

Analysing pathways and potential of agri-food value chains to deliver nutrition impacts

Final report

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About the Nutrition Research Facility

The Knowledge and Research for Nutrition project of the European Commission (2020-2026) aims to provide improved knowledge and evidence for policy and programme design, management and monitoring & evaluation in order to reach better nutrition outcomes.

The project is implemented by Agrinatura - the European Alliance on Agricultural Knowledge for Development – which has established a Nutrition Research Facility, pooling expertise from European academia and having the ability to mobilise internationally renowned scientific networks and research organisations from partner countries.

The Nutrition Research Facility provides expert advice to the European Commission and to the European Union (EU) Member States and Partner Countries.

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List of Acronyms

AU	African Union
CCA	Cotton and Cashew Council (Conseil du Coton et de l'Anacarde)
EU	European Union
FLW	Food Loss and Waste
FNS	Food and Nutrition Security
IFAD	International Fund for Agricultural Development
INTPA	Directorate-General for International Partnerships of the European Commission
LMIC	Low- and Middle-Income Countries
MSME	Micro, Small and Medium-sized Enterprises
NCD	Non-Communicable Diseases
NGO	Non-governmental organisation
NRF	Nutrition Research Facility
NSVC	Nutrition-Sensitive Value Chain
NUS	Neglected and Underutilised Species
PNG	Papua New Guinea
RUTF	Ready to Use Therapeutic Food
SBC	Social-Behaviour Change
SDCC	Société de Développement du Coton du Cameroun
SHG	Self-Help Group
VC	Value Chain
VCA4D	Value Chain Analysis for Development

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Executive summary

To attain Sustainable Development Goal 2, food systems must deliver more nutritious food to populations globally. However, for this to happen a ‘transformation’ of the current food system is urgently needed. With 3.1 billion people (42%) on the planet unable to afford a healthy diet, food systems are struggling to provide foods that support nutrition and health in an equitable, and sustainable, manner. However, the complexity and interconnecting factors that determine individuals’ diets within the food system may make any necessary transformation seem daunting. The use of a value chain (VC) approach allows addressing the transformation of food systems at the level of its subcomponents (e.g. VC’s governance and coordination, agri-food production, storage, transportation, processing, marketing, etc.) that can be analysed and transformed through direct punctual interventions. However, traditional VC analyses and interventions do not sufficiently consider nutrition in their objectives. Indeed, the evidence on nutrition-sensitive VCs is weak, particularly post farm gate. Understanding how agri-food VCs can deliver nutrition results is pivotal to understanding what changes need to be made to create more equitable and sustainable healthy food systems.

Belgium and France representatives both expressed an interest in seeking support from the NRF in relation to nutrition sensitive VCs with the view to improving the access to healthy foods, as well as improving nutrition in Africa and among their other programmes. This study attempts to further analyse 44 VC studies (reports) carried out by Agrinatura’s Value Chain for Development (VCA4D) project¹, but with a nutrition lens, to generate ideas and insights, and collate evidence related to potential agri-food VCs to deliver nutrition impacts in Africa.

The main objective of this study is to understand the level of contribution of a range of agricultural VCs in achieving nutrition impact in Africa. To achieve this, we first investigated the current contribution of agri-food VCs to achieving nutrition results, and then discussed how this contribution could be improved if constraints to improving nutrition results were addressed.

There are several theories around VC Analysis for Nutrition. This analysis leaned towards those proposed by Morgan et al. (2018) and Hawkes (2009), and initially used the frameworks provided by de la Pena et al. (2018) and Gelli et al. (2015) as a guide. De la Pena et al. surmises three main pathways to describe how agri-food VCs may deliver nutrition impact, through: production, income and market pathways. However, this framework only considers smallholder farmers as the consumers and not non-farmer consumers such as those in urban and peri-urban settings, which ignores an important part of the community as end-users. To include the wider community, a broader food system lens was considered framing the results around three possible strategies to make VCs more nutrition sensitive: 1. increase supply 2. increase demand for safe and diverse food, and 3. add nutrition value/minimize nutrition losses along the VC, across three distinct, though intersecting pathways, namely supply chain, food environment, and consumer behaviour. In addition, ‘mediators’ of nutrition impact such as women’s empowerment and social capital were examined as part of the analysis.

The methods were fourfold and included a pilot study², a literature review and both a quantitative analysis and a qualitative narrative synthesis of the VCA4D reports. Stakeholder consultations were carried out at various times throughout the research study to get feedback, directions and gauge progress³.

¹ The VCA4D project is funded by the EU and implemented by Agrinatura. At the time of this report had implemented 44 VC studies. in 28 countries (Annex 1): Africa (20), Asia (3) and Latin America (5).

² The pilot study was carried out to assess the objectivity of the analysis, examine the assumptions for using this secondary data as well as testing a framework adapted specifically for this study.

³ Four presentations were carried out. The first to Belgium MS to present the findings of the pilot study and to agree on the next steps (June 2023), the second to present the initial findings of the narrative synthesis and literature review to Belgium MS, EC

Findings

Enhancing agricultural yields while prioritising nutritional outcomes and reducing food waste presents both significant advantages and challenges.

VCs play a vital role in supporting vulnerable communities by providing income, enhancing food security, and improving nutrition. While agricultural diversification can promote dietary variety, it does not always lead to better nutritional outcomes. The link between income and food choices is complex. Sustainable agroecological practices, women's empowerment, and local food production are key pathways for sustainable development. Local markets improve food accessibility and community resilience, while producer organisations help smallholder farmers by enhancing collaboration and resource access. Small-scale producers face significant challenges such as economic barriers, inadequate infrastructure, and climate vulnerabilities, which impede productivity and sustainability. A comprehensive food systems approach is necessary, integrating nutrition-specific and sensitive interventions tailored to local contexts. Collaboration between the private and public sectors is essential for ensuring access to affordable, nutritious food. Empowering women in agriculture through resources and education, alongside strengthening smallholder farmers' organisations, is crucial for resilience in agri-food VCs. The analysis of individual VCs across countries limited the assessment of dietary quality and nutrition impacts. The absence of nutrition-related data was evident of a lack of nutrition objectives within traditional VC analyses.

Conclusions

The findings from the literature review and VCA4D project reports underscore the complex relationship between agriculture and nutrition, emphasising the need for more integrated, evidence-informed approaches within agri-food VCs. While the evidence is limited, particularly regarding the food environment and consumer behaviour, the data from the reports aligns with existing literature. The analysis reveals that benefits and barriers are context-specific, highlighting the importance of tailored strategies to promote positive nutritional outcomes across diverse national and sub-national settings. The study highlights the need for careful interpretation of results and more evidence from a 'Value Chain for Nutrition' approach to enhance nutrition outcomes.

Recommendations

Strengthen women's roles in agriculture and support small-scale producers by developing comprehensive strategies that address vulnerabilities, promote sustainable practices, improve labour conditions, empower women through resource access and leadership opportunities, and adopt a holistic food systems approach tailored to local contexts.

Address small-scale producers interconnected challenges that hinder productivity and sustainability. The susceptibility of these producers to external shocks highlights the urgent need for comprehensive strategies and a concerted effort from policymakers, stakeholders, and communities to foster resilience and sustainable practices. Address sector labour issues characterised by precarious working conditions and high turnover.

Strengthen producers' organisational structures, by fostering mutual trust, and enhancing representation in decision-making processes. Strengthen bargaining power, develop capacities to negotiate fair prices and adversely impacting income and sustainability.

Design interventions inspired and guided by a comprehensive food systems approach, which requires a good understanding of the contexts at the national and subnational level. Avoid interventions exclusively based on single VCs which may miss opportunities to increase dietary diversity even though increased

consumption of a specific nutrient-dense food may contribute to improved diet quality. Combine nutrition-specific with nutrition-sensitive VCs interventions as a route to improving maternal and child nutrition status.

Make further efforts to preserve nutrient content during processing and storage, improve food safety and reduce food losses and waste.

Create a favourable environment for the agri-food private sector, particularly national/local MSMEs (Micro, Small and Medium-sized Enterprises), which have a critical role to play in enabling availability of and access to healthy, affordable and sustainably produced nutritious food, collaborating with public entities to address broader nutrition challenges.

Enhance consumer awareness of the nutritional benefits of diverse foods through behavioural change communication. Improve poor consumers accessibility to quality products at affordable prices. Strengthen access to markets that provide nutritious foods at an affordable price. Support local producers.

Create a stronger evidence-base informed by nutrition-sensitive VC approaches, including more evidence from the food environment and around consumer behaviours.

Key words

Agricultural products, consumer behaviour, food environment, food system, literature review, nutrition sensitive intervention, supply chain, smallholder farmer, value chain, women's empowerment.

1. Introduction

1.1 Background and context

Responsible investments in agriculture and the food system beyond the farm are crucial for improving nutrition results through food security, dietary quality, and food consumption patterns (FAO and IISD, 2020; Ruel et al., 2018). Especially so as rising incomes and consumption, and changing food demand, together with an increasing population and expanding urban centres are putting unprecedented demands on agriculture and natural resources. Current food systems are struggling to provide foods that support nutrition and health in an equitable, and sustainable, manner. The result is 3.1 billion people (42%) were unable to afford a healthy diet in 2021 (FAO, IFAD, UNICEF, WFP and WHO, 2013). Unhealthy food is one of the main drivers of malnutrition (both under and over) in low-income populations and is the world's leading contributor to diet-related health issues, including obesity, diabetes, and cardiovascular diseases (Afshin et al., 2019). It is estimated that diet-related chronic diseases or non-communicable diseases (NCDs) are responsible for 41 million (74%) deaths each year, of which 77% are in Low- and Middle-Income Countries (LMICs), highlighting the urgent need for improved access to healthy food options and effective public health strategies to combat these preventable conditions (WHO, 2021). There are an estimated 17 million premature deaths (deaths before age 70) from an NCD of which 86% occur in LMICs (WHO, 2021). This is only set to get worse as the already present structural weaknesses in the global food system are further exacerbated by factors such as climate change, economic instability, and inequitable access to nutritious foods, leading to increased health disparities and greater challenges in addressing malnutrition and diet-related diseases (IPES-Food, 2022). A transformation of how we produce and consume food is urgently needed. However, considering the complexity of agri-food systems it is necessary to tackle this at a feasible scale, for instance, through a value chain (VC) approach, acknowledging the multiple VCs that make up the agri-food system. Understanding how agri-food VCs can deliver nutrition results¹ is pivotal to understanding what changes need to be made to create more equitable and sustainable healthy food systems.

With this context in mind, in November 2022 the Nutrition Research Facility (NRF) conducted consultations with representatives of Belgium and France, both of whom had expressed an interest in seeking support from the NRF in relation to nutrition VCs and improving the access to healthy foods, as well as having nutrition results in Africa and among their other programmes.

The objective of this research study was to generate ideas and insights and collate evidence related to some promising agri-food VCs which could potentially deliver nutrition impacts in Africa and could potentially be a candidate for the continental /regional approach as per the AU-EU (African Union and European Union) cooperation (EC/INTPA Note, 2022).

To meet this objective, an analysis was carried out to understand whether and how agri-food VCs could be made more 'nutrition-sensitive', along with an examination of the constraints and barriers for this to happen. This was a data-driven exercise using data provided by Agrinatura's Value Chain for Development (VCA4D) project² to gather and synthesise information to understand the pathways and their potential contribution of specific VCs to deliver nutrition results. At the date of carrying out this study, the VCA4D project had conducted and completed 44 VC studies in 28 countries (Annex 1): Africa 20 studies considering 32 VCs; Asia 3 studies considering 4 VCs; and Latin America 5 studies

¹ See the EC's [Nutrition Results Framework](#)

² Details of the VCA4D project here - <https://europa.eu/capacity4dev/value-chain-analysis-for-development-vca4d>

considering 8 VCs, analysing both the contribution and inclusiveness of the VCs to economic growth as well as their functional, social and environmental sustainability.

Due to time constraints and the length of the reports, as well as containing information not relevant to this study, a decision was made to review specific sections of the VC study reports:

- Executive summary.
- Functional analysis,³ which provides an overall description of the VC system.
- Food and nutrition security, gender equality and social capital domains, which are part of the 'social' analysis in the VC studies.

The analysis was initially framed by a Nutrition-Sensitive Value Chain (NSVC) approach (de la Pena et al., 2018) which considers an agri-food VC that has been shaped to alleviate constraints in the supply or demand of food by creating accessible and inclusive markets and by making diverse and nutritious food available, accessible, affordable and desirable. Given that food is not only produced, but also stored, processed, distributed, and marketed, the NSVC approach has the potential to unpack the complexity of food systems and provide clear nutrition entry points (de la Pena et al., 2018). Specifically, the framework proposes three possible strategies to make VCs more nutrition sensitive: 1. increase supply 2. increase demand for safe and diverse food, and 3. add nutrition value/minimize nutrition losses along the VC. However, a limitation of this framework is that it is directed toward smallholder producers and so ignores the needs of the consumer, especially those living in urban and peri-urban settings. This needed to be taken into consideration and during an exploratory pilot phase, together with stakeholder feedback and evidence from a literature review, an adaptation of the proposed framework with subsequent evidence framework (Table 1) was developed.

Ultimately mapping findings against a food systems framework and its intersecting pathways, namely supply chain, food environment, and consumer behaviour, enabled identification of some of the enabling factors and barriers for nutrition-focused interventions.

This research will provide the basis in which to engage further with EU Delegations and EU funded programmes on improving VCs' nutrition sensitiveness.

1.2 Objective and Research Questions

The main objective of this study was to understand the level of contribution of a range of agricultural VCs in achieving nutrition impact in Africa. In line with this objective, the research study will seek to answer the following two questions:

RQ1: What is the contribution of agri-food VCs in catalysing positive nutrition pathways for nutritionally vulnerable communities and individuals in African countries?

RQ2: How can this contribution be improved by addressing constraints to unleash the pathways to deliver nutrition impact?

1.3 Assumptions

The assumptions that were made during the inception of this research study were as follows:

- That sufficient information from the 44 VCA4D studies would be available to inform an objective assessment of the VCs contribution to nutrition and healthy diets.

³ <https://europa.eu/capacity4dev/value-chain-analysis-for-development-vca4d-/wiki/11-functional-analysis>.

- That there is relevant evidence available in the published and grey literature to help inform the assessment.

These limitations were further considered during the exploratory pilot phase. Addressing the first point, it was clear that information was largely insufficient e.g., whilst there is some information on food security, including mediators such as women's empowerment, specific nutrition objectives were not part of the original plan for these traditional VC analyses. Due to limited time and the scale of the research it was not possible to delve further into any missing data identified except to carry out a broader sweep of the literature, beyond Africa and the specific VCA4D studies.

1.4 Key stakeholders

The direct beneficiaries of this study are Belgium and France member states, who expressed an evidence need related to understanding the potential of agri-food VCs to deliver nutrition impacts in Africa. Since this research study can potentially contribute to refining the design of EU programmes, the other beneficiaries of this research are the EU Delegations in African countries. More broadly, other beneficiaries are organisations and practitioners involved in the design, implementation and evaluation of initiatives supporting VC development in LMICs.

While the scope of the research study was limited to VCs in Africa, all 44 VC studies (except Georgia due to time issues and because it was considered an outlier) completed by the Agrinatura VCA4D project were reviewed and synthesised to capture other important information that could be relevant to African contexts.

Indirect beneficiaries potentially include populations experiencing or at risk of malnutrition. These vulnerable groups could benefit⁴ from the specific evidence-informed policies and programmes that may then be implemented.

1.5 Risks and limitations

Traditional VC analyses and development seldom focusses on the (non-farmer) consumer, let alone their nutrition and health. These consumers are solely considered as the purchasers driving the demand. Whilst these studies do include some information on food security (availability, access, utilisation and stability), as part of the 'social' analysis, the coverage and quality were variable and rarely responded to questions around consumer 'demand' including behaviours. Given this situation, the assessment and interpretation of how nutrition-sensitive a VC is, was limited to the available information.

The focus of this research study was on analysing the 'potential contribution' of each of the VCs towards nutrition-related results/impact. The study did not review or analyse how these VCs were prioritised, nor how any interventions related to upgrading these VCs was designed and implemented. This research study provides evidence-informed insights related to the 'nutrition-sensitiveness' of the various VCs, to contribute to EU programming.

This data-driven research analysis was on single VCs across several countries and not across a country's wider agri-food system, allowing an analysis of dietary gaps rather than overall quality of the diet. This may hinder our inferences related to improvements in nutrition from VCs as people have complex diets involving several VCs and most people don't eat enough of any one product to make a

⁴ Benefitting from the evidence will only happen if evidence-informed programming becomes a reality and if the specific nutrition-sensitive programmes are implemented well enough to improve the nutrition well-being of the vulnerable population.

significant contribution to nutrition (Morgan et al., 2018). As well, it is highly likely that changes to the performance of one VC may have positive or negative knock-on effects of another VC (Cornelsen et al., 2014)⁵. Without this knowledge, caution was made on the study inferences and recommendations made to address this point. However, for some countries there were 2 or more VCs which could provide an opportunity to explore situations beyond one VC, but again with caution made on inferences as this was not an objective of the VC assessments themselves. For example, there were 3 VCs for Zambia (aquaculture, egg and maize) and 2 VCs for Mali (cashew, fish).

The lack of information on nutrition-related issues in the VCA4D reports that have been analysed does not necessarily mean that there was an absence of potential pathways, just that this evidence had not been collected. The results of this study should be carefully interpreted owing to the heterogeneity and quality of the primary data in the original reports. Whilst for the VCA4D project there is a standard data collection and reporting methodology for these analyses this does not take into account the differences between reporting due to specific interests of the researchers who collected these data.

2. Methods

The methods utilised to carry out this study included:

- Pilot study for testing and fine tuning the methodology of the study⁶.
- Literature review.
- Quantitative analysis of nutrition-sensitiveness of VCA4D agri-food VCs.
- Narrative synthesis to assess the contribution of VCA4D agri-food VCs to deliver nutrition results.

Stakeholder consultations were carried out at various times throughout the research study to get feedback, directions, and gauge progress⁷. Whilst the pilot highlighted the lack of analysis and weak evidence on VCs with a nutrition lens there was still some interesting and important information that were considered as useful entry points affecting (current/future) nutrition outcomes, although not along the whole VC. These results were presented to Belgium representatives in June 2023 for feedback and direction. The outcome of the meeting was to continue with the analysis as set out, bearing in mind the limitations. Further changes and refinements were made to the analytical framework to account for the outcomes of the pilot and the feedback received as well as a further review of the evidence (to accompany the initial literature review).

Literature review

A literature review was carried out to understand the potential synergies, constraints, negative effects and trade-offs in the way VCs are organised or are functioning. The literature review also supported

⁵ Cornelsen L, Green R, Turner R, et al. What happens to patterns of food consumption when food prices change? Evidence from a systematic review and meta-analysis of food price elasticities globally. *Health Econ.* 2014. doi:10.1002/hec.3107.

⁶ The pilot study was carried out as an initial step of the study and included in the inception report. It consisted of the analysis of three VCs: Cote D'Ivoire – **Cassava value chain** (as a food crop – mainly women led); São Tomé and Príncipe (STP) – **Cocoa value chain** (cash crop, export-oriented); and Nigeria – **Maize value chain** (staple crop), and was instrumental for the testing of the methodology that has then been adopted.

⁷ Four presentations were carried out. The first to Belgium MS to present the findings of the pilot study and to agree on the next steps (June 2023), the second to present the initial findings of the narrative synthesis and literature review to Belgium MS, EC etc. (December 2023); the third to Capacity 4 Nutrition (C4N) (February 2024); the fourth at a public event organised in Gent by the Belgian Presidency of the EU, in collaboration with the University of Gent and the FAO (April 2024).

an analysis of any evidence gaps. This review was based on peer reviewed journal articles published on the topic of nutrition-sensitive agriculture and (non) food VCs and nutrition. The search terms used were focussed broadly on the different areas of interest of the food VC, i.e., terms within supply chains, food environment and consumer behaviour, and on nutrition outcome terms i.e. dietary diversity, quality, intake and status. Based on a search of PubMed, Web of Science /Science Direct and Google Scholar, we found relevant published and grey resources, including recent reviews and systematic reviews. These have been summarised to enhance the understanding of the available evidence base and to complement the findings from the 44 VC studies of the VCA4D project.

Based on the structure of the Food System Framework of the High-Level Panel of the Experts of the World Committee on Food Security and Nutrition (HLPE, 2017), and following the pilot, feedback and evidence review an evidence template was developed to extract and analyse the available evidence from individual VCA4D reports on the potential pathways to nutrition outcomes (Table 1). Two important documents particularly of use to create the adapted evidence framework included the IFAD (International Fund for Agricultural Development) review of interventions to prevent overweight and obesity (Herens et al., 2023) and a systematic review on food VCs and nutrition outcomes (Nicholson et al., 2021).

This resulting template is articulated across three distinct, though intersecting pathways, namely supply chain, food environment, and consumer behaviour. The supply chain encompasses all activities for food production, storage, distribution, processing, packaging, retailing and marketing. The food environment refers to the context in which consumers make their decisions about acquiring, preparing and consuming food. It includes food availability, access, affordability and acceptability. Consumers behaviour reflects food choices and decisions made by consumers, at the household or individual level, both in urban and rural settings. These three pathways are in turn conditioned by social “mediators” such as women’s empowerment and producers’ and consumers’ organisations.

Pathway	Component	Entry points to add nutrition value	
Supply chain	Production	Improve nutrient content	Nutrition-sensitive agriculture to improve nutrients or dietary diversity (e.g., adoption of improved varieties, promotion of VCs, organic production, agroecological practices ⁸)
			Develop new crop varieties (e.g., biofortification)
		Increase yield	Access to inputs (e.g., seeds, micronutrient fertilisers, tools, technical assistance, training)
			Input cost subsidies, access to credit
	Storage & Trade, Packaging and Processing, Retail & Marketing	Improve quality and quantity of food	Setting/reviewing food standards (regulations to reduce salt, sugar, trans fats; improve food safety)
			Reduce losses and waste (e.g. Improved processing, storage, new varieties)
		Improve nutrient content	Fortification of food products
			Reformulation of processed food for more nutrients

⁸ The Food and Agriculture Organization of the United Nations (FAO) define agroecology as “an integrated approach that simultaneously applies ecological and social concepts and principles to the design and management of food and agricultural systems” that “aims to optimise the interactions between plants, animals, humans and the environment while taking into account the social aspects that must be addressed for a sustainable and equitable food system”.

		Lower VC costs and risks management	Coordination, contracting, improving regulatory environment, subsidies, improved infrastructure
Food environment	Improve availability and accessibility to healthy food		Consumer subsidies or taxes
			Public purchases and distribution of food
	Improve acceptability		Reduce loss and waste in consumption (e.g. packaging)
Consumers' behaviour	Improve demand and uptake of healthy food		Modify consumer awareness around impact of choices (e.g., food labelling, Social and Behaviour Change)
			Improve information and guidelines e.g., (food preparation information)
	Improve choice of where and what to buy		In the workplace, household, community/ general public/private sector
	Improve acceptability		Cultural/environmental factors
		Context (country-specific)	
Social mediators	Improve environment for uptake of healthy foods		Women's empowerment (e.g., food purchases and dietary intake, work time, decision making)
			Producers' organisations

Table 1. Framework to analyse evidence in VCA4D reports on pathways to nutrition outcomes

Quantitative analysis of the nutrition-sensitiveness of the VCs reported by VCA4D

A quantitative assessment was carried out on the 44 VCA4D reports. Based on the frameworks that inspired the study methodology and the table above, in total, 13 main criteria were identified for assessing VCs sensitiveness across VCA4D reports (Table 2).

Pathway/Social mediator	Entry points
Supply chain	Improved nutrient content/diversity of crop
	Improved yield
	Improved quality and quantity of food, including food safety
	Improved nutrient content in processing/storage
	Reduced losses and waste
	Lower VC costs and demand
Food environment	Improved availability and access to healthy food
	Improved acceptability through packaging, varieties
Consumer behaviour	Improved demand and uptake of healthy food
	Improved choices, including from where and what to buy
	Improved acceptability of nutritious food, culturally
Social mediators	Women's empowerment
	Social capital

Table 2. Criteria for assessing VCs sensitiveness across VCA4D reports

The quantitative assessment was carried out by two of the team's researchers to reach consensus on the current and potential future levels of contribution (by observing constraints) to nutrition outcomes. This was done by creating a dashboard adopting a traffic light (dot) system to show the existence of strategies or actions mentioned within the reports: no actions evident (red), limited concrete actions (amber) and clearly evident actions (green). The cases of 'no evidence' were marked with a black dot.

The assessment was consolidated, and patterns were analysed by different typologies of VCs (i.e., cash crops, dairy & meat, fish, fruit & vegetables, pulses & nut, roots & grains) and by the export /domestic market orientation of each VC. A further analysis was done to observe any patterns between the 13 criteria and national childhood stunting⁹ prevalence (%). Given the limitation of the ordinal scale and the critical evidence gaps hindering a full analysis in the VC reports (from a nutrition standpoint), the analysis presented here is only indicative and not definitive or conclusive.

As well it is worth remembering that the reports were not homogenous, and the 'weight' of available evidence differed between reports. The reports were compiled by different independent teams of researchers who each have different expertise and interests. So, caution also needs to be applied when interpreting this analysis.

Further, nutrition sensitiveness of a VC was assessed using the similar 3-point scale as explained above (different coloured dots). The 'dot' scores were summarised by the criteria and by typology of the VC. The resulting mean /median scores were analysed using the following guidance:

A score ranging from 2 to 3 - where strategies are clearly evident, and concrete actions are being taken by the VC players

A score from 1 to 2 - where strategies exist but currently limited concrete actions being taken by the VC players

A score of <1 - where from a nutrition standpoint, no strategies exist, or no specific actions are taking place at VC or at country level

Nutrition-sensitiveness of value chains was also quantitatively analysed exploring different patterns (similarities and differences) by:

- Typology of the value chain: Fruit & vegetables, pulses & nuts and roots, grains VCs cash, dairy & meat, fish.
- Export or domestic market orientation of the VC.
- Association between childhood stunting (at country level) and women's empowerment scores assigned to each VC.
- By the extent to which VC focus on women's empowerment might have contributed to reduction of stunting at the country level.

Qualitative analysis of the nutrition-sensitiveness of the VCs reported by VCA4D

The narrative synthesis was carried out to organise and systematically assess the data, using the evidence template that was developed after the pilot and review.

The initial findings from the narrative synthesis of 17 agri-food VCs and literature review were shared during an online meeting with representatives from INTPA, EU member states (Belgium and France). The meeting was extremely useful to share emerging insights with the purpose of understanding 'how' these insights could be gainfully utilised by INTPA and EU members states in programme designs and in other ways such as integrating nutrition in other initiatives of the EU.

⁹ Stunting refers to a condition in which a child's height is significantly lower than the average height for their age, indicating chronic malnutrition or insufficient growth.

A research assistant was hired to summarise the remaining VC reports (excluding Georgia¹⁰) and to provide a synopsis for each report highlighting the most important parts relevant to nutrition. Once these had been summarised the team came together in Montpellier (19-23 February 2024) to pull together the different contributions/constraints of each VC to highlight the potential strategies/interventions that could improve the current/future 'potential' contribution to nutrition outcomes.

