

A core recommendation is to **shift from input intensive, chemically dependent production towards agroecological and organic farming systems.** The regional dialogue and national reports call for transitions away from heavy reliance on synthetic fertilisers and hazardous agrochemicals, tighter regulation of substances such as glyphosate and atrazine, and active promotion of organic and agroecological practices that sustain soil health and biodiversity. Realising this transition requires agricultural and environment ministries, pesticide regulators and standards authorities to revise input policies and enforcement, while extension services, farmer organisations, agrodealers and NGOs support farmers (recognising the different ways of accessing men and women farmers) with practical alternatives, such as integrated pest management, diversified rotations and organic soil amendments.

A second cluster of recommendations stresses **embedding nexus thinking in policy – explicitly linking water, energy and food systems.** The farming pathways highlight the importance of "nexus" policy coherence, urging governments to align agricultural, water, energy and climate strategies so that irrigation expansion, energy subsidies and land use planning reinforce, rather than undermine, conservation agriculture and climate smart production. Here, ministries responsible for agriculture, water, energy and environment, planning commissions and regulatory bodies need to jointly design and implement cross sectoral policies, while utilities, water user

associations and farmer groups (with consideration of both men and women farmers) participate in planning processes to ensure that infrastructure and subsidy regimes support sustainable production choices on the ground.

A third recommendation area focuses on **investing in water infrastructure and climate resilient production systems at farm and landscape scales.** Evidence from Tanzania and regional dialogues points to the need for improved water storage and irrigation schemes, especially small scale and drip systems, as well as mulching and other soil moisture conservation practices that can buffer farmers against rainfall variability. Implementing this will require public investment by water and agriculture ministries and local governments in dams, small reservoirs and distribution systems, complemented by private and donor financing for on farm technologies, with irrigation agencies, extension services and farmer organisations ensuring that schemes are technically appropriate, equitably governed and environmentally sustainable.

Another set of recommendations emphasises **protecting and restoring soil health, agrobiodiversity and domestic genetic resources.** Regional actors call for prioritising soil rehabilitation, biodiversity conservation and the establishment or strengthening of gene and seed banks to safeguard crop diversity and support future adaptation needs, alongside efforts to preserve and research domestic cultivars within value chains. Key actors include agricultural research institutes, gene bank managers, seed regulatory authorities and environment ministries, working with farmer organisations, seed companies and community seed initiatives to conserve genetic resources, mainstream soil-health monitoring and embed biodiversity objectives into extension packages and incentive schemes.

The pathway also underlines the need to **strengthen food safety, phytosanitary systems and post-harvest management as part of sustainable landscapes.** Recommendations include setting or updating national limits for key hazards, institutionalising systems approaches to phytosanitary risk management, and investing in storage, cold-chain and logistics to reduce post-harvest losses and maintain quality, especially for export-oriented horticultural chains. This demands coordinated action by plant health and food safety authorities, laboratories, customs and port authorities, together with exporters, packhouses, cold-chain providers and producer groups, supported by donors investing in infrastructure and capacity so that environmental risk management and market access go hand in hand rather than being treated as separate agendas.

Finally, several recommendations highlight **the human and institutional side of farming system transformation: mindsets, knowledge and local innovation systems.** The regional dialogue notes the need to tackle resistant mindsets among farmers, politicians and consumers around sustainable farming, while national reports emphasise building communities of practice, strengthening extension networks, modelling tools such as iFEED for long term planning, and integrating indigenous knowledge into research programmes. To advance this agenda, ministries of agriculture, research councils, universities and extension departments need to collaborate with farmer organisations, traditional authorities, NGOs and media to coproduce and disseminate knowledge, create spaces for peer learning and experimentation and use foresight and modelling tools to make long term trade-offs tangible for decisionmakers.

5.5 Equity and Local Aspirations-oriented Pathways

An aspirations approach to food system transformation emphasizes understanding and integrating the hopes, desires, and goals of smallholder farmers into development strategies, and offers a useful counterpoint to top-down, policy-driven pathways. Aspirations are not limited to economic objectives; they encompass broader notions of a “good life,” shaped by cultural norms, social expectations, and perceived opportunities. This perspective recognizes that farmers’ decisions and investments are influenced by what they believe is achievable within their social context.

FoSTA Health operationalized this approach through qualitative research in Malawi and Tanzania, using in-depth interviews and oral histories to explore how aspirations evolve over time.

By foregrounding farmers’ aspirations, this approach challenges conventional policy models that prioritize productivity and economic metrics over lived realities. Top-down strategies often assume uniform goals, overlooking the diversity and complexity of aspirations and rural trajectories. In contrast, an aspirations approach has the potential to represent a more inclusive pathway for food system transformation, aligning interventions with what farmers value and perceive as attainable.

5.5.1 Equity and Local Aspirations-oriented RTP Summaries

RTP	Narrative Scenario (2050)	Key Modelling Assumptions
Malawi Community aspirations of organisation and market engagement	Government support to all farmers in the form of targeted equitable subsidies for agrobiodiversity; land rights; increased access to inputs, especially organic; finance; technology; information; education; extension services; and improved and increased markets allows farmers across Malawi to diversify agricultural production in a way that supports their desire for resilience, independence, and community control over agricultural production and improved household nutrition The Malawian Department of Family Nutrition drives this change, emphasizing the importance of a healthy balanced diet from all the six food groups that includes half the diet with diverse local vegetables and fruits, and the other half with staples (grains and tubers), legumes and nuts, foods from animals, and fats. Farmers form cooperatives to help improve production with a reduction in postharvest losses by 50%, and collective marketing to reach expanded local markets that reflect an educated consumer base demanding local, diverse foods and better nutrition.	•Agriculture is diversified to reflect Malawi's food groups with a 20% increase in indigenous food groups. • Proportions of maize and soybean grown for animal feed altered to support protein targets in accordance with Malawi's Food Group recommendations. • For all indigenous food crops, yields will be increased to reflect agroecological farming methods • PHL reduced by 50% across all crops • 16% of miombo woodland is used to grow nitrogen rich fodder trees
Tanzania Community aspirations of organisation and market engagement	Government subsidies and international donors Government support leads to the expansion and consolidations of agricultural cooperatives across Tanzania, which, along with strategically placed public-private partnerships, help develop system that allow communities greater access to agricultural inputs, finance, and export certification schemes. This, combined with country-wide, community-level, development of post-harvest storage, indigenous seed banks, and now-casting technologies, leads to appropriate planting times, adaptation to changing season lengths, and a reduction in post-harvest losses by 75%.	• All priority horticultural crops will have PHL reduced to 5% and their yields, genetics, and planting dates optimised. • PHL in other crops will be reduced by 50% • Cropping system fractions will represent a combination of those for horticultural export and those for nutrition. • Staple crops will have their yields, genetics, and planting dates optimised. • 16% of miombo woodland will be left fallow to produce nitrogen rich fodder trees

Table 6: Summary descriptions of Equity and Local Aspirations-oriented RTPs and notes on assumptions that were made within iFEED when modelling these RTPs

5.5.2 iFEED Modelled Impacts of Equity and Local Aspirations-Oriented Pathways

Food System Indicator	RTP Malawi: Community aspirations of nutrition security, agricultural diversification, and hybridized management	RTP Tanzania: Community aspirations of organisation and market engagement
Vegetable yield (t ha-1)	-0.2% (9.97)	10% (9.23)
Vegetable availability (g day-1)	31.4% (47.32)	1082.2% (91.27)
Tubers yieki (1 ha-13	1.2% (18.4)	67.3% (7.35)
Total food (lannes)	29.2% (4.6K)	120.4% (11.6K)
Kcal capita-1 day-1	22.1% (3.3K)	79.8% (2.9K)
Total value agriculture (S)	142.1% (58.28)	238.9% (164.2B)
Agricultural export value (S)	1804.7% (5.6B)	327.7% (11.98)
Women with no fruit intake (%)	-16.5% (0.69)	-74.2% (0.25)
Children with no fruit intake (%)	-23.1% (0.48)	-79.3% (0.17)
Population meeting kcal needs (%)	2.5% (1)	28.8% (1)
Women meeting MDD (%)	11.5% (0.65)	75.6% (0.72)
Children meeting MDD (%)	8.3% (0.52)	104.4% (0.58)
Nul yield (1 ha-1)	214.8% (1.87)	16.4% (0.81)
Legume yield (tha-1)	-20.8% (0.79)	72.4% (2.28)
Kg capita -1 year-1	43.5% (82.33)	167.6% (75.34)
Cost of a healthy diet ($, total)	-31.8% (6.4B)	-69.2% (14.28)
Fruit yield (tha-1)	4.7% (15.2)	51.4% (12.07)
Ecosystem function (-)	230% (0.72)	234.1% (1.72)
Crop shock icsses (S)	97.5% (838.5K)	290% (2.1M)
Cereal yield (tha-1)	19.9% (4.18)	113.7% (5.32)
Agriculturel water withdrawal (m³)	5119% (3373.4B)	2215.3% (9541.4B)
Agricultural land expansion (ha)	0% (1.76)	0% (2.25)

Figure 8: Heatmap output of the iFEED integrated modelling approach for the Equity and Local aspirations-oriented RTPs, against 22 food system indicators, for 2050. Each column represents one RTP. Outcomes are expressed as an absolute measure (in brackets) in the relevant unit for each indicator, and also as a percentage change relative to a business-as-usual model run for the relevant country in 2050. Orange colour represents that the RTP is desirable with regards to the given indicator, and blue represents undesirable. Grey represents that the indicator was fixed as a modelling assumption for that RTP. The shading is a composite indicator of the magnitude and the certainty (i.e. the strength of the signal relative to the uncertainty associated with it) of the result, with darker shading representing greater combined magnitude and certainty.

5.5.3 Grounded Research on Equity and Local Aspirations-Oriented Pathways in FoSTA Health

In Tanzania's Tanga Region, spice production is promoted as a "triple-win strategy" for climate mitigation, environmental conservation, and livelihood diversification. Women and youth are active in spice production, but their roles are often limited to lower-earning tasks like harvesting and sorting. Men dominate higher-value activities such as transport and sales, and contracts with private spice traders are typically made with male farmers, who are seen as household heads and landowners. Farmers expressed aspirations linked to improving living conditions and securing education for their children. Spice production was seen as a pathway to these goals, yet its seasonality prompted desires for livelihood diversification, such as starting small businesses or engaging in motorcycle taxi services. Farming remained central—not necessarily as an end goal, but to achieve stability and support broader ambitions.

Empowerment is frequently measured through economic indicators like income, training, productivity, and group membership. In Tanzania, women access loans via Village Savings and Loans Associations (VSLAs), NGOs, district policies, and formal institutions. However, there is a risk of high default rates often lead to conflict, marital strain, and even displacement. Formal loans typically require collateral or male guarantors, excluding women without assets or supportive spouses. Community-led VSLAs often have inbuilt mechanisms to reduce likelihoods of loan losses and defaulting, for example through providing support to members and training in savings habits and money management skills. CARE has observed that microfinance institutions can favour working with VSLAs because of those developed money skills, and because they have a proven track record of repaying loans.

In Malawi, aspirations also focused on children's education and on transforming farming into a business. Farmers aimed to increase maize and rice production for market sales, often through irrigation, fertilizer use, and land acquisition. Diversification into crops like groundnuts, bananas, and soybeans, or ventures such as cattle rearing, featured prominently. Non-farm aspirations, including small trade or migration for work, were also common, reflecting the interplay between agricultural and non-agricultural goals. Migration-related aspirations were more pronounced in Mangochi, where migration to Mozambique or South Africa constitutes a more important livelihood strategy than in Zomba. However, aspirations were constrained by market access, storage limitations, and climate shocks, such as drought, which delayed plans and forced adaptation. These variations illustrate the need to consider contextual factors that shape livelihood strategies and aspirations in food systems transformation interventions.

Findings from FoSTA Health research reveal a complex relationship between women's empowerment and household nutrition in Malawi. While women often possess knowledge and skills related to nutrition and crop choices, their ability to act is constrained by entrenched gender norms and power dynamics. Despite FFBS promoting inclusive decision-making, structural barriers—such as lack of land ownership and male-dominated agricultural decisions—limit the transformative potential of agriculture and business training and capacity building. Women who challenge traditional roles often face relational tensions, highlighting the need to address underlying social inequalities in development interventions.

This research revealed that aspirations are nuanced, dynamic and relational, shaped by life events, social norms, and structural barriers. Failed aspirations often stemmed from health crises, family deaths, or early pregnancies, highlighting the vulnerability of rural households without safety nets. Despite these challenges, in both Tanzania and Malawi farming persisted as an adapted aspiration—a fallback strategy and a cultural norm deeply embedded in rural identity.

5.5.4 Recommendations for Actions under Equity and Local Aspirations-Oriented Pathways

Recommendations for actions under equity and local aspiration-oriented pathways have been distilled from across FoSTA-Health outputs. For a fully referenced list of recommendations categorised by the responsible actor see Table B4 in Appendix B.

A first priority is to **bring smallholder farmers from the margins to the centre of value chains through tailored finance and risk sharing mechanisms.** Regional dialogue recommendations call for dedicated financial products from banks and microfinance institutions that recognise smallholders as key economic actors, not residual beneficiaries, and that lower barriers to investment in improved practices and technologies. Realising this requires ministries of finance and agriculture, central banks and development finance institutions to create enabling regulations and guarantees, while commercial banks, microfinance institutions and impact investors design accessible loan and insurance products, including for women farmers, in partnership with farmer organisations and cooperatives that can aggregate demand and reduce transaction costs.

A second cluster of recommendations focuses on **inclusive governance and community ownership of transformation pathways.** The project highlights the need to engage traditional leaders, local governments, civil society and community-based organisations – including with equitable representation of women and men - so that plans for changing farming systems, markets or diets reflect local aspirations and lived realities rather than being externally imposed. Key actors include decentralised government structures, customary authorities, producer associations, women's and youth groups and NGOs, who must be involved in agenda setting, planning and monitoring processes, while national ministries and regional bodies create frameworks and provide resources that formalise and sustain this inclusive governance.

A third theme is **bridging the disconnect between research, extension and farmers to ensure innovations are usable and equitable.** Recommendations stress that academic evidence, modelling tools and policy analysis too often fail to reach small scale producers in actionable form, particularly women farmers, and that extension systems must be reoriented to two way learning rather than top-down technology transfer. To achieve this, universities, research institutes and think tanks need to work with extension departments, farmer organisations and NGOs, ensuring inclusion of women farmers, to codesign research agendas, translate findings into local languages and practical tools, and establish long term communities of practice that embed experimentation and feedback in everyday decision making.

Another set of recommendations centres on **securing land and resource rights for marginalised groups, especially women and tenants,** as a foundation for equitable transformation. The regional dialogue emphasises coordinating land-use planning to reduce competition between crops and livestock, while also securing tenure for farmers currently vulnerable to displacement or exclusion from contracts, training and finance. Land ministries, local land boards, customary authorities and justice systems need to collaborate to recognise and document legitimate land claims, promote joint spousal titling, and provide legal support to women and other marginalised groups, while development partners and civil society help monitor rights violations and support grievance and redress mechanisms.

Finally, the equity pathway stresses **recognising women and youth as agents of transformation in policy, markets and local institutions,** rather than passive beneficiaries. Recommendations call for integrating gender transformative approaches into food system policies, ensuring meaningful youth participation, and providing targeted support for women and young people in value chains such as export horticulture. Ministries responsible for gender, youth, agriculture and labour, together with private sector actors, producer organisations and donors, must create leadership opportunities, quotas or parity measures in decision-making spaces, redesign extension and training to be gender and youth responsive, and ensure that financing, contract farming and certification schemes explicitly include and empower women and young producers.

6

Conclusion

Sustainably transforming food systems in southern Africa requires recognising the complexity and interconnectedness of human, animal, plant and environmental health.

The FoSTA-Health project demonstrates that pathways toward a more sustainable, equitable and resilient future cannot be delivered through single-sector interventions or narrow technological fixes. Instead, transformation emerges from the interactions between policies, markets, landscapes, and the aspirations of the people whose livelihoods depend on agriculture.

Across Malawi, Tanzania, South Africa and Zambia, four broad families of Representative Transformation Pathways (RTPs) highlight the diversity of opportunities and trade-offs facing the region: market-oriented commercialisation, nutrition- and demand-driven dietary change, landscape-scale farming system shifts, and equity- and aspirations-driven community pathways. While each pathway offers distinct potential benefits, they also carry risks that must be managed to ensure that food system transformation delivers positive One Health outcomes. Commercialisation, for example, can expand income and market opportunities but may exacerbate gender inequalities, increase dependence on agrochemicals and heighten exposure to food safety and zoonotic risks. Similarly, dietary transitions may offer opportunities for improved nutrition but can also be associated with increased exposure to unhealthy food environments.

The analysis underscores the importance of context-specific approaches that integrate scientific evidence with local priorities. Agroecological practices, diversified cropping, and sustainable water and soil management offer promising solutions for building long-term resilience—yet they require enabling policy environments, functioning extension systems and equitable access to inputs, land and finance. At the same time, farmers' aspirations reveal that transformation must speak to wider goals of security, dignity and opportunity. Policies and interventions that fail to account for these aspirations risk reinforcing existing inequalities or undermining community agency.

Effective transformation requires aligning policy, markets, landscapes, and lived experiences through participatory, evidence-based, and One Health-oriented approaches. It rests on strengthening governance, improving cross-sector coordination, investing in climate-resilient and nutrition-sensitive systems, and ensuring that women, youth and marginalised communities are central to decision-making.

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Appendix A

List of FoSTA-Health-submitted deliverables

All FoSTA-Health Deliverables are available at: https://fosta-health.eu/index.php/resources/project-documents

1. Abhigya et al. / FoSTA-Health Consortium (2026) Research handbook. (FoSTA-Health Deliverable 1.5). FoSTA-Health Consortium

2. Abhigya et al. [AA1.1]/FoSTA-Health Consortium (2026) Food Systems Map. FoSTA-Health Deliverable 6.3). FoSTA-Health Consortium.

3. Abhishek, A. (2023). *FoSTA-Health data management plan (update)* (FoSTA-Health Deliverable D7.3, Report No. 03, Version 1.1). Wageningen University.

4. Abhishek, A., Fleskens, L., Katzer, K., Knipp-Rentrop, K., Mkandawire, R., Mwamakamba, S., Tasser, M. & Whitfield, S. (2024). *Plan for exploitation, dissemination and communication of results* (FoSTA-Health Deliverable D7.4, Version 1.0). FoSTA-Health consortium.

5. Assogba, G., Malunga, A. & Pawar, R. (2024). *Soil health and nutrition training event* (FoSTA-Health Deliverable D2.2, Version 1.1). FoSTA-Health consortium.

6. Cain, R. (2025). *iFEED modelling framework results* (FoSTA-Health Deliverable D6.1, Version 1.1). FoSTA-Health consortium.

7. Cain, R., Whitfield, S., Challinor, A., & Fleskens, L. (2025). *Maize RTPs report* (FoSTA-Health Deliverable D2.3, Version 1.1). Wageningen University.

8. Cain, R., Whitfield, S. & Challinor, A. (2025). *Land-use change RTPs report* (FoSTA-Health Deliverable D3.2, Version 1.1). FoSTA-Health consortium.

9. Cain, R., Whitfield, S., & Challinor, A. (2025). *Dietary transitions RTPs report* (FoSTA-Health Deliverable D5.3, Report No. 20, Version 1.1). University of Leeds.

10. Cain, R., Whitfield, S., & Challinor, A. (2025). *Market and supply chain RTPs report* (FoSTA-Health Deliverable D4.3, Report No. 17, Version 1.1). University of Leeds.

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12. FoSTA-Health Consortium [AA4.1](2026) Outcomes of the second national policy engagement event (FoSTA-Health Deliverable 1.3). FoSTA-Health consortium

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15. Mwamakamba, Sithembile; Mkandawire, Rachel[AA2.1]/ FoSTA-Health Consortium (2026) Food Systems Transformation Policy Brief (FoSTA-Health Deliverable D6.6). FoSTA-Health Consortium.

16. Mwamakamba, S. & Mkandawire, R. (2024). *Outcomes of the regional policy engagement event* (FoSTA-Health Deliverable D1.6, Version 1.1). FoSTA-Health consortium.

17. Mwanaumo, Erastus et al. / FoSTA-Health Consortium (2026) One Health Business Forum (FoSTA-Health Deliverable D1.4). FoSTA-Health consortium.

18. Onyango, C.M., Smith, F., Waized, B., Smith, R., Cromwell, J., Mpelangwa, E., Gong, Y.Y., Yiga, P., Jordaan, D., Korsten, L., Whitfield, S., Mostert, C., & de Bruin, W. (2025). *Food standards report* (FoSTA-Health Deliverable D4.2, Version 1.1). FoSTA-Health consortium.

19. van Kessel, A. (2023). *FoSTA-Health project website* (FoSTA-Health Deliverable D7.2, Report No. 02, Version 1.1). Wageningen University.

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21. Various. (2024). *Practice abstracts – batch 2* (FoSTA-Health Deliverable D7.6, Version 1.1). FoSTA-Health consortium.

22. Various. (2025). *Practice abstracts – batch 3* (FoSTA-Health Deliverable D7.7, Version 1.1). FoSTA-Health consortium.

23. Vincent, Katharine; Vosloo, Collette/ FoSTA-Health Consortium (2026) Future Food Systems Workshop (FoSTA-Health Deliverable D6.4). FoSTA-Health consortium.

24. Vincent, Katharine et al/ FoSTA-Health Consortium (2026) Food Systems Transformation Report (FoSTA-Health Deliverable D6.5). FoSTA-Health consortium.

25. Whitfield, S. (2024). *Maize systems infographic* (FoSTA-Health Deliverable D2.1, Version 1.1). FoSTA-Health consortium.

26. Whitfield, S. (2024). *Land-use change infographic* (FoSTA-Health Deliverable D3.1, Version 1.1). FoSTA-Health consortium.

27. Whitfield, S. (2024). *Diet transition infographic* (FoSTA-Health Deliverable D5.1, Version 1.1). FoSTA-Health consortium.

28. Whitfield, S. (2025). Transformation-specific action plans (FoSTA-Health Deliverable D6.2, Version 1.1). FoSTA-Health consortium.

29. Whitfield, S., & Fleskens, L. (2023). *FoSTA-Health project management protocols* (FoSTA-Health Deliverable D7.1, Report No. 01, Version 1.1). Wageningen University.

30. Yiga, P. & Jordaan, P. (2025). *Urban food systems report* (FoSTA-Health Deliverable D5.2, Version 1.1). FoSTA-Health consortium.

Appendix B

Detailed recommendations tables

Table B1: Summary of recommendations for market-oriented pathways, categorised by actor type. References refer to those documents listed in Appendix A.

Recommendation	Actions for government/policy	Actions for private sector/commercial	Actions for donors/development partners	Actions for individuals (producers/consumers)
Mobilise sustained public and private investment to expand productive capacity and market infrastructure across the region	Create favourable policy environment for inward investment (Ref 23)	Encourage investment in processing and expand into emerging markets (South Africa)(Ref 11)	Facilitate access to finance for inputs (Ref 11)	
	Reduce taxes on soybean processing equipment to support local value addition (Zambia)(Ref 14)	Scale up, scale out, and scale deep successful models, embedding practices locally (Ref 16)		
	Promote microfinance to empower smallholders Regional (Ref 23) and Malawi (Ref 14)	Support provision of microfinance to empower smallholders (considering access for women, who do not always have land access or collateral) (Malawi)(Ref 14)	Support provision of microfinance to empower smallholders (considering access for women, who do not always have land access or collateral) (Malawi)(Ref 14)	
		Invest in transportation/cold chain; enhance port facilities (South Africa)(Ref 11)		
		Invest in cold rooms, cold-chain and packhouse capacity (Tanzania)(Ref 11)		
		Support adoption of market-preferred varieties via access to planting material (Tanzania)(Ref 11)		
		Increase private sector role in inputs Regional (Ref 23)		
Strengthening public–private partnerships (PPPs) and improving the enabling environment for value addition and trade	Promote opportunities for structured public-private partnerships to drive investment in produce and input markets, for example through transparent and enforceable contract farming arrangements, including supporting women-led contract farming arrangements where women are signatories (Refs 23, 14)	Strengthen market governance—formalize broker/trader conduct and support farmer negotiations (Tanzania)(Ref 11)	Facilitate public-private partnerships at multiple scales	
	Establish public private partnerships for healthier food environments Urban (Southern Africa)(Ref 30) and regional (Ref 16)			
	Map and reduce duplication across national, regional and international regulations Regional (Ref 18)			
	Provide tailored financing for smallholder farmers through banks and microfinance Regional (Ref 23)	Provide tailored financing for smallholder farmers through banks and microfinance Regional (Ref 23)	Provide tailored financing for smallholder farmers through banks and microfinance Regional (Ref 23)	Access available finance through banks and microfinance Regional (Ref 23)

Table B1: Summary of recommendations for market-oriented pathways, categorised by actor type. References refer to those documents listed in Appendix A.

Recommendation	Actions for government/policy	Actions for private sector/commercial	Actions for donors/development partners	Actions for individuals (producers/consumers)
Upgrading quality, standards and compliance systems to support competitive regional and international trade	Support accelerated implementation of AfCFTA (ref 16)	Strengthen compliance to international quality and phytosanitary standards (South Africa) (Ref 11)	Support enhancement, adoption and compliance with standards (Ref 11)	
	Strengthen food safety enforcement; finalize and gazette ZABS standards (Zambia)(Ref 14)	Institutionalise systems approaches to phytosanitary risk management (Regional Southern Africa)(Ref 18)		
	Introduce grading standards and enforce weight/measurement norms at farmgate and wholesale markets (Tanzania)(Ref 11)			
	Harmonize regional food standards and SPS measures (EAC/SADC/AfCFTA)(Tanzania)(Ref 14)			
	Strengthen governance of emergent horticultural export value chains; ensure compliance with SPS (Tanzania)(Ref 14)			
	Speed up registration/licensing of approved inputs (Ref 11)			
	Develop SPS/TBS-compliant frameworks for domestic and regional trade (Tanzania)(Ref 11)			
Research, development and innovation to drive productivity and commercial growth	Prioritize and invest in R&D (Ref 23)	Actively apply IT solutions (open data, AI) and reconfigure education (Ref 16)	Support research, development and innovation solutions (Refs 23, 16)	Actively apply IT solutions and participate in education opportunities (Refs 23, 16)
	Develop crop-specific fertiliser blends (Ref 11)	Assess and enhance the role of agricultural biotechnology in food system transformation (Ref 16)		

Table B1: Summary of recommendations for market-oriented pathways, categorised by actor type. References refer to those documents listed in Appendix A.

Recommendation	Actions for government/policy	Actions for private sector/commercial	Actions for donors/development partners	Actions for individuals (producers/consumers)
Strengthening extension, farmer capability and producer organisations to connect smallholders to higher-value markets	Integrate gender-transformative approaches into food systems policies and programs (Tanzania)(Ref 14)	Explore alternative markets while maintaining compliance with EU/US/Asia requirements (Ref 18)		Explore alternative markets while maintaining compliance with EU/US/Asia requirements (Ref 18)
	Improve extension services and reskill farmers to ensure scientific research translates into practical use (Zambia, Tanzania)(Refs 23, 11, 14)	Establish certified citrus/avocado nurseries with disease-resistant stocks (Tanzania)(Ref 11)		Ensure farmers organise into associations/cooperatives to improve negotiation power (Tanzania)(Ref 11)
	Expand farmer training/extension on orchard husbandry (pruning, irrigation, IPM)(Tanzania) (Ref 11)			Ensure farmer participation in training on orchard husbandry (pruning, irrigation, IPM)(Ref 11)
	Provide training/resources to small-scale growers; establish cooperative models (South Africa)(Ref 11)			Participate in cooperative models (Ref 11)
	Establish communities of practice for consistent farmer extension messaging (Malawi)(Ref 14)	Engage in communities of practice for consistent farmer extension messaging (Malawi)(Ref 14)	Support communities of practice for consistent farmer extension messaging (Malawi)(Ref 14)	
Targeted financial and risk-management instruments to unlock diversified, market-oriented production	Establish and prioritize gene banks at AU/REC level (Ref 16)	Enhance private sector engagement (insurance products, agroforestry)(Malawi)(Ref 14)	Facilitate access to finance for small irrigation; incentivize legume intercropping (Ref 11)	Practice risk management, for example through small scale irrigation and legume intercropping
	Invest in seed banks and irrigation schemes to build resilience (Tanzania)(Ref 14)			
	Incentivize crop diversification and develop direct crop markets (Malawi)(Ref 14)			
	Incentivise diversified food production and supply chains (biofortification, aquaculture) Urban (Southern Africa)(Ref 30)			

Table B2: Summary of recommendations for diet- and demand-oriented pathways, categorised by actor type. References refer to those documents listed in Appendix A.

Recommendation	Actions for government/policy	Actions for private sector/commercial	Actions for donors/development partners	Actions for individuals (producers/consumers)
Build nutrition literacy and shift social norms around diets, especially among young people	Improve school food environments: integrate dietary guidelines; restrict advertising near schools Urban (Southern Africa)(Ref 30)		Invest in sustained public education campaigns to shift consumption habits toward healthier diets (Ref 23)	
	Strengthen nutrition literacy via accredited education programs, public campaigns, and mandatory industry training (Ref 30)			
Re shaping food environments through regulation and standards that favour healthier choices	Use public-private dialogues to align incentives and lobby for nutrition-sensitive agriculture policies (Ref 23)	Engage in public-private dialogues to align incentives and lobby for nutrition-sensitive agriculture policies (Ref 23)		Lobby for and participate in public-private dialogues to align incentives and lobby for nutrition-sensitive agriculture policies (Ref 23)
	Address dual burden of undernutrition and obesity with targeted actions Regional (Ref 16)	Foster collaboration with the private sector to implement food environment policies, such as reformulation targets and zoning laws, balancing public health goals with economic interests (Ref 30)		
	Comprehensive national food balance sheet (Malawi)(Ref 14)			Lobby for comprehensive national food balance sheet (Malawi)(Ref 14)
	Improving the coordination of nutrition and public health interventions and strengthen regulation around unhealthy food marketing (Ref 30)		Support to improving the coordination of nutrition and public health interventions and strengthen regulation around unhealthy food marketing (Ref 30)	
	Strengthen cross ministerial coordination for urban food & nutrition policies Urban (Southern Africa)(Ref 30)			
		Create market opportunities, new products and supply chains for diverse and indigenous crops with high nutrient value (Ref 28)		
Nutrition-sensitive food labelling and consumer information systems	Implement context-appropriate front-of-pack labelling to guide healthier purchasing Urban (Southern Africa)(Ref 30)	Implement context-appropriate front-of-pack labelling to guide healthier purchasing Urban (Southern Africa) (Ref 30)		Lobby for context-appropriate front-of-pack labelling to guide healthier purchasing Urban (Southern Africa)(ref 30)
	Strengthen ICT infrastructure to provide access to nutrition and food safety data Regional (Ref 23)		Support strengthening of ICT infrastructure to provide access to nutrition and food safety data Regional (Ref 23)	
Retail and marketing practices that "nudge" consumers toward nutritious and indigenous foods	Issue retail guidelines to prioritise indigenous and nutrient-rich foods at eye-level shelves	Focus on product development to ensure healthy food is as appealing as fast food alternatives Regional (Ref 23)		Lobby for indigenous and nutrient-rich foods (ref 30)

Table B2: Summary of recommendations for diet- and demand-oriented pathways, categorised by actor type. References refer to those documents listed in Appendix A.

Recommendation	Actions for government/policy	Actions for private sector/commercial	Actions for donors/development partners	Actions for individuals (producers/consumers)
Strengthening food safety governance and domestic standards as a foundation for healthier demand and trusted markets	Prioritize development and enforcement of domestic food safety standards Regional (Southern Africa)(Ref 18)			
	Formalise and modernise wet markets via community-led PPPs focusing on sanitation, cold storage, and waste management Urban (Southern Africa)(Ref 30)	Formalise and modernise wet markets via PPPs with vendors Urban (Southern Africa)(Ref 30)		Formalise and modernise wet markets via PPPs with vendors Urban (Southern Africa)(Ref 30)
	Enhance food safety in small-scale juice processing with hygiene training and HACCP (Tanzania)(Ref 11)			

Table B3: Summary of recommendations for farming system- and landscape-oriented pathways, categorised by actor type. References refer to those documents listed in Appendix A

Recommendation	Actions for government/policy	Actions for private sector/commercial	Actions for donors/development partners	Actions for individuals (producers/consumers)
Shift from input intensive, chemically dependent production towards agroecological and organic farming systems	Policies (including subsidy reform) to prioritise agroecological practices, alternative methods of pest, soil and animal health management, and reduction of agro-chemical dependency (Refs 23, 28)	Create and develop commercial markets for agroecological and ecologically sensitive products and support and incentivise producers to adhere to comply with recommended practices	Provide support to producers through training, access to information and services for diversification and agroecological practices (Ref 28)	Practice alternatives to agrochemicals for pest, soil and animal health management, drawing on agroecological principles, should be practiced (Ref 28)
	Regulate imports of carcinogenic agrochemicals; promote organic farming (Zambia)(Ref 14)			
	Use iFEED modelling to improve maize yields sustainably (Zambia)(Ref 14)			
	Preserve & research domestic cultivars; strengthen domestic supply chains (Tanzania) (Ref 11)			
	Provide support to small scale farmers to document and prove compliance with deforestation-free supply chain requirements (e.g. when producing for export markets)(Ref 28)	Provide support to small scale farmers to document and prove compliance with deforestation-free supply chain requirements (e.g. when producing for export markets)(Ref 28)	Provide support to small scale farmers to document and prove compliance with deforestation-free supply chain requirements (e.g. when producing for export markets)(Ref 28)	Participate in deforestation-free supply chains (e.g. when producing for export markets)(Ref 28)

Table B3: Summary of recommendations for farming system- and landscape-oriented pathways, categorised by actor type. References refer to those documents listed in Appendix A

Recommendation	Actions for government/policy	Actions for private sector/commercial	Actions for donors/development partners	Actions for individuals (producers/consumers)
Embedding nexus thinking in policy – explicitly linking water, energy and food systems.	Implement nexus policies addressing interconnectedness of water, energy, and food (Ref 23)			
	Improve policy coherence and alignment with conservation agriculture (Zambia, South Africa)(Ref 14)			
	Improve coordination between climate and agriculture ministries for timely advisories (Malawi)(Ref 14)			
	Review and align policies with One Health principles across sectors (Malawi)(Ref 14)			
	Empower National Planning Commission to integrate One Health across frameworks (Malawi)(Ref 14)			
Investing in water infrastructure and climate resilient production systems at farm and landscape scales	Promote climate-smart agriculture and resilience (climate-resilient crops, water management)(Ref 16)	Appraise irrigation investments to ensure design to withstand the negative impacts of climate change on irrigation (Ref 28)	Encourage promotion of climate-smart agriculture and resilience (climate-resilient crops, water management)(Ref 16)	Promote climate-smart agriculture and resilience (climate-resilient crops, water management)(Ref 16)
	Address energy constraints via renewable solutions and microgrids (South Africa)(Ref 14)			
	Improve water availability and storage facilities (Ref 23)		Improve water availability and storage facilities (Ref 23)	
	Support irrigation (drip) and mulching to conserve water (Tanzania)(Ref 11)		Support irrigation (drip) and mulching to conserve water (Tanzania)(Ref 11)	
	Promote water-efficient irrigation and climate-resilient cultivars (South Africa)(Ref 11)			
	Develop models for pesticide runoff impacts and remedial measures (Zambia)(Ref 14)			
		Promote increased productivity through the advancement of sustainable intensification technologies and techniques, such as precision farming (Ref 28)		

Table B3: Summary of recommendations for farming system- and landscape-oriented pathways, categorised by actor type. References refer to those documents listed in Appendix A

Recommendation	Actions for government/policy	Actions for private sector/commercial	Actions for donors/development partners	Actions for individuals (producers/consumers)
Protecting and restoring soil health, agrobiodiversity and domestic genetic resources	Prioritize restoration and maintenance of soil health and biodiversity (Ref 16)	Ensure that producers have fair and secure contracts for production that do not indirectly incentivise deforestation (Ref 28)	Encourage prioritisation of restoration and maintenance of soil health and biodiversity (Ref 16)	Prioritize restoration and maintenance of soil health and biodiversity (Ref 16)
	Subsidise fertilisers and soil/leaf/water testing for smallholders (Tanzania)(Ref 11)			Maintaining natural habitats (i.e. forest stands) within agricultural landscapes is important for reducing pest and disease risk for humans and livestock (Ref 28)
	Establish and ensure compliance with designated protected woodland laws and agricultural zoning and land use planning requirements (Ref 28)			
Strengthening food safety, phytosanitary systems and post-harvest management as part of sustainable landscapes	Domesticate African Union Circular Economy Action Plan for food & nutrition security (Ref 16)	Better enforcement of, and support for producers to comply with, sanitary and phytosanitary regulations, particularly associated with use of chemical pesticides (Ref 28)		
	Address post-harvest losses by investing in storage, cold chain and logistics (Tanzania & Zambia)(Ref 18)			
Farming system transformation through institutions and people: mindsets, knowledge and local innovation systems.	Promote structured research programs integrating indigenous knowledge systems (Ref 16)	Implement One Health-aligned handling improvements from farm to fork (Tanzania)(Ref 11)		
	Address mindsets and resistance to sustainable farming transition Regional (Ref 23)			
	Operationalise rural urban linkages and logistics for urban consumption patterns Urban (Southern Africa)(Ref 30)			
	Land use planning to incorporate woodland conservation and restoration and limit agricultural expansion to existing potential arable land (Ref 28)			

Table B4: Summary of recommenda4ons for equity and local aspira4on-oriented pathways, categorised by actor type. References refer to those documents listed in Appendix A

Recommendation	Actions for government/policy	Actions for private sector/commercial	Actions for donors/development partners	Actions for individuals (producers/consumers)
Bring smallholder farmers from the margins to the centre of value chains through tailored finance and risk-sharing mechanisms	Encourage fair and inclusive business models for women exporters, e.g. through Productive Alliances (Ref 18; 1st Tanzania National Dialogue Report)		Provide support for women and youth to engage in opportunities to transition to export production	Women and youth to engage in opportunities to transition to export production
	Provide inclusive support for women and youth in transition to export production (Tanzania) (Ref 11)			
Inclusive governance and community ownership of transformation pathways	Engage local stakeholders including traditional authorities for community-owned transformation Regional (Ref 23)		Invest in capacity strengthening to bridge policy–research gaps Regional (Ref 16)	
	Adopt consumer and smallholder-driven approaches that empower safe choices Regional (Southern Africa)(Ref 18)		Build capacity of non-state actors to engage in policy processes Regional (Ref 16)	Create demand for safe choices
Bridging the disconnect between research, extension and farmers to ensure innovations are usable and equitable	Close research-extension-farmer disconnect to ensure evidence-based innovations are accessible, Regional (Ref 23)		Support overcoming the research-extension-farmer disconnect to ensure evidence-based innovations are accessible, Regional (Ref 23)	
	Restructure extension services to reach more female farmers Regional (Southern Africa)(Ref 18)			
Securing land and resource rights for marginalised groups, especially women and tenants	Coordinate land use planning and secure land tenure for marginalized groups, particularly women Regional (Refs 23, 18)			
Recognising women and youth as agents of transformation in policy, markets and local institutions	Prioritize gender-transformative approaches through policy change; empower women in leadership and resources Regional (Ref 16; Titukulane Programme in Malawi; FoSTA Regional Dialogue Report)		Provide support for prioritisation of gender-transformative approaches to empower women in leadership and resources, recognising women value empowerment in terms of relations well-being, family provision and aspirations for children's education (FoSTA Regional Dialogue Report)	
	Advocate for meaningful youth participation reflecting demographic realities Regional (Ref 16)			

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