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THE ROLE OF THE 'HIDDEN MIDDLE' FOR AGRI-FOOD SYSTEMS VALUE CHAIN DYNAMICS

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Abstract

This paper analyses the role and importance of midstream actors in the agri-food value chain, drawing on experiences from cash crops, vegetables and fruits, animal-based products and food staples. Main attention is given to the value added (VA) captured and the employment creation by midstream actors. This provides insights into the efficiency aspects (resource use), the equity implications and welfare effects that result from these midstream dynamics.

Differences in structure and performance of agri-food value chain are explained by characteristics of products (i.e. opportunities for investments in scaling and risks of perishability), the conditions for realizing transactions between value chain parties (prices, wages, etc.) and the type of interactions between stakeholders (spot exchange or contractual agreements). Gender implications (opportunities for female entrepreneurship) and the environment (emissions) receive special attention.

The paper contributes to the debate on the role of the 'hidden middle' for upstream parties and may identify critical possibilities for enhancing value chain dynamics through midstream innovation. We use a mixed methods approach to assess drivers of midstream performance and to identify wider development implications.

We find that commercial and modernizing value chains (VCs) for capital-intensive commodities generate higher midstream employment and value added. Demand-side motives are driving the midstream transition: urbanization and a favourable business environment support investment in inclusive and sustainable midstream activities. Higher midstream value added share are accompanied by a gradual increase in profitability. The interaction between both processes enhances overall attractiveness of midstream activities. Midstream capital investments are associated with a strict control of midstream agents over value added operations, even while several midstream processing activities are still fairly labour-intensive and therefore contribute to employment generation.

These findings have both theoretical and policy implications. System approaches are necessary for a full understanding of midstream VC dynamics, identifying both market and governance drivers to enhance inclusiveness. Policy instruments for supporting midstream investments and VC performance of value chains should rely on instruments for risk reduction and lower transaction costs to reduce access constraints and to enable broad participation.

Keywords*: Agricultural Value Chains, Midstream actors, Hidden Middle, Value Added, Employment.*

1. Introduction

The food security debate has focused largely on the farm sector and the international food trade. More neglected or 'hidden' from this debate are the middle segments of the value chain - including processing, logistics, storage, packaging and handling - of agrifood value chains in developing countries. This 'midstream' forms a substantial part of the value added and investments in food value chains. The productivity of the midstream is as important as farm yields for food security and employment in poor countries (Reardon, 2015). Investing in midstream operations might also have important effects on upstream dynamics.

The role and importance of midstream agents widely differ between countries and regions due to variation in downstream variables, such as the available infrastructure and according to the degree of urbanization (related to the demand for more processed goods). Similarly, upstream factors related to possibilities for intensification, diversification and commercialization of farming systems of primary agricultural commodities also influence midstream dynamics. The interactions between upstream and downstream components of the value chain influence short-term costs, profits and value-added distribution, but could also lead to long-term diverging trends in business competition and innovation.

Reardon et al. (2019) and Reardon and Minten (2021) distinguish three stages of transformation (see Table 1) of the agri-food value chain:

a) In the **traditional stage** agri-food value chains are spatially short because the urban share of the population in the food market is low. They include few intermediaries because much of the market is in the rural area and even the same village. The share of value-added in postharvest segments is small: home processing reigns and the wholesale and logistic sectors are small because food is not moved far. Most of the segments are fragmented: there is little quality differentiation or economies of scope. Technologies are labour intensive per unit of output and enterprise scale is small. Spot markets dominate food value chains, and contracts are rarely used.
b) In the **transitional stage** agri-food value chains become spatially longer because the urban share of the population in the food market is growing. However, short value chains still dominate highly perishable products such as leafy greens, fruits, fish and dairy. Food value chains become intermediationally longer as many small and medium-scale actors in the midstream emerge to add value and move food from rural to urban areas. The share of value-added in postharvest segments is moderately large as wholesale, processing, and logistics sectors are blossoming. There is still little quality differentiation, but public standards emerge for food safety and quality. Purchased processed foods and convenience foods develop rapidly in this stage. Most technologies are still labour intensive, but machine use increases in farming and (home) processing. Small and Medium Enterprises (SMEs) play a big role in logistics and wholesale. Spot market relations still dominate, but in a few cases, contracts are beginning to emerge.
c) In the **modern stage**, agricultural markets are becoming spatially long but intermediationally short with a trend toward "disintermediation"—as supermarkets and large processors transact directly between themselves and in some cases buy direct from farms. Processing and retailing become more concentrated and are increasingly controlled by Foreign Direct Investments (FDI). The share of value-added in postharvest segments of the agri-food value chain is large. The product cycle shifts to more differentiated products based on quality differentiation, and private standards take over from public standards. Technologies are largely capital intensive and become strongly information-based systems (such as smart chips in packaging and logistics and drones in agriculture production).

Table 1 Value chain characteristics of different agri-food systems

	Traditional VCs	Transitional VCs	Modern VCc
Socio-economic conditions			
Urbanization	Low	Medium	High
Diets	Grains & Staples	Mixed	Processed foods
Seasonality	High	Medium	Low
Market outlets	Local	National	Global
Market structure			
VC Length	Short	Medium	Long
Value Addition	Low	Medium	High
Concentration	Moderate	Low	High
Supply chain performance			
Quality differentiation	Low	Emerging	High
Standards	Few	Public	Private
Technology	Labour-intensive	Medium	Capital-intensive
Exchange relationships	Spot markets	Mixed	Contracts
Value chain configuration			
Upstream input provision	Local providers with commitment	Contract farming & cooperatives	Input delivery by preferred suppliers
Midstream processing	Domestic & competitive	SME proliferation	Private & consolidated
Midstream logistics	Fragmented	Regional brokers	Concentration by dedicated buyers
Downstream retail	Fragmented	Mixed	Supermarkets

Source: based on Reardon & Minten (2021)

This paper analyses the value added generated and employment generated by midstream actors in different types of the agri-food value chains. We, therefore, compare information from cash crops (cocoa, cotton), fruits and vegetables, animal-based products and staple crops concerning their value added and employment distribution.

Basic information is provided by Agrinatura-EU-VCA4D studies that offer a careful registration of the production and trading structures and their social and environmental effects for different types of agri-food commodities in specific developing countries (see: Capacity4dev | Connecting the Development Community (europa.eu). VCA4D performs value chain analyses (VCAs) across a range of agricultural commodities and countries to appraise their contribution to growth and job creation, taking into account the sustainability and inclusiveness of these value chains (VC).

In this paper we address the following key Research Questions (RQs):

a) How important are midstream activities and agents in selected VCA4D case studies (in terms of the value added share and wage employment generation)?

b) What explains the differences in midstream dynamics between 'typical' agri-food value chains configurations?

c) How do midstream value chain operations influence the relationships and the linkages with upstream farmers?

We mainly look at the structure of value added creation and direct employment (i.e. hired labour) generation in the production stage and during midstream operations, and try to explain the differences between value chains from structural characteristics related to the value chain organization and the stakeholder interactions and coalitions. This may provide further insights into different prospects for the dynamics of agri-food system transformation (AFST) processes that are required to responds to challenges from transitions in demography (urbanization), diets (nutrition), climate change (environment) that demand inclusion and resilience (IFAD, 2021).

In addition, we use the qualitative information from VCA4D studies to assess prospects for employment creation, opportunities for female entrepreneurship, efficiency aspects and welfare effects that result from these midstream dynamics. This paper contributes to the debate on the role of the 'hidden middle' for upstream parties and identifies critical possibilities for enhancing VC dynamics through midstream innovation.

The remainder of this paper is structured as follows. In section 2 we outline the theoretical framework for analysing the dynamic and performance of midstream VC activities. Section 3 presents the analytical framework to understand (differences in) midstream performance from structural VC characteristics and the VC governance environment. We identify different determinants or potential causes of variation in the midstream agri-food value chain structure and the main factors influencing midstream performance. Section 4 describes the key characteristics of eight specific VCs located in Sub-Sahara Africa that differ with respect to technology (input intensity), market outlets, the scale of operations, and value chain organization. In Section 5 we make a comparative analysis of investments, employment and profitability of different types of midstream VCs, and identify wider implications for AVC development. Section 6 discusses the causes and consequences of midstream differentiation. Finally, Section 7 summarizes the major conclusions and outlines some lessons for further research and policy making for strengthening midstream VCs.

2. Theoretical background: midstream value chain dynamics

The research is embedded in the current interest of value chain[1] theory where attention is increasingly focused on a better understanding of the delivery and exchange relationships between different partners or stakeholders.

Value chain analysis has been developed originally by Michael Porter (1985) as a framework for breaking down an organization's activities into strategically relevant pieces to get a fuller picture of the cost drivers and sources of differentiation. The value chain (VC) concept is based on the process view of organizations, where organizations function as a system, made up of subsystems each with inputs (land, labour, materials, equipment), transformation processes (transport, processing, storage, packaging) and outputs (marketing & sales). Support activities (infrastructure, human resources, technological innovation and procurement procedures) can substantially improve supply chain operations efficiency.

How value chain activities are organized and carried out determines costs and affects profits. In between primary production and final consumption, several key activities contribute to higher profits and generate considerable employment, such as inbound logistics, operations, outbound logistics, marketing and sales, and services.

Figure 1: Value Chain structure (from Porter, 185)

The original value chain framework has been extended by Gereffi et al. (2005) to assess the governance of **global value chains** (GVCs) in developing countries. It makes a distinction between upstream activities (sourcing of raw material inputs, logistics and processing) and downstream activities (post-manufacturing and distributing the product to the final customer). These interactions are guided by three streams of literature: (i) transaction costs economics, (ii) production networks, and (iii) technological capability and learning. It identifies three variables that play a key role in determining how global value chains are governed and change: (1) the complexity of transactions, (2) the opportunities to standardize transactions, and (3) the capabilities in the supply-base. Gereffi et al. (ibid) distinguish five types of global value chain governance, ranging from high to low levels of coordination and power asymmetry (hierarchy, captive, relational, modular, and market). Coordination and power differences determine to a large extent the prospects for value chain upgrading and the opportunities for increasing inclusiveness and sustainability.