3. Results

3.1 Literature review

Finding 1 - The food and agriculture sectors are still hesitant to integrate nutrition interventions into their frameworks.

The potential pathways through which good quality nutrition can be delivered through agri-food VCs to vulnerable people are multiple and complex, with limited and mixed evidence. Understanding how food systems and agriculture (FAO, 2013) could be more nutrition-sensitive to benefit nutrition outcomes is not a new concept; yet the food and agriculture sectors are still hesitant to integrate nutrition interventions into their frameworks (Duncan, 2022) and rarely engage with explicit nutrition objectives; instead, being more motivated with improving quantity to ensure food security and generating income (Nicholson et al., 2021). In 2013 there were a number of reports and initiatives that revealed the lack of evidence on the topic. Waage et al. carried out an evidence gap map on agriculture for improved nutrition and revealed eight important research gaps and concluded that most projects 'did not consider the VC and few measure nutritional status' (Waage, 2013). Ruel et al., highlighted the opportunities to improve nutrition through nutrition-sensitive agriculture (Ruel et al., 2013). The Agriculture-Nutrition Community of Practice provided a set of 10 recommendations for improving nutrition through agriculture (Ag2Nut, 2013). And yet, more than 10 years later, progress has been very slow, and the evidence base is still limited, even with the resounding calls to generate more, and better quality, evidence on the topic (Ruel et al., 2013; Hawkes et al., 2011; Morgan et al., 2018; Nicholson et al., 2021).

Despite the growing interest and agreements on the conceptual frameworks and potential pathways that link agri-food VCs to nutrition outcomes (e.g., Hawkes et al., 2011; Dangour et al., 2012; Gelli et al., 2015; Maestre, 2017; Morgan et al., 2018; de la Peña et al., 2018; Ridoutt et al., 2019; Gillespie et al., 2019; Duncan et al., 2022; Sharma et al., 2022) the evidence for the effective entry points and the understanding how nutrition may be affected throughout the chain is surprisingly lacking (Maestre, 2017; Allen et al., 2019 (in Fan et al., 2019); Ruel et al., 2018; Turner et al., 2018; Sparling et al., 2024). A systematic review in 2021 carried out specifically on food VC interventions and nutritional outcomes, found fewer than 5 studies, out of 113 potential studies identified, that either addressed nutrition outcomes or provided a study protocol to do so (Nicholson et al., 2021).

There are a number of reasons cited for this lack of evidence and include not only those mentioned above but also because those engaged in the nutrition sector may not have the necessary transdisciplinary training required to fully understand the functioning of the food VC (Fanzo et al., 2017). The lack of evidence also, however, may be due to a number of factors including small heterogeneous studies with weak methods rather than a lack of impact (Ruel et al., 2013; Olney et al., 2021; Sharma et al., 2020; Nicholson et al., 2021). Using a systems approach allows the examination

¹⁰ Georgia was the only country outside the 3 regions

of the different stages across the whole food system to understand the links, including potential synergies and trade-offs, between agriculture, food systems and nutrition. However, the application of these approaches has naturally resulted in a predominantly linear focus on agriculture (farm) toward nutrition (consumer), starting primarily with downstream activities that focus on food security and quantity. This rather narrow approach may miss important post-farmgate pathways such as those that consider the food environment¹¹ (Maestre, 2017; Turner et al., 2018; Sparling et al., 2024), markets, where it is imperative to understand the constraints that prevent markets from supplying nutritious foods (Thorpe et al., 2016) and individual consumer behaviours, where the least evidence is available (Hawkes, 2009); particularly related to outcomes such as food affordability, dietary diversity and health and nutrition (Gillespie et al., 2017). Measurement of these could help ‘elucidate food access gaps and inform the design of nutrition-sensitive interventions’ (Herforth, 2015). Also, rather than being linear, these particular pathways may also be circular and bi-directional, and this too needs to be considered (Maestre, 2017; Hawkes, 2009).

The lack of motivation regarding nutrition and resulting lack of evidence on what are the potential best practices to improve nutrition outcomes through the agriculture and food sectors, is accompanied by the continuing disconnect between the different sectors in terms of their priorities, policies and analysis, with neither sector considering the complexities involved of the other (Lock et al., 2010; Gillespie et al., 2012). Changing VCs to support the production, supply and consumption of more nutritious foods, to address priority nutrition concerns, requires shifting the incentives of the different VC actors involved, with a move toward public actions and policies to shape the functioning of the food system is needed (Maestre, 2017). This needs to start from the consumer perspective working backwards along the VCs within the food system (Hawkes, 2009); from fork to farm (Brouwer et al., 2021).

Finding 2 - Technological advances may support better nutrition by increasing yield and reducing nutrient losses, especially when women have access.

Increasing agricultural yields is essential to reducing hunger and poverty, especially in the light of rising population growth and concerns over environmental impact and land use. One way to improve yields is through improving agricultural production and post-harvest technologies to preserve the nutrient content and safety of fresh produce. Such technologies include improved water and soil management practices (including agroecological practices), use of new climate resilient seed varieties and organic fertilisers, biofortification¹², increased mechanisation (including artificial intelligence), vacuum packaging, improved cold chain storage etc.

Despite the improvements in yield this is somewhat offset by food loss and waste (FLW), resulting in important nutrient losses. FLW occurs throughout the food VC. The need for a more holistic, and integrated, approaches to align VC analyses with food systems has been highlighted through several reviews (Farmery et al., 2021; Eastman et al., 2022). Eastman et al. and Creedon et al. point out the need for a more holistic approach to ‘identify the hazard points for nutrient loss, using a multisectoral, transdisciplinary approach’ with the aim of maximising the availability and accessibility of nutrients of the food that is delivered to the consumer (Eastman et al., 2022). However, understanding how any

¹¹ The food environment refers to the physical, economic, and social contexts in which people acquire, prepare, and consume food.

¹² Biofortification is the process of increasing the nutritional value of food crops through agricultural practices. This can be achieved by enhancing the levels of essential vitamins and minerals in crops during their growth, typically through selective breeding or genetic modification. The goal of biofortification is to improve the nutritional quality of staple foods, particularly for populations that may have limited access to a diverse diet.

gains made from technological advances are passed onto the consumer to improve their nutrition outcomes is not well studied (Habtewold et al., 2022; Eastman et al., 2022). However, there is some evidence that the uptake of agricultural technologies, especially where women are more empowered, leads to an increase in dietary diversity, not just for the woman herself but for the household in general (Kassie et al., 2020).

It is also important to understand where new technologies may have a negative impact on nutrition. For example, a study by van Ginkel and Cherfas in 2023 concluded that biofortification of starchy staples has ‘failed to improve nutrition’ despite huge investments and that biofortification ‘further imposes a yield penalty and risks of genetic uniformity’. This they say would overall require ‘more land to supply nutritionally adequate diets’ (van Ginkel et al., 2023). The authors also say that the funding directed toward biofortification would be better put to use to study how dietary diversity could improve nutrition and health (van Ginkel et al., 2023).

Finding 3 - Agricultural diversification may increase household dietary diversification.

The evidence on agricultural production diversity on household dietary diversity is mixed (Sibhatu et al., 2018). There is some evidence where agricultural diversification increases dietary diversification within farming households (Jones et al., 2014; Koppmair et al., 2017; Ecker, 2018; Pradhan et al., 2021), especially where existing dietary diversity is low (Jones, 2017). At the same time, declines in the diversity of agricultural production, and therefore supply, is said to negatively affect diets and nutrition outcomes (Jones, 2017; Mehraban et al., 2021). However, there is also evidence that improvements in dietary diversity through agricultural diversification may be insufficient unless other factors such as women’s empowerment, literacy, education and nutrition awareness and overall income are addressed at the same time (Rosenberg et al., 2018; Gupta et al., 2018; Chegere et al., 2020).

Agroecological practices, especially crop diversification can have a positive impact on food security and nutrition outcomes, including dietary diversity, but less so on anthropometric status (Santoso et al., 2021., Luna-González et al., 2018). A recent systematic review concluded that agroecological practices¹³ such as crop diversification, intercropping, agroforestry, integrating crop and livestock, and soil management measures can have a positive impact on food security and nutrition outcomes, especially when applying a more diverse set of practices with multiple components (Bezner Kerr et al., 2021). The increased production and consumption of nutrient-dense neglected and underutilised species (NUS), including indigenous fruit trees, is being encouraged in light of the urgent need for more sustainable and resilient food systems (under the continuing threat of climate change), and because of their potential to contribute to food and nutrition security, by promoting sustainable healthy diets, in vulnerable areas and populations (Mudau et al., 2021). However, NUS VCs are poorly understood because of the lack of interest in them from the research and development communities and as such as described as ‘being immature with few activities and actors’ (Mabhaudhi et al., 2017).

Finding 4 - Improvements in dietary diversity do not necessarily translate into improved anthropometric status.

Improvements in dietary diversity alone does not necessarily lead to improvements in anthropometric outcomes of vulnerable household members (Rosenberg et al., 2018; Ruel et al., 2018; Luna-González

¹³ Agroecological practices refer to a set of agricultural methods that integrate ecological principles into farming systems. These practices aim to create sustainable and resilient food production systems by considering the interactions between plants, animals, humans, and the environment.

et al., 2018; Chegere et al., 2020; Santoso et al., 2021; Sharma et al., 2021). Although this evidence is limited and mixed. For example, the review by Jones found only 6 studies that had assessed anthropometric status and agricultural biodiversity; 4 of these studies highlighted an improvement in linear growth of pre-school children, albeit small (Jones, 2017). It is commonly accepted that interventions aimed at increasing anthropometric status (and other nutrition outcomes) need to be accompanied by other interventions such as water and sanitation, health, and nutrition social and behaviour change (SBC), social protection, reproductive health, micro-nutrient fortification and women's empowerment if a stronger impact on anthropometric status is to be seen (Ruel et al., 2018; Sharma et al., 2021; Margolies et al., 2022). Ruel et al. also propose that the focus of these interventions be on household dietary intake and diversity rather than on child nutrition status, as they frequently are (Ruel et al., 2018).

Understanding the particular pathways to nutrition status is imperative to know where appropriate entry points are for appropriate intervention. A recent systematic review with a broader focus on nutrition-sensitive agriculture interventions with specific nutrition objectives identified a number of pathways to improve access to food as well as potentially addressing underlying causes of undernutrition (unhealthy environments and inadequate care practices), namely: food production (food availability), agricultural income (nutrition-related expenditure), nutrition-related knowledge (including water and sanitation, education and health), women's empowerment (nutrition outcomes), and strengthening of local institutions (Sharma et al., 2021).

Knowing how these pathways interact with the context, including cultural, economic, and food environment factors is critical since the results from nutrition-sensitive interventions are contextually (and culturally) relevant and may vary according to e.g., the type of intervention (including intensity and duration), the foods consumed and how they are produced, seasonality, access to roads, age and sex of children, household income and wealth status, women's education, empowerment, utilisation of time and nutrition status and the multisectoral integration of other sectors (Ruel et al., 2018; Sharma et al., 2020; Boedecker et al., 2021; Duncan et al., 2022).

Finding 5 - Adequate supply of nutrition-rich crops can potentially improve nutrient intake and dietary diversity, however, the evidence of the impact of biofortification on nutrition is severely limited, especially for urban and rural non-farmer groups.

The main pathways from food production to delivering nutrition outcomes are **directly** through 'own-production' (for own consumption), to increase the household supply of nutrient-dense food, or more **indirectly** through 'income' from sales of produce and women's empowerment, and through caring and her own nutrition. All three pathways are interrelated and are expected to impact dietary diversity and access to health and care practices to drive improvements in nutrition outcomes (SPRING, 2014).

A recent review on supply-side food and agricultural interventions to inform decision-makers on reducing malnutrition in South Asia highlighted the importance of strategies to enhance the production and availability of 'naturally nutritious food' through small-scale activities (home gardens and animal agriculture (including aquaculture)) and by enhancing the nutritional value of food (biofortification and fortification) (Dizon et al., 2021a). However, the reviewers warn that the evidence is associative in nature and from small studies mostly from India.

Local food production strategies, such as home, school and community gardens, have largely been overlooked as an important strategy to improve nutrition outcomes and livelihoods, even though they have been around for centuries. There is a growing evidence base showing a potential positive effect of home gardens, including school and community gardens, on household dietary intake and diversity,

including macro and micronutrient intakes (Girard, 2012; Gaihre et al., 2016; Pandey et al. et al., 2016; Gupta et al., 2020; Mustafa et al., 2021; Olney et al., 2021; Bassey et al., 2022; Margolies et al., 2022; Baliki, 2023), but not on improvements in child anthropometric status.

Provision of nutrient rich crops through e.g., biofortification of specific crops to enhance both micronutrient density, bio-accessibility and bio-availability, is a growing strategy to reduce micronutrient deficiencies and improve nutrition (Ruel et al., 2013; Pandey et al., 2016; Huey et al., 2022; Ofori et al., 2022). However, the evidence of the impact of biofortification on nutrition is severely limited, especially for urban and rural non-farmer groups (Huey et al., 2022). The evidence that is most pertinent comes from own production (& consumption) of orange flesh sweet potato (OFSP) and the impact on vitamin A intake and status (Huey et al., 2022). Ruel et al. further posit that these interventions are more likely to have a nutrition impact where women are targeted and include women's empowerment activities (Ruel et al., 2013). They also comment on the lack of robust quality studies to be able to draw on to make inferences on nutrition outcomes and caution the available evidence in that nutritional benefits can differ across contexts due to physical availability of nutritious food, nutrient density, and bioavailability, etc (Ruel, 2003). As well, the uptake, through promotion of production and consumption of biofortified crops and foods, needs also to take into account consumer acceptability and political and economic challenges (Ofori et al., 2022).

Finding 6 - Evidence from several studies suggests that production and income improvements alone are not sufficient to improve household diets or the nutrition of vulnerable groups.

The relationships of improvements in agriculture production and income with dietary diversity are complex and not straight forward. A review quoted several studies of agricultural interventions on nutritional outcomes showing inconclusive results (Allen, 2018). Another review pointed to the limited evidence between food VCs interventions and nutritional outcomes suggesting a crucial need for more evidence given the multiple food VCs and pathways within the food system (Nicholson et al., 2021).

However, it is unclear as to the pathways through which these improvements operate i.e., either own production (and consumption) &/or income (Girard, 2012). The pathways through which home food production may have an impact on nutrition outcomes are not homogenous (Baliki, 2023) and are highly contextualised, and influenced for instance by 'gender, wealth, control of household decisions (whether women participate or not), the relative market-orientation of a household's agricultural production, and the specific nature of farm diversity' (Jones et al., 2014). Because of this there are questions to the scalability of such interventions to have an impact on nutrition outcomes, especially where markets are underdeveloped (Cooper et al., 2024). Attention also needs to be drawn to this inconclusive evidence as the lack of impact may be down to lack of evidence collected through methodologically weak studies, a conclusion highlighted by several others (Ruel et al., 2018; Nicholson et al., 2021; Sharma et al., 2022).

It is widely accepted that strategies to improve nutrition outcomes need to be combined with other interventions. A number of studies argue that production diversity may not be the most effective strategy to improve diets in smallholder farm households and propose that improving access to markets, productivity-enhancing inputs and technologies, distribution, increased incomes and increased awareness and knowledge seems to be more promising (Jones et al., 2014; Chegere et al., 2016; Koppmair et al., 2017; Maestre, 2017). More recent studies argue that concerns over food safety and the provision of information on the nutrition benefits, e.g. through labelling of fortified foods, are important factors that determine whether consumers are 'willing to pay' for safe nutritious food, and including those most vulnerable (Chege et al., 2019; Dominguez-Viera et al., 2022).

Finding 7 - Combining nutrition-specific with nutrition-sensitive interventions, to tackle undernutrition by addressing the underlying determinants, is also widely accepted as a promising route to maternal and child nutrition status.

Stronger evidence exists where combining nutrition-sensitive agricultural programmes, including home food production, with nutrition social-behaviour change (SBC) and women's empowerment components are more effective than agriculture interventions alone in supporting improvements in dietary diversity (Ruel et al., 2018; Olney et al., 2021; Margolies et al., 2022). Combining nutrition-specific with sensitive interventions, to tackle undernutrition by addressing the underlying determinants, is also widely accepted as a promising route to maternal and child nutrition status. Nutrition-sensitive interventions can potentially increase the scale, coverage and effectiveness of nutrition-specific interventions by acting as a delivery platform for them (Ruel et al., 2013) for example, by adding fortified foods to complementary feeding practices (Bhutta et al., 2013).

Finding 8 - Physical availability of 'local' nutritious food is an essential prerequisite, though not a sufficient condition, for nutritious food consumption.

Several of the located literature described VC interventions seeking to improve the production and supply of nutritious food, and thereby increase availability (Ridoutt et al., 2019; Mustafa et al., 2021; Bahadur et al., 2018; Rosenberg et al., 2018; Gupta et al., 2020). One study suggests that food choices affecting dietary patterns can 'only be based on foods that are physically present' (Ridoutt et al., 2019). There is evidence also that urban communities benefit from connected markets that can contribute to diverse diets in Cameroon and Ghana while rural communities in Rwanda were reportedly disadvantaged by unstable food markets (Mustafa et al., 2021; Bahadur et al., 2018). While food access is critical, the gains are not automatically transferred downstream to diets nor nutrition status, especially for young children and their mothers. Rosenberg et al. illustrate this point by recommending that this 'transfer' of food access to nutritional gains should be a priority for the design and evaluation of future nutrition-sensitive agricultural programmes (Rosenberg et al., 2018). The main point that these studies illustrate is that the physical availability is a necessary prerequisite but is not a sufficient condition for achieving nutrition outcomes.

Finding 9 - Accessible markets that provide foods at an affordable price are critically important and nutritious food choices needs to be culturally valued and be sufficiently marketed to compete with unhealthy foods.

There is mixed evidence on the performance of markets on nutrition outcomes. A study by Jones et al. highlights the necessity of diverse, market-oriented production on nutrition if the income from that production is 'translated into nutrient-dense, diverse foods' (Jones et al., 2014). This, of course, requires accessible markets that provide such foods at an affordable price, and that are culturally valued or are sufficiently marketed to 'compete with highly processed, nutrient-poor foods and drinks that may be equally accessible, and aggressively marketed'. There is some positive evidence that improving market access and integration has a positive benefit on dietary diversity (Koppamair et al., 2017; Gupta et al., 2020; Mehraban et al., 2021), especially for the purchase of non-staples (Gupta, 2020) and especially where that access is improved for women (Kassie et al., 2020). Also, as Chegere et al. conclude, to improve the nutrition status of children, market integration needs to be combined with programmes addressing e.g., education and income and recommend that health policies need to have a broader focus to include some of these factors (Chegere et al., 2020).

Finding 10 – Analyses of the linkages of agriculture growth, economic growth and global VC integration to improved nutrition outcomes present a 'mixed' picture.

The debate on agriculture growth, economic growth and global VC integration contributing to improved nutrition outcomes has been elucidated in several papers which present a ‘mixed’ picture. Pandey et al. report that although rapid economic and agricultural growth significantly contributed towards reducing stunting rates in many developing countries, it was not a sufficient condition for addressing the problem of malnutrition, because the impact of agricultural growth was context specific (Pandey et al., 2016). Headey reported that high agricultural growth rates in some states of India, such as Gujarat, Rajasthan and Bihar, were not accompanied by a decrease in under-nutrition (Headey, 2012). Thus, it was not clear whether agricultural growth is more pro-nutrition as compared with growth in non-agricultural sectors. Ridoutt et al. state that while greater economic opportunities may accrue in some cases, there exists ample case study evidence demonstrating that poverty alleviation has not always followed global VC integration (Ridoutt et al., 2019).

Finding 11 - Higher levels of disposable income do not always translate into healthier food choices.

There is a common assumption that higher levels of disposable income will lead to healthier food choices. This is not always the case, as highlighted by Ridoutt et al. drawing on the evidence of poor dietary patterns seen in many middle- and high-income communities, especially where food costs are a relatively small proportion of income (Ridoutt et al., 2019). Similarly, a study by Mehraban and Ickowitz highlighted declines in dietary diversity, due to declines in production diversity, even though incomes rose over time (Mehraban et al., 2021).

Finding 12 - The private sector has a central role in nutrition.

Maestre & Poole point out critical role of private sector in enhancing access to, and consumption of, foods that are naturally rich in micronutrients (Maestre et al., 2018). Herein, the paper states that business innovations or systems improvements requires both private and public sectors for improving infrastructure, removing other distribution barriers, or designing directly subsidised food distribution programmes by the government, donors, or other stakeholders (Maestre et al., 2018). The 2022 Global Nutrition Report says that the private sector (food and non-food businesses) has a critical role to play in transforming the food system and enabling access to healthy, affordable and sustainably produced food. However, the report indicates that the majority of private sector commitments are currently focussed on internal corporate policies rather than contributing to achieving impact goals such as reducing undernutrition, obesity and diet related NCDs etc (GNR, 2022).

Finding 13 – Public procurement is recognised as a driver for local value chain to promote healthy diets.

Public procurement of food (for schools, hospitals, food aid, etc.) is recognised as a powerful driver for the development of local food systems that promote healthy diets. However, for effectiveness, the public sector purchasing power should be a catalyst for development and used as a strategy to stimulate the responsible participation of the private sector in the market, to ensure long-term sustainability of interventions. Civil Society Organisations can play important roles, such as fostering partnerships among actors towards healthy diets and advocating for ethical standards, transparency, and accountability (Leão et al., 2023).

Finding 14 - Single VCs may miss opportunities to increase dietary diversity even though increased consumption of a specific nutrient-dense food may contribute to improved diet quality.

There is evidence that isolated VC interventions or those with too-narrow a focus on a single crop, or targeting a single market are unlikely to have a major impact on diet quality (Ridoutt et al., 2019) and may leave smallholder farms and farming families vulnerable (Jones et al, 2014). Crops are rarely

selected solely for nutrient content and more likely chosen 'based on a mix of agronomic, nutritional, social or economic considerations' (Jones et al., 2014). Nicholson et al. highlight that VC actors, and particularly the private sector actors, are generally legitimately motivated by profit or improvements in livelihood, and nutrition-relevant choices are generally not 'built in' to existing relationships and motivations (Nicholson et al., 2021). Gelli et al. demonstrated the need for a broader focus from 'a single value chain perspective to the range of priority value chains relevant to diets, identifying intervention options based on prevailing supply and demand conditions' (Gelli et al., 2020).

Finding 15 - Consumer preferences and needs can influence the direction of the food and agriculture system.

Food choice is both a conscious and unconscious, but complex decision-making process through which individual behaviours contribute to determining what is produced, procured, prepared, supplied and consumed. Understanding food choice is imperative to knowing how best to plan appropriate behaviour change interventions. However, most of the research available comes from the context of the food environment and is more limited with regards to individual choices which are influenced by 'consumer preferences, socioeconomic conditions, the social environment, psychological factors, attitudes and cultural relevance' (Karanja et al., 2022).

Individual-based food choices are affected by several factors. A study in 2022 identified 40 individual-based motives of food choices made in LMICs which they further classified into 7 clusters: health and nutrition perceptions, psychological factors, sociocultural factors, sensory appeal, social interactions, socio-demographic variables, and ethical concerns (Karanja et al., 2022). Other evidence exists on the major mechanisms through which a change in livelihoods may affect food choices i.e., occupation, locality, time, income, and social relationships (Kenney et al., 2024), food safety (Karanja et al., 2022) and on participation in women's group-based programmes (Kumar et al., 2018). More evidence highlights the importance of the nutritious quality of food, including food safety, on individual preference and choice (Chege et al., 2019; Dominguez-Viera et al., 2022). Brouwer et al. argue that consumer needs and preferences need to be a priority food system solution to drive longer-term shifts toward sustainable healthy diets for all (Brouwer et al., 2021).

Finding 16 - Where women play a central role in the VC, nutrition is better supported.

It is a well-researched fact that, in general, women are more likely to use resources on their family's food and nutrition (Kumar, 2018) and that improving women's empowerment, nutrition knowledge and awareness has a strong association with food production, consumption, and expenditure on food and thus is crucial for nutritional outcomes (van den Bold et al., 2013; Pandey et al., 2016; Allen et al., 2018; Rao et al., 2019; Heckert et al., 2019; Santoso et al., 2019; Sharma et al., 2021; Dizon, 2021b et al.; Duncan et al., 2022; Connors et al., 2023).

Women's empowerment is a critical component toward increasing nutrition outcomes and is one of the three main pathways through which food production is expected to impact on nutrition outcomes (alongside food production and income pathways) (Kadiyala et al., 2014). Women's empowerment also acts as a mediator across the other two pathways. Most of the available evidence surrounding women's empowerment, however, relates to the 'consumer behaviour' part of the food system, with women as the role of carers (Njuki et al., 2021). There is limited evidence within the 'food environment' and 'supply chain' components of the food system (Njuki et al., 2021).

The reviewed literature presents strong evidence of a positive impact of women's group-based programmes, specifically those aimed at behaviour change, and improving women's empowerment towards child nutrition and household food security (Kumar et al., 2018; Heckert et al., 2019; Njuki et

al., 2021). There is evidence that agricultural interventions aimed at improving women's empowerment can have a positive impact on dietary diversity through boosting technology adoption (Kassie et al., 2020) and that interventions addressing women's empowerment, coupled with women-friendly agricultural technologies, resulted in an increased intra-household bargaining power and a larger say in household resource allocation (Pandey et al., 2016). Ethnographic studies in India and Pakistan found that women engaged in cotton harvesting, or paddy transplanting, are more prone to intensive effort and poor health during this season, and if pregnant, more likely to have low birth weight babies (Rao et al., 2019).

However, women are often disempowered within the VC due to 'prevailing societal norms or gender-specific barriers,' with culture and context being strong mediators towards whether any activity within the VC is empowering or not (Quisumbing et al., 2021). Women's time-use can hinder their attempts to participate in VCs even if they are interested. A study in Peru on the cacao VC concluded that even though women had a strong interest in participating in the VC 'participation was thwarted by household responsibilities and exclusion from training' (Armbruster et al., 2019). Care has to be taken when designing interventions to consider the context and culture to avoid any exacerbation of existing gender inequalities (Quisumbing et al., 2021).

Finding 17 - Producers organisations can help producers consolidate produce for transport and marketing and cultivate more fruits and vegetables, but vertical and horizontal linkages need strengthening.

A study by Allen et al. indicates that 'from a nutrition standpoint, participation in producer organisations can help producers consolidate produce for transport and marketing and cultivate more fruits and vegetables' reducing transaction costs (Allen et al., 2018). The EU Quick Tip on [Nutrition-sensitive VCs](#) talks about improving smallholder access to markets 'by strengthening *vertical linkages*, for example by promoting contract agreements between farmers and retailers or processors, or *horizontal linkages*, by creating producer organisations to assimilate produce and reduce transaction costs or providing of market and price information'.

However, there is evidence that many of these organisations are blighted by e.g., poor management and governance issues, limited finance, have poor identification of market opportunities and external interference that affects their successfulness (Allen et al., 2018). While a useful entry point for nutrition, more evidence is needed in this sphere to better understand what factors make these producers organisations successful in encouraging the participation in VC development for nutrition outcomes.

3.2 Analysis of the VCA4D reports

3.2.1 Quantitative assessment of the contributions of VCA4D agri-food VCs to deliver nutrition impacts.

The contribution of 44 VC studies on nutrition-related aspects were assessed based on three pathways components (supply chains, food environment, consumer behaviour) and two mediators (women's empowerment and social capital). Table 3 illustrates the number of reports that reported on each criterion.

Pathway/Social mediator	Component	No. of reports
Supply chain	Improved nutrient content/diversity of crop	43
	Improved yield	44
	Improved quality and quantity of food, including food safety	38

	Improved nutrient content in processing/storage	25
	Reduced losses and waste	38
	Lower VC costs and demand	43
Food environment	Improved availability and access to healthy food	32
	Improved acceptability through packaging, varieties	28
Consumer behaviour	Improved demand and uptake of healthy food	27
	Improved choices, including from where and what to buy	27
	Improved acceptability of nutritious food, culturally	29
Social mediator	Women's empowerment	44
	Social capital	44

Table 3. Number of VCA4D reports that consider the specific Pathway/Social Mediator criterion

It makes sense that the number of reports reporting on the food supply chain and social mediators are largest as these were two of the main focuses of the reports. Whereas consumer behaviour and the food environment were commented on the least.

Figure 1 presents a summary assessment of the overall nutrition-sensitiveness of all the VCA4D reports. In practice the analysis provides an indication of the more commonly reported entry point pathways to increase nutrition across the reports. Whereby those entry point pathways scoring higher are suggestive of positive steps (more green dots) already being taken toward supporting nutrition, compared to extra efforts needed where the score is lower (more red and amber dots). So, for the 44 reports concrete actions that are already being taken to support nutrition include improving acceptability (culturally and through packaging) and increasing nutrient content. This is in comparison to where extra efforts may be needed regarding improving nutrient content which are during processing and storage, improving food safety and reducing food loss and waste.

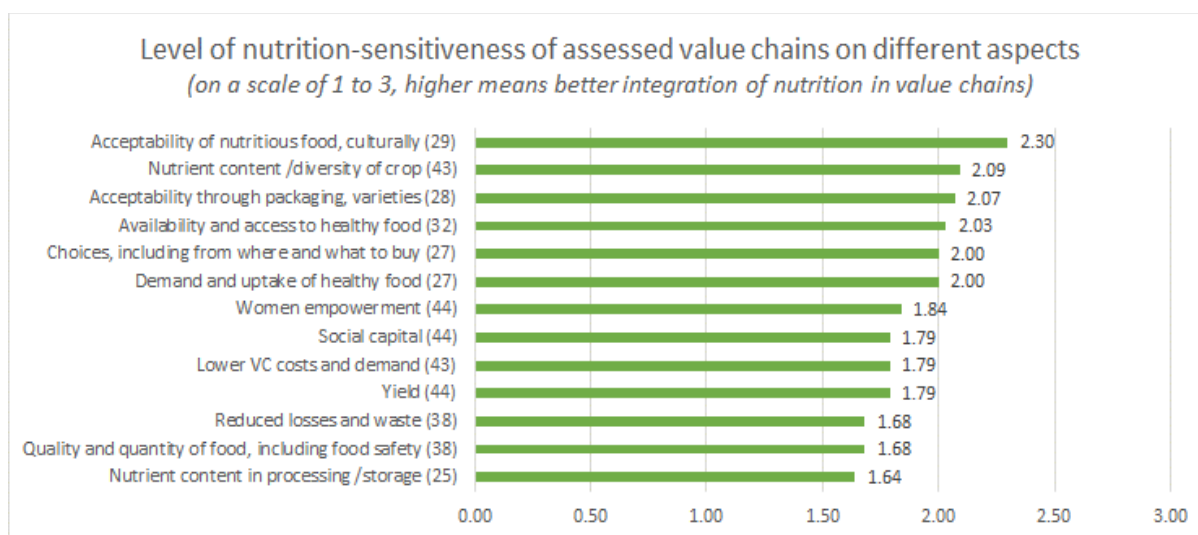


Figure 1: Assessment of VCs' nutrition-sensitiveness according to the 13-entry point pathway components of the analytical framework

A quantitative analysis of nutrition-sensitiveness by VC typology indicates the following:

- Fruit & vegetables, pulses & nuts and roots & grains VCs are slightly better in terms of their nutrition-sensitiveness scores over other typologies of VCs (cash, dairy & meat, fish).** Overall, across different typologies of VCs, more specifically with cash crops, dairy & meat and

fish, mean/median scores indicate that more concrete actions are needed to improve the contribution of VCs towards nutrition outcomes (Table 3.)

- **Export VCs demonstrate slightly better nutrition-sensitiveness than the VCs which cater to mainly domestic markets.** In fact, countries with export-oriented VCs have lower stunting levels than countries with domestic-oriented VCs. This difference though is only marginally significant and therefore there is no definite statistical indication that export-oriented VCs are associated with a lower level of stunting at country level (Table 4 & Figure 4).
- **Women's empowerment scores at VC level have some low to moderate association (-0.26) with stunting levels at country level.** This is understandable as the situation regarding women's empowerment for different VCs and country contexts is dependent on several factors, for which this information was not available. Similarly, there are several underlying (such as unhealthy household environment and inadequate health services), and immediate drivers/determinants (such as disease/health status) of stunting and undernutrition (UNICEF, 2021) at country level. Therefore, statistical association of stunting at country level with women's empowerment for different VCs is likely to be not strong. Nonetheless, evidence from the VC reports indicate some association of women's empowerment with stunting at country level.

Pathway to Nutrition Outcome	Cash (Crop)	Dairy & Meat	Fish	Fruit & Veg	Pulses & Nuts	Roots & Grains	Interpretation
Supply Chain	1.86	1.86	1.37	1.9	1.67	2.05	The evidence highlights the current contribution of the root & grain VCs to nutrition outcomes through supply chains aspects is higher than the other VCs and suggests that there are clear strategies and concrete actions being taken here. For the other VCs there is limited action being taken, especially in the fish VC. For these VCs there are important entry points (e.g. reducing losses and waste, for) that could be supported through the supply chain to improve their contribution to nutrition outcomes.
Food Environment	1.82	1.9	2.0	2.4	1.83	1.75	Both the fruit & vegetable, fish and meat VCs appear to have more strategies and concrete actions being taken by VC actors in the food environment compared to other VCs, especially the root & grains VCs. Important entry points here could focus on improving availability, accessibility of healthy foods (those having higher nutrition values than, e.g., staple cereals or processed food). The overall indications are that limited concrete actions are taking place across different typologies of VCs to make the food environment (nutritious food acceptability, accessibility, affordability, and desirability) more nutrition sensitive.
Consumer Behaviour	1.75	2.3	2.04	2.42	1.62	2.52	-Overall indications are that some concrete actions are taking place across root grains, fruit & vegetables and dairy & meat VCs for positively influencing consumer behaviours around improving nutritional choices and cultural acceptability of food with higher nutrition value (than e.g., staple cereals or processed food). Across other typologies (cash, fish, pulses & nuts), limited concrete actions are happening around improving demand and uptake, improving nutritional choices and improving cultural acceptability of these choices.
Women's Empowerment	1.5	1.6	1.83	2.25	2.0	2.25	For women's empowerment, root grain, fruit & veg, and pulses & nut VC scores are slightly higher than other typologies of VCs. Overall indications are that some concrete actions are taking place across root grains, fruit & veg and pulses & nut VCs for positively influencing women's empowerment. Across other typologies (cash, fish, dairy and meat), limited or not much concrete actions are happening around improving women's empowerment.
Social Capital	1.57	1.6	1.5	2.25	1.86	2.25	On social capital, root grain, fruit & veg, and pulses & nut VC scores are slightly higher than other typologies of VCs. Overall indications are that some concrete actions are taking place across root grains, fruit & veg and pulses & nut VCs for positively influencing collectivisation. Across other typologies (cash, fish, dairy and meat), limited or not much concrete actions are happening around improving social capital.

Table 4. Indicative assessment of the reported nutrition-sensitiveness of VCs by typology.

Nutrition-sensitive framework element	Mean Export	Mean Domestic	Explanation
Supply chains	1.89	1.68	Export-oriented VCs have comparatively better supply chain strategies from a nutrition standpoint. This difference in mean /median score is statistically significant when running the comparison across export-oriented and domestic market VCs (see Figure 1). Overall results are based on 22 export and 22 (mainly) domestic market-oriented VC studies.
Food environment	2.0	1.95	On food environment, there is no significant difference among the export-oriented and mainly domestic market VCs. The mean /median scores on food environment-related nutritional aspects viz. food acceptability, affordability, access and desirability indicate that much more needs to be done to make VCs nutrition-sensitive
Consumer behaviour	1.98	2.17	On consumer behaviour, there is no significant difference in mean /median scores among the export-oriented and mainly domestic market VCs.
Women's empowerment	1.77	1.90	On women's empowerment (mediator), there is no significant difference in mean /median scores among the export-oriented and mainly domestic market VCs.
Social capital	1.81	1.77	On social capital (mediator), there is no significant difference in mean /median scores among the export-oriented and mainly domestic market VCs.
Nutrition outcome Stunting	24.48%	30.50%	Analysing association of stunting (at country level) by export /domestic VCs generate some indication that in countries with export-oriented VCs have lower stunting levels than the countries with VCs mainly serving domestic markets.

Table 5. Indicative assessment of the reported nutrition-sensitiveness of export-oriented vs. domestic market-oriented VCs.

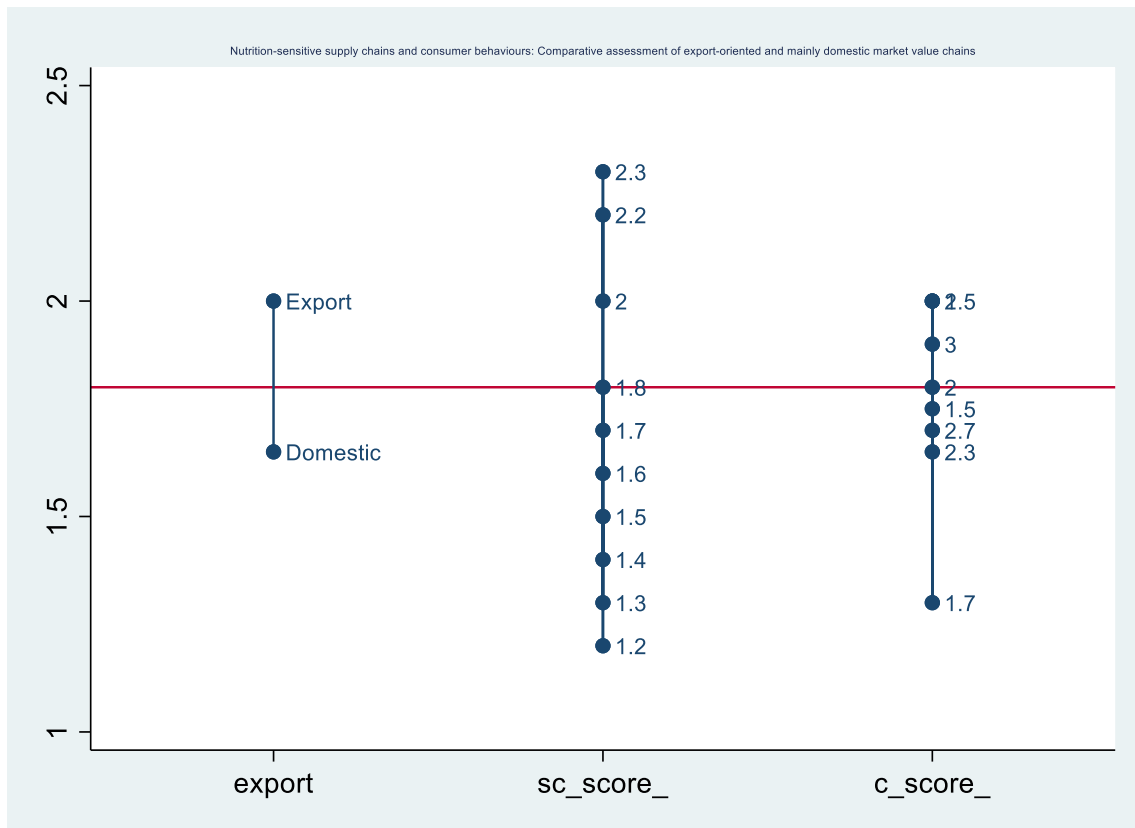


Figure 2: Reported Nutrition sensitiveness (median scores) of export and domestic market VCs on supply chains and consumer behaviour

As is shown in Figure 2, export-oriented VCs have higher scores (on a scale of 1 to 3) indicating more concrete actions are happening to support nutrition of participants in these VCs, than the domestic market VCs.

The association between childhood stunting (at country level) and women’s empowerment scores (at VC level) indicate that increasing level of stunting at country level is associated with a decreasing level of concrete action in support of women’s inclusion and empowerment in the VCs (Table 5). Since patterns of stunting and women’s empowerment are influenced by diversity and complexity of factors, this association should be seen as indicative of some relationship and does not present a definite argument though the findings of the literature review, as presented above, support this inverse association of stunting with women’s empowerment.

Stunting category	No. of VC studies on different score* on women's empowerment			Explanation
	1	2	3	
1 (stunting <20%)	1	8	2	At lowest stunting level (<20%), the most VC studies provide evidence of placing women's empowerment at either at 2 (limited concrete action) or at 3 (clearly evident concrete action) score.
2 (stunting 21 to 29%)	6	9	2	As stunting at country level increases, evidence from 6 VC studies indicate women's empowerment scores at 1, meaning no strategies or no specific actions are taking place for empowering women at VC or at country level.
3 (stunting 30 to 39%)	2	7	1	As stunting at country level increases further, most women's empowerment score at VC level remains at level of '2', meaning that VC evidence show limited concrete action for women's empowerment in VC of the countries where stunting level are upwards of 30%.
4 (stunting >39%)	3	3	0	With highest stunting level, 3 VC studies indicate women's empowerment score at a level of 1 (meaning no strategies or action) while 3 other studies indicate women's empowerment score at a level of 2 (meaning some concrete action), while there are no VC studies having women's empowerment score at a level of 3 (meaning clearly evident concrete action).

Table 6. Association of stunting at country level with the women's empowerment scores at VC level

3.2.2. Qualitative analysis of the nutrition sensitiveness of VCA4D agri-food VCs.

A qualitative assessment of the nutritional sensitivity of each VC was carried out by examining existing nutrition-related strategies and punctual actions and reading those strategies and actions through the lens of the analytical framework we developed, articulated along the three major impact pathways and the two major social mediators. This analysis was carried out clustering the agri-food VCs by product group (typology). The following provides a summary across all VC typologies of benefits to nutrition and barriers that need to be overcome if gains in nutrition are to be made. Whilst this provides a summary it is important to consider that VCs are very context specific. For a more in-depth and context specific analysis see the results tables in Annex 4.

3.2.2.1 Fisheries, coastal fisheries and aquaculture

Includes Aquaculture in Cambodia, Zambia and Georgia, Coastal Fisheries in Tanzania and Zanzibar, and Fisheries in Gambia, Mali, and Comoros.

A. Supply chain: (Annex 4; Table 1)

Benefits:

Food Security: Provides a source of animal-sourced proteins for communities.

Economic Growth: Contributes significantly to local and national economies through job creation and income generation.

Diversification of Livelihoods: Offers alternative income-generating activities, especially for vulnerable populations.

Nutritional Value: Enhances dietary diversity and nutrition through the availability of fish and aquaculture products.

Community Resilience: Supports local economies and helps communities adapt to economic changes.

Cultural Importance: Plays a significant role in the traditions and livelihoods of many coastal and riverine communities.

Barriers:

High Cost of Fishing Materials: Expensive equipment can limit participation in fishing activities.

Inadequate Size of Fishing Canoes: Smaller vessels restrict access to profitable fishing grounds.

Lack of Technical Know-How: Insufficient skills and knowledge can hinder effective practices.

High Input Costs in Aquaculture: Importation of feed and seed raises operational costs.

Limited Access to Markets: Challenges in reaching markets can affect profitability.

Environmental Changes: Climate change and habitat degradation threaten fish stocks and aquaculture sustainability.

Regulatory Challenges: Complex regulations can deter participation in fisheries.

Inadequate Infrastructure: Poor transport and storage facilities limit distribution efficiency.

B. Food environment: (Annex 4; Table 2)

Benefits:

Income and Food Source for Vulnerable Populations: The fish VC serves as a critical safety net for vulnerable communities, providing income and food security.

Increased Food Availability: Improved rice yields in integrated aquaculture and agriculture systems and stable fish prices (regulated by the government to protect consumers) contribute to greater food availability, bolstered by a consistent supply of imported fish.

Nutrition Accessibility: Provides an important source of nutrition, with fresh fish being the most affordable animal protein for resource-poor populations.

Income Contribution in Coastal Communities: Can provide both direct and indirect income, with a predictable supply enabling consistent fish availability in local markets

Barriers:

Cost of Farmed Fish: Larger farms produce fish that can often be too expensive for rural and urban poor populations.

Market Price Fluctuations: The price of local fish can increase due to seasonal decreases in catches, affecting food access.

Price Regulation: Whilst consumers may be protected by regulated fish prices this may have a knock-on effect on fishers' income.

Impact on Staple Food Prices: High demand for feed can negatively impact staple food prices and increase vulnerability to fluctuations in fish stocks and food prices among rural and urban poor.

Income and Food Security Risks: Intense exploitation of fish stocks (overfishing) poses risks to fisher's income and food security.

Market Variability: Supply of local fish products can vary significantly, complicating access.

Dependence on (low quality) Imports: Rising costs and reliance on lower-quality imported fish threaten food security and undermines local fisheries.

C: Consumer behaviour: (Annex 4; Table 3)

Benefits:

Increased Awareness: Social media health and nutrition (coordinated) campaigns can have positive contributions to increase in fish consumption.

Barriers:

Food Restrictions: Certain foods, including fish, may be restricted during pregnancy in some cultures.

Cultural Perceptions: In some contexts, there is a stigma associated with eating some fish e.g., like anchovies, as it is viewed by some as a sign of being lazy

D: Mediators (women's empowerment and social capital): (Annex 4; Table 4)

Benefits:

Active Participation: Women are significantly involved in small-scale semi-intensive and cage farms, contributing to the fish VC.

Leadership Roles: Women hold important positions in organisations at landing and processing sites and often form leadership roles within village fisher associations and processing cooperatives.

Economic Contributions: Women engage in processing and marketing, contributing to local economies and community resilience.

Social Capital: High levels of social capital facilitate knowledge sharing and community organisation through women's groups, farmer's associations and cooperatives.

Trust and Collaboration: Formal and informal networks promote trust and information sharing among coastal fisheries actors.

Supportive Networks: Primary-level organisations in fishing villages strengthen women's roles and support collective action.

Barriers:

Underrepresentation in Leadership: Despite their involvement, women are often underrepresented in decision-making roles.

Longer Working Hours: Women frequently work longer hours than their male counterparts without equivalent recognition or reward.

Financial Barriers: Limited access to capital and financial resources compared to larger (male-dominated) traders creates economic disparities.

Gender Discrimination: Women face discrimination in larger fish farms where they have limited access to assets and economic decision-making opportunities.

Weak Group Cohesion: Trust and cohesion within women's producer groups may be weaker compared to other VCs, affecting women's negotiating power.

Youth Involvement: Limited engagement of youth in these sectors can hinder the transfer of knowledge and sustainability of practices.

Conflict and Rights Issues: Tensions between seasonal migrants and local fishermen can complicate fishing rights and access to resources.

3.2.2.2 Meat & Dairy

Includes Beef in eSwatini and in Zimbabwe, Cheese in Colombia, Egg in Zambia and Milk in Burundi.

A. Supply chain: (Annex 4; Table 5)

Benefits:

Improved Cattle Breeds: Genetic selection can lead to better meat quality, higher yields, and increased resilience to diseases, which can enhance overall productivity.

Health and Veterinary Services: Better access to veterinary care helps reduce livestock diseases and mortality rates, benefiting both smallholders and larger operations.

Economic Buffering: Livestock sales can provide financial stability during droughts, helping farmers manage their income more effectively.

Multi-Purpose Livestock: Cattle provide valuable resources beyond meat, including draft power, manure for fertilisation, and milk and milk products, which can enhance food security and nutrition (for animals also).

Job Creation: The VCs for milk and egg production generates numerous job opportunities in processing and marketing, especially in rural areas.

Barriers:

Resource Limitations: Limited land, water, financial resources and feed availability can hinder livestock production and growth.

Financial Challenges: Issues such as delayed payments in contractual agreements and difficulties in repaying input credits can threaten the sustainability of the meat & dairy VC.

Animal Diseases: The prevalence of diseases poses a significant risk to livestock health and productivity.

Quality Standards: There is a need for improved slaughtering and processing practices to meet consumer expectations for quality and safety, which many small operators struggle to achieve.

Biodiversity Concerns: The promotion of improved breeds can marginalise local breeds, leading to a loss of animal biodiversity.

Climate Change: Increasing temperatures and extreme weather events can disrupt production and threaten livestock health. Increased livestock production can contribute to greenhouse gas emissions, particularly methane from ruminants, threatening agricultural sustainability.

Insufficient Coverage of Extension Services and Access to Technical Information: Farmers may not receive adequate support or training, which can hinder their productivity and ability to implement best practices in livestock management.

Infrastructure Issues: Poor infrastructure, including inadequate roads, transportation and storage facilities, hampers market access and distribution efficiency.

Informality and Land Tenure: Uncertain land tenure and informal land use can limit farmers' access to resources and markets.

Price Volatility: Due to high levies and duties, stock theft, government purchasing practices that distort market prices, low productivity in livestock systems, and fluctuating feed costs, all of which create financial instability and uncertainty in their operations.

B. Food environment: (Annex 4; Table 6)

Benefits:

Growing Local Demand: Increased consumer interest allows local beef producers to expand supply and better meet domestic needs.

Improved Access to Eggs: Urban availability and affordability of eggs enhance nutrition for low-income communities.

Enhanced Milk Production: Efforts to boost milk production and distribution improve access to milk in urban areas.

Barriers:

Seasonal Food Insecurity: Risks associated with out-grower cash cropping for soya can lead to food insecurity for rural communities.

Supply Constraints: Demand for beef exceeds supply due to limited grassland, leading to reliance on lower-grade imports.

Limited Consumer Purchasing Power: Low purchasing power restricts access to milk for many consumers.

C. Consumer behaviour: (Annex 4; Table 7)

Benefits:

Increased Consumption of Solid Dairy Products: There is a growth in the demand for cheese and other solid milk products.

Enhanced Beef Flavour: Feedlot feeding can improve the taste qualities of beef, appealing to consumer preferences.

Accessibility of Eggs: The convenience and affordability of eggs make them more accessible to lower-income households, with targeted marketing strategies by producers.

Barriers:

Low Rural Egg Consumption: Even with chicken rearing projects, rural households often prefer to produce chickens rather than consume eggs.

Dispersed Butcheries: Small-scale butcheries are spread out, making access less convenient; closer locations could enhance consumer benefit through improved accessibility (including reduced costs) and food quality.

Quality and Safety Concerns: Consumers worry about the quality and safety of beef due to unhygienic

slaughtering and processing practices.

D. Mediators (women's empowerment and social capital): (Annex 4; Table 8)

Benefits:

Empowerment through Ownership: Cattle ownership can enhance women's status and resilience within households, contributing to Food Security and Nutrition (FNS).

Active Participation: Women are increasingly involved in food engineering and management, particularly in sectors like cheese production.

Access to Resources: In certain regions, women have access to land and livestock, especially in matrilineal societies, which supports their agricultural activities.

Community Support: Community-based organisations and cooperative associations enhance farmers' access to resources and support through strong social networks, trust, and collaboration, fostering effective agricultural practices and governance.

Cooperative Movement: Revitalisation of legislation and cooperatives can play a crucial role in rural development.

Barriers:

Exclusion from Decision-Making: Women often face exclusion from key roles and decision-making processes, particularly in traditional settings.

Low Organisation Levels: There is a low level of farmer organisation, which affects the bargaining power and support for women in meat & dairy VCs.

Gender Inequities: Significant gender gaps exist in workload, leadership, and empowerment, with traditional norms dictating roles within households.

Limited Social Capital: Weak trust and support networks hinder effective collaboration and information sharing, particularly in the egg and dairy sectors.

Challenges in Cooperatives: There are issues with trust in cooperative management and limited capacity to support farmers effectively.

Low bargaining power: Limits the ability of farmers to negotiate better prices and terms, which can adversely affect their income and sustainability in agricultural markets.

3.2.2.3 Cash Crops

Cash crops include coffee in Angola, Ecuador, Honduras, and Tanzania. Cocoa in Papua New Guinea (PNG), Cameroon, Ecuador, Nicaragua, Sao Tomé e Príncipe, and Colombia. Cotton in Cameroon and Ethiopia, Palm Oil in Sierra Leone, and Vanilla in Papua New Guinea.

A. Supply chain: (Annex 4; Table 9)

Benefits:

Diversification: Integrating multiple crops, such as food and cash crops, helps improve resilience and sustainability in farming systems. This practice can enhance food security and provide additional income for farmers.

Nutritional Improvements: Diversifying crops, such as incorporating soybeans into cotton zones, can enhance nutritional outcomes for farming communities.

Job Creation: Specialty coffee and cocoa production often require more labour-intensive processes, which can lead to increased employment opportunities (especially youth) at various levels of the value chain.

Financial Support: Programmes like the 'Coffee Trust' in Honduras provide financial security for producers, enabling better access to credit and resources for cultivation.

Research and Development: The introduction of pest-resistant and drought-tolerant crop varieties, along with technical assistance, helps improve yields and sustainability in coffee production.

Environmental Practices: Strategies such as eco-pulping, soil conservation, and irrigation systems are implemented to minimise environmental impacts, tackle water scarcity and enhance soil fertility (Good Agricultural Practices).

Certification and Market Access: Fair Trade and Rainforest Alliance certifications can improve marketability and provide farmers with better prices for their products, while also promoting sustainable practices.

Tourism and Commercial Opportunities: Linking agricultural products with tourism can create additional revenue streams for farmers and local communities.

Cost Management and Marketing: Distributing inputs and equipment on credit helps farmers manage costs and risks, while effective marketing strategies may enhance profitability and ensure fair pricing.

Quality and By-product Utilisation: Emphasising the nutritional advantages of e.g., cottonseed oil can improve its market appeal, and leveraging byproducts like oilcake and animal feed provides additional income opportunities, contributing to overall farm sustainability.

Barriers:

Economic Challenges: Small-scale farmers rely heavily on government subsidies and financial support, but they often lack access to credit and necessary inputs.

Price Volatility: Producer prices fluctuate greatly, which makes it hard for farmers to maintain stable incomes.

Governance and Policy Issues: Governance is weak, and regulations are poor. Public policy support is not consistent, the legal frameworks are confusing, and there is a lack of coordination among stakeholders.

Infrastructure and Technical Support: Infrastructure is inadequate, including irrigation and transportation systems, and there are weak state services for technical assistance and training with low levels of investment in research and technology transfer.

Market Dynamics: Fluctuations in the market hinder investments in quality improvements. There is limited access to global market information for farmers.

Production Challenges: There is poor crop management and low productivity due to aging trees and limited resources coupled with a lack of disease monitoring and control over agricultural practices.

Infrastructure and Technology Needs: There is a need for better logistical infrastructure, including transportation and processing facilities, to enhance quality and reduce losses. Investment in technology, such as biodigesters and eco-pulping methods, is crucial for improving production efficiency.

Environmental Challenges: Climate change poses significant risks, including rising temperatures, water scarcity, and changes in rainfall patterns. Deforestation and the expansion of monocrop systems threaten biodiversity and sustainable land use.

Certification and Traceability Issues: While certification through Fair Trade and Rainforest Alliance exists, it reaches only a small minority of producers due to organisational capacity issues. Difficulties in implementing traceability systems hinder the recognition of organic management practices.

Quality and Market Access: Poor quality of beans and high logistical costs limit market access and competitiveness. Certain regions face challenges in meeting the standards of specialised markets due to inadequate post-harvest management.

Socioeconomic Factors: Workloads in coffee production can impact family welfare, including childcare and nutrition. There is a lack of labour availability, despite employment opportunities in some regions.

Coordination and Policy Challenges: Decision-makers face difficulties related to demographic growth, soil degradation, and the need for coordinated public and cooperative actions.

B. Food environment: (Annex 4; Table 10)

Benefits:

Access to Credit and Savings: Coffee income can help farmers access credit, allowing them to invest in their farms and save for future needs, which acts as a safety net against food insecurity and healthcare expenses.

Resilience Against Food Insecurity: In regions where cocoa is a primary cash crop, the income generated can enhance resilience against shocks to food production, reducing the risk of long-term food insecurity.

Contribution to Food Security: Cocoa not only provides income but also supports food security through the cultivation of associated crops like bananas and jackfruit, which can supplement diets.

Quality and Market Value: Some local coffee varieties are recognised for their high quality, which can command better prices in the market, benefiting producers.

Affordable Products: Low-priced chocolates allow consumers with limited purchasing power to enjoy cocoa products, contributing to local economies.

Agroforestry Systems: Small-scale family farmers often integrate cocoa cultivation with other subsistence and commercial activities, promoting biodiversity and sustainability through agroforestry systems tailored to local conditions.

Barriers:

Access to Markets: Difficulties in accessing food markets due to poor road networks and currency devaluation limit farmers' ability to sell their products and purchase food. This can lead to a cycle of poverty and food insecurity.

Income Limitations: Many coffee producers are unable to earn enough from coffee sales to secure a stable food supply, which compromises their nutritional security. The income generated often only allows for the purchase of limited food quantities.

Vulnerability of Labourers: Smallholders and labourers face multiple risks, including poverty, food insecurity, and fluctuations in international coffee prices. These factors can prevent them from earning a living wage sufficient to cover basic needs.

Seasonal Income Scarcity: The scarcity of income before the harvest season, combined with climate change impacts and agricultural challenges, exacerbates financial instability for farmers.

Sustainability Concerns: Expanding cultivation areas for coffee or cotton can lead to unsustainable practices that negatively affect food security and land availability. Late payments can force vulnerable producers to sell off cereals, impacting their food security.

C. Consumer behaviour: (Annex 4; Table 11)

Benefits:

Increase in Domestic Consumption: There is a growing trend toward consuming higher quality coffee, particularly among the youth, which enhances local appreciation for the product.

Rising Domestic Demand: Domestic coffee demand is increasing, with a notable percentage of coffee

now being sold on the national market, indicating a shift towards local consumption.

Development of SMEs: The growth of small and medium-sized enterprises (SMEs) in the roasted and ground coffee industry is boosting local market supply and transforming consumption habits, especially in urban settings.

Training for Quality Improvement: Training programmes for cupping and barista skills help ensure consistency in coffee quality and improve the overall image of locally produced coffee.

Local Preferences for Nutritional Qualities: There is a preference for certain types of cooking oils due to their nutritional benefits, which can support local agricultural practices and consumption.

Barriers:

Use of Cocoa Powder and Palm Oil: Many locally made chocolates use cocoa powder, and some replace cocoa fat with palm oil, which may affect the quality and authenticity of the chocolate products.

Consumer Preferences: Consumers tend to favour chocolates and cocoa derivatives with high sugar and fat content, which can limit the market for higher-quality, less processed chocolate products.

Competition from Agro-Industrial Products: The long-standing importation of agro-industrial products by transnational companies can overshadow local production, making it harder for local producers to compete.

Low Domestic Chocolate Consumption: There is very little domestic consumption of chocolate products, which can hinder the growth of the local cocoa market.

D. Mediators (women's empowerment and social capital): (Annex 4; Table 12)

Benefits:

Women's Participation in Production: Women are significantly involved in the production phase of coffee, contributing to harvesting and processing, and often holding prominent roles in administrative functions within the VC.

Empowerment and Leadership: There has been progress in women's participation in decision-making and leadership roles, which contributes to their empowerment within the agricultural sector.

Labour Contribution: Women provide the majority of the labour during coffee production, either on their own household farms or as labourers on other farms, often participating in farmers' groups.

Legal Frameworks: Although the legal environment for gender equality exists, its practical implementation can enhance women's roles in cocoa production and other sectors.

Cooperative Participation: Women actively participate in cooperatives, contributing to the collection and processing of cocoa and palm oil, which enhances their empowerment and economic independence.

Decision-Making Control: Women have greater control over decisions related to food crop gardens, allowing them to manage resources effectively and improve household food security.

Community-Based Certification: Initiatives like the "Sello Chakra Kichwa Amazónica" promote community participation and trust-based certification, which can enhance local production standards.

Organisational Structures: The presence of cooperatives and producer organisations strengthens the

inclusivity and organisation of the VC, facilitating access to markets and resources for small farmers.

Support for Fair Trade and Organic Production: The coordination of small producers fosters the development of fair trade and organic practices, benefiting both producers and consumers.

Social Capital Development: Producers' groups enhance social capital, fostering community cohesion and supporting infrastructure development through agricultural revenues.

Quality Improvement: Producers' associations play a vital role in improving the quality of cocoa and coffee, leading to positive socioeconomic impacts in their communities.

Barriers:

Cultural Perceptions and Decision-Making: Cultural biases often label certain crops as "male," leading women to prefer crops where they feel valued. Their participation in decision-making is limited, with men dominating leadership roles.

Access to Resources and Financial Barriers: Women struggle to obtain identification, land titles, and credit, restricting land ownership and investment in their farms. Limited access to finance affects their financial independence.

Visibility and Recognition: Women's contributions are often undervalued, with recognition primarily limited to domestic roles.

Workload Inequality and Cooperative Structures: Women bear a disproportionate share of agricultural work without recognition or control over income. Weak cooperatives hinder collaboration among small producers.

Education and Management Skills: Limited access to education and training restricts women's advancement. Poor management skills impact operational efficiency.

Asymmetrical Relationships and Community Cohesion: Relationships favour larger traders, marginalizing smallholders. Crop specialization can erode community cohesion.

Trust and Representation Issues: Weak ties with government limit access to resources. Many producers lack membership in organisations, leading to inadequate representation and distrust in trade associations.

Indigenous Rights Recognition: There is insufficient recognition of indigenous rights and poor communication among value chain actors.

3.2.2.4 Roots & Grains

Roots and grains include Cassava in Ivory Coast, Maize in Zambia and Nigeria, Sorghum in Ghana.

A. Supply chain: (Annex 4; Table 13)

Benefits:

Drought Resistance: Cassava can thrive in arid conditions, making it suitable for regions with inconsistent rainfall.

Minimal Input Requirements: These crops, particularly cassava, require fewer fertilisers and pesticides, lowering production costs for farmers.

Higher Yields from Improved Varieties: Advances in breeding have led to cassava varieties that yield more, including bitter cassava, which has been shown to produce higher outputs.

Commercial Market Development: A transition from subsistence farming to commercial production enhances market opportunities for crops like cassava and maize, particularly through processed products.

Value Addition and Economic Growth: Enterprises that process maize into products like stock feed, beverages, and snacks create jobs and diversify income streams for farmers and local communities.

Sustainable Soil Management: Practices that enhance soil fertility, such as crop rotation and organic amendments, are encouraged, reducing reliance on chemical fertilisers.

Nutritional and Safety Benefits: The availability of maize varieties rich in vitamin A and resistant to aflatoxin, along with methods like fermentation and blending with legumes, enhances diet quality. And can be important in addressing nutritional deficiencies.

Government Support Programmes: Initiatives like the Farmer Input Support Programme provide subsidised fertilisers and hybrid seeds, which help reduce production costs for small-scale farmers.

Quality Standards and Market Access: Quality assurance systems ensure that crops meet industry standards, improving access to lucrative markets and reducing post-harvest losses.

Accessible Extension Services: Agricultural advisory services are made available to farmers, particularly in aggregation schemes, helping them adopt improved practices and mitigate risks.

Barriers:

Nutritional Limitations: Cassava is low in essential nutrients, which can impact diet quality and food security.

Investment Challenges: There is a lack of investment in the VC, which disproportionately affects women. Poor infrastructure, including inaccessible roads, increases transport costs and limits market access.

Land Use and Costs: The rising popularity of cassava production has led to increased land use and higher rental prices, making it more difficult for smallholders to afford land.

Climate Vulnerability: The cassava sector has been reported to be susceptible to climate-related crises, such as droughts, which can lead to food shortages and instability.

Environmental Concerns: The common agricultural practices promoted, such as the use of hybrid seeds and chemical fertilisers, may have adverse effects on the environment and human health. Transitioning to sustainable practices is often met with resistance and challenges.

Low Yields: Smallholder farmers often experience low yields due to reliance on indigenous varieties and limited use of yield-enhancing inputs, further exacerbated by financial constraints. This is compounded by a lack of trust in these inputs, poor soil fertility, and inadequate extension services, leading to lower yields and increased risk of contamination from improper grain storage.

Need for Improved Extension Services: There is a need for better agricultural extension services, particularly regarding weather information and market access, to support farmers effectively.

Seed and Input Access: In some regions, farmers face challenges in accessing improved seed varieties, fertilisers, and pesticides, which are crucial for enhancing productivity.

Market Regulation Issues: The lack of regulation in informal markets can lead to unassessed quality of maize grain, affecting consumer safety and confidence.

Policy Criticisms for Maize Production: Current maize policies face criticism for perpetuating inequalities among farmers regarding subsidy access, while failing to address the low productivity and sustainability challenges of smallholder cropping systems.

B. Food environment: (Annex 4; Table 14)

Benefits:

Disaster Relief Support: In maize-growing areas, initiatives to store maize locally for resale during lean seasons help reduce dependency on urban food relief, enhancing local resilience.

Affordability of Local Products: Locally produced maize products are often more affordable than commercially produced maize meal, suggesting opportunities for developing local markets and decreasing transportation and production costs.

Food Security and VCs: Maize production plays a crucial role in food security and supports various VCs, including poultry, aquaculture, and livestock, contributing to dietary diversification and consistent local supply.

Nutritional Value of Traditional Varieties: The red (traditional) maize variety is an important yet underappreciated nutritious food crop, primarily used for household consumption and traditional brewing, highlighting its cultural significance.

Government Support for Maize Production: Active government encouragement of smallholder maize production has led to a gradual replacement of more nutritious grains (like sorghum and millet) and cassava in rural diets, indicating a shift in agricultural practices and consumption patterns.

Barriers:

Food Insecurity: Poor households struggle due to unaffordable fertilisers and seeds, compounded by climate variability, pest and disease challenge and declining soil health.

Cassava Demand vs. Supply: Unreliable supply from farmers leads to food shortages amid high demand.

Price Volatility: Seasonal price fluctuations for cassava create economic instability, making food less affordable during dry periods.

Food Accessibility: Seasonal harvest cycles cause temporary food accessibility issues, with maize overtaking sorghum in importance.

C. Consumer behaviour: (Annex 4; Table 15)

Benefits:

Commercial Production: The shift from family production for self-consumption to commercial production has increased the availability of attiéké (cassava semolina), particularly in urban areas, where it is valued for its affordability and convenience.

Variety: The existence of different types of attiéké (low end to high end: garba, standard attiéké, and abodjama) caters to a range of consumer preferences and price points, enhancing market accessibility.

Diverse Food Products: Cassava is versatile, being available in dried, flour, and fermented paste forms, which can be used in various culinary applications.

Barriers:

Nutritional Deficiencies: The introduction of orange maize to combat vitamin A deficiency has faced challenges. Despite positive consumer acceptance, widespread adoption by small-scale farmers has not occurred, primarily due to institutional barriers in the maize seed and milling sectors.

Consumption Patterns: While maize is a staple food, the majority is either home-consumed or processed for urban markets, which may limit opportunities for alternative crops to gain traction.

Cultural Taboos: The consumption of sorghum is hindered by cultural perceptions, particularly the taboo against children consuming unfermented pito, which limits its nutritional benefits for younger populations.

D. Mediators (women's empowerment and social capital): (Annex 4; Table 16)

Benefits:

Strong Female Presence: Women are increasingly involved in all stages of agricultural VCs, from production to processing and retail, which enhances their economic opportunities.

Access to Land: There is a growing trend of women gaining access to land through inheritance, rental, or donation, which empowers them in decision-making processes.

Leadership Opportunities: Women are taking on leadership roles in community associations and public speaking, contributing to their visibility and influence.

Market Demand: The rising demand for products like cassava provides women with better income opportunities as prices increase.

Well Organised Producers: Producers are in some case well organised and in these cases a significant percentage of producers are part of professional organisations, which can enhance their bargaining power and access to resources.

Barriers:

Limited Access to Credit: Women often face challenges in accessing financial resources, which limits their ability to invest in their agricultural activities.

High Illiteracy Rates: Educational barriers can hinder women's participation in decision-making and leadership roles.

Increased Workload: Expanding household production often increases the burden on women, affecting their ability to provide essential care for their families.

Traditional Gender Roles: Strong cultural norms regarding gender roles can restrict women's participation in leadership and decision-making.

Weak Bargaining Power: Women and smallholder farmers often lack the bargaining power necessary to negotiate fair prices and terms within the VC.

Limited Market Access: Women and smallholder farmers may have less access to market information and opportunities, which can diminish their income potential.

Low Trust Levels: Mistrust among stakeholders and lack of information sharing, leading to inefficiencies and poor collaboration.

Lack of Influence: Inability to affect decisions on agricultural inputs and poorly organised farmer associations resulting in fragmented representation. Difficulty for smallholders to negotiate favourable terms with larger players and challenges in obtaining financing due to lack of collateral.

Capacity Challenges: Representative organisations often lack the ability to effectively advocate for farmers.

3.2.2.5 Fruit and Vegetables

Includes Banana in Burundi and Dominican Republic, Green Beans in Kenya, Mango in Burkina Faso, Mango & Lime in Guinea-Bissau, Mango & pineapple in the Dominican Republic, Pineapple in Benin and Togo.

A. Supply chain: (Annex 4; Table 17)

Benefits:

Organic Matter Fertilisation: Utilising organic matter as fertiliser enhances soil fertility and productivity, which is crucial for sustainable agricultural practices. This method can lead to healthier crops and improved yields.

Local Production: Increasing local agricultural production through sustainable practices can enhance food availability. This includes growing a variety of crops that meet the dietary needs of the community.

Crop Rotation and Diversity: Implementing crop rotation and intercropping with diverse crops like taro, beans, and sweet potatoes can improve soil health and reduce vulnerability to diseases. This practice also supports dietary diversity and food security.

Improved Varieties: The introduction of improved crop varieties, such as bananas and pineapples, can significantly increase yields. For instance, bananas can yield between 60 to 90 tons per hectare with good agricultural practices.

Economic Benefits: The commercialisation of crops like bananas and mangoes supports local economies. Regular income from these crops can enhance the livelihoods of rural households, helping them meet various needs such as food, education, and healthcare.

Fair Trade and Community Impact: The fair-trade premium contributes positively to communities, promoting better living conditions and supporting local development. This approach can lead to increased competitiveness in the agricultural sector.

Access to Resources: The availability of agricultural inputs and technical assistance from local suppliers and organisations enables small and medium-sized producers to enhance their productivity.

Food Processing: Processing foods (like mangoes and pineapples) can extend their availability beyond the harvest season, allowing communities to access these foods year-round.

Barriers:

Varietal Limitations: New banana varieties may enhance yields but can also lead to juice extraction issues and declining productivity. Additionally, many plantations over 50 years old face reduced yields and increased vulnerability to diseases like fusarium.

Climate Vulnerability: Erratic rainfall patterns necessitate improved water management and irrigation techniques, as climate change poses threats such as droughts and floods that significantly impact production.

Market Competition: Small-scale producers struggle to compete with more efficient producers due to commercial and climatic changes, compounded by high-interest rates and strict collateral requirements that limit access to financial services.

Sustainability Threats: Insecure land tenure and declining soil fertility threaten sustainability, particularly in pineapple production, while reliance on chemical fertilisers and pesticides raises health concerns and highlights the need for better soil management.

Weak Governance: Weak governance and lack of technical provision and support hinder effective marketing, and small producers often struggle to meet stringent quality standards.

Barriers to Financial Access: Agricultural SMEs face limited access to financial services, high borrowing costs, and inefficient credit processes, compounded by insufficient integration into public policies, hindering growth and support for small producers.

High import costs: For fuel, pesticides, and fertilisers raise production expenses and dependency.

Labour and Innovation Challenges: The agricultural sector faces high turnover rates, low productivity, and a lack of qualified workers, alongside limited knowledge and training that restrict producers' ability to innovate and improve practices.

Infrastructure Issues and Logistics: Poor road infrastructure and inadequate storage disrupt supply chains, while inefficient logistics and transportation methods increase costs and reduce overall efficiency.

Export Barriers: High barriers to export, including strict quality requirements, limit access to international markets, and the lack of a cold chain system affects the quality of perishables, undermining freshness and consumer trust.

Health Risks: The unregulated use of ripening chemicals presents significant health risks, and studies have identified heavy metals, pathogens, and pesticide residues in local produce, raising concerns about food safety.

Informal Market Practices: Informal market actors often lack food safety training, leading to unsafe handling and distribution practices.

B. Food environment: (Annex 4; Table 18)

Benefits:

Income Stability: Bananas provide year-round income for rural households and secure local market availability, despite higher profits from exports; large plantations offer meals to workers, and Fair-Trade certification enhances food quality and provides rations.

Nutritional Improvement: Fresh mangoes improve local nutrition, especially in areas with limited dietary diversity.

Value Addition: Processing units add value by transforming mangoes, cashews, hibiscus leaves, and coconuts into various products.

Market Access: The presence of local markets where food can be bought and sold is crucial for food availability and nutrition. Strong market systems can help ensure that food produced in rural areas reaches urban consumers

Barriers:

Food Insecurity: New banana varieties yield heavier bunches but take longer to mature and may not ensure food security for smallholders.

Income Limitations: Low incomes for smallholders and workers due to labour-intensive production and fluctuating international market prices.

Access to Food: Limited food access for urban and rural households, with low-income individuals facing higher prices and rural households vulnerable to drought.

Seasonality: The availability of certain foods can vary by season. For example, mangoes are seasonally available from early April to mid-July, which can impact food access during off-seasons.

Export Focus: Export focus on mango and pineapple detracts from local food security and nutrition priorities.

Food Safety Hazards: Food safety hazards arise from poor hygiene and handling practices in informal markets, with produce often placed on the ground and exposed to unsanitary conditions.

C. Consumer behaviour: (Annex 4; Table 19)

Benefits:

Consumer Outreach: Producers' organisations enhance consumer outreach and nutritional education, promoting bananas as a healthy dietary choice.

Food Security: Mangoes serve as a crucial food source during harvest seasons, often included in children's meals, and help support food security for low-income households.

Value Addition: The processing of pineapples into juice and dried fruits adds value to the raw product and enhances its nutritional availability and market diversity.

Barriers:

Taste Acceptance: New banana varieties may address agricultural challenges but can lead to consumer taste preferences that complicate acceptance.

Local Promotion: There is a need to increase the visibility and promotion of pineapple products to encourage local consumption.

Nutritional Challenges: Challenges related to food utilisation, such as affordability, dietary diversity, and concerns over the quality and safety of fresh produce in informal markets, hinder nutritional practices.

D. Mediators (women's empowerment and social capital): (Annex 4; Table 20)

Benefits:

Economic Empowerment: Increased participation of women in banana, mango, and pineapple production and processing leads to greater economic autonomy, allowing women to control their income and contribute to household finances.

Leadership Development: Women taking on leadership roles within the VCs can foster more inclusive decision-making processes and promote gender equality in agricultural sectors.

Increased Visibility: The notable presence of women in various segments of the VC helps to challenge traditional gender norms, promoting a more equitable view of women's roles in agriculture.

Improved Nutrition: Given the correlation between women's education and child nutrition, empowered women can make better nutritional choices for their families, leading to healthier outcomes for children.

Community Development: Organisations and cooperatives often engage in community development projects, improving access to education, healthcare, and essential services, which benefits the entire community.

Enhanced Production Practices: Access to training and technical support helps producers improve their agricultural practices, leading to increased productivity and higher-quality products.

Market Access: Being part of organised groups or cooperatives can enhance market access for smallholder farmers, allowing them to pool resources and negotiate better terms.

Social Support Networks: Cooperative structures provide a platform for mutual assistance and knowledge sharing, fostering a sense of community and collaboration among producers.

Sustainability Practices: Training and support from organisations can encourage the adoption of sustainable agricultural practices, benefiting the environment and ensuring long-term viability of farming operations.

Resilience Building: Organised groups can help smallholder farmers manage risks and reduce costs, making them more resilient to market fluctuations and environmental challenges.

Barriers:

Legal and Customary Constraints: Women often face legal and customary barriers that limit their access to land ownership and inheritance rights, resulting in dependency on male family members for access to land.

Decision-Making Power: A significant gender gap exists in decision-making power related to agricultural resources, where women may have limited influence over production decisions despite their substantial contributions.

Access to Resources: Women frequently have limited access to agricultural resources, including credit and land tenure titles, which restricts their ability to invest in and manage their agricultural activities effectively.

Dual Workload: Women often bear a dual workload, managing both agricultural activities and household responsibilities, which can lead to burnout and limit their participation in paid labour opportunities.

Underrepresentation in Leadership: Women are underrepresented in leadership roles within processing units and cooperatives, which can perpetuate gender inequality and limit their ability to advocate for their rights and interests.

Public Speaking and Advocacy: Women may have a low level of public speaking and advocacy skills, which can limit their ability to express their needs and influence decision-making processes.

Health and Safety Awareness: There is often low awareness of health risks among workers, particularly women, which can lead to unsafe working conditions and health issues.

Limited Organisational Capacity: The lack of organisation and professionalisation among stakeholders can hinder collective action and the ability to negotiate better terms within the value chain.

Trust Issues: Limited trust among actors in the VC can affect collaboration and the effectiveness of cooperative structures, impacting overall productivity and support for women.

Inequality in Income Distribution: Income distribution often favours men, with the profits from agricultural activities being predominantly controlled by male family members, further entrenching gender disparities.

Insufficient Support Structures: While some associative structures exist, they may lack the institutional capacity to address quality standards, technical challenges, and financial management, limiting their effectiveness.

3.2.2.6 Pulses & Nuts

Pulses and nuts include Cashew in Cote D'Ivoire, Mali, and Sierra Leone, Cowpea in Niger, Groundnuts in Ghana and Niger.

A. Supply chain: (Annex 4; Table 21)

Benefits:

Income Generation: Groundnuts and cashews contribute significantly to household income, especially for women, who are often the primary workforce in production and processing. Block farms provide higher daily wages compared to conventional farming, attracting more workers.

Job Creation: The VCs create numerous jobs, providing income not only to smallholder farmers but also to processors, retailers, and labourers.

Youth Engagement: Initiatives like “Planting for Food and Jobs” aim to attract youth to agriculture, fostering a new generation of farmers.

Diverse Products: Development of multiple products (e.g., oil, flour) increases market opportunities and demand.

Nutritional and Diverse Food Production: Groundnut products, including Ready to Use Therapeutic Food (RUTF), play a crucial role in combating malnutrition and enhancing food security. Additionally, the cultivation of crops like cowpea and cashew not only improves dietary diversity but also supports local food production, further contributing to overall food security.

Processing Innovations: Innovations, such as vitamin A-enriched peanut oil and various processed products, create strong domestic market demand and enhance nutritional quality.

Sustainable Practices: Adoption of agroecological practices enhances the resilience and sustainability of the VC.

Regulatory Framework: Organisations like the Cotton and Cashew Council (CCA) promote better governance and quality control within the VC.

Capacity Development: Development projects and NGOs (Non-Governmental organisation) frequently provide training and support through methods like Farmer Field Schools, enhancing farmers' skills and knowledge.

Barriers:

Food Safety Concerns: Effective management strategies and improved post-harvest practices are necessary to reduce aflatoxin levels in groundnut products, which is crucial for export potential. Conservation insecticides in cowpea pose health risks and export barriers in Niger, while groundnut pesticides often contain unauthorized substances, raising regulatory concerns.

Financial and Labour Challenges: Micro and small enterprises face funding challenges that limit growth, compounded by low labour access and high loan repayment rates affecting workers' financial stability and rights.

Informal Work Structures: Many workers operate informally without contracts or benefits like health insurance and pensions, leading to precarious working conditions.

Limited Access to Inputs: Farmers often struggle to access certified seeds, fertilisers, and support for improved agricultural practices, which hinders productivity.

Information and Processing Capacity: Limited access to agricultural extension services and market information discourages investment in cashew production, and minimal value-added production from cashew apples restricts income potential. Low-quality production tools hinder efficiency and output.

Poor Organisation of Trade: The cashew nut trade in countries like Mali is poorly organised, with asymmetric relationships among VC actors, leaving producers under-informed about market prices.

Market Price Volatility: Fluctuations in the prices of raw nuts and kernels can impact the financial stability of producers, particularly those already living below the poverty line.

Market Regulation: The absence of well-defined markets and producer organisations makes it difficult for farmers to negotiate fair prices, discouraging further investment.

Governance and Coordination Issues: Poor organisation and governance from public institutions can lead to inefficiencies and hinder support for farmers.

Food Insecurity: Smallholders face risks from external shocks threatening livelihoods. Groundnut production relies heavily on unpredictable rainfall and soil fertility, with sector growth posing risks such as deforestation and increased land conflicts due to cashew expansion.

Dependence on Imports: Areas that used to produce highly nutritious crops are increasingly reliant on imports to meet demand, which can undermine local agriculture.

Access to Land and Water: Limited and expensive access to land and water resources, often controlled by rural institutions, can exclude women and young people from participating in agricultural activities.

B. Food environment: (Annex 4; Table 22)

Benefits:

Culinary importance: Groundnuts vital for domestic consumption, used in local dishes and snacks, contributing to food security.

Nutritional Enhancement: Cowpeas can enhance nutritional quality and accessibility, with a significant portion of production consumed or donated, bolstering food security.

Price Stabilisation: Government efforts to sell cowpea at moderated prices reduce food price volatility, stabilising food security.

Local Consumption: Strong domestic demand for groundnut, with only a small percentage exported, while almonds and cashew apple juice are consumed locally.

Barriers:

Land Competition: Cashew cultivation competes with staple crops, encroaching on agricultural land and threatening food security.

Health Risks: High aflatoxin levels in local products raise health concerns.

Accessibility Challenges: Rising food and vegetable oil prices challenge accessibility, forcing rural households to borrow for sustenance.

Low Local Consumption: Low per capita consumption of cowpea and cashew, with a high percentage of cashews exported and prices too high for most local consumers.

C. Consumer behaviour: (Annex 4; Table 23)

Benefits:

No data

Barriers:

Cultural Preferences and Culinary Traditions: Both cowpea and cashew fruit face challenges due to established dietary habits that favour traditional staples and a lack of incorporation of the fruit into local cuisines.

Lack of Awareness and Knowledge Gaps: There is limited knowledge about the nutritional benefits of cowpea and the culinary potential of cashew fruit, which hinders their acceptance and use in meals.

Market Demand and Accessibility: Cowpea may not be readily available in local markets, while the low demand for cashew fruit discourages its harvesting and sale, limiting consumer access.

D. Mediators (women's empowerment and social capital): (Annex 4; Table 24)

Benefits:

Empowerment and Financial Independence: Women may dominate the groundnut VC, providing them with self-esteem and financial independence. Women's involvement in processing enhances leadership opportunities.

Increased Income Contribution: Women's participation in cowpea and cashew production and processing positively impacts household income, with women controlling incomes from processing and trade.

Social Capital and Community Inclusion: Strong networks and mutual aid among women and youth associations foster community ties and support. Cooperatives play a vital role in providing education and capacity-development opportunities.

Leadership Opportunities: The formation of female peasant organisations and cooperatives allows women to take on leadership roles, even if they face limitations in broader organisational leadership.

Innovative Farming Practices: Block and semi-block farming models, especially in cashew trading and processing, encourage women's social involvement and enhance agricultural productivity.

Barriers:

Limited Access to Resources: Women often lack access to land, education, and financial services, which restricts their decision-making power and ability to invest in their agricultural activities.

Decision-Making Constraints: Despite holding leadership roles, women's decision-making capacity is often limited by traditional norms, with significant decisions usually deferred to men.

Underrepresentation in Key Activities: Women are often absent in crucial areas of the high-income crops such as transport, marketing, and production tasks like land preparation, which limits their overall involvement in the VC.

Workload Imbalance: Women frequently face a heavier workload compared to men, often managing small personal plots without secure ownership while still contributing to family farming.

Weak Organisational Structures: Farmers' organisations supporting groundnut farmers are limited, and there is a notable absence of structured cooperatives within the cowpea VC, impacting bargaining power and negotiation capacity.

Legal and Cultural Barriers: Although legal frameworks may recognise women's rights to land, traditional biases and the practical application of these laws often hinder women's access to land and resources.

Precarious Working Conditions: Women involved in processing often face dangerous working conditions without protection, and their roles in marketing are minimal, further limiting their economic opportunities.

4. Conclusions

The evidence from both the literature review and the analysis of the VCA4D project reports confirms the complex relationship between agriculture and nutrition and that this complexity necessitates a more integrated and evidence-informed approach within agri-food VCs. However, similarly to many other nutrition-sensitive interventions, evidence is lacking, especially from the food environment and on consumer behaviour; something that is more recently starting to be addressed. Although the VCA4D reports present a partial picture, the evidence reported is nevertheless telling and largely in agreement with what is already present in the literature.

Enhancing agricultural yields while prioritising nutritional outcomes and minimising food waste presents both important benefits and challenging barriers. Through the analysis of reports on different VCs in different countries it was possible to highlight the situations in which benefits for nutritional outcomes can be promoted through the different impact pathways of the adopted analytical framework; at the same time, existing barriers were highlighted. It became clear from the analysis that benefits and barriers are specific to different national and sub-national contexts. Below is a summary of the main headlining points that came out of the analysis across all VCs. For a more context-specific understanding please see Annex 4.

Conclusions on Research Question 1 *“What is the contribution of agri-food VCs in catalysing positive nutrition pathways for nutritionally vulnerable communities and individuals in African countries”?*

The main conclusion on this research question is that **agri-food VCs are contributing to catalysing positive nutrition pathways for communities and individuals in African countries**. However, the following points should be noted:

- This catalytic function is very country and context specific.
- It is not known if these positive nutrition pathways are targeting nutritionally vulnerable communities.
- There are important knowledge gaps about VC nutrition impact pathways.

The types of contribution of agri-food VCs to nutrition pathways can be summarised as follows:

- The evidence highlights the important role of VCs as facilitators in supporting vulnerable communities by providing income, enhancing food security, and improving nutrition.
- Agricultural diversification is crucial for enhancing household dietary diversity, but context-specific strategies must address broader social factors and integrate health determinants to effectively improve nutrition, particularly for vulnerable populations; evidence shows that while diversification can enhance dietary diversity, it does not guarantee better nutritional outcomes or anthropometric status.
- The contribution of improved agricultural production and income to increased dietary diversity is complex and not straight forward and higher levels of disposable income do not always translate into healthier food choices.
- By embracing innovative and sustainable (agroecological) practices, VCs can effectively address challenges posed by environmental changes, thereby promoting food and nutrition security, economic stability and increasing resilience.
- Local food production, innovative practices (e.g., biofortification), and women's empowerment emerge as interconnected pathways for sustainable development, emphasising the essential role of women in enhancing health and nutrition outcomes.

- Local markets enhance food accessibility and economic stability by facilitating direct connections between rural producers and urban consumers, while government support for price stability and agricultural production strengthens community resilience against food insecurity, ultimately ensuring that local VCs address immediate dietary needs and uphold cultural significance within communities.
- Access to markets and ensuring quality are crucial for farmers to grow their businesses while meeting standards that benefit everyone.
- The evolution of food markets, influenced by increasing consumer demand for taste and nutrition, along with the support of small businesses and educational initiatives, suggests a potential shift towards healthier and more locally sourced food options that may enhance overall food quality and consumer awareness.
- Food choice is both a conscious and unconscious, but complex decision-making process through which individual behaviours contribute to determining what is produced, procured, prepared, supplied and consumed. Understanding food choice is imperative to knowing how best to plan appropriate social and behaviour change interventions. However, most of the research available is very limited with regards to individual choices which are influenced by consumer preferences, socioeconomic conditions, the family and social environment, psychological factors, attitudes and cultural relevance.
- The involvement of young people and women, along with training initiatives and certification practices like transition to organic and Fair-Trade, further strengthens community ties and job creation, contributing to a more robust food system.
- Women play a crucial role in the agricultural and fisheries sectors, contributing to local economies and community development, though their full potential is still underutilised.
- The increasing presence of women in agriculture may challenge traditional gender norms and promote better nutrition and community well-being, although societal barriers may still exist.
- In VCs where women are actively involved, there tends to be better support for nutrition. A holistic approach that prioritises consumer needs and empowers women is essential for effectively improving nutrition and food security.
- Through involvement in cooperatives and producer groups, women can access resources and training that may enhance their agricultural practices and product quality, while access to land and decision-making power has the potential to further enhance their agency, enabling influence over household finances and community initiatives, ultimately leading to improved economic opportunities. Overall, the roles of women and producer organisations in agriculture may be essential for promoting sustainable and more resilient practices and improving livelihoods, with impacts that extend to entire communities and broader development goals. Producer organisations are important for supporting smallholder farmers by facilitating collaboration, improving access to resources and essential services, and enhancing market opportunities. These organisations may strengthen social capital within communities, promoting trust and empowering members, particularly women, to take on leadership roles. The networks formed within these groups foster collaboration and mutual support, which could enhance resilience against market fluctuations and environmental challenges.
- More evidence is needed to better understand what factors could make producers' organisations successful in encouraging the participation in VC development for nutrition outcomes.

Conclusions on Research Question 2 *“How can this contribution be improved by addressing constraints to unleash the pathways to deliver nutrition impact?”*

The main conclusion on this research question is that VC contribution to nutrition pathways should be inspired and guided by a comprehensive food systems approach, which would require a good understanding of the contexts at the national and subnational level. Interventions on single VCs may miss opportunities to increase dietary diversity even though increased consumption of a specific nutrient-dense food may contribute to improved diet quality. Combining nutrition-specific with nutrition-sensitive VCs interventions should be adopted as a preferred route to improving maternal and child nutrition status.

The areas where the contribution of agri-food VCs to nutrition pathways should be pursued can be summarised as follows:

- Small-scale producers in agriculture and fishing face interconnected challenges that hinder productivity and sustainability, including economic barriers like high costs and limited access to financial services, inadequate infrastructure, and gaps in technical knowledge that stifle innovation. Environmental vulnerabilities from climate change threaten the viability of crops and livestock, while weak governance and regulatory frameworks complicate the market landscape.
- Additional challenges include limited access to essential resources, competition from larger producers, health and food safety concerns affecting consumer trust, and labour issues characterised by high turnover and precarious working conditions.
- The susceptibility of these producers to external shocks highlights the urgent need for comprehensive strategies and a concerted effort from policymakers, stakeholders, and communities to foster resilience and sustainable practices.
- In order to increase VCs nutrition sensitiveness extra efforts are needed regarding improving nutrient content during processing and storage, improving food safety and reducing food loss and waste.
- The private sector, particularly national/local MSMEs, has a critical role to play in enabling availability of and access to healthy, affordable and sustainably produced nutritious food, highlighting the need for collaboration with public entities to address broader nutrition challenges. While such partnerships can lead to significant advancements, isolated interventions that focus solely on single crops or markets are inadequate.
- Accessible markets that provide nutritious foods at an affordable price are critically important.
- The complexities of food consumption and production highlight the need for nutrition-sensitive approaches that consider cultural perceptions, access, and food quality to address nutritional deficiencies and dietary diversity.
- Targeted interventions that consider local conditions, cultural contexts, and the roles of various stakeholders, particularly women, are necessary for promoting better nutrition through agri-food VCs.
- Established cultural habits often favour traditional staples over alternative, nutrient-rich options, while limited access to quality foods and safety concerns further exacerbate nutritional challenges.
- Enhancing consumer awareness of the nutritional benefits of diverse foods, improving accessibility to quality products, and supporting local producers are vital for promoting better health outcomes.
- Consumer behaviour is influenced by cultural beliefs, limited access to certain foods, and competition from agro-industrial products, which can hinder local consumption and market growth. Understanding the factors which influence consumers' choices, and then analysing the food environments in which consumers make their choices ("from fork to farm") would be an important starting point for designing interventions for making VC more nutrition-sensitive.

- Women in the agricultural sector face significant challenges, including underrepresentation in leadership, limited access to resources, and cultural discrimination, which hinder their potential and contributions to productivity.
- Enhancing women's access to financial support, land, and education is crucial for fostering gender equality and empowering them to advocate for their rights and participate in decision-making.
- Legal frameworks that recognise women's rights must be complemented by practical measures to dismantle traditional barriers, and investing in education and training tailored for women can improve their operational efficiency and leadership capabilities.
- Empowering women in agriculture is vital for sustainable development, requiring a collective commitment from governments, NGOs, and the private sector to create an inclusive environment for women as leaders and equal partners.
- Weak bargaining power, capacity challenges, and trust issues also affect smallholder farmers, limiting their ability to negotiate fair prices and adversely impacting income and sustainability.
- Strengthening producers' organisational structures, fostering trust, and enhancing representation in decision-making processes are essential for empowering smallholder farmers.

5. Recommendations

The main recommendations to increase nutrition sensitiveness of VC interventions can be summarised as follows:

- Address the interconnected challenges faced by small-scale producers that hinder their productivity and sustainability, including economic barriers such as high costs and limited access to financial services, inadequate infrastructure, and gaps in technical knowledge that stifle innovation. The vulnerability of these producers to external shocks underscores the urgent need for comprehensive strategies and coordinated efforts from policymakers, stakeholders, and communities to enhance resilience and promote sustainable practices. Strengthen the resilience of specific VC productions to climate change through targeted adaptation strategies. Improve governance systems within value chains and simplify regulatory frameworks that complicate the market landscape. Enhance small producers' access to essential resources while mitigating competition with large-scale producers. Finally, address labour issues within the sector, which are characterised by precarious working conditions and high turnover rates.
- Design interventions inspired and guided by a comprehensive food systems approach, which would require a good understanding of the contexts at the national and subnational level. Avoid interventions exclusively based on single VCs which may miss opportunities to increase dietary diversity even though increased consumption of a specific nutrient-dense food may contribute to improved diet quality. Combine nutrition-specific with nutrition-sensitive VCs interventions as a route to improving maternal and child nutrition status. Adopt nutrition-sensitive approaches that consider cultural perceptions, access, and food quality to address nutritional deficiencies and dietary diversity. Design targeted interventions that consider local conditions, cultural contexts, and the roles of various stakeholders, particularly women, which are necessary for promoting better nutrition.
- Make further efforts to preserve nutrient content during processing and storage, improve food safety and reduce food losses and waste.

- Create a favourable environment for the agri-food private sector, particularly national/local MSMEs, which have a critical role to play in enabling availability of and access to healthy, affordable and sustainably produced nutritious food, collaborating with public entities to address broader nutrition challenges.
- Address health and food safety concerns affecting consumer trust. Enhance consumer awareness of the nutritional benefits of diverse foods through social and behavioural change. Improve poor consumers accessibility to quality products at affordable prices. Strengthen access to markets that provide nutritious foods at an affordable price. Support local producers. Fill the knowledge gap about the factors which influence consumers' choices, and about the food environments in which consumers make their choices. Promote a new approach for designing interventions for making VC more nutrition-sensitive "from fork to farm".
- Promote women's empowerment in the agricultural sector by strengthening access to resources, fight cultural discrimination, and promote increased leadership. Governments, NGOs, and the private sector should commit to create an inclusive environment for women as leaders and equal partners. Complement legal frameworks that recognise women's rights by practical measures to dismantle traditional barriers and invest in education and training tailored for women can improve their operational efficiency and leadership capabilities.
- Strengthen producers' organisational structures, by fostering mutual trust, and enhancing representation in decision-making processes. Strengthen bargaining power, develop capacities to negotiate fair prices and adversely impacting income and sustainability.

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Annex 1: Countries and VCs

VC group	VC	Countries
Cash	Cocoa	Cameroon, Colombia, Ecuador, Nicaragua, Sao Tome and Principe
	Coffee	Angola, Ecuador, Honduras, Tanzania
	Cotton	Cameroon
	Palm Oil	Sierra Leone
	Vanilla	Papua New Guinea
Dairy/Meat	Beef	Eswatini, Zimbabwe
	Cheese	Colombia
	Egg	Zambia
	Milk	Burundi
Fish	Aquaculture	Cambodia, Zambia
	Coastal fisheries	Tanzania
	Fisheries	Comoros, Gambia (The), Mali
	Freshwater Aquaculture	Georgia
Fruit & Vegetables	Banana	Burundi, Dominican Republic
	Green Beans	Kenya
	Mango	Burkina Faso
	Mango & Lime	Guinea-Bissau
	Mango & pineapple	Dominican Republic
Pulses & nuts	Pineapple	Benin, Togo
	Cashew	Cote D'Ivoire, Mali, Sierra Leone
	Cowpea	Niger
Roots & grains	Groundnuts	Ghana, Niger
	Cassava	Cote D'Ivoire
	Maize	Nigeria, Zambia
	Rice	Mali
	Sorghum	Ghana

Annex 2: Theories and Frameworks

There are several theories around VC Analysis for Nutrition. The analysis was informed by Morgan et al., (2018) and Hawkes (2009) and used the frameworks provided by de la Pena et al. (2018) (Figures 1 & 2) and Gelli et al. (2015) (Figures 3 & 4) as a guide.

Specifically, the de la Pena et al. framework surmises three main pathways to describe how agri-food VCs may deliver nutrition impact, through:

- Own production pathway (including own consumption)
- Income pathway
- Market pathway

In addition, 'mediators' of nutrition impact such as women's empowerment and social capital were examined as part of the analysis.

However, this framework only considers smallholder farmers as the consumers and not non-farmer consumers such as those in urban and peri-urban settings and so ignores an important part of the community through which a NSVC would relate. For this analysis, to include the wider community, a food system approach was considered but still using the de la Pena et al. as well as the Gelli frameworks, but more broadly. These frameworks attribute entry points and typologies to different VC scenarios and makes it easier to understand where each VC fits and how it may become more nutrition-sensitive depending on how different supply and demand conditions may be met. Specifically, the de la Pena et al. framework proposes three possible strategies to make VCs more nutrition sensitive: 1. increase supply, 2. increase demand for safe and diverse food and, 3. add nutrition value/minimize nutrition losses along the VC.

The Gelli framework was interesting and yet whilst most of the VCs analysed were considered high demand this did not mean that demand at consumer level was adequately captured and that interventions considered to improve demand e.g., specifically promoting consumption by, social marketing, nutrition education, social and behaviour change communication and recipe development, had been implemented. This information was lacking. In which case this framework was considered less useful.

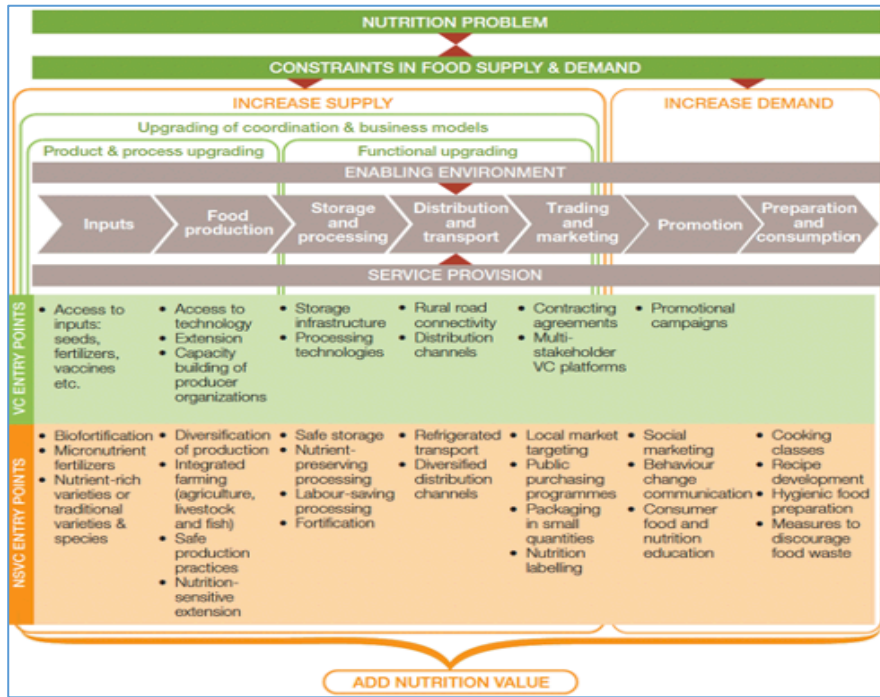


Figure 1: The NSVC framework: Strategies and entry points (Source: De la Pena, Garret and Gelli, 2018)

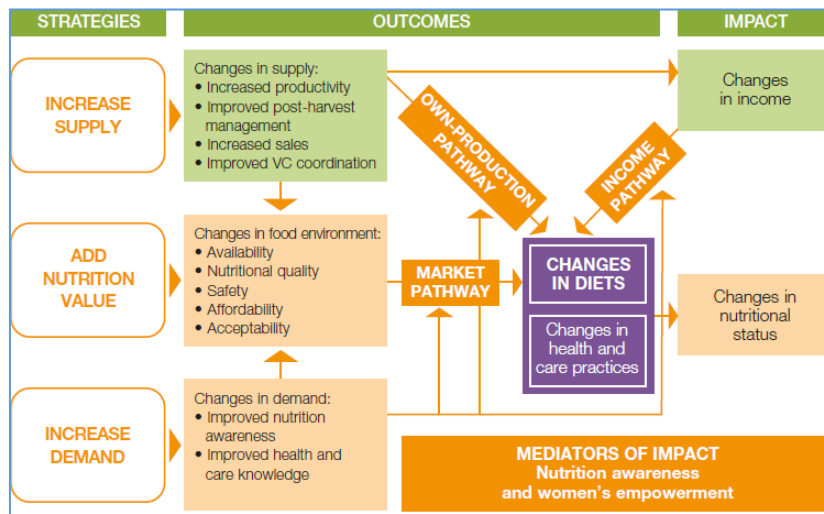


Figure 2 : Analytical framework for analysing pathways and potential of agri-food VCs to deliver nutrition impacts (Source: De la Pena, Garrett and Gelli, 2018).

Typology	Objectives	Target groups	Interventions
C, D	Promoting consumption of nutritious food	Consumers, producers	Nutrition and health messaging Product labeling Nutrition education
B, D	Enhancing supply of nutritious food	Producers	Income transfer, food assistance Training on production, postharvest, and marketing practices Access to technology, inputs, and credit Organising producer groups Expansion of market outlets Nutrition and health messaging
A	Increasing pro-nutrition added-value	Processors, producers, consumers	Food safety, detoxification Fortification, reformulation, combination Reducing costs Product labeling Nutrition and health messaging

Figure 4 : Examples of value chains for nutrition objectives and interventions within the different typologies (source : Gelli et al., 2015)

Annex 3: Templates for evidence synthesis from VCA4D reports

VC/drivers	Nutrition pathways			Contribution to nutrition	
	Own production	Market	Income	Current	Potential
• Changes in supply					
Availability of					
- Land availability					
- Water					
Land and Soil Degradation					
Climate change (e.g., flooding & drought)					
Access to inputs to support productivity e.g., seeds, tools, technical assistance					
Post-harvest losses					
Technological Innovations					
- Improved and new varieties (e.g., drought resistant)					
- Precision Farming and Digitalization					
Diversifying the crop production system					
- Sustainable Intensification					
- Conservation Agriculture					
Access to credit e.g., microfinance					
Distribution/trade: Access to					
• transport					
• training					
• equipment					
Policies facilitating/mitigating trade					
VC coordination/organisation (linkages across the VC)					
Governance					
• Changes in nutritional value					
Food availability, affordability and acceptability					
Food loss or waste					
Biofortification/fortification					
Cyanide or aflatoxin etc					
Growing concerns for food safety					
Nutrient-preserving storage and transport					
Innovation (SMS)					
Nutrition labelling					
• Changes in demand					
• Consumer behaviours					
- Improved nutrition awareness (growing attention paid to diet)					

- Improved health and care knowledge					
• Mediators					
Gender equality					
Social capital					

Figure 1: Original template developed for evidence synthesis

Food system area	Intervention strategies	
Food Supply Chain: Production	Nutrition sensitive agriculture for improved dietary diversity	<i>Promotion of vegetable and fruit production</i>
		<i>Promotion of (Small) livestock and Fisheries</i>
	Household production	<i>Promotion of traditional food production</i>
		<i>Organic production</i>
Biofortified food production	<i>Vit A (maize, cassava, sweet potato)</i>	
		<i>Iron (beans)</i>
		<i>Zinc (rice)</i>
Food Supply Chain: Storage & trade Packaging & processing Retail & Marketing	Setting/reviewing Food standards	<i>Regulations for reducing salt and sugar</i>
		<i>Regulations for reducing fat, especially trans-fats</i>
		<i>Regulations of food safety (in processing, transport, storage)</i>
	Fortification	<i>Iron (bread), Vitamin A (oil)</i>
	Taxation	<i>Sugar (especially soft drinks)</i>
	Setting/reviewing food labelling	<i>Inclusion 'new', processed foods, focus local language</i>
	Update Food Composition Tables	<i>Inclusion 'new', processed foods</i>
		<i>Good Logo Campaign</i>
Food environment	Availability	<i>Food subsidies</i>
	Affordability	<i>School feeding programmes</i>
	Acceptability	<i>School Gardening</i>
	Information & guidelines	<i>School environments</i>
		<i>Food-Based Dietary Guidelines</i>
	Policy conditions	
Consumer health & behaviour	Choice where & what food to acquire	<i>General public</i>
		<i>Workplace</i>
		<i>Private sector</i>
		<i>Households</i>
		<i>Community based</i>
	Food handling	
Awareness of impact of choices		

Figure 2: Final template developed for evidence synthesis

(from <https://www.ifad.org/en/web/knowledge/-/addressing-overweight-and-obesity-in-lmics-in-rural-development-and-food-systems-country-mapping>)

Annex 4: Result tables

Fisheries, Coastal Fisheries and Aquaculture

Table 1 Supply Chain benefits and barriers for fisheries, coastal fisheries and aquaculture

Current benefits
<p>Diversification of food production (<i>Rice-Fish aquaculture in Cambodia</i>); important source of animal sourced proteins (<i>Aquaculture in Zambia and Fisheries Tanzania</i>); Self-consumption for fisher folks (<i>Fisheries in Comoros</i>).</p> <p>Key contributor to economic growth, employment and finance (<i>Fisheries in Gambia</i>); important activity where most vulnerable populations can find a diversification of income-generating activities, ensuring a form of resilience (<i>Fisheries in Mali</i>); significant contribution to the local economy, providing direct and indirect employment and income for fishermen, traders (<i>Fisheries in Comoros</i>).</p>
Barriers
<p>High cost of fishing materials, inadequate size of fishing canoes, and lack of technical know-how among Gambian fishers prevent their participation in profitable fisheries activities (e.g. sole, cuttlefish); high input costs, due to importation of feed and seed (<i>Aquaculture in Zambia and Cambodia</i>).</p> <p>Limited access to finance of smallholder farmers, fisher folks, and young entrepreneurs (<i>Fisheries in Gambia, Aquaculture in Zambia and Cambodia</i>); high economic risks and limited profitability due to market price fluctuations, also due to large volumes of cheap imported low-quality fish from neighbouring countries (<i>Aquaculture in Cambodia</i>); imports of frozen freshwater or marine fish have increased over recent decades due to needs of a growing population (<i>Fisheries in Mali</i>)</p> <p>Governance issues affect control and management of fish landing and processing facilities (<i>Fisheries in Gambia</i>); lack of direct government subsidies, and small-scale fishers pay no licenses or permits; long and complicated licensing processes for medium/ large-scale farms (<i>Aquaculture in Zambia</i>); weak VC structure, no national umbrella structure or organisation (<i>Fisheries in Mali</i>); a major obstacle to the development of the VC concerns rights relating to access to water, fishing and land (<i>Fisheries in Mali</i>).</p> <p>Formal support service capacity to fishers is generally weak (<i>Fisheries in Tanzania and Zanzibar</i>); limited access to information, training, markets, especially for women that are cage producers (<i>Aquaculture in Cambodia</i>).</p> <p>Lack of robust animal health and food safety control measures. Non-existent professional services to prevent, diagnose and treat disease (<i>Aquaculture in Cambodia and Zambia</i>); poor hygiene practices and standards at trade and processing levels (<i>Aquaculture in Cambodia</i>).</p> <p>Issues of water availability due to drought (<i>Aquaculture in Cambodia</i>); water pollution due to use of agricultural chemicals and pesticides (<i>Aquaculture in Zambia and Cambodia</i>); decreasing production due to overfishing and degradation of stock health and biodiversity (<i>Fisheries in Gambia and Comoros</i>); high use of fossil fuels for fishing operations and combustion of firewood and cooking oil for processing activities (<i>Fisheries in Gambia</i>).</p> <p>Exclusion of smallholder farmers due to larger-scale operations continuing to grow and become the dominant players (<i>Aquaculture Zambia</i>).</p> <p>Fishermen are discredited in terms of access to agricultural land (<i>Fisheries in Mali</i>).</p> <p>Outdated engines and inefficiency of the machinery and infrastructure used, e.g. outdated engines, braziers, poor cold chain system (<i>Fisheries in Gambia</i>); attempts to install cold rooms have not yielded expected results due to operational and management difficulties (<i>Fisheries in Comoros</i>); weak infrastructure, only an obsolete ice factory, no landing ports, very precarious fish smoking</p>

conditions (*Fisheries in Mali*); lack of infrastructure, investment, and formalization, alongside environmental and social sustainability issues (*Fisheries in Comoros*).

Table 2 Food Environment benefits and barriers for fisheries, coastal fisheries and aquaculture

Current benefits
<p>Important activity where most vulnerable populations can find a source of income and food, acting as a FNS safety-net (<i>Fisheries in Mali</i>).</p> <p>Increase in food availability, attributed to improving rice yields, price stability, and the consistent presence of fish in local markets, including large quantity imported fish (<i>Aquaculture in Cambodia</i>).</p> <p>Smallholders farmed fish important source of nutrition to rural people, the price of fresh fish has become the lowest among animal sourced proteins, making it accessible to resource-poor (<i>Aquaculture in Zambia</i>)</p> <p>In coastal communities, fisheries make a direct and indirect income contribution to FNS; predictable supply pattern enabling fishers to supply fish consistently (<i>Fisheries in Tanzania and Zanzibar</i>).</p> <p>In Zanzibar fish is frequently consumed, 4.6 times/week (<i>Fisheries in Tanzania and Zanzibar</i>).</p> <p>Certain municipalities set fish prices to protect consumers at the expense of fishers' income (<i>Fisheries in Comoros</i>).</p>
Barriers
<p>Farmed fish from larger farms is cost-prohibitive for rural people/urban poor (<i>Aquaculture in Zambia</i>); price increase in local markets due to decrease of catches depending on the seasons (<i>Fisheries in Gambia</i>); possible impacts on staple food prices due to high demand for feed and negative effect on FNS among the rural and urban poor (<i>Aquaculture in Zambia</i>); increased dependence on purchased food increases vulnerability to variability in fish stocks and food prices (<i>Fisheries in Tanzania and Zanzibar</i>); risk of a drop in fishermen's income and their food security in places linked to the intense exploitation of fish stocks (<i>Fisheries in Mali</i>); market supply of local fish products varies significantly between islands (<i>Fisheries in Comoros</i>); even though production and incomes are increasing in rural areas, seasonal hunger still exists (<i>Aquaculture in Zambia</i>).</p> <p>Low-price imported fish of poor quality (<i>Aquaculture in Zambia and Cambodia</i>).</p> <p>High dependence on imported consumables with rising costs (lower quality) - fish plays a critical role in food security (<i>Fisheries in Comoros</i>).</p> <p>Potential threat to food security from the establishment of additional Fishmeal Plants, which can divert fish from local consumption to industrial use during periods of low fish production (<i>Fisheries in Gambia</i>).</p>

Table 3 Consumers Behaviour benefits and barriers for fisheries, coastal fisheries and aquaculture

Current benefits
<p>Some social media health and nutrition campaigns (general) and fish consumption increased over past 10 years (<i>Aquaculture in Cambodia</i>).</p>
Barriers
<p>Some restrictions of certain foods during pregnancy (<i>Aquaculture in Cambodia</i>); lack of coordinated promotion campaign (<i>Fisheries in Tanzania and Zanzibar</i>); majority feels that eating fish such as anchovy is a sign of being a loafer (<i>Fisheries in Tanzania and Zanzibar</i>).</p>

Table 4 Social mediators benefits and barriers for fisheries, coastal fisheries and aquaculture

Current benefits

Women participate extensively, mainly in small-scale semi-intensive and cage farms (Aquaculture in Cambodia); women are present along the VC chain; important positions of women in organisations at landing and processing sites (Fisheries in Gambia); strong involvement of women in processing and marketing; low discrimination against women in VC activities, strong organisation of fishmongers (Fisheries in Mali); women participate in various levels of the fishing VC (shoreline fishing, processing, marketing); women able to make decisions and are autonomous in their work; are active members of village fisher associations and recently established processing cooperatives and form own organisations; hold leadership positions in women-only organisations (Fisheries in Comoros); high and increasing women's involvement in coastal fisheries postharvest; some women economically empowered through fisheries and with leadership roles (Fisheries in Tanzania and Zanzibar).

In rural settings, high levels of social capital exist; knowledge in rural areas is shared mostly through "learning by doing"; women's groups, clubs, and farmer associations and cooperatives exist to help organize people, pool resources or labour, build social cohesion, access services; women are very active in farmers associations and cooperatives and as leaders (Aquaculture in Zambia); coastal fisheries actors belong to a range of formal and informal organisations and are embedded in a complex web of social relations (Fisheries in Tanzania and Zanzibar); the social capital of the VC is good; relies on fishermen and dealer organisations that promote social cohesion; they play an important role in the circulation of information and in establishing a climate of trust, and contribute significantly to social participation; primary level organisations, associations or cooperatives, present in almost all fishing villages (Fisheries in Comoros).

Barriers

Women are underrepresented in leadership positions and decision-making and work longer hours than men (Aquaculture in Cambodia); financial constraints for women and a highly gendered division of labour highlight gender inequality issues; increasingly limited access to the fish for women processors due to the competition with fishmeal factories (Fisheries in Gambia); women small scale traders have limited capital and negotiating power in relation to large scale traders who are mostly male but have not organised to overcome this (Aquaculture in Cambodia); cooperatives and collectives are not a common form of enterprise among women fish processors (Aquaculture in Cambodia); women comprise only 8% of the workforce and there is gender discrimination on larger fish farms (Aquaculture in Zambia); limited access to assets for women in rural areas (Aquaculture in Zambia); poor contribution of women to economic decision-making (except for market gardening) due to the traditional structure of society (Fisheries in Mali); the marketing of fish, which traditionally was an activity reserved for women, is seeing the arrival of men in particular in the imported frozen fish sub-chain (Fisheries in Mali); presence of a few female fishers, generally near the shore with traps (Fisheries in Mali).

Trust, reciprocity, solidarity, and group cohesion not as vibrant as in other VCs; producers' groups may be a good channel for farmers to share knowledge and learn together, but not as a means of production or fish farming as a business; limited role for youth (Aquaculture in Zambia); many fishers do not feel well represented (Fisheries in Tanzania and Zanzibar); negotiating capacities of professional organisations within the fisheries VC are weak; actors in the VC face challenges in accessing information, impacting their efficiency (Fisheries in Gambia); low representation, organisation and education of fishermen nationally; uncommon supply cooperatives at village and camp levels (Fisheries in Mali); fishers' organisations are weak and with limited negotiation capacity; neither the most impoverished fishers nor those operating 9-meter boats typically join these organisations (Fisheries in Comoros).

Conflicts between seasonal migrants and local fishermen; calling into question of the right to fish by other users of the water bodies, in most hydro-agricultural systems and in certain conflict zones (Fisheries in Mali).

Traditional fishing societies are in a crisis because they are poorly regarded despite the knowledge they hold of the environment, species and fishing techniques (Fisheries in Mali).

Meat & Dairy

Includes Beef in eSwatini and in Zimbabwe, Cheese in Colombia, Egg in Zambia and Milk in Burundi.

Table 5 Supply Chain benefits and barriers for meat and dairy

<p>Current benefits</p> <p>Improved cattle breeds through genetic selection (Beef in eSwatini).</p> <p>Better health and veterinary services, including to smallholders, to reduce livestock diseases and mortality rates (Beef in eSwatini).</p> <p>Buffering effect of livestock sales during droughts (Beef in eSwatini and Zimbabwe).</p> <p>Cattle provide draft power, valuable manure, milk and contribute to increased farm production, including staple crops like maize.</p> <p>Manure used as fertilizer, indirectly contributing to food security and nutrition by increasing the efficiency and yield of other agricultural products (Beef in eSwatini and Zimbabwe, Milk in Burundi)</p> <p>High quality of the milk in terms of its fat and total solids content allows the development of cheese production (Cheese in Colombia)</p> <p>Milk producers use whey for rearing pigs (Cheese in Colombia).</p> <p>Eggs production and distribution profitable at all levels so the VC offers good investment opportunities (Egg in Zambia).</p> <p>The VC generates many jobs for the marketing and processing of milk in rural and urban areas (Milk in Burundi).</p>
<p>Barriers</p> <p>Limited available land, water resources and animal feed (Beef in eSwatini).</p> <p>Contractual agreements with delayed payments (Beef in eSwatini); difficulty in soya feed farmers repaying inputs credit is putting egg VC scalability and sustainability at risk (Egg in Zambia); VC costs and risks, coordination among stakeholders, current contractual agreements for better predictability and security, level of investment in infrastructure to streamline logistics (Beef in eSwatini).</p> <p>Animal disease is considered a significant risk (Beef in eSwatini and Zimbabwe).</p> <p>Need for improvement in slaughtering and processing practices to meet both domestic and international consumers' expectations for quality and safety (Beef in eSwatini); many small butchers are not able to meet the basic requirements in terms of hygiene and processing standards for marketing beyond the national borders (Beef in eSwatini); poor hygienic – sanitary conditions; informality of cheese VC; poor transport conditions which hinder traceability, as milk from producers is mixed during collection in plastic cans, despite efforts to improve quality through accessible practices such as the use of metal milk cans (Cheese in Colombia); milk quality in the informal VC is uncertain; improvement in milk collection and cooling needed to maintain milk quality (Milk in Burundi).</p> <p>Absence of improved breeding stock combined with increase communal grazing has reduced the size and quality of animals over time (Beef in Zimbabwe); the promotion of improved breeds in the process of rebuilding the herd ultimately promotes the marginalisation of local breeds and therefore the loss of animal biodiversity (Milk in Burundi).</p>

Climate change (increase of temperature, flood and drought) is a significant risk (Beef in eSwatini and Zimbabwe); unfavourable impact of the expansion of the agricultural frontier and deforestation on the population and biodiversity (Cheese in Colombia); intensification of production may increase environmental impacts (Milk in Burundi).

Insufficient coverage of extension services and access to technical information and assistance (Beef in Zimbabwe, Cheese in Colombia, Egg in Zambia, Milk in Burundi); inadequate access to capital (Beef in Zimbabwe, Egg in Zambia); limited access to markets (Beef in Zimbabwe).

Farmers selling cattle are facing high formal and informal levies, duties and rents; and endemic stock theft (Beef in Zimbabwe).

Public livestock purchases at high prices distort domestic beef economy (Beef in Zimbabwe).

Low productivity of livestock systems (Cheese in Colombia, Milk in Burundi); need to improve land management, in animal husbandry practices, forage systems, and veterinary care (Milk in Burundi).

Informality in land tenure and use (Cheese in Colombia); lack of tenure rights, and unsecure access to grazing areas and water points (Beef in Zimbabwe).

Upgrade of machinery e.g., collective cooling tanks fallen into disuse due to costs, management difficulties, and public order issues (Cheese in Colombia); need of training on sustainable labelling, farm management, machinery maintenance, manure management, fertilization and pesticide application, waste management and recycling (Egg in Zambia).

Inadequate infrastructure development, including roads, transportation and storage facilities, to enhance the distribution of eggs and access to markets (Egg in Zambia).

Volatility in feed price affects farmer's demand and egg production (Egg in Zambia).

Table 6 Food Environment benefits and barriers for meat and dairy

Current benefits
Growing demand of local consumers and opportunities for local producers to increase supply and more effectively meet domestic needs (Beef in eSwatini).
Availability and affordability of eggs in urban areas improving access to nutritious food; egg consumption increasing in low-income, high-density urban and peri-urban communities (Egg in Zambia).
Efforts to enhance milk production and distribution, which can contribute to improving the availability and access to milk in urban areas (Milk in Burundi).
Barriers
Potential risks of seasonal rural food insecurity associated with out-grower cash cropping arrangements for soya (Egg in Zambia).
Demand outweighs supply, limited grassland so fewer cows and highly dependent on lower-grade beef imports from SA and Mozambique (Beef in eSwatini).
Limited purchasing power of consumers (Milk in Burundi).

Table 7 Consumers Behaviour benefits and barriers for meat and dairy

Current benefits
Growth in consumption of solid milk products (Cheese in Colombia).
Feedlot feeding can positively impact the taste qualities of the beef from the consumer's perspective (Beef in eSwatini).

<p>The convenience and affordability of eggs, making them more accessible to lower-income households; marketing strategies of most egg producers in Zambia target consumers in low-income communities.</p>
<p>Barriers</p>
<p>Rural consumption of eggs is low, even in households participating in chicken rearing projects due to preference to produce chickens (Egg in Zambia).</p> <p>Small-scale butcheries are dispersed every 5km. Closer butcheries would provide more benefit and convenience to the consumers: proximity and accessibility with reduced travel time and cost for food shopping; freshness and quality, food safety and transparency; culinary diversity (Beef in eSwatini).</p> <p>Consumers' concerns regarding the quality and safety of beef, linked to unhygienic (home) slaughtering and processing practices (Beef in eSwatini).</p>

Table 8 Social mediators benefits and barriers for meat and dairy

<p>Current benefits</p>
<p>Indirect link between cattle ownership and women's empowerment through improved food and nutrition security within households (Beef in eSwatini); active participation of women in food engineering, management, and accounting within the processing industry (Cheese in Colombia); women in many parts of rural Zambia have access to land, livestock, and farming equipment, especially in areas with matrilineal kinship systems; increased opportunities for inclusion of women through more widespread uptake of the "aggregator" model (egg in Zambia).</p> <p>Cattle ownership gives status and enhances resilience (Beef in Zimbabwe).</p> <p>Community-based organisations contribute to supporting farmers' access to draft power and credit (Beef in Zimbabwe); social capital in Burundi encompasses networks of relationships among individuals, fostering effective functioning through interpersonal connections, shared identity, trust, and cooperation (Milk in Burundi).</p> <p>Small-scale farmers rely on cooperative associations and emerging relationships for trust-based access to inputs and support; rural Zambia retains social capital for organizing agriculture, while knowledge is informally shared within communities (Egg in Zambia); governance of the industrial sub-system relies on strong relationships and interdependence between farmers and downstream actors, with price negotiations taking place at the cooperative level and through contracts defining prices and quality standards (Milk in Burundi).</p> <p>The cooperative movement in Burundi has been revitalised through new legislation, cooperatives play a crucial role in rural development, especially in the agro-sylvo-pastoral sector, and promote the dairy industry through provincial platforms (Milk in Burundi).</p>
<p>Barriers</p>
<p>Risks of women's exclusion from: VC roles beyond cattle production on Swazi National Land ; opportunities for improved cattle production and reduced drudgery; participation in household and public decision-making (Beef in eSwatini).</p> <p>Low level of farmers organisation in cattle production (Beef in eSwatini and Zimbabwe)</p> <p>Low social capital and minor involvement and support of women in the VC (Beef in Zimbabwe).</p> <p>Gender and generational inequities (Cheese in Colombia).</p> <p>Significant gender gap in terms of workload, decision-making, leadership, and empowerment (Cheese in Colombia).</p>

In rural households, traditional gender norms often dictate that men are responsible for making key decisions related to crop production and marketing of grain (Egg in Zambia).

Multiple dimensions of gender inequality in Rural Areas; women are underrepresented in the VC, particularly in terms of land rights (Milk in Burundi).

Lack of an organisation of industrial actors, as well as a smaller organisation of marketers of chopped cheese and salad at the departmental level (Cheese in Colombia).

Low bargaining power of farmers in the sale of products (Cheese in Colombia).

Links of some actors with illicit activities (Cheese in Colombia).

Limited inter-segment social capital exists in the Egg VC, with weak trust between rural households and key grain sector actors (Egg in Zambia).

Longer-term trust-building is challenging with egg traders, but feasible with institutions; secrecy among larger egg farmers limits information sharing (Egg in Zambia).

Limited trust of farmers in cooperative managers and milk buyers; lack of reliable means of disseminating information; limited capacity of dairy cooperatives (Milk in Burundi).

Cash Crops

It includes Coffee in Angola, Ecuador, Honduras, and Tanzania. Cocoa in Papua New Guinea, Cameroon, Ecuador, Nicaragua, Sao Tomé e Príncipe, and Colombia. Cotton in Cameroon and Ethiopia, Palm Oil in Sierra Leone, and Vanilla in Papua New Guinea.

Table 9 Supply Chain benefits and barriers for cash crops

Current benefits
<p>Diversification of production; agroforestry systems and diversified farming practices cultivation is integrated with a variety of food and other plant species, e.g. beans, maize, vegetables, and medicinal (Coffee in Ethiopia, Ecuador, Honduras, Tanzania, Cocoa in Ecuador, Nicaragua, Sao Tomé and Príncipe, Colombia); for the smaller vanilla producers, all their vanilla gardens were intercropped with food crops, for the medium scale vanilla producers over 60% of vanilla gardens were intercropped with food crops and over 30% mixed food and cash and for the larger vanilla producer over 50% of vanilla gardens were intercropped with food crops and almost 40% with mixed food and cash crops such as betel nut and cocoa (Vanilla in PNG).</p>
<p>Differentiated coffee sub-chain employs many workers due to the care that this type of coffee requires in all processes, from planting and maintenance, to harvest and post-harvest; speciality coffees attracting younger workers (Coffee in Ecuador); production, processing and export actors favours job creation at all levels of the VC (Cocoa in Sao Tomé and Príncipe).</p>
<p>Honduras has a financial program called the 'Coffee Trust,' where the Instituto Hondureno del Café (IHCAFE) holds back \$9 from producers for every quintal sold and exported, providing a bank guarantee for credit access, with unused funds returned to the producer upon coffee sale reporting by exporters (Coffee in Honduras); cocoa is the main exported product of the country (Cocoa in Sao Tomé and Príncipe)</p>
<p>National institute for coffee distributes new plants (seedlings) of varieties resistant to pests and provides technical assistance (Coffee in Ethiopia); use of improved and new coffee varieties, such as disease-resistant and drought-tolerant types; seedlings for improved varieties have become available (Coffee in Tanzania); some training in Good Agricultural Practices (Coffee in Tanzania); strategies such as promoting environmental mitigating measures, including soil conservation and the availability of irrigation systems, are intended to maintain soil fertility and tackle water scarcity (Cocoa in Sao Tomé and Príncipe); some producers use eco-pulping methods which reduces environmental impacts and potentially decrease of post-harvest losses (Coffee in Tanzania); significant work is being done to tackle downturn in cocoa production and quality following devastating cocoa pod borer) infestation (Cocoa in PNG); to reduce bioaccumulation or transfer of</p>

Cd to cocoa plants, treatments with agricultural lime and biochar have been effective, significantly controlling soil pH and favouring Cd retention in the soil while minimizing its transfer to the plant (Cocoa in Colombia).

Extension services and support developed by the biggest exporters (Cocoa in PNG); producers with better access to *fermentaries*, tend to have increased yield and improved quality of cocoa beans (Cocoa in PNG); middle and bigger producers have better organized transportation and fermentation process (Cocoa in Cameroon).

Fair Trade and Rainforest Alliance certification available - strategy to improve the quality and marketability of cocoa products, with a focus on targeting niche markets (abroad) that demand specific flavours and qualities; higher price for certified beans (Cocoa in PNG); there is pressure from European market - promoting cacao zero deforestation (Cocoa in Cameroon); organic certification (Cocoa in Ecuador); premium prices are paid to those farmers organised under the fairtrade label or those producing organic chocolate (Cocoa in Sao Tomé and Príncipe); promising initiatives exist to strengthen trust, utilizing certification (organic and fair trade) and/or contracts among stakeholders (Coffee in Honduras); improved incomes in the certified and organic coffee (Coffee in Honduras, Ecuador, Tanzania); certified producers, especially those organised into small groups, are less vulnerable to price volatility compared to the more conventional producers (Cocoa in Sao Tomé and Príncipe); a Participatory Guarantee System is an alternative to Third Party Certification, focusing on multi-stakeholder participation, transparency, and trust, emphasizing good governance, gender equity, and sustainability at a local level (Cocoa in Ecuador).

Touristic projects linked to cocoa increase commercial opportunities (Cocoa in Sao Tomé and Príncipe).

Production has been on the rise for the past several years without negative indications for food security at the farms concerned; encouragement of soybean production within the cotton zones - diversifying the agricultural landscape and improving nutritional outcomes by adding variety to the crops produced; high-yield cotton varieties available; credit system for inputs facilitates access to necessary resources for cotton cultivation; inputs are distributed to producers on credit by the producer groups (Cotton in Cameroon).

Strategies for managing costs and risks within the VC include distribution and management of inputs and equipment on credit and marketing of cotton grains (Cotton in Cameroon).

Emphasis on improving the quality of cottonseed oil and its nutritional advantage; the focus is on the intrinsic nutritional quality of cottonseed oil produced by the Société de Développement du Coton du Cameroun (SDCC) as superior to other local oils; cotton VC includes production of byproducts, such as oilcake and animal feed (Cotton in Cameroon).

Areas of PNG are agro-ecologically ideal for vanilla production, very high value to weight ratio, high returns per hectare and per workday when prices high (Vanilla in PNG).

Barriers

Only way of survival for small producers is access to subsidies (Coffee in Ethiopia); development of incentives (direct contracting between exporters and producers, certification and traceability, financial promotion) to improve the quality and net value of coffee (Coffee in Honduras); need for economic incentives for increasing yields and for farmers' to attend trainings on good agricultural practices (Coffee in Tanzania); advocating for favourable policies like subsidies or tax incentives for coffee production and export (Coffee in Tanzania); investment needed in training and technical skills development, particularly in phytosanitary control and environmental management, along with developing social competencies in rural areas (Cocoa in Sao Tomé and Príncipe); the average size of cocoa production units does not allow the activity to generate sufficient income for producers (Cocoa in Colombia); weak governance (Coffee in Ethiopia and Ecuador) and infrastructure (Coffee in Ethiopia); confusing legal framework for associations and lack of coordination between national actions, international cooperation, and public policy directives (Coffee in Ecuador); poor regulatory environments and infrastructure such as irrigation systems

(Coffee in Tanzania); the coordination of public action is weak, the use of public funds is considered ineffective, and this support reaches only a small number of smallholders (Cocoa in Cameroon); lack of continuity and instability in public policy support for the VC from the State (Cocoa in Ecuador); services provided by the state (technical assistance, training, etc.) are weak (Cocoa in Sao Tomé and Príncipe); need for strategies for financial and policy support to improve input cost subsidies and credit access (Cocoa in Colombia).

The level of investment in public research is insufficient (Cocoa in Ecuador); need for developing tailored research and technology transfer (Cocoa in Colombia); weak research (Cotton in Ethiopia).

High volatility of producer prices (Coffee in Honduras and Ecuador), which mainly affects conventional coffees (Coffee in Ecuador); market and prices fluctuations do not favour investments towards coffee upgrading (Coffee in Tanzania); farmers have no influence over the price they can get at auction, beside the ability to differentiate between better or poorer quality coffee (Coffee in Tanzania); smuggling of cocoa with Ecuador (not recorded but is evident) generates unexpected product flows and distorts production and quality indicators in both territories, which can hinder the orientation of strategies and the making of sectoral decisions in line with reality (Cocoa in Colombia); country imports chocolate products, lack of domestic processing; cocoa is consumed at the national level after its second transformation artisanal and industrial (Cocoa in Nicaragua); low volumes of industrial activities given the lack of raw material, low quality of production for all actors and a weak commercial network (Coffee in Ethiopia); insufficient domestic production and large amount of raw material for soluble and freeze-dried coffee imported from Vietnam, Brazil, and Honduras; industry dependence on imports (Coffee in Ecuador).

Inadequate access to inputs, credit, and technical support specially for small-scale farmers (Coffee in Ecuador and Tanzania, Cocoa in Ecuador and Nicaragua); land titling needed, to improve access to bank credit and technical assistance (Coffee in Honduras); issues related to centralised auction systems, delayed payments, and limited access to rural finance and input provision (Coffee in Tanzania); access to credit (Cocoa in Sao Tomé and Príncipe), very low access of the farmers to information and agriculture extension services (Palm Oil in Sierra Leone); lack of individual access to finance for trading and access to global market information (Vanilla in PNG).

Poor crop management and little control over use of phytosanitary products and pesticides due to lack of disease monitoring and knowledge (Coffee in Ecuador); low productivity of farmers (Coffee in Ethiopia and Ecuador); decline in production due to declines in international coffee prices, low levels of productivity, the dollarisation of the economy that increased the cost of labour (Coffee in Ecuador); low farm productivity, coffee quality, and price; intensification in the management of natural and human resources is needed, both in primary production (pruning management, fertilization), as well as during the processing (drying), post-harvest management and throughout marketing (Coffee in Honduras); low yields and also decreasing over time, possibly due to relatively old trees, limited fertilizer applications and losses due to coffee diseases (Coffee in Tanzania); productivity in decline due to poor management, land reforms, non-mechanisation, lack of water (in some areas) and ineffective phytosanitary measures, lack of labour and supervision, degradation or even disappearance of transport and irrigation, as well as the aging of the orchards (Cocoa in Sao Tomé and Príncipe); absence of technology for cocoa production adapted to the territories and; insufficient coverage of technical assistance and training (Cocoa in Colombia); the vanilla VC is underperforming but current high prices are supporting viability particularly at the producer level - Vanilla is a high-risk and high value business in PNG (Vanilla in PNG).

Recognition of organic management throughout the chain is needed, with improvements in traceability and reduction of waste; investment in technology and knowledge of biodigesters needed (Coffee in Honduras); importance of upgrading processing facilities, such as adopting eco-pulping methods (Coffee in Tanzania); small producers need better transportation and processing (fermentation), enhancing fermentation and drying techniques can significantly reduce losses and improve the quality of cocoa beans; poor transportation and need for vehicles with greater capacity for transporting cocoa beans (Cocoa in Cameroon); lack of productive and logistical infrastructure and of sectoral information for strategic decision-making (Cocoa in Colombia).

Rising temperatures and uncertain rainfall patterns related to climate change threaten the coffee development (Coffee in Tanzania); water scarcity in some areas (Cocoa in Sao Tomé and Príncipe); risk of deforestation, and area expansion of monocrop systems (Cocoa in PNG); deforestation is a threat – and indirectly climate change (Cocoa in Cameroon); growing influence of "commodification" (e.g., commercialization) of production in the Amazon region (deforestation, loss of biodiversity), due to the activity of large transnationals present in the country (Cocoa in Ecuador); potential heavy metal presence in soil (Cocoa in Colombia); climate change could affect agro-ecology and increase disease risk, vanilla is not sufficiently recognised by central government to be a valuable contributor to the national economy, there has been a major increase in the area of land planted to vanilla over last 20 years (over 98% in East Sepik) and it is done mainly at expense of primary/secondary forest (Vanilla in PNG).

Certification has recently emerged through Fair Trade and Rainforest Alliance standards, but it is only reaching a small minority of producers and fermentaries because of the lack of organisational capacity at producers' level (Cocoa in PNG); difficulties in implementing certification schemes and traceability systems (Cocoa in Cameroon); The greatest risk faced by the cocoa value is the proliferation of illicit crop cultivation.

Poor quality of the beans coupled with high logistical costs and difficulties (Cocoa in PNG); The quality of Putumayo cocoa receives low market ratings, and Tumaco's mostly does not meet the standards of specialized markets due to post-harvest management (Cocoa in Colombia).

Coffee production workloads affect childcare and nutrition, indicating the need for holistic approaches to farming that consider family welfare (Coffee in Tanzania); whilst employment opportunities are available there is a lack of labour (Cocoa in Sao Tomé and Príncipe).

The VC decision makers are facing challenges linked to demographic growth, soil and ecosystems degradation, poverty, long-term intensification in a semi-arid region, and the coordination of different public and cooperation actions (Cotton in Cameroon).

Table 10 Food Environment benefits and barriers for cash crops

Current benefits
<p>Coffee income facilitates access to credit; enables savings and acts as a safety net against food insecurity and health care needs (Coffee in Tanzania); population in areas in which cocoa is a common cash crop are in a better position to withstand shock to food production and less at risk of long term food insecurity because of the cash flow derived from cocoa (Cocoa in PNG); cocoa contributes to the food security of the population by the income it brings as well as by the associated crops, banana, jackfruit, etc. (Cocoa in Sao Tomé and Príncipe).</p> <p>Some local varieties considered as high quality (Coffee in Angola).</p> <p>Despite their low purchasing power, Nicaraguan consumers can afford low-priced chocolates (Coffee in Nicaragua).</p> <p>Producers engaging in small-scale family farming combine cocoa with other subsistence and commercial activities on their land, forming agroforestry systems adapted to local agroecological conditions (Cocoa in Colombia).</p>
Barriers
<p>Difficulty accessing food markets; problems with road networks and currency devaluation with consequent decreases in purchasing power (Coffee in Ethiopia); the population of coffee-growing areas has difficulty accessing food markets for problems with road networks and currency devaluation with consequent decreases in purchasing power (Coffee in Angola).</p>

For the vast majority of conventional coffee producers, the income generated only allows them to buy some food goods in limited quantities; as a result, coffee fails to contribute to their food and nutritional security, leading to high food insecurity (Coffee in Ecuador).

The majority of day labourers, cutters, smallholders and small producers are vulnerable to poverty, food insecurity, climate and phytosanitary risks, as well as the decrease in international coffee prices, failing to generate an income equivalent to the cost of the basic basket of goods or the minimum agricultural wage (Coffee in Honduras).

Scarcity of income during the months prior to harvest, aggravated by climate change, variability in grain ripening and incidence of phytosanitary crises/rust (Coffee in Honduras).

Expanding cultivation areas for increased production volumes is not sustainable; inward expansion (into already cultivated areas) has negative impacts on food security and land availability for growing food; food insecurity for the most vulnerable cotton producers forced by late payments to sell off cereals during the harvest period (Cotton in Cameroon).

Table 11 Consumers Behaviour benefits and barriers for cash crops

Current benefits
<p>Increase in domestic consumption; promotes a culture of consuming better quality coffee, especially among youth (Coffee in Ecuador). The domestic coffee demand is on the rise. Currently between 7-10 percent of the coffee is sold on the national market (Coffee in Tanzania); development of small and Medium-sized Enterprises in the roasted and ground coffee industry, boosts local market supply and changes consumption habits, particularly in urban cafes (Coffee in Ecuador).</p> <p>Training of qualified personnel for cupping and for 'baristas' in order to obtain a greater consistency of coffee and a better global image of Honduran coffee (Coffee in Honduras).</p> <p>There is a local preference for red oil for cooking because the nutritional qualities of palm oil depend on their carotenoid and vitamin contents, which vary according to the type of extraction process and are higher in the red artisanal oil (Palm Oil in Sierra Leone).</p>
Barriers
<p>Many chocolates are locally made with cocoa powder, and sometimes, the fat is replaced with African palm oil; Nicaraguan consumers prefer chocolates and cocoa derivatives with high sugar and fat content; agro-industrial products made by transnational companies have been imported for decades (Coffee in Nicaragua); very little domestic consumption of chocolate products (Cocoa in Cameroon).</p>

Table 12 Social mediators benefits and barriers for cash crops

Current benefits
<p>Women participate mainly in the production phase, including the harvest, prominent female presence in administrative functions in coffee VC (Coffee in Angola); some progress in women's participation in decision-making, leadership and empowerment (Coffee in Honduras); significant contribution of women to coffee production and processing, women provide the majority of labour capacity during production, either working on their household farm and/or as labourers on other farms and estates, there are women in farmers groups, often inheriting their position from their husbands (Coffee in Tanzania); adequate legal environment on gender, although not in practice (Cocoa in Ecuador); active participation by some women in cooperatives, in the collection of red cocoa, or in the manufacturing of chocolates and derivatives (Cocoa in Nicaragua); high participation of women in producers' organisations, but the majority of producers are male (Cocoa in Colombia); women contribute significantly to traditional palm oil production and processing,</p>

doing more than 60% of the job, they are actively involved in processing, trading, and enhancing their empowerment (Palm Oil in Sierra Leone); women have much greater control over decisions relating to food crop gardens and betel nut than cash crop gardens (Vanilla in PNG).

The "Sello Chakra Kichwa Amazónica" Sistema Participativo de Garantías, promoted by the Autonomous Decentralized Government of the Province of Napo, involves a broad coalition of stakeholders, including production units, producer organisations, technical delegations, an ethics committee, and the general assembly, aiming to certify based on trust and community participation (Cocoa in Ecuador).

The prevailing forms of social assistance are family relationships, but these are less organised when it comes to commercialisation (Coffee in Angola).

The VC features a higher level of organisation (cooperative/associative) among producers; the inclusive nature of the chain is strengthened by cooperative business organisation and progress in certification; the Honduran coordination of small producers represents a solid basis for the development of fair trade and organic production (Coffee in Honduras); producers' organisations are active in the cocoa VC, considerable promise in cooperative development and some success to alleviate constraints in marketing, land tenure insecurity, small land holdings, poor infrastructure, and lack of access to capital (Cocoa in PNG); group membership is important for small farmers allowing access to markets, either through direct sales to private buyers or through the auction (Coffee in Tanzania); some producers' associations play an important role in improving cocoa quality and achieve positive socioeconomic effects in the involved communities (Cocoa in Ecuador); cooperatives are production umbrella organisations, with a social dimension for producers, such as managing premium, providing technical assistance, there is good agreement with employers on the salaries paid and respect of the work contract conditions (Cocoa in Sao Tomé and Príncipe); more than 2,000 producers' group constitute the most visible social capital, especially at village level, the cotton VC strengthens social capital through the structure provided by the Confédération Nationale des Producteurs de Coton du Cameroun (CNPC-C) and SDCC, fostering community cohesion and supporting social infrastructure development with cotton revenues (Cotton in Cameroon).

Barriers

Coffee cultivation is perceived by women as a "male" crop, therefore they favour food crops as there is a greater need and women find it more difficult to obtain identification documents, land titles and credit; women's participation in decision-making is weak (Coffee in Angola); a significant gender gap continues to exist despite undeniable progress, particularly at the legal level and participation in specialty coffee sub-chains; the lag in aspects related to decision-making and leadership and empowerment tends to be reduced in specialty coffee sub-chains (Coffee in Ecuador); low visibility of women's participation in activities; difficulty in accessing land, limiting their access to services; need for improving women's participation in cooperative and rural management (Coffee in Honduras); limited access to finance and banking for women, coffee is still considered a man crop, and it is men who largely control its marketing and revenues, few women legally own their coffee farms (Coffee in Tanzania); women mostly in subordinate positions in decision-making, participation, control over income, and access to resources and services (Cocoa in PNG); limited recognition of women beyond their roles as domestic labour, lack of ownership, significant gender disparities in property rights and economic empowerment, inequality in workload and decision-making, women are still vastly underrepresented or entirely absent, the workload is not distributed equally between genders, women often bearing a heavier burden (Cocoa in Cameroon); lack of gender inclusion in production and trade decision-making processes, there is little equality in practice (Cocoa in Ecuador); women and youth are underrepresented in production roles, and female employment is limited, few women in production, limited access to land and credit, male-dominated and violent society against women, especially in rural areas, limited control of income by women, except when they have salaried jobs, few women in leadership positions in the chain (Cocoa in Nicaragua); landowners are primarily men (Cocoa in Colombia); marginalisation of women in the VC despite their efficiency, increased penalisation of women in medium and large farms, tendency to expand cotton farms without reforming social structures

including the new rights of women (Cotton in Cameroon); limited access to skills trainings, education, innovative agricultural inputs and finance, limited career opportunities and unsatisfactory working conditions textile and garment sector, limited ownership and control over productive assets and technologies for production, less involvement of women in management decisions in factories owned by men, difficult access to rural land and property inheritance; at the factory level, the low wages and poor career opportunities for women (Cotton in Ethiopia); women not involved in the industrial segment that offers better wages and working conditions, women not at all involved or consulted in the decision-making for land-leasing processes even though the new National Land Policy includes specific provisions, women have very poor access to financial and agriculture extension services (Palm Oil in Sierra Leone); gender and inter-generational inequality are major challenges (not unique to the vanilla VC), women have very limited access to credit, particularly in the formal sector (Vanilla in PNG).

Failure of associative/cooperative systems and weak social participation of small producers (Coffee in Ethiopia); large number of small, unorganized, and dispersed producers in different geographical territories (Cocoa in Ecuador); social capital is the main weakness of the VC, especially in terms of associativity and lack of trust among actors (Coffee in Ecuador); there are not many services provided by the few existing associations or cooperatives; the different actors do not dialogue with each other – disorganisation; traders benefit from the incipient associative structures for establishing client relationships with producers; coffee sector not attractive to young people (Coffee in Angola); the relationships between the different actors in the cocoa VC are asymmetrical and to the detriment of the farmers, cooperatives face many constraints such as failing services, lack of trust from farmers, bypassing by intermediaries (Cocoa in Cameroon); many producers' associations exist only "on paper" (Cocoa in Ecuador); weak producers' organisations, recent structuring of the multi-actor and multi-level VC, albeit chaotic, deterioration of relations between private and public actors after 2018, suboptimal circulation of information and trust among chain actors, limited participation of rural communities in decision-making (Cocoa in Nicaragua); the autonomy of cooperatives could be compromised in the long term, due to the lack of financial means and the end of strengthening projects, the negotiating capacity to deal with medium and large companies is still low, as regards to inputs, volumes, sale prices, etc., even with the presence of cooperatives and associations, the interests of small producers are scarcely considered and their negotiating power is limited (Cocoa in Sao Tomé and Príncipe); producers' organisations do not have a clear understanding of their role in the chain, enhancing the capacity of producer organisations to offer services like nutritional education alongside agricultural extension services can help in disseminating knowledge about nutrition-sensitive agriculture, focusing on community benefit centers for nutrition education and distribution of nutrient-rich foods alongside cocoa products (Cocoa in Colombia); community cohesion risks erosion if a specialisation cotton happens, difference between the large producers that are not in a producers group and the smaller ones who still depend on the village community (Cotton in Cameroon); inadequate knowledge and skills in management affecting operational efficiency and ability to support cooperative's members, lack of trust, support or good relations with government institutions hindering access to resources, information, and opportunities for cooperative members (Cocoa in PNG); more than half of palm oil producers and processors are not part of any farmer-based organisation or agri-business centre, lack of accountable and transparent leadership (Palm Oil in Sierra Leone); collective capacity generally low; particularly in marketing PNG vanilla as a brand, low capacity of farmer organisations, no one (stop-shop) organisation representing the vanilla sector (Vanilla in PNG).

Poor recognition of the indigenous rights, poor communication between the VC actors and institutions (Cotton in Ethiopia).

Trade associations play a significant role, although many producers don't feel adequately represented or benefited by their actions; distrust among actors is prevalent due to the oligopoly situation of the four largest exporters (Coffee in Honduras).

Roots & Grains

Includes Cassava in Ivory Coast, Maize in Zambia and Nigeria, Sorghum in Ghana.

Table 13 Supply Chain benefits and barriers for roots and grains

<p>Current benefits</p> <p>Cassava is drought resistant, can be grown on marginal land where other cereals do not do well, and requires little inputs (Cassava in Ivory Coast).</p> <p>Improved varieties, bitter cassava have higher yields (Cassava in Ivory Coast); availability of maize varieties rich in vitamin A and Aflatoxin resistant (Maize in Nigeria).</p> <p>Fertilizers are not used as they reduce the dry matter content of cassava reducing market value, good land management practices leading to good soil fertility, even without fertilisers; new markets for processed cassava, valorisation of by-products, main transformation of cassava is into <i>attiéké</i> (semolina) in which a change from family production of self-consumption to commercial production has been seen (Cassava in Ivory Coast); growth of enterprises adding value to maize, generating employment, and income diversification, including products like stockfeed, beverages, and snack foods; enhanced quality and level of agricultural advisory services and input supply (e.g. to reduce on-farm storage losses) to reduce the current risks to growing maize, improve the opportunities for value addition at local level and reduce the environmental footprint of the maize crop (Maize in Zambia).</p> <p>Improvements in increased vegetable availability linked to increased maize production - this is not well understood, possibly linked to investments from maize sales into vegetable production (Maize in Zambia); various methods, including fermentation and blending maize with grain legumes, have been applied to improve the nutritional content of cereals like maize (Maize in Zambia).</p> <p>Around half of small-scale farmers benefit from subsidised supplies of fertilizer and (high yield) hybrid seed, lowering their production costs, through the Farmer Input Support Programme; the maize VC receives more than half of the public funds managed by the Ministry of Agriculture; high-income (for all actors) is the result of public subsidies; urban consumers indirectly benefit from these subsidies that favour the stabilisation of price; maize surpluses are often with good rainfall and the sustained provision of government subsidies on both the production and marketing side (Maize in Zambia).</p> <p>Traditional mixed cropping systems (Sorghum in Ghana).</p> <p>Planting for Food and Jobs programme under which the government distributes improved seed, fertiliser and pesticides to farmers, including sorghum farmers; a subsidy of 50% provided by the GOG aims to address affordability challenges which farmers face (Sorghum in Ghana).</p> <p>Sorghum aggregators in the north of Ghana have a quality assurance system based on quality standards set by the breweries and their farmers are trained to comply with the set standards; the product quality standards, which the industrial brewery has to comply with are enforced by the Ghana Standards Authority and the Ghana Food and Drugs Authority (Sorghum in Ghana).</p> <p>North of Nigeria better quality grain allows access to the more remunerative markets, better storage facilities and post handling practices so lower post-harvest losses, rapidly growing number of micro/small-scale millers (Maize in Nigeria); the One District One Warehouse (1D1W) government initiative is expected to improve postharvest crop handling by making available modern, off-farm storage infrastructure (Sorghum in Ghana).</p> <p>Extension services easily accessible for large-scale farmers and those participating in schemes alongside aggregators (Maize in Nigeria).</p>
<p>Barriers</p> <p>Cassava lacks nutritional value, as it is a poor source of protein, vitamins, and minerals (Cassava in Ivory Coast).</p>

Investments in the VC is low (disproportionately affecting women), in part due to reduced access due to inaccessible and poor road conditions and increasing transport costs; good practices around rotations of intercropping or leaving fields fallow may reduce yield, popularity of cassava production has resulted in increase in land use and so increase in the rental price of land along with abusive rents, high land rental prices (Cassava in Ivory Coast).

Cassava sector is affected by crises, e.g., due to climatic events such as drought (Cassava in Ivory Coast); severe climate shocks led to food crises in some years; conventional intensification with the package of hybrid seed, mineral fertilizer and herbicide is the main approach promoted by agro-dealers and Farmers Inputs Support Programme (FISP), but these have likely adverse environmental effects on ecosystems and on human health; transition to more sustainable cropping practices (promoted by NGOs and public extension services (minimum tillage, mulching, legume rotation, use of animal manure and herbicides) remains a challenge in terms of uptake (Maize in Zambia); sorghum cultivation affects ecosystems quality due to land use and freshwater eutrophication derived from soil erosion and chemical fertilizers (Sorghum in Ghana); deforestation, erratic rainfalls and other climate change effects (Maize in Nigeria).

Low yields of small-scale farmers who adopt mixed cropping systems SHF and cultivate indigenous varieties with inherent low yield potential and scarcely apply yield-enhancing inputs such as fertiliser, facing acute liquidity problems during the planting season (Sorghum in Ghana).

Improvements needed to extension services - esp. weather-related; the main constraints are the lack of inputs and equipment, knowledge and markets ; the main criticisms to the current maize policy are inequalities between actors that receive subsidy or not and the low productivity and uncertain sustainability of the smallholders' cropping systems are not addressed (Maize in Zambia).

South of Nigeria lack of access to and trust in the improved seed varieties, lack of access to fertilisers and pesticides (poor soil fertility) and to extension services, high aflatoxin content; dominated by smallholder farmers with lower yields from land being used for other crops, as an important risk strategy in case of maize crop failure; possibility of maize products for complementary feeding, but inappropriate storage of grain may lead to contamination (Maize in Nigeria).

Informal markets not regulated and so the quality of the maize grain is not assessed (Maize in Nigeria).

Table 14 Food Environment benefits and barriers for roots and grains

Current benefits
<p>In maize growing areas often receiving disaster relief, support initiatives to store maize locally for resale/release during the lean season – reducing dependency on food relief provided from urban centres (Maize in Zambia).</p> <p>Locally produced maize products are more affordable than commercially produced maize meal, indicating potential for further development of local markets and reduced costs related to transportation and production (Maize in Zambia).</p> <p>Importance of maize production for food security and in other VCs e.g., poultry, aquaculture, and livestock which are important for diet diversification; a consistent supply of maize within the country (a small amount is exported) because of production and storage facilities in North (Maize in Nigeria).</p> <p>The red (traditional) variety is an important yet underestimated nutritious food crop – used mainly for household consumption and <i>pito</i> (beer) brewing (Maize in Zambia).</p>
Barriers

Under 5-year-old stunting rate often high in traditional producing areas and where production is on the increase; potential link between the uptake of hybrid maize and declining diversity in household diets (Maize in Zambia).

Food insecurity risks for poorer households (unable to afford fertilizer or hybrid seed at market prices, and not in receipt of subsidised inputs), due to climate variability, pest and disease challenge and declining soil fertility (Maize in Zambia).

Demand outweighs supply, unreliable supply by farmers (Cassava in Ivory Coast).

Market prices undergo very strong variations, or volatility, due to the climatic seasonality: prices rise in dry periods and they fall during rainy ones (Cassava in Ivory Coast).

Temporary problems in food accessibility between June-August for the majority of Northern populations, including sorghum farmers/brewers Maize (cheaper crop) is overtaking sorghum in terms of relative importance in the food systems in Northern Ghana (Maize in Ghana).

Maize has gradually replaced small more nutritious grains (sorghum, millet) and cassava in rural households due to active government encouragement of smallholder maize production and consumption (Maize in Zambia).

Table 15 Consumers Behaviour benefits and barriers for roots and grains

Current benefits
<p>Main transformation of cassava is into <i>attiéké</i> (semolina) – in which a change from family production of self-consumption to commercial production has been seen; the phenomenon is even more pronounced in urban areas where the attraction of <i>attiéké</i> is explained by its affordable price and its "ready-to-use" characteristics; three different types depending on quality (low-end to high): <i>garba</i>, (standard) <i>attiéké</i>, and <i>abodjama</i>; cassava is also provided as dried, flour and a fermented paste (Cassava in Ivory Coast).</p> <p>To address vitamin A deficiency, researchers in Zambia have released and promoted varieties of "orange maize" in recent years.</p> <p>85 to 90% of the production is used for food, hence Zambian people are among the largest consumers of maize (120 to 170 kg/head/year) in Africa. Nearly half of this production is home consumed in rural and peri urban areas and half is processed by industries into meal for urbans (Maize in Zambia).</p>
Barriers
<p>Sorghum is currently a missed nutritional opportunity, especially for children, taboo for children to consume the unfermented <i>pito</i> (Sorghum in Ghana).</p> <p>While consumer acceptance ratings of orange maize were initially favourable according to a recent evaluation orange maize not yet been widely adopted by small-scale farmers, in spite of donor and government backed efforts; the reasons appear to be largely institutional within the maize seed and maize milling sectors (Maize in Zambia).</p>

Table 16 Social mediators benefits and barriers for roots and grains

Current benefits
<p>Strong presence of women in all stages, access to land (inheritance, rental, donation) increasingly associated with decision making (household, community), public speaking and leadership in associations, increasing demand for cassava products comes increases prices and interesting income opportunities for women (Cassava in Ivory Coast); women are active at all stages of the sorghum VC: farmers, workers, retailers and <i>pito</i> brewers (Sorghum in Ghana); presence of some</p>

government or NGO development programmes facilitating women's access to extension services and input supplies (Maize in Nigeria).

Good organisation of producers; 40% of producers are in professional organisations; there are some inter-professional associations and informal groups; traders are trying to gather in purchasing groups to be able to pool high transport costs (Cassava in Ivory Coast). Presence of farmer producers' organisations and professional associations at various levels of the VC but highly gendered (Maize in Nigeria).

Barriers

Women have less access to credit; weak access to financial structures; high illiteracy and burdensome female tasks (Cassava in Ivory Coast); Expansion of household production increasing the burden for females (weeding, harvesting and threshing) - not available to provide regular and suitable meals for their children; female household members have limited say on how the money from sale of the surplus is used, prominence and influence of males in grain trading, milling, rural cooperatives and commercial seed growing (Maize in Zambia); strong traditional role and task division between men and women, little time for women in rural areas to exercise leadership, although more opportunities are present at the level of the industrial breweries; participation in the VC does not influence on the decision power for women at production and expenditure level, which remains low; very challenging for women to get access to credit due to lack of collateral; access to land and land title for women (Sorghum in Ghana); less participation of women in downstream activities due to limited education and mobility, women's weak access to information and credit and control over the income earned from maize production (Maize in Nigeria).

Weak bargaining power and access to credit of producers' organisations (Cassava in Ivory Coast); low levels of trust between the players in the VC: input suppliers and small-scale farmers (no credit); traders and small-scale producers (no loyalty), millers and traders, producer cooperatives and members, commercial farmers and government; no influence of district cooperatives in the choice of varieties and fertiliser provided government support (Maize in Zambia); Lack of well organised farmer associations, representations and cooperatives; lack of one farmer voice, lack of transparency and information within the VC, horizontal and vertical trust between VC actors is low (enchaining late payments), power imbalances between the main industrial actor and the SHF, or between commercial farmers and SHF in input supply, lack of effective lobby and advocacy sector platform (Sorghum in Ghana); smallholder farmers' limited access to market or technical information, lack of trust among smallholder farmers, power imbalances between VC actors, lack of capacity of representative organisations to address key challenges facing VC actors (Maize in Nigeria).

Fruit and Vegetables

Includes Banana in Burundi and Dominican Republic, Green Beans in Kenya, Mango in Burkina Faso, Mango & Lime in Guinea-Bissau, Mango & pineapple in Dominican Republic, Pineapple in Benin and Togo.

Table 17 Supply Chain benefits and barriers for fruit and vegetables

Current benefits

Organic matter fertilization and biomass from the tree to increase soil fertility and productivity is already a common practice around the Urugo (housing hut) - The Urugo system favours more intensive production and crop rotation with taro, beans, maize, aubergines, sweet potato, etc. (Banana in Burundi). Promotion of organic farming for banana production, with improved soil health; low level of vulnerability to diseases (Banana in Dominican Republic).

Improved varieties can yield 60 to 90 t/ha with good agricultural practices (Banana in Burundi). The introduction of new pineapple varieties (like the MD-2 variety from Costa Rica) supported the growth of pineapple sector (Processed fruit in Dominican Republic).

Banana is the most commercialised food crop throughout the country's markets, from local, national up to the regional level - Bananas can be found all year round and across the entire country, guarantying regular income for rural households (Banana in Burundi). Mangoes contribute significantly to household income through production and processing, Seasonally available early April to mid-July (payments immediate), processing staff paid at the end of month, selling cashews and mangoes is vital for income when other revenue sources are scarce, earnings support various needs, including purchasing food, housing construction, agricultural activities, education, goods, and healthcare (Mango in Burkina Faso); producers' income, complementing the production of rice and cashew; lime VC offers significant advantages for small producers, mainly due to the profitability of lime vinegar production (high demand in local markets) and fewer issues with market (Mango and Lime in Guinea Bissau); the production of pineapples contributes to food availability and income for purchasing food; the annual income of small pineapple producers is significantly higher than the minimum wage, equivalent to 14 times the minimum wage; this demonstrates the profitability and potential for livelihood improvement for smallholder producers engaged in the pineapple VC (Pineapple in Togo).

The agricultural input supply chain is well-supplied and competitive, with suppliers offering support and technical assistance to producers; small and medium-sized producers often buy inputs from local businesses or benefit from joint purchases by associations and exporters; utilisation of advanced agronomic techniques (Banana in Dominican Republic).

The VC has a very positive impact at community level thanks to the use of the premium coming from fair trade, that equals €17 million per year (Banana in Dominican Republic); government supporting the organic banana market; includes educational and promotional efforts to enhance banana sector competitiveness and productivity; facilitation of public and private sector collaboration; aims to increase competitiveness and productivity in the banana sector; leading agricultural export product; privileged relation with European clients; geographic proximity to export markets compared to regional competitors; niche market for new certification (Demeter) (Banana in Dominican Republic).

Mango and lime farmers are encouraged to diversify their crops by intercropping with other nutritious crops, such as vegetables or legumes, to enhance overall food security and dietary diversity. Access to credit and microfinance is facilitated by services for small-scale mango and lime farmers, enabling them to invest in productivity-enhancing measures (Mango and Lime in Guinea Bissau). *Système National de Vulgarisation et d'appui Conseil Agricoles* was established for advisory services (Mango in Burkina Faso).

Pineapple yields in Togo are similar to those in other countries, despite lower reliance on chemical inputs, due to the naturally fertile soil; the region offers abundant agricultural land with favourable pedoclimatic conditions for pineapple cultivation (Pineapple in Togo).

Barriers

The spread of new varieties such as the Goldfinger banana developed by the *Fundación Hondureña de Investigación Agrícola* (FHIA) is an improvement, but this is not enough to efficiently and sustainably address the plant diseases (Banana in Burundi). New varieties solve some problems but create others: juice extraction problems, regressive productivity over time; ageing banana plantations (some over 50 years old) resulting in poor yield; improved disease management and control measures needed, especially against fusarium which affects nearly all production areas (Banana in Burundi); lack of availability of high-quality offshoots for pineapple producers (Pineapple in Togo).

Improved water management needed, especially with erratic rainfall patterns, including improved irrigation techniques (Banana in Burundi); vulnerability to climate change, droughts and floods, availability of natural resources; unfair competition due to commercial and climatic changes impacting the VC, only the more efficient producers, those with higher productivity and technical skills will be able to compete, while small-scale producers will be in a vulnerable position (Banana in Dominican Republic); challenges like insecure land tenure situations and a gradual decline in soil

fertility pose potential threats to the sustainability of the pineapple VC in Togo (Pineapple in Togo). Decreased soil fertility is a threat to yields due to the low organic matter supply (Pineapple in Togo); concerns about the use of chemical fertilizers, pesticides, and their impact on human health are highlighted (Pineapple in Togo); emphasize the importance of soil health and fertilizers; need for proper soil management is crucial (Green beans in Kenya).

In the mango VC weak governance systems, including technical service provision, and lack of support associations, and market informality; lack of an efficient commercial system for gathering mangoes from remote regions leads to a significant portion of mango production going unharvested, resulting in zero income generation (Lime and Mango in Guinea Bissau); challenges in access to financial services for agricultural producers and SMEs, including mango processing units; sector growth is restricted as only 15-20% of SMEs have access to financial services; barriers include high interest rates, collateral requirements, and slow credit procedures (Mango in Burkina Faso); integration of the banana VC into public policies as well as in commercial negotiations on minimum selling prices is needed to benefit small-scale producers and workers (Banana in Dominican Republic). Limited access to credit within the VC; high-interest rates increase the cost of borrowing for participants in the industry (Pineapple in Togo).

High cost of fuel and inputs due to imports, especially pesticides and fertilisers; dependency on imported inputs undermine the cost of production; low technical and education level of producers, bad cultivation practices (Banana in Dominican Republic).

High rotation of the labour force, not qualified, low level of labour productivity; lack of workers' availability and low attractiveness of agriculture; exclusion of producers due to the low capacity to comply with quality and more demanding requirements; low land productivity and low level of yields (Banana in Dominican Republic). The fresh vegetable labour market is sensitive to demand variability and requires a flexible workforce (Green beans in Kenya).

Challenges related to standards compliance, access to land, and environmental sustainability (Mango in Burkina Faso); the creation of a quality charter for Dominican bananas could provide greater recognition and differentiation in international markets (Banana in Dominican Republic); strict enforcement of standards, which can be a threat to sub-sectors targeting the EU market (Mango in Burkina Faso); loss of organic certification, ban on the use of calcium carbide for pineapple destined for EU markets (Pineapple in Togo).

Support services, such as producers' extension services, as well as market organisation are still weak (Banana in Burundi); difficult access to finance for small-scale producers (Banana in Dominican Republic); limited advisory services in mango production; producers lack specific follow-up from agricultural advisors; effectiveness and accessibility of this system are unclear (Mango in Burkina Faso); improving post-harvest handling, enhancing storage and transportation infrastructure, and adopting efficient supply chain management practices (Banana in Dominican Republic); lack of innovation and quality improvement, need for product diversification and enhanced competitiveness; enhancement needed in agro-processing capabilities; aim to add value and diversify income sources for farmers (Mango and Lime in Guinea Bissau). Low innovation (Pineapple in Togo); limited knowledge among mango tree owners about various mango varieties and their commercial potential; insufficient information and resources available to effectively combat the fruit fly disease; need for technical training and support for farmers to enhance management of crop varieties and explore commercial opportunities; financial barriers to scaling up and modernizing operations, investing in production activities, cold chain installations, and transformation processes (Mango and Lime in Guinea Bissau); phytosanitary issues mainly in mango VC (Mango and Lime in Guinea Bissau); availability of packaging, as agents struggle to coordinate their supplies (Mango in Burkina Faso); road infrastructure needs development (Pineapple in Togo); exclusion of producers due to the low capacity to comply with quality and more demanding requirements; low land productivity and low level of yields (Banana in Dominican Republic); majority of producers sell to traditional intermediaries due to limitations like volume and negotiation power; export barriers are high, with only premium fruits being exportable; streamlining the supply chain process from production to distribution; this involves improving

logistics, handling, and transportation methods to enhance efficiency and reduce costs (Processed fruit in Dominican Republic); unregulated use of ripening chemicals is common; actors in informal markets lack formal food safety training; lack of awareness regarding related risks and regulations; producers typically need certified seeds from buyers before planting; some producers source cheap seeds from previous seasons or commercial outlets without contracts (Green beans in Kenya); many Kenyan consumers purchase food from local markets or directly from farmers, where products are not refrigerated, impacting quality; the absence of a cold chain system makes higher-quality products less affordable for consumers; weak enforcement of safety standards for the domestic market contributes to these challenges, with rejected export produce sometimes entering domestic markets; a 2016 study in Nairobi, Nakuru, and Machakos found calcium carbide in ripened bananas, mangoes, and oranges, as well as heavy metals, pathogenic micro-organisms, and pesticide residues in leafy vegetables; rejected export produce sometimes sold in domestic markets (Green beans in Kenya).

Table 18 Food Environment benefits and barriers for fruits and vegetables

Current benefits
<p>Bananas can be found all year round and across the entire country, guarantying regular income for rural households (Banana in Burundi). The availability of bananas for the local market remains secure - year round availability (even though exporting would be more profitable); widespread employment of labour force; workers in large-scale plantations normally have right to a meal during their working hours; Fair Trade certification plays important role for improving the quality of food or providing food rations using Fair Trade premiums (Banana in Dominican Republic).</p> <p>Local market crucial for fresh mango accessibility to the local population; vital for improving nutrition, particularly in areas with limited dietary diversity (Mango in Burkina Faso)</p> <p>Processing units in additions to dry mangoes to transform cashews, hibiscus leaves into <i>bissap</i> syrup, and coconuts into chips Mango in Burkina Faso).</p>
Barriers
<p>New varieties have heavier bunches produced more frequently than traditional varieties - but need more time to mature, and do not guarantee food security of smallholder producers (Banana in Burundi).</p> <p>Relatively low income especially for smallholders and workers (labour-intensive production, so low salaries; dependence on banana-derived income; international market prices vary throughout the year depending on demand (Banana in Dominican Republic).</p> <p>Food access is limited by income levels for urban and rural households; urban areas have disparities in food costs among different socio-economic groups; low-income individuals buy smaller quantities of food at higher prices from local petty traders; urban households heavily rely on their earnings for food; rural households can grow some of their food, but it may not be enough, and they face vulnerabilities like drought (Green beans in Kenya).</p> <p>Mango and pineapple are important in the diet of Dominicans, but food security and nutrition aspects are not prioritized due to their export focus; despite being sold and consumed locally, a significant portion of the fruits are exported (Processed food in Dominican Republic).</p> <p>Food safety hazards can arise during storage, transportation, and retailing due to poor hygiene and handling practices; informal markets often lack tables or platforms, leading to produce being placed on the ground, potentially in contact with dirt; unhygienic market conditions, such as garbage bins or waste piles near traders, pose food safety risks (Green beans in Kenya).</p>

Table 19 Consumers Behaviour benefits and barriers for fruits and vegetables

<p>Current benefits</p> <p>Producers' organisations facilitating consumer outreach; representative and accountable leadership facilitates more effective consumer outreach programs; outreach programs can target nutritional education and promote bananas as part of a healthy diet (Banana in Dominican Republic).</p> <p>Mango consumption in mango-producing regions: children frequently have mangoes for breakfast and/or lunch during harvest season; excessive consumption or improper mango washing can lead to diarrhoea and child malnutrition; mangoes act as an additional food source, particularly when food stocks are low, benefiting poor households; workplace nutrition programs for mango processing units: implement nutrition programs for workers; programs may include health and dietary education; focus on primary income-generating mango campaign months (Mango in Burkina Faso).</p> <p>The VC has been recognized for its potential in transforming pineapples into juice and dried fruits; this transformation process adds value to the raw product and can increase its nutritional availability and diversity in the market (Pineapple in Togo).</p>
<p>Barriers</p> <p>New varieties solve some problems but create others: consumer taste issues (Banana in Burundi).</p> <p>Need to promote local consumption of pineapple products and place pineapple juice and dried pineapples in high-visibility areas; need to encourage the use of local products, including pineapples, in national events (Pineapple in Togo).</p> <p>Challenges in food utilization and nutritional practices include issues of affordability, dietary diversity, and concerns about the quality and safety of fresh produce, particularly in informal markets, where inadequate enforcement and awareness contribute to these challenges (Green beans in Kenya).</p>

Table 20 Social mediators benefits and barriers for fruits and vegetables

<p>Current benefits</p> <p>Notable presence of women in semi-industrial processing of banana products; around 60% of fixed contract holders in this sector are women; progress in gender equality within certain segments of the banana VC; increasing involvement of women in agricultural activities, including banana cultivation and marketing; bananas no longer exclusively considered a male domain; women participating more in the maintenance and marketing aspects of banana cultivation (Banana in Burundi); active involvement of women in the banana sector as producers and workers, with a concentration in specific segments like packaging (Banana in Dominican Republic); vinegar production empowers women to take on leadership roles within the VC (Mango and Lime in Guinea Bissau); women are primarily involved in mango processing and packing; women dominate the retail market for mangoes in the national market; the proportion of malnourished children decreases with the mother's level of education; children of mothers with higher levels of education are less likely to suffer from malnutrition (Mango in Burkina Faso). Strong presence of women (35% of producers and 97% of fruit sellers in the local market) who control their own income (Pineapple in Togo); women make up approximately 80% of the workforce in both production and processing; women benefit from job opportunities and a degree of economic autonomy within the industry; women hold leadership roles within the sector (Green beans in Kenya).</p> <p>Producers' associations are in the process of formation; range from informal associations in production hills to more formal associations and cooperatives; all these organisations are in the setup stage and supported by various international institutions and NGOs (Banana in Burundi); producers are well organised; good access to information; high social involvement in the VC at community level; both formal and informal farmer organisations and cooperatives are significant contributors to the VC; group/cooperative membership inclusivity is essential; presence of</p>
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representative and accountable leadership is crucial (Banana in Dominican Republic). The mutual assistance guarantee is based on the extended family (Mango and Lime in Guinea Bissau); mango producers involved in export-oriented production receive training on certification standards such as (Fairtrade Labelling Organizations International) FLO, BIO, and (Global Agricultural Practices) Global) GAP; companies provide technical support and cover certification costs; prime funds from fair trade initiatives are used for community development projects, including education, healthcare, and water access; mango processing companies contribute to various social projects, such as supporting correctional facilities, orphanages, schools, and infrastructure development (Mango in Burkina Faso); organisations and cooperatives facilitate access for organic pineapple producers to information on agricultural practices, policies and market prices; some cooperatives receive bonuses for their participation in local development from fair trade companies (Fair For Life); organisational structuring supports producers' organisations benefits cooperatives and unions of cooperatives, and enhances farming practices (Pineapple in Togo); encouraging the adoption of cooperative business models, particularly for small and medium-sized producers, to enable them to pool resources, share risks, and access new markets more effectively; the role of clusters and associations in supporting fruit production, such as APROPIC for pineapples and PROMANGO for mangoes; these organisations have received support for infrastructure development, technical assistance, and access to improved production technologies (Processed fruit in Dominican Republic); large farms and export companies are part of organized alliances and smallholder farmers are organized into Self-Help Groups (SHGs); large commercial farms and export companies have better access to information and industry networks; smallholder farmers and SHGs value the training they receive; SHGs in Fresh Fruits and Vegetables Chain manage risk and reduce costs; companies provide varying levels of support to SHGs; NGOs focus on livelihood and community issues within the VC; informal cooperative groups (Chama groups) focus on community welfare (Green beans in Kenya).

Barriers

Gender inequality in land and water rights in Burundi; women do not have automatic equal land rights as men; access, use, and ownership of land dependent on relationships with male family members (e.g. fathers or brothers); significant gender gap in agricultural resources and decision-making power (Banana in Burundi); moderate labor safety due to low awareness of health risks among workers, especially women; limited access to land, land tenure titles, and credit for women, and minimal participation in production decisions; limited leadership and empowerment of women, especially among female workers; women bear a dual workload but are protected from the most strenuous tasks in the field (Banana in Dominican Republic); women are highly vulnerable in the community, undertake most agricultural activities but are often excluded from paid labour opportunities; income distribution tends to favour men, as the low profits from local markets often go to them (Mango and Lime in Guinea Bissau); women are underrepresented in permanent positions within processing units; women's work in mango processing units adds to their already substantial household chores; women have limited access to land ownership due to customary and legal constraints; few women hold leadership positions in mango processing units; women who work in these units have some influence in household decision-making regarding their income (Mango in Burkina Faso); women are disadvantaged in acquiring land; low level of public speaking by women; workloads greater than men and exposure to strenuous tasks (Pineapple in Togo); despite their contributions, women face disparities in land ownership and inheritance rights; these disparities are attributed to the partial implementation of new laws affecting land rights for women (Green beans in Kenya).

Organisation and professionalisation of stakeholders missing (Pineapple in Togo); limited trust among actors in the VC; workers not well organised (Banana in Dominican Republic); there are some associative structures linked to the management of collective goods and some activities led by NGOs, but with no ambition to join synergies for higher risk entrepreneurship (Mango and Lime in Guinea Bissau); cooperative and associative life in the mango sector in Burkina Faso lacks institutional capacity and struggles with issues like quality standards, technical challenges, and unpaid dues; trust issues exist within the VC, including discrepancies in labelling and price reporting

(Mango in Burkina Faso); SHGs have limited influence beyond their relationship with their buyers; smallholder farmers and SHGs rely on their buyers for communication and information; trust between buyers and smallholder farmers is influenced by engagement, communication, and contractual reliability (Green beans in Kenya).

Pulses & Nuts

Include Cashew in Cote D'Ivoire, Mali, and Sierra Leone, Cowpea in Niger, Groundnuts in Ghana and Niger.

Table 21 Supply Chain benefits and barriers for pulses and nuts

Current benefits
<p>The groundnut VC creates significant jobs and provides incomes to a large number of smallholder farmers, but also to many processors, retailers and workers; since 2018 initiative Planting for Food and Jobs” flagship programme expected to attract youth to agriculture; moreover, international development partners, NGOs and now the Ministry of Food and Agriculture of Ghana (MoFA) provide information, extension services and support to the agricultural sector and rural households; Ghana part of the Project Peanut Butter B, an initiative producing Ready to Use Therapeutic Food (RUTF) from groundnut (Groundnut in Ghana); contributes to the resilience of households by providing a source of income and supplementation from self-consumption (80% consumed); despite low productivity, this activity generates significant profits (Groundnut in Niger); contributes significantly to household income, especially through women's incomes; block farms offer more than double of the daily wages than in conventional agriculture, and can be attractive to youths (Cashew in Sierra Leone); cashew-producing families benefit from greater food diversity when they are located in vegetable or rice production areas and if the farmers are "wealthy"; cashew nuts have gradually become one of the main cash crops, after cotton, in southern Mali; food and nutritional security in the cashew production area has improved significantly in recent years thanks to the increase in local food production (cereals, tubers, vegetables, fruits and pulses) and the supply of food products to local markets; and partly to cashew income (Cashew in Mali); main source of monetary income for around 500,000 farmers (in the North), especially for women who constitute the primary workforce for both production and processing ; the Cotton and Cashew Council (CCA) is responsible for regulating and developing the cashew sector since 2014 - promotes better governance and remuneration for actors in both VCs, addresses issues related to product quality, and provides monitoring of the cashew product marketing system (Cashew in Ivory Coast); cowpea is highly valued for its nutritional content, playing a significant role in shortening the lean season and fighting malnutrition; cowpea by-products, including leaves and shells, are significant for livestock feeding; cowpea is harvested one to two months before millet, aiding in bridging gaps between harvest seasons, contributing to dietary diversity and price stabilization of other food items on the market; use of agroecological practices like crop association and natural regeneration; farmers often receive capacity development through development projects and NGOs, with Farmer Field Schools being a common method (Cowpea in Niger).</p> <p>Existing innovations: vitamin A-enriched peanut oil; multiple products and by-products e.g., oil and paste enhancing nutritional quality due to their high protein content, leading to diversified practices and strong domestic market demand; processed products also support food security through the development of products often consumed within or outside households, such as groundnut meal (Groundnut in Niger); cowpea is processed into flour, pasta, biscuits, couscous (Cowpea in Niger); processing is mainly industrial; the increase in processing capacity is mainly driven by multinational companies; nut is not perishable as fruits (Cashew in Ivory Coast).</p>
Barriers
<p>Effective management strategies, including improved post-harvest practices, sorting, and innovative solutions like Aflasafe, are crucial in reducing aflatoxin levels in groundnut products and ensuring food safety; need improved aflatoxin control if groundnut are to become a major export commodity to both the regional and European markets; difficulty to enforce food safety and other</p>

regulations (Groundnut in Ghana); use of conservation insecticides poses health risks and represents a phyto-sanitary barrier to exports (Cowpea in Niger); despite low quantities, commercially available pesticides, present concentrations and active substances which are not always authorized or approved by the authorities (Groundnut in Niger).

Farmers with lack of support are facing serious challenges in getting certified seed, fertiliser, and support for improved agricultural techniques and marketing; agricultural practices are extensive with little fertiliser applied due to low availability and low use of herbicides, even though they are available; availability of quality (certified) groundnut seed needed to increase to improve crop yield and protect the ecosystem through extensive land use (Groundnut in Ghana).

Margins are low, competition is high and the micro or small-scale enterprises have problems of accessing funds (Groundnut in Ghana); groundnut largely dependent on rainfall and soil fertility, which are highly variable in Niger; low individual purchasing power of actors and producers limits their access to inputs and credits; key risks include market fragmentation, governance asymmetry among intermediaries, social issues related to land management and credit access, and environmental impacts on human health from large-scale operations; transport issues (Groundnut in Niger); governance poorly organized from a public institutional perspective (Groundnut in Niger); limited access to formal credit ties producers to informal lenders, impacting their financial stability (Cowpea in Niger). Producers have very low access to information and agriculture extension services, which discourages producers to invest in cashew; low access to labour; low access to finance, resorting to loans with high repayment rates, especially during hungry season; weak coordination and governance, except in block farms, the majority of work is 'informal', meaning that workers have neither a contract nor any benefits, such as health, insurance, pension etc.; improper or unregulated marketing structures; there is no well-defined place for cashew markets in districts, nor producers' organisation to negotiate for fair prices, which discourages producers to invest in cashew (Cashew in Sierra Leone); the cashew nut trade in Mali is very poorly organised; relationships among VC actors perceived as asymmetric; producers under-informed about market prices, which are instead set by traders at the time of direct purchase from producers; low quality and performance of the equipment (production and processing); energy inefficiency; risks associated with the expansion of cashew cultivation include land grabbing by large private investors, increased land conflicts; smallholders face risks such as social and food insecurity, vulnerability to external or internal shocks (Cashew in Mali); lack of technical support for producers; access to financing and the cost of credit remain major obstacles to the profitability of cashew VC operations; contribution to deforestation; lack of transparency in the VC; price variability of raw nuts and kernels; cashew producers in the northern part of the country have incomes below the poverty line; the producer "only survives" and cannot invest in additional labor, thus suggesting that cashew remains appealing if it requires no inputs or additional workload (Cashew in Ivory Coast).

Governance of the sector often the result of local dynamics; individual initiatives ensure the development and maintenance of an informal governance model, with a strong network; emergence of forms of mutual aid and organisation - trust-based relationships among producers, collectors, semi-wholesalers, and wholesalers playing a crucial role (Groundnut in Niger).

Significative groundnut losses across the VC, due to storage conditions, sheller type, overall quality of grain; roasting technologies and equipment demand urgent review and up-grading to improve health condition (Groundnut in Ghana).

Areas under production of highly nutritious food crops (groundnut, millets and sorghum) have decreased; increasing reliance on imports to meet demand (Groundnut in Ghana).

Access to land and water, controlled by specialized rural code institutions; land availability is limited and expensive which excludes women and young people (Groundnut in Niger).

Despite the sector's economic performance and contribution to food security and job creation, it faces challenges in governance, inclusivity, and environmental sustainability; the growing demand

for cowpea, coupled with limited land availability and productivity challenges, presents a significant risk to the sector's development (Cowpea in Niger).

At present, the production of juice, syrup or jam from cashew apples remains marginal; cashew apple juice is distributed and consumed locally; processing units are small-scale artisanal or semi-industrial and do not comply with the international production and packaging standards of the agri-food industry; only 4% transformation (artisanal or semi-industrial) stays in the country; market price volatility; the incomes of artisanal processors, the majority of whom are women, are often fragile and very low; global supply and demand volatility; quality may decrease depending on the duration and conditions of storage (Cashew in Ivory Coast).

Table 22 : Food Environment benefits and barriers for pulses and nuts

Current benefits
<p>Groundnut produced mainly for domestic consumption and is a key ingredient in local dishes such as groundnut paste, snacks (roasted), oil, flour, and <i>kulikuli</i> (fried cake) (Groundnut in Ghana); the introduction of cowpea into diets has improved nutritional quality, with its diverse products offering a range of choices and accessibility to households; about 24% of the total production is either consumed by the producers themselves or donated within communities, helping to ensure food security (Cowpea in Niger).</p> <p>The government's efforts to sell cowpea at moderated prices during the lean season across the nation help reduce price volatility of food items, further stabilizing food security (Cowpea in Niger).</p> <p>Domestic demand is strong - only - 3% exported; groundnut for food, fodder and oil, competes with various substitute products, such as imported vegetable oils (Groundnut in Niger).</p> <p>Almonds are partly self-consumed or sold locally in supermarkets</p> <p>Cashew apple juice is distributed and consumed locally (Cashew in Mali).</p>
Barriers
<p>Cashew is particularly important in the question of food security when it competes for agricultural land with the staple food, yam, as the expansion of cashew cultivation onto agricultural land is gradually encroaching on village surroundings, pushing food crop fields to the periphery, into the bush. Ivorian nuts have bad reputation (Cashew in Ivory Coast).</p> <p>High aflatoxins found in <i>kulikuli</i> and groundnut paste (Groundnut in Ghana).</p> <p>Food accessibility is a major challenge for households due to rising prices of food items and vegetable oil; rural households often resort to borrowing from merchants to secure sufficient quantities for consumption (Groundnut in Niger).</p> <p>Despite its importance, per capita consumption is relatively low, as much of the production is exported (Cowpea in Niger); very little consumed from the local market (most exported); among smallholders only 10% consumed (variable) (Cashew in Sierra Leone); most of cashews are exported (96%); cashews are too expensive for the majority of the population's purchasing power (Cashew in Mali).</p>

Table 23 Consumers Behaviour benefits and barriers for pulses and nuts

Current benefits
No data.
Barriers

Cowpea is not yet fully integrated into Nigerien dietary habits, highlighting the need for promotional campaigns to encourage its consumption (Cowpea in Niger).

Cashew fruit is not valorised for human consumption; animals like to eat the fruit; cashew nuts are rarely or not at all part of Ivorian dietary habits (Cashew in Ivory Coast).

Table 24 Social mediators benefits and barriers for pulses and nuts

Current benefits
<p>Groundnut VC becoming an exemplary pro-women, pro-poor and pro-youth development; 90% of all actors (workers included) in the VC are women; groundnuts provide self-esteem, and financial independence to women (Groundnut in Ghana). Women are key actors, participating in agricultural work from sowing to harvesting and leading in groundnut processing; the formation of numerous female peasant organisations has significantly minimized women's exclusion from VC activities; the strong mobilization of women in processing offers them opportunities for leadership and empowerment (Groundnut in Niger); women are significantly involved in the cowpea VC, particularly in production (harvesting, shelling) and dominating processing but typically work in groups for support - contributing to household income (Cowpea in Niger); the contribution of women to total family income in processing families is quite noteworthy; women are involved in harvesting and family farming activities; part of farm management groups in block farming model; women control incomes from processing and trade (Cashew in Sierra Leone); women are dominant in the "harvest" (alongside children); majority in "artisanal and semi-artisanal transformation" of cashew kernels and apple juice; women can own small ruminants and poultry alongside cashew; women can be leaders in women producer groups, but not of an organisation in general (Cashew in Mali).</p> <p>High social capital, strong inclusion of producers towards their communities, families, networks and villages; farmers' organisations, women's and youth associations within cooperatives, unions, or producer federations are led by democratically elected active members; cooperatives play a significant role in providing information, education, and training to their members, facilitating access to capacity-building opportunities (Groundnut in Niger); social capital is strong in terms of mutual aid and the robustness of individual networks, based on trust (Cowpea in Niger); cashew producers organized into village or communal cooperative societies grouped into unions at the "circle" level (Cashew in Ivory Coast); dissemination of price information through social networks (even if insufficient); social distinction in villages accentuated by land ownership favoured by cashew plantation (Cashew in Ivory Coast); dissemination of price information through social networks (even if insufficient); social distinction in villages accentuated by land ownership favoured by cashew plantation (Cashew in Ivory Coast).</p> <p>Block and semi-block farms, women-centric cashew trading and processing are the most important experiments of social involvement at small scale (Cashew in Sierra Leone).</p>
Barriers
<p>Women's access to resource, services and education is weak. Creates a barrier to decision-making; women do not have any formal rights to land, getting marginal or non-premium lands for their groundnut cultivation (Groundnut in Ghana); despite holding leadership roles in their organisations, women's decision-making capacity, especially regarding investments in land and equipment, is limited and often deferred to men (Groundnut in Niger); women are notably absent in transport and marketing; women's workload often exceeds that of men; women in rural families may not work on collective family fields but often manage small personal plots without secure ownership; legal frameworks recognize women's rights to land but practical application and traditional biases limit their access (Cowpea in Niger); underrepresented in production, particularly in land preparation (clearing, stumping, ploughing), transplanting or sowing, and in the transportation, drying, and bagging of nuts; women and vulnerable groups at risk of marginalization, potentially increasing social inequalities; risk of increasing economic dependency and impoverishment of</p>

women (Cashew in Mali); involvement of women mainly as laborers in collection, sorting, and drying activities (Cashew in Sierra Leone); precarious and dangerous jobs (without protection) for women in processing; low presence of women in marketing; absence of women from decision-making spaces within cooperative environments (Cashew in Ivory Coast).

Farmers-based organisations providing support to groundnut farmers is currently limited (Groundnut in Ghana); absence of cooperative organisations or formal and informal organisations; notable weakness in the structuring of organisations and federations within the cowpea VC (Cowpea in Niger); no producer organisations (Cashew in Sierra Leone); insufficient functionality of their professional organisations; lack of negotiation capacity with other actors and partners; the VC is mostly favourable to farm managers (men) and lineages of landowners who manage access to land according to customary law; these rights generally exclude women, young people and certain vulnerable groups, limiting their access to the means of production (Cashew in Mali); low functionality of cashew cooperatives, limited bargaining power in negotiations with middlemen or processing companies (Cashew in Ivory Coast).

the 1990s, the number of people who have been employed in the public sector has increased in all countries.

There are a number of reasons for the increase in public sector employment. One reason is that the public sector has become a more important part of the economy. In many countries, the public sector now provides a significant portion of the total output. This has led to an increase in the number of people who are employed in the public sector.

Another reason for the increase in public sector employment is that the public sector has become a more attractive place to work. This is due to a number of factors, including the fact that the public sector is often seen as a more stable and secure place to work. Additionally, the public sector often offers better benefits and working conditions than the private sector.

There are also a number of other reasons for the increase in public sector employment. For example, the public sector has become a more important part of the economy in many countries. This has led to an increase in the number of people who are employed in the public sector. Additionally, the public sector has become a more attractive place to work in many countries. This is due to a number of factors, including the fact that the public sector is often seen as a more stable and secure place to work.

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