Based on these approaches, attention is gradually shifting to a more detailed analysis of the so-called **midstream** segment of global agricultural value chains. The midstream includes all activities from farm-gate to retail outlet: input provision (and credit supply), transport, processing, storage, logistics, packaging, wholesale, and delivery to local market outlets. This

[1] We use 'supply chain' and 'value chain' interchangeable. The term 'supply chain' refers mainly to the physical transactions taking place between stakeholders, while 'value chain' is related more to the economic and financial transactions.

analysis is particularly inspired by earlier studies by Reardon (2015; 2020) and Liverpool-Tasie et al (2020) that emphasize the growing economic importance of midstream activities as opportunities for engaging in non-farm employment (especially for women and youth) and for the creation of value added (through quality upgrading and efficiency improvement). Differences in midstream dynamics may be due to market conditions (competition), entry costs (initial capital investments) and requirements of scale. Moreover, value chain networks may include many different stakeholders and can be short (locally oriented) or longer (export- oriented). This is usually accompanied by a shift in relationships from informal spot market exchange to more formalized contracting agreements.

The relevance of analysing the 'hidden dynamics' of midstream VC segments is that it provides possible new insights on how upstream producers or downstream consumers could be supported through investments in the midstream. Since a large number of midstream stakeholders belong to the so-called 'informal sector', it is also important to identify opportunities for targeted midstream support that 'trickle down' to other VC segments. There is, however, still little knowledge on the causes for the existing diversity in midstream arrangements.

This research intends to go further than mere description (what is the importance of midstream agents in terms of the value added share and employment generation?) and tries to generate further insights into the underlying determinants of this diversity in **midstream operations**. This could be related to the physical characteristics of the activities involved (i.e. the type of products) but may also be explained by differences in VC governance as shaped by the delivery relationships and the linkages with upstream farmers. Some VCs involve closer ties and stringent contracting procedures (sometimes also including cost-sharing arrangements), while other VCs are based on loose deliveries (spot exchange) and limited product differentiation. These differences are likely to have a huge impact on the prospects for decent employment and equitable value added distribution.

In addition to the comparative appraisal, we perform an explorative analysis of the role of the resource use in midstream activities and the implications for **efficiency** and **profitability**. We, therefore, compute relevant indicators for the capital/labour intensity and the labour productivity of midstream processes that influence differences in labour returns (wages) and profit shares (profit as a share of value added). Once we understand better the importance and role of the organization of midstream VC segment for economic and social outcomes, we may be able to identify suitable measures and incentives for improving governance and for supporting equity.

3. Analytical framework

In this comparative analysis of the midstream segment of agri-food value chains, we apply a mixed methods approach, identifying the relationship between key outcome performance variables (i.e. value added distribution and employment generation) with major supply chain characteristics, such as factor intensity (capital/labour ratio), factor productivity (of capital and labour), the scale of operations, profitability, exchange relations and governance structure). We, therefore, rely on a combination of quantitative methods for selected parameters of typical agri-food value chain characteristics (capital use, labour intensity, labour productivity and profit ratio), with more qualitative methods for understanding differentiation in social relationships and trust in agri-food value chains.

We start with an analysis of the role and importance of midstream agents in selected VCA4D studies in terms of value added share (in USD) and employment generation (labour days). Unfortunately, data is not always complete and consistent and therefore we used national standard values (for wages, unit prices and costs) to calculate comparative volume levels.

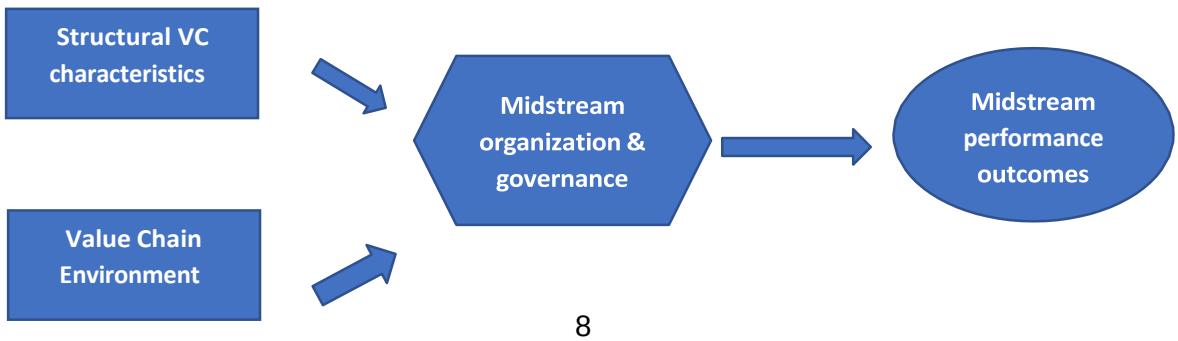
Figure 2:
The typical agricultural value chain

Production	Harvesting and transport	Primary processing and storage	Secondary processing	Distribution, packaging, and handling	Wholesale and retail markets
• Smallholder farmers • Farmer associations • Input providers	• Smallholder farmers • Farmer associations • Logistics companies	• Primary processors • Machinery suppliers	• Secondary processors • Machinery suppliers	• Packaging companies • Logistics companies	• Grocery stores and supermarkets • Food and beverage companies

Source: A.T. Kearney analysis

We start with the characterization of each agri-food value chain according to the sequence of activities (see Figure 2). Hereafter, we identify the structural value chain determinants and the main performance outcomes. We focus on different determinants or potential causes of variation in the midstream agri-food value chain structure and to understand which factors are influencing midstream performance (see Figure 3)

Figure 3: Analytical framework for agri-food midstream value chains



With this framework we can pay attention to three different levels of variation:

- Spatial level: Type Country (market structure & infrastructure; governance)
  Type of region (market differentiation; degree of urbanization)
- Product level: Type of Commodity (perennial, perishable, etc.)
  Type of Technology (labour and capital intensity)
- Business level: Scale of operations (large/small)
  Knowledge & Innovation (quality management)

This multi-level framework enables us to identify different driving factors for variation in midstream organization and performance. It is also useful to better understand how interactions between different system levels may determine the space for midstream development.

We consider product/commodity and country characteristics largely as exogenous and therefore focus on business level differences in VC organization and governance as explanatory variables for performance outcomes (see Box). This also enables us to identify strategic policy interventions and investment priorities that may support VC transformation and that can be used for midstream upgrading.

Based on the differences in performance, we can distinguish between three archetypes of value chain dynamics:

A. Production-oriented VCs in traditional food systems that still generate a major share of value added generation and employment in primary production activities,
B. Balanced VCs in transitional food systems that more or less equally divide value added generation and employment creation between primary production and midstream VC segments,
C. Midstream-dominated VCs appear in modern food systems where post-harvest processing activities are becoming most important in terms of value added and employment.

BOX: Definition of VC Performance indicators

Throughout this report, the following definitions are used:

- Capital intensity: capital/output ratio (excluding depreciation)
- Profitability: profit as share of valued added
- Labour productivity: value added per unit of labour (in local currency)
- Capital/labour ratio: value of intermediary inputs by labour employed
- Capital/output ratio: value of intermediary inputs by midstream value added

4. Descriptive appraisal

This study mainly uses data materials generated by the VCA4D project and tries to embed this information in the analytical framework of midstream value chain dynamics. The purpose of VCA4D program is to provide decision makers with evidence-based information to support inclusive and sustainable development strategies. It is directed to policymakers and stakeholders, and supports policy dialogue. Analysing VCs sheds light on impact, uncovers main pathways, and identifies at which stages of the chain and for which actors, investment and support can generate benefits, eliminate drawbacks and constraints and foster sustainability and inclusiveness.

The VCA4D program analyses agricultural value chains according to the sequence of production processes from the primary production to its end uses. It considers a system of different types of actors orientated towards the markets (input providers, farmers, collectors, processors, wholesalers, retailers, etc.).

The VCA4D program uses a common methodological framework, intending to appraise the sustainability of a VC from an economic, social and environmental perspective. This is preceded by a functional analysis, that provides a general description of the VC, a technical diagnosis of its different stages and an analysis of its governance and power structure.

We selected from the VCA4D portfolio 8 studies that cover different categories of products and production systems, focussing on cases from the sub-Sahara region (to control for major variation from contextual sources). This enables a comparison of the importance of some 'typical' midstream VC configurations for different categories of products (see Table 2):

- Cash crops: cotton (Ethiopia); cocoa (Cameroon)
- Fruit & Vegetables: green beans (Kenya) and pineapple (Benin)
- Animal products: beef (Zimbabwe)
- Staple Food crops: maize (Nigeria); groundnut and sorghum (Ghana)

Table 2: Comparison of midstream sector structure and market dynamics

Value Chain	Commodity	Country	Input Intensity	Market outlets	Scale of Operations	Value Chain linkages
Cash crops	Cocoa	Cameroon	Medium	Export	Mixed	Contracts
	Cotton	Ethiopia	Low	National	Medium	Contracts
Fruit & Vegetables	Green Beans	Kenya	High	Export	Large (Industrial)	Contracts
	Pineapple	Benin	Medium	Regional	Medium (semi-) Industrial	Differentiated
Animal products	Beef	Zimbabwe	Low	National	Communal/ Commercial	Differentiated
Food staples	Groundnut	Ghana	Low	National	Small	Spot exchange
	Maize	Nigeria	Low	Local	Small	Spot exchange
	Sorghum	Ghana	Medium	Local	Small	Differentiated

Notes: mixed (scale) refers to co-existence of firms with different scales of operation;
differentiated (VC organization) refers to simultaneous linkages to multiple agents.

There is considerable variation in the configuration of midstream sector structures (see Annex 1, Table A2). Commodities oriented towards regional and export markets (cocoa, green beans and pineapple) generally rely on more input-intensive technologies, mainly to safeguard quality and freshness. On the other hand, trading and processing activities in most food staples (maize, sorghum, groundnut) oriented towards local and national markets are usually characterized by low or mediocre resource-intensity. For almost all products, firms engaged in midstream value chains include both small-scale self-employment as well as more formal SMEs. These businesses mostly co-exist (mixed) or are mutually connected (differentiated), but in some countries, this is controlled by government regulation (Ethiopia) or contracts (Kenya).

For a further comparison of the different midstream configurations, we focus on some key performance indicators that reflect factor intensity (capital/labour ratio), production efficiency (capital-output ratio and labour productivity) and profitability (profit as a share of value added); see Annex A1.[1] Most midstream operations are highly profitable, with the notable exception of cocoa (Cameroon) and cotton (Ethiopia). This may be explained by the large differentiation at the recollection stage combined with a more monopolistic situation in final marketing. It may be due to specific arrangement between the processors in the VCs and their “client” further down and out of the VC perimeters, where the latter is the actual VC driver.

Almost all commodities exhibit a strong capacity for employment generation, but labour productivity remains low in the more differentiated midstream segments of food staple production (maize, sorghum, groundnut) for local and national market outlets. Both land-extensive production systems (beef) and capital-intensive processing regimes (green beans) can guarantee a substantially higher midstream labour productivity. Even while employment in primary cash crop production (cocoa, cotton) remains exceptionally high, returns to labour are challenged by high self-employment (sometimes including children) and limited options for labour-saving practices and technologies (McCullough, 2015).

Differences between midstream dynamics at country level are mainly caused by external factors, such as natural resource constraints (water, energy), access to factor inputs (land, capital) for realizing capital investment, the functioning of local labour markets and the competitiveness of output markets. Profitability is expected to be higher in countries with more favourable natural conditions, better infrastructure and more open markets. Profit shares may be relatively lower in countries that maintain strong market regulations.

On the other hand, most midstream operations require substantial capital – both long-term capital for infrastructure investment (transport, warehouses, processing plants) as well as short-term capital for operational use (pre-finance). Commodities with a longer supply chain and a larger scale of operations usually need more capital resources (cocoa, green beans, pineapple). Otherwise, commodities that rely on low-input processing and are oriented towards local and (sub)regional market outlets are likely to be less capital intensive (maize, sorghum, meat).

[1] Employment in primary production might be underestimated due to difficulties to consider for own account work and self-employment

5. Comparative analysis

We start the data analysis with an overview of the relative importance of value added creation and employment generation in respectively primary production and the midstream segment of the supply chain (see Figure 4). This data could be derived from the detailed cost structures for each of the products at different stages of the value chain. The employment data are calculated from the salaries (divided by wage rate) and the number of farms (self employment).

Important differences in socio-economic structures can be observed that are likely to be related to the underlying production regimes and/or the production environment (context). We distinguish three main archetypes:

A. Production-oriented VCs

Value chains that generate a major share of value added and an important share of employment in primary production activities typically form part of traditional food systems.

For commercial commodities like cocoa in Cameroon and cotton in Ethiopia, primary production remains fairly labour-intensive but some value added generation takes place in midstream activities (sorting, grading). The transition of agri-food systems towards longer supply networks is accompanied by investments in local transformation (fermentation; spinning/ginning) that take place at a larger scale and creates substantial value added. Even while these VCs remain largely 'traditional', trade is increasingly influenced by contractual relationships.

Most products are sold with limited processing (except some artisanal home conservation). This archetype is mostly found in traditional agri-food systems where supply chains are relatively short and production and trade take place within geographical boundaries. Even while the 'bulk' character of these commodities is maintained, with growing urbanization new employment is created in marketing, transport and wholesale activities. Still, a large part of the businesses are family owned and operated, but sales are becoming more diversified.

B. Balanced VCs

Value chains that divide value added generation and employment creation between primary production and midstream VC segments during the shift towards transitional food systems.

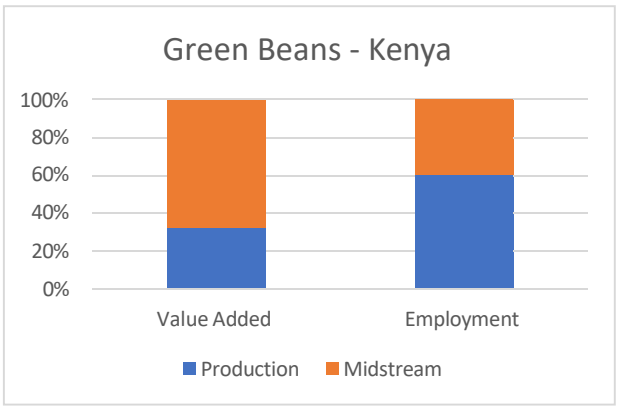
The production sphere remains especially important for value added creation of staple foods, such as maize in Nigeria and groundnut in Ghana), even while in employment generation the role of midstream agents in employment (and income) generation is becoming increasingly relevant.

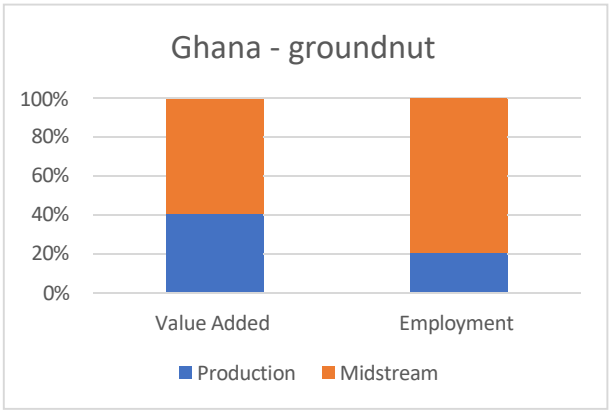
C. Midstream-dominated VCs

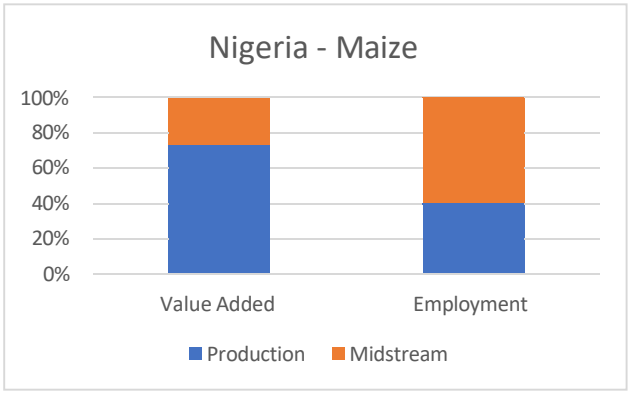
Value chains where post-harvest activities are becoming more important in terms of value added and (slightly delayed) employment creation as part of the modernizing food system.

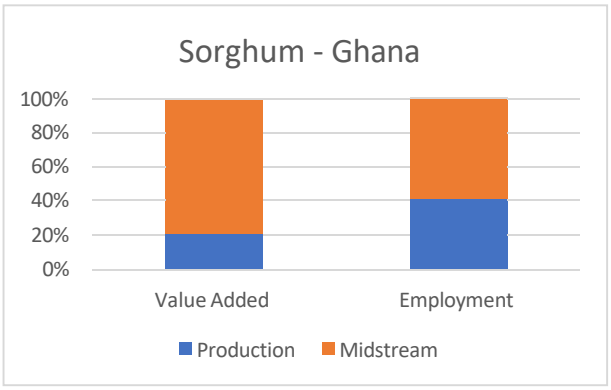
This situation is especially relevant for perishable commercial products such as pineapples from Benin, beef from Zimbabwe and – to a minor extent – green beans from Kenya and sorghum in Ghana. Even while these products still remain employment-intensive in primary production, a major share of the value added is generated in the midstream segment. Activities like quality grading, product selection and packaging are critical for maintaining a competitive position in demanding export markets. This is typical for modernizing agri-food systems where markets are spatially distant but linked through intermediation contracts. Processing and trade are also more concentrated and are often controlled by foreign companies. Downstream technologies are more capital intensive and need more sophisticated quality management systems.

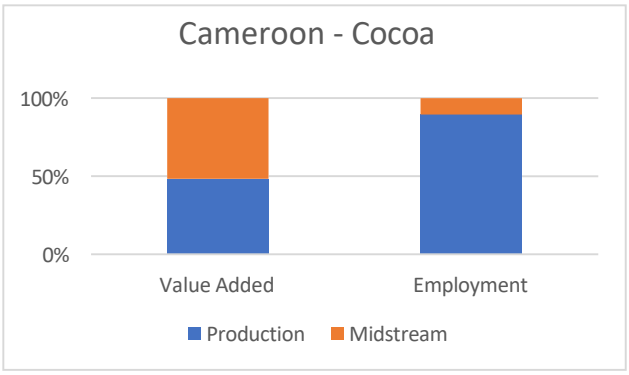
Figure 4: Value added and employment in production and midstream (in %)

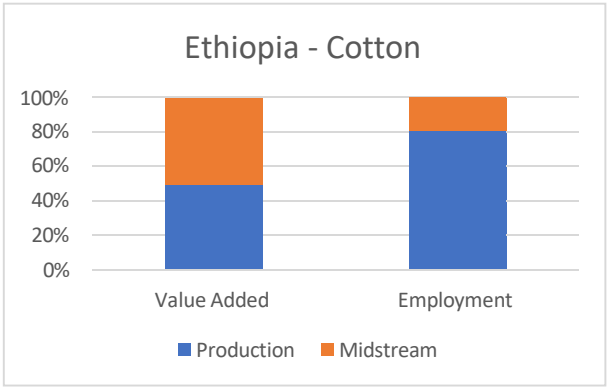


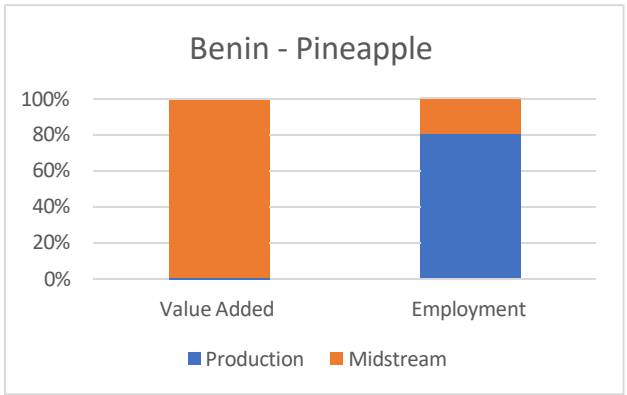


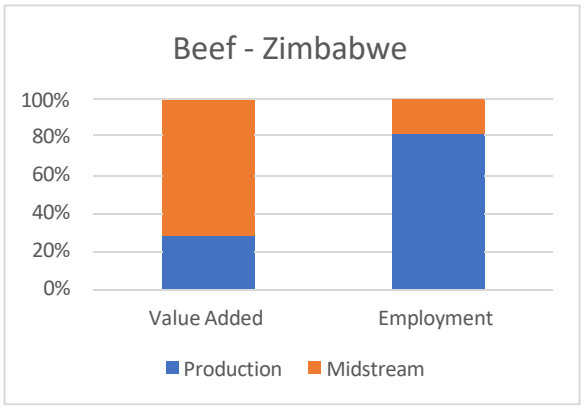












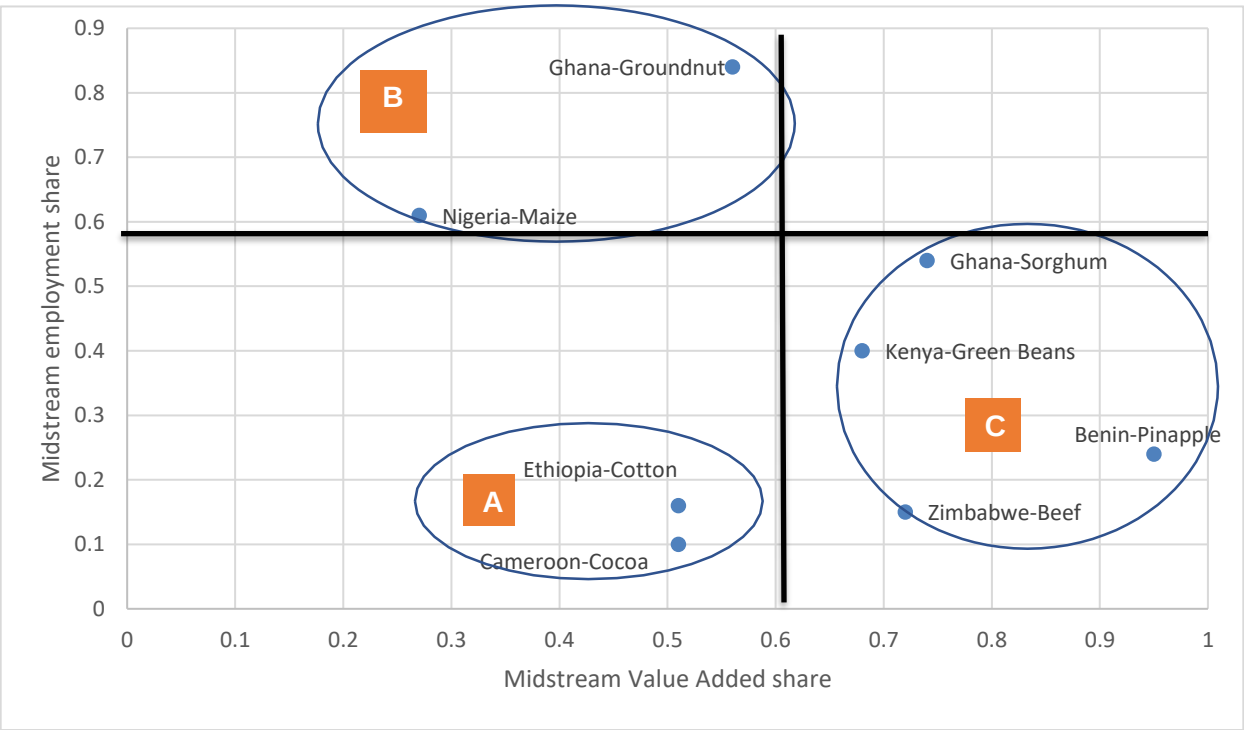
If we compare the different value added and employment structures for the selected commodities and countries, three different archetypes are compared (see Figure 5):

A. **Production-oriented VCs** that generate a major share of value added (> 60%) and most wage and self-employment (> 80%) in primary production activities. This is the case with cash crops such as cocoa (Cameroon) and cotton (Ethiopia) that are traded on (inter)national markets meeting rather standard buying conditions.

B. **Balanced VCs**, that more or less equally divide value added generation between primary production and midstream VC segments, and combine processing with rather limited midstream employment creation. This is mainly observed in VCs for primary food staples – such as maize in Nigeria and groundnut in Ghana – that are traded with limited processing and through spot transactions on local and regional markets.

C. **Midstream-dominated VCs** where post-harvest activities are becoming important in terms of value added creation (> 60% midstream) and employment generation (20-50% in midstream). This includes VCs of green beans (Kenya), pineapple (Benin), sorghum (Ghana) and beef (Zimbabwe) that focus on broad markets and have a perishable character, and therefore require selection, packaging and processing.

Figure 5: Different types of midstream dynamics

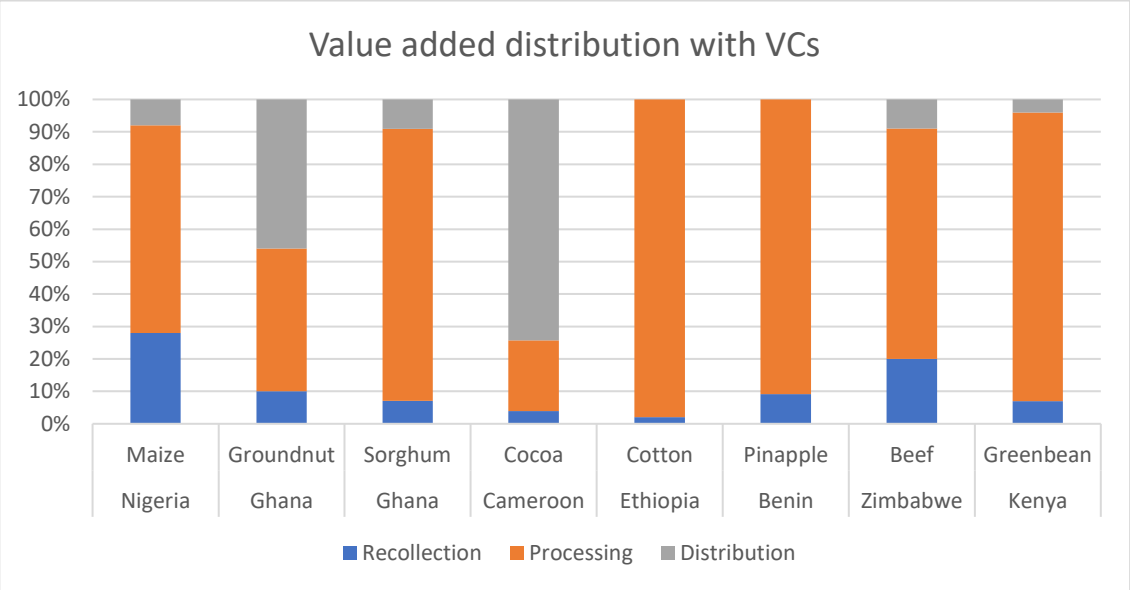


Note: (A) production-oriented, (B) balanced, and (C) midstream-dominated

This variation in midstream value added shares is also related to important differences in the composition of midstream activities, the degree of market competition and the leading role of specific stakeholders (see Figure 6). In most VCs – with the notable exception of cocoa – all types of processing activities are creating and capturing a growing share of value added. This is particularly the case in VCs of perishable commodities (green beans, pineapple, and - to a minor extent - beef) and raw materials (cotton) that require more investment in equipment and thus rely on a minimum scale in processing.

On the other hand, in VCs of basic food commodities (maize, groundnut, beef) the role of traders in recollection and distribution still remains strong. Consequently, more short-term credit is required for their operations and profits margins depend mainly on the swiftness of transactions. Recollection activities generate important value added in cocoa and groundnuts VCs that only require basic processing and are involved in long-distance transactions.

Figure 6: Composition of value added distribution in midstream activities



Note: the cotton case stops at yarn production and therefore the distribution segment is not included.

Finally, opportunities for midstream agents depend on macro-economic conditions and governance systems that enable profitable agri-food operations and investments for scaling (Porter, 1985). Table 3 provides an overview of the progress in socio-economic transformation in each of the selected countries. The degree of urbanization and annual per capita economic growth are indicative of the demographic and diet transitions (e.g. growing middle class with demand for purchased and processed food). Infrastructure availability and the World Bank Ease of doing Business Index (2020) are used as indicators to illustrate the transaction costs and risks associated with midstream activities.

Table 3: Midstream dynamics by type of country (2019/20)

Commodity	Country	Urbanization (2020) (% population)	Economic growth p.c. (2010-19)	Road density (km per km^2)	Business environment (EDB index)
Maize	Nigeria	52	0.90	21	131
Groundnut	Ghana	57	4.48	46	118
Sorghum	Ghana	57	4.48	46	118
Cocoa	Cameroon	58	2.24	10	167
Cotton	Ethiopia	22	5.99	11	159
Pineapple	Benin	48	2.12	14	149
Beef	Zimbabwe	32	-1.19	23	140
Green Beans	Kenya	28	2.83	30	56

Source: World Bank indicators

Note: EDB = Ease of Doing Business index (high = 1; low = 190)

The role of these structural differences for midstream VC is illustrated in Annex 2. Urban food markets are the largest in West Africa (Cameroon, Ghana, Nigeria) and offer scope for larger midstream operations in transport, storage and distribution. In a similar vein, countries with higher macro-economic growth and monetary stability (Ethiopia, Ghana) favour scaling and investments for local processing. Minor differences appear with respect to the availability of physical infrastructure for transport and energy: all countries have mediocre performance, with Ethiopia and Cameroon at the lowest rank. Kenya – to some distance followed by Ghana - show most outstanding performance in terms of the business climate as an enabling condition for foreign direct investment in green beans and groundnut/sorghum processing that created substantial and permanent midstream employment (partly for women).

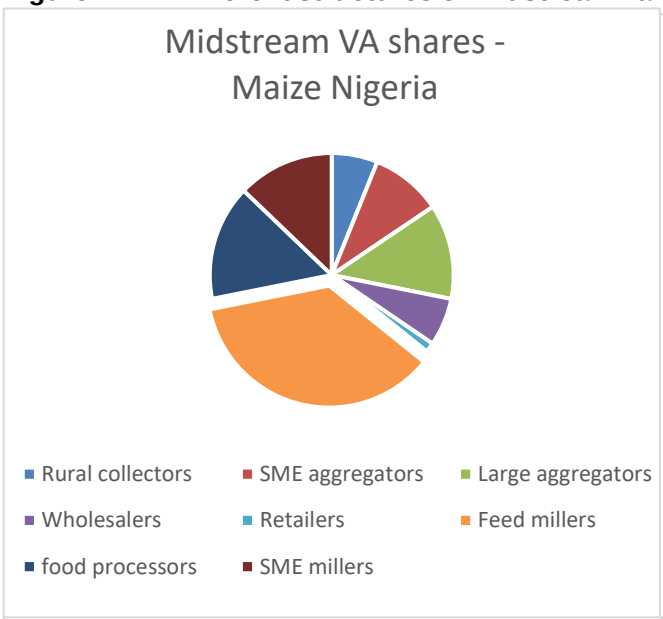
6. Causes and consequences of midstream differentiation

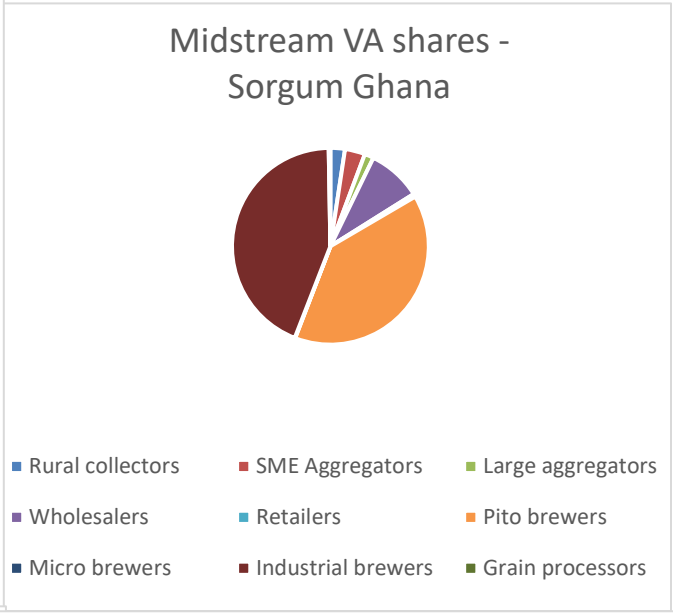
Explaining the underlying causes and the socio-economic consequences of differences in midstream VC dynamics, we focus on some critical commodity, market- and country-specific differences in VC structure and performance.

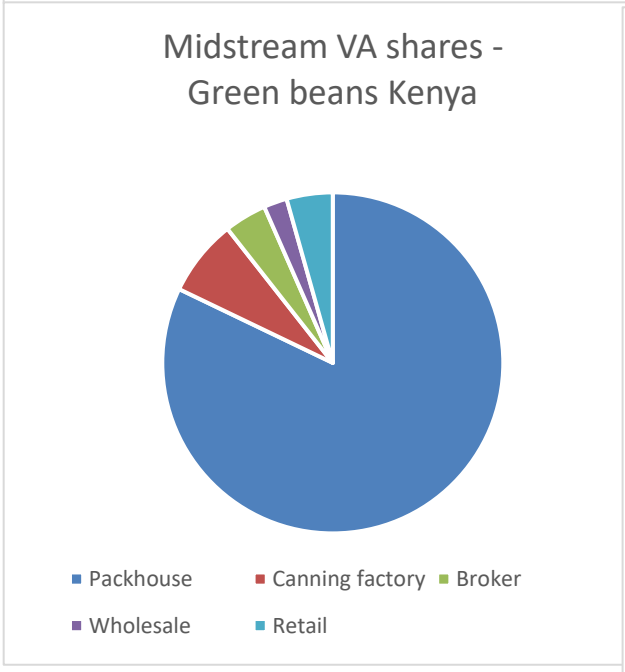
6.1. Midstream structures

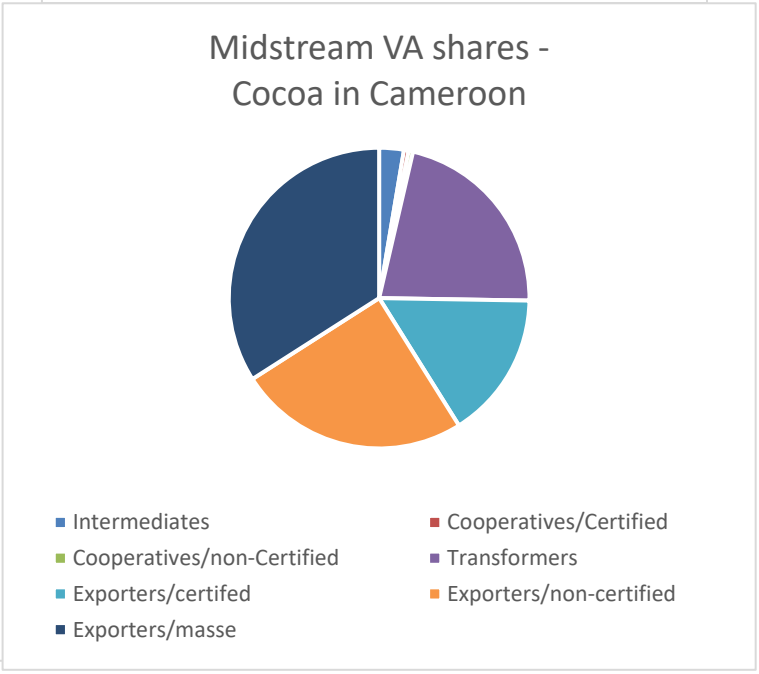
First, we can observe major differences in the **structure of midstream agents** (see Figure 7). In the VCs of green beans (Kenya) and sorghum (Ghana), there are one or two major types of agents that control more than 75% of value added (beans packers and canning factories; beer brewers). Other VCs for maize (Nigeria) and cocoa (Cameroon) include a larger variety of midstream agents – either collectors for the local markets or traders for exports - that create more competitive market relationships that finally may also favour primary producers.

Figure 7: Different structures of midstream value added distribution for selected value chains









Second, differences in the type of **market relationships** and the segmentation of market outlets may influence the competitive position of midstream agents in employment creation and value added generation. Value chain configurations with more domestic processing (such as sorghum and groundnuts), products oriented towards multiple market outlets (combining local and exports markets), products for multiple purposes (food for human consumption and feed for animals) and sectors with opportunities for product differentiation through certification (cocoa, pineapple) meet higher prospects for VA midstream generation.

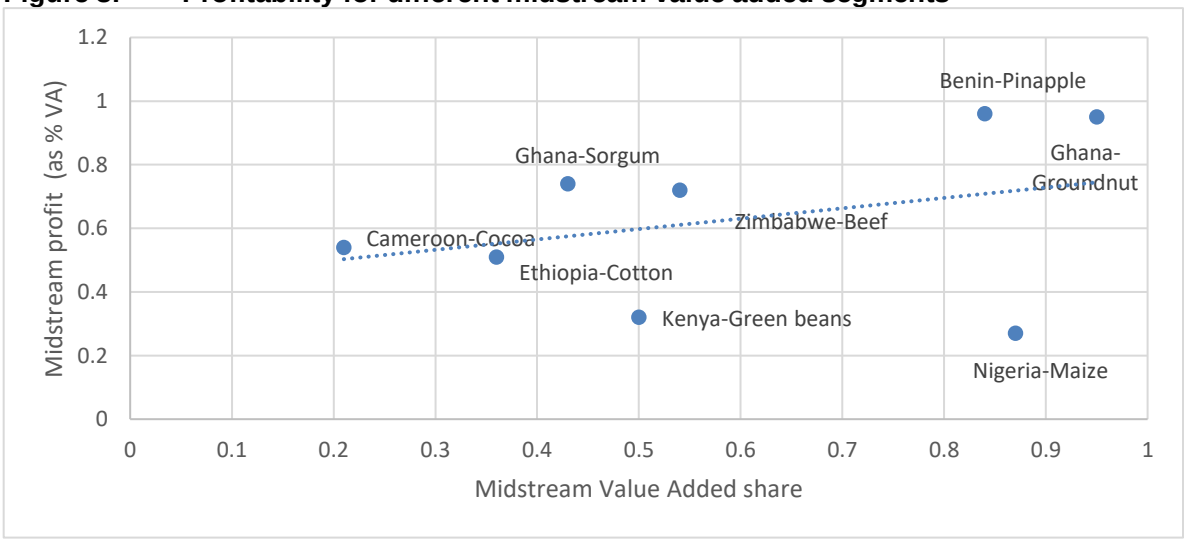
The capacity for midstream employment creation depends far more on the length of the value chain and the processing technologies involved. Interestingly enough, several staple food VCs for local markets are already engaged in low labour-intensive processing activities (milling, brewing, snacks) whereas more established market-oriented commodities (cotton, cocoa, pineapple and beef) still maintain high labour use in midstream operations. In addition, the latter may be explained by very low wage (rural) rates in several low-income countries (Cameroon, Ethiopia, Benin and Zimbabwe), while other countries offer wider opportunities for engagement in alternative off/non-farm employment.

Third, the **VC governance and market environment** offer different scopes for linking agri-food producers with midstream traders and processors. This is partly induced by the availability of (physical and communication) infrastructures but may also be caused by public or private regulation of exchange relationships. In Ethiopia (cotton) and Cameroon (cocoa), the organization of cooperative or communal production may favour the competitive position of farmers. In Kenya (green beans) and Benin (pineapple), it was found that delivery contracts guarantee more permanent employment and reasonable salaries in primary production, even while a major share of value added is generated in processing plants. Other, more differentiated VCs are still able to combine formal and informal channels but may experience further concentration with the introduction of new capital-intensive processing technologies.

6.2. Midstream performance

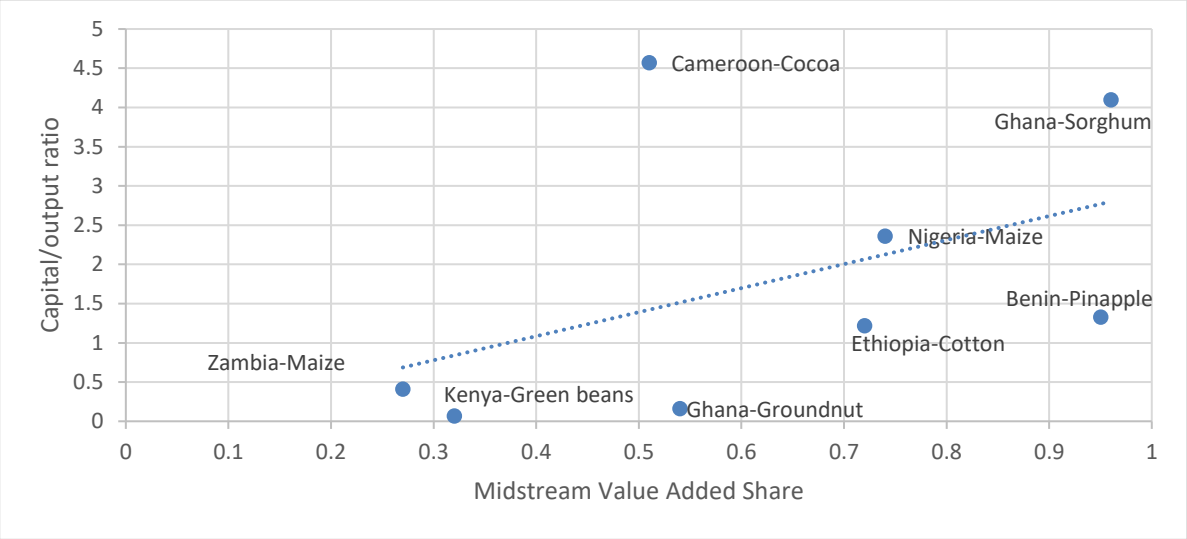
There are important differences in the internal organization and profitability of midstream VC segments. With a rising share of the midstream value added we also note a gradual increase in profitability (see Figure 8). However, the causality between both processes remains to be determined: higher profit shares could be a cause for increasing midstream value added, but otherwise larger value added can also be a driver for better profitability. The interaction between both processes is likely to enhance the overall attractiveness of midstream activities.

Figure 8: Profitability for different midstream value added segments



As shown in Figure 9, the rising capital-intensity of midstream operations is strongly associated with the higher midstream share in total value added. This is likely to be related to asset-specific investments for trade and processing activities that require greater control of midstream stakeholders over value added operations. Greater midstream capital investments thus deliver clear returns in terms of value added generation. It should be noted that several midstream processing activities are also fairly labour-intensive and therefore results in additional employment generation.

Figure 9: Capital intensity of midstream value added segments



Some important differences between countries and commodities should be noted. The capital-output ratios – reported in Annex 1 - in Ethiopia (cotton) and Ghana (groundnut) are considerably higher than in other countries, probably reflecting the availability of more credit and finance facilities (either through public intervention or as a result of market liberalization). On the other hand, high capital investments for trade and processing of commercial commodities such as green beans (Kenya) and cocoa (Cameroon) are accompanied by a rather modest midstream value added share, reflecting the importance of primary production for guaranteeing quality and reputation. Competition between midstream players to operate at the highest utilization of capacities may also explain the limited share of midstream in VA generation.

6.3. Wider effects of midstream development

Different midstream VC configurations also generate diverse development outcomes in terms of gender empowerment, environmental externalities (sustainability), participation opportunities (inclusion), and prospects for reaching nutritional adequacy and healthy diets. Information on these wider effects is captured in Annex 3 and summarized in Table 4.

Opportunities for female entrepreneurship are higher in VCs that maintain a substantial component of artisanal processing (i.e. pineapple, cotton, groundnut)[3] and small-scale informal trade (maize, sorghum). Even in green beans, the workforce (mainly women) is employed on an informal, casual or temporary basis. The performance of this VC depends on retaining access to a flexible (informal, casual & temporary), low skilled/semi-skilled workforce.

VC sustainability is threatened by high post-harvest losses (green beans), phytosanitary problems (maize, groundnut, cocoa), occupational health (green beans, beef) and growing reliance on water and energy. More engagement in export markets could potentially enhance compliance with labour and pesticide standards. Several midstream VCs face problems of inclusion due to oligopolistic market structures and low SME organization. In some cases, there

are contractual arrangements that provide linkages between primary producers, traders and processors (cocoa, cotton, sorghum), but this is not general practice. Access to midstream SME activities is favoured by more public investment in infrastructure, access to finance and lower entry costs, i.e. when relatively simple processing technologies are used and innovations are easily distributed (such as in sorghum and groundnut).

Table 4: Wider effects of midstream development

Commodity	Country	Gender	Environment	Inclusion	Nutrition & Diets
Maize	Nigeria				
Groundnut	Ghana				
Sorghum	Ghana				
Cocoa	Cameroon				
Cotton	Ethiopia				
Pineapple	Benin				
Beef	Zimbabwe				
Green Beans	Kenya				

Note: positive | mixed | negative

The transitional (type B) balanced VCs (maize & groundnut) produce key ingredients for local diets and offer wide opportunities for (female) engagement in SME trade and processing activities. There are, however, considerable environmental risks and externalities from post-harvest losses and aflatoxin contamination. Groundnut processing offers more opportunities for remunerative wage labour and self-employment.

Production-dominated (type A) cocoa and cotton VCs face barriers of entry for SME businesses due to oligopolistic production structures and higher public levies. Consequently, they pay low and inadequate wages and thus offer their labour force fewer options for reaching nutritional adequacy. While cocoa still offers limited opportunities for women outside primary production, women's self-employment groups remain important for cotton ginning and weaving.

Midstream oriented (type C) of green beans (Kenya), pineapple (Benin) and beef (Zimbabwe) demonstrate positive effects for reaching nutrition adequacy. There is much female employment involved in beans packaging and pineapple processing, but occupational health hazards (beans) and high energy and packaging costs (pineapple) may threaten sustainability. Circularity in beef processing is remarkably high. In a similar vein, trade standards with quality and safety requirements can be a limiting factor for inclusion of smallholders.

Finally, information on backwards linkages through the effect of midstream activities on upstream relationships with farmers is scarce. Products that require permanent operations and have scale economies (green beans) and where efficiency depends on full capacity utilization for processing (cocoa, cotton, sorghum) try to engage farmers for reliable deliveries (i.e. avoiding side sales) by creating trustful relationships. Stronger linkages through direct payment or pre-finance relationships are still scarcely found, and there remains therefore scope for further midstream development.

7. Discussion, Conclusion and Outlook

There is a growing importance of midstream VC operations for trade, processing and distribution of agri-food commodities. However, midstream activities are highly diverse in terms of scale, technologies (i.e. capital intensity) and profitability. Based on the VCA4D case studies, we identified three archetypes that involve different configurations of employment creation and value added generation between primary production and midstream activities.

First, we looked at country-level determinants of midstream VC development. Stronger urbanization and a more favourable business environment are supportive for the investment in midstream activities and are also helpful to enhance their inclusivity, but only have a marginal effect on midstream profitability. Fastly growing urban food markets in sub-Sahara Africa thus offer a wide scope for midstream development. Against common ideas, better infrastructure and overall economic growth appear as less critical for enabling midstream investments. This implies that demand-side motives are leading the midstream transition. Policy instrument to further promote midstream development could therefore focus on lower entry barriers (easy permits; concessional loans), market information systems (transparency) and scale-neutral technological innovations,

Second, we analysed the impact of particular commodity characteristics on the organization of midstream VCs. Production-oriented VCs remain important for commercial commodities (cocoa in Cameroon and cotton in Ethiopia), where primary production remains labour-intensive but value added generation requires some investments in local transformation (drying, fermentation and spinning/ginning) that take place at a larger scale and depend on longer supply networks that are increasingly dominated by contractual relationships. Balanced VCs are typical for staple foods (maize in Nigeria and groundnut in Ghana) that are relatively short, use small-scale processing facilities and deliver within geographical boundaries. Midstream-dominated VCs are mainly found in perishable commodities (pineapples from Benin, beef from Zimbabwe and green beans from Kenya) where downstream activities for quality grading, product selection and packaging are critical for maintaining a competitive market position.

Third, we analysed differences in midstream firm organisation and economic performance and discussed their implications for agro-food system development. An growing midstream value added share is accompanied by a gradual increase in midstream profitability. This is mainly due to the shift in power relations in favour of midstream firms. Most midstream investments are associated with a strict control of midstream agents over value chain operations. Moreover, several midstream processing activities are still fairly labour- intensive and therefore result in additional off-farm employment generation.

Fourth, the theoretical relevance of analyzing the structure and operations of midstream agri-food VCs can be highly relevant to better understand the backwards linkages with on-farm operations and the forward linkages to retail outlets and final consumers. Midstream agents control a major share of value added and have a decisive influence on agri-food sustainability and equity. In addition to studies that analyse the midstream structure and value added, attention should be given to a more systematic assessment of entry costs, investment and innovation strategies, and the role of power, coordination and dependency in contractual networks (Mekonnen et al., 2022; Ruben et al., 2021; Vos & Cattaneo, 2021).

Fifth and finally, midstream VCs may provide important leverage points for agri-food policies. Instead of focussing on direct investments in agricultural intensification, it could be more effective to support midstream agents and strengthen VC governance for enabling backward investment linkages and delivery contracts. Reduction of risks and transaction costs can become key components of public policy toward more inclusive and sustainable agri-food VCs.

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Annex 1: Midstream performance by commodities

Table A1: Comparison of VC Midstream performance indicators

Commodity	Country	Labour productivity	Profits as % Value Added	Capital/labour ratio	Capital/output ratio
Maize	Nigeria	42	87	n.d	0.41
Groundnut	Ghana	15	84	62	4.10
Sorghum	Ghana	94	43	222	2.36
Cocoa	Cameroon	n.d	21	n.d	0.16
Cotton	Ethiopia	n.d	36	n.d	4.57
Pineapple	Benin	n.d	95	8.8	1.33
Beef	Zimbabwe	606	54	n.d	1.22
Green Beans	Kenya	1.604	58	110	0.07

Source: calculations based on accounting data in VCA4D reports

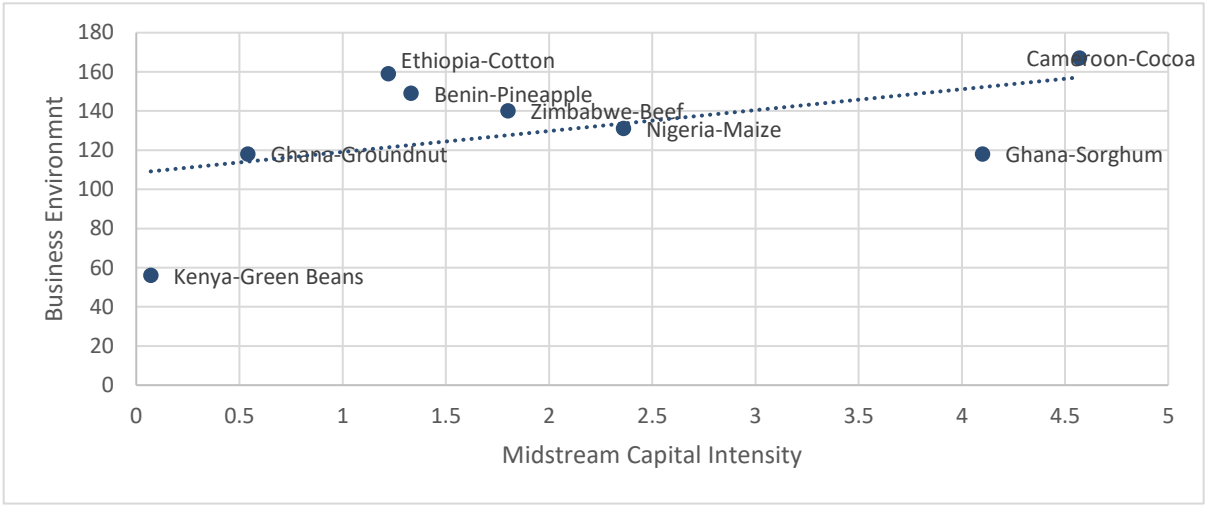
Notes: labour productivity = value added per unit of labour (in local currency)
profit = net operating surplus as share of total value added (in %);
capital/labour ratio = value of intermediary inputs by labour employed
capital/output ratio = value of intermediary inputs by midstream value added.

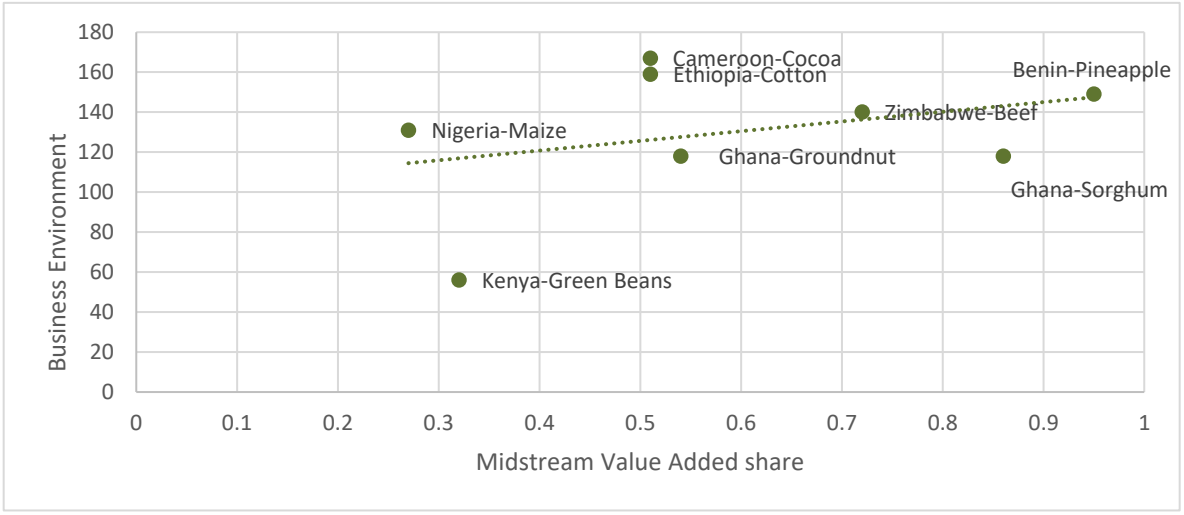
Table A2: Comparison of major commodity features

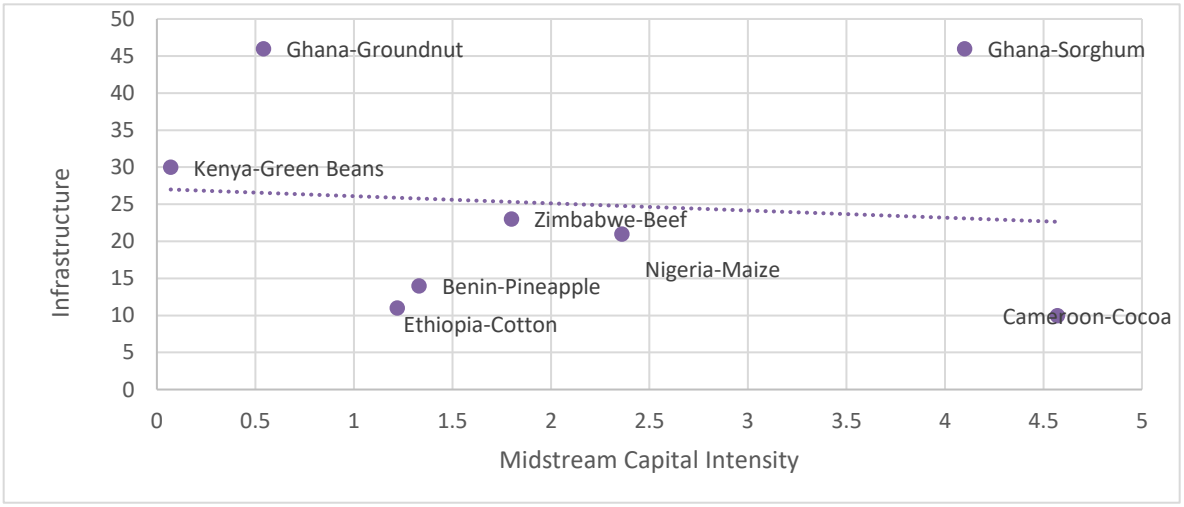
Commodity	Country	Perishable	Bulky	Quality variation	Product differentiation	Demand elasticity
Maize	Nigeria					
Groundnut	Ghana		X		X	
Sorghum	Ghana	(X)			X	
Cocoa	Cameroon		X	(X)		X
Cotton	Ethiopia		X		(X)	
Pineapple	Benin	X		X		
Beef	Zimbabwe	X				X
Green Beans	Kenya	X		X		X

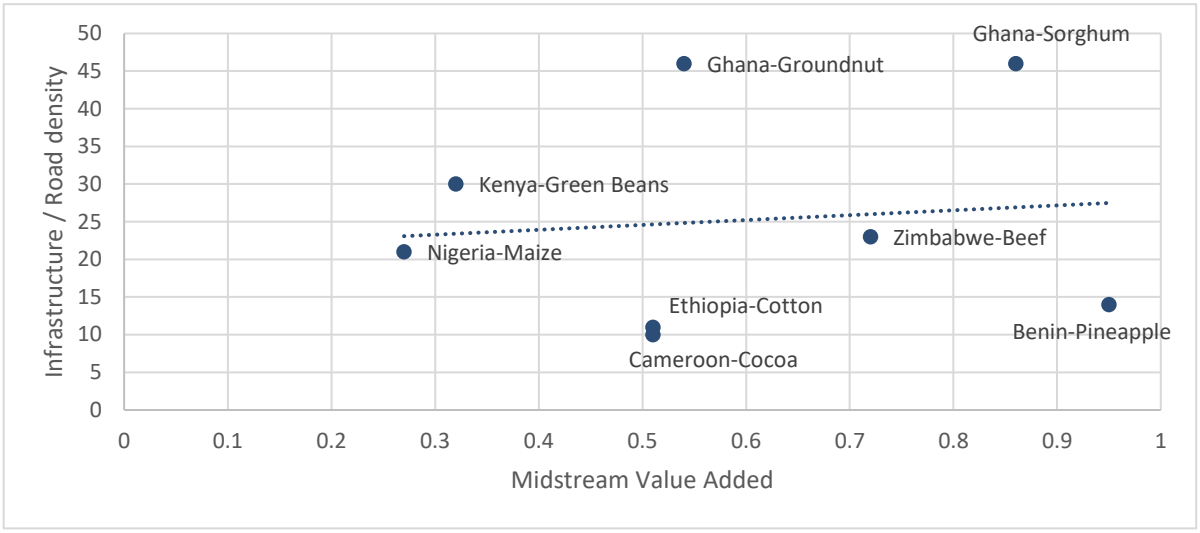
Source: FAO 2021, Characteristics of Agricultural Goods. Rome: FAO

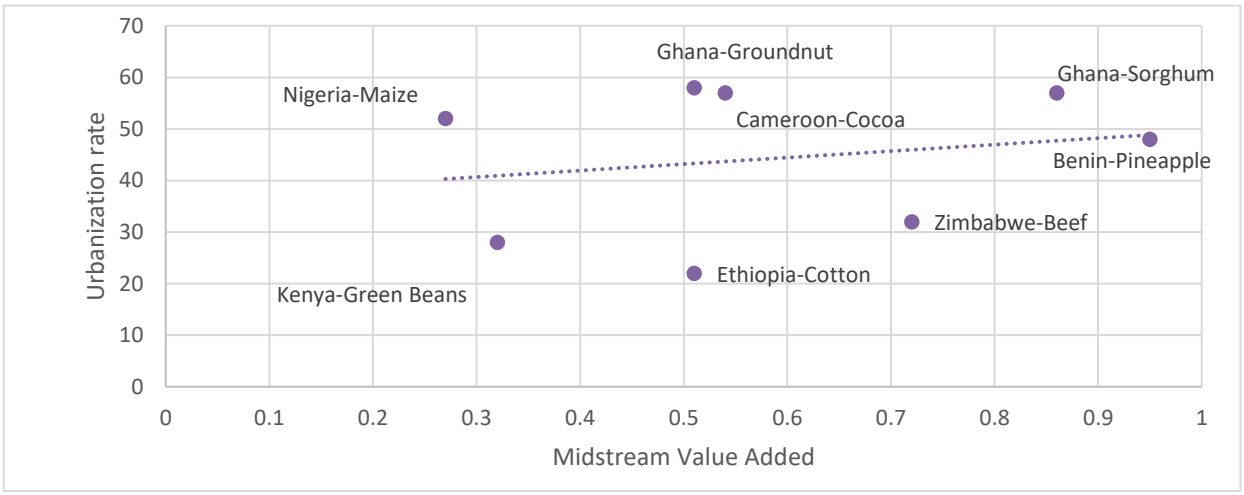
Annex 2: Midstream performance by food system environment characteristics

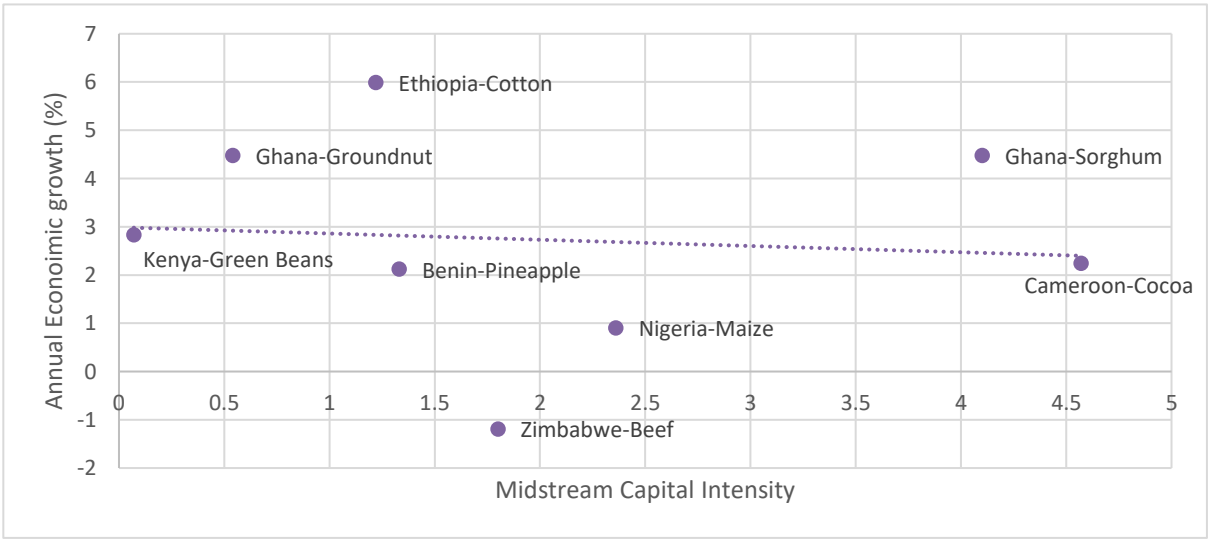







Infrastructure / Road density
Midstream Value Added
Ghana-Sorghum
Ghana-Groundnut
Kenya-Green Beans
Zimbabwe-Beef
Nigeria-Maize
Ethiopia-Cotton
Benin-Pineapple
Cameroon-Cocoa


Urbanization rate
Midstream Value Added
Ghana-Groundnut
Ghana-Sorghum
Nigeria-Maize
Cameroon-Cocoa
Benin-Pineapple
Zimbabwe-Beef
Ethiopia-Cotton
Kenya-Green Beans


Annual Econoimic growth (%)
Midstream Capital Intensity
Ethiopia-Cotton
Ghana-Groundnut
Ghana-Sorghum
Kenya-Green Beans
Benin-Pineapple
Cameroon-Cocoa
Nigeria-Maize
Zimbabwe-Beef

Annex 3: Wider effects of midstream development

Commodity	Country	Gender	Environment	Inclusion	Nutrition & Diets
Maize	Nigeria	Opportunities for female SME entrepreneurship; 40% informal trade.	Post-harvest losses (15%); energy & water use; risk of aflatoxin contamination.	Self- & wage employment; low wages; hazardous work conditions; limited organization.	Flour for traditional meals (*tuwon masara*); potential for vitamin A fortification & feed for poultry.
Groundnut	Ghana	90% of workers are women; contribute to self-esteem & independence.	Post-harvest losses (9-16 %) and Aflatoxin risk. Low environmental impact.	Artisanal SME processing (88%); high employment; low organization (6%); low literacy.	Major ingredient for soups (Northern diet). Poor access to water, sanitation & housing.
Sorghum	Ghana	Women involved in grain milling, but entry barriers for local brewing. Limited finance to engage in aggregation.	Environmental grain milling impacts are negligible; energy & water use in (industrial) brewing; re-usable glass packaging; waste (12%) for feeding pigs.	Self-employed pito brewers (5,500); youth employment & female workers (15,000). Work safety risks; no child labour. Active FBOs.	Consumption as gluten-free & protein + mineral-rich food; traditional beer processing (substitute for barley imports). 50-75% household income for food expenditures.
Cocoa	Cameroon	Much (non-remunerated family work & informal employment. Only 12% women engaged in trade & transformation; strong wage differentiation.	Growing phytosanitary problems; energy use for transport & fermentation; no waste management in place.	Informal traders & contracts with farmer groups (40%); oligopoly in processing & exports; high fiscal levies; some opportunities for certification.	Low prices and salaries below living wage; high stunting & undernutrition.

Cotton	Ethiopia	Comfortable midstream margins with 300-400,000 self-employed weavers; state-owned & foreign textile firms with 50-70,000 wage employment; low salaries for women in ginning plants & child labour in weaving.	Desire for environmental (organic) & social branding; use of subproducts like cotton cake (animal feed) & cottonseed; low ginning outturn & low oil content; (hydro)energy and water use.	Complex and diversified VC with strong forward linkages. Stand-alone & integrated factories. Poor maintenance and underused capacity. Strong manufacturers associations & weak states.	Strong dualism between traditional (handloom) and industrial VCs. Salaries far below living wage; limited dietary diversity; quality and competitiveness constraints.
Pineapple	Benin	Female employment up to 80% in trade and 40-60 % in (artisanal) processing; some federal/cooperative organization in place.	Mainly conventional & biological production (1%); artisanal & industrial processing; reliance on energy and packaging materials (25% of costs).	Low entry costs for local trade & processing; Regional & export trade by refrigerated trucks. Scarce use of contracts & limited access to finance.	Largely informal VC; Low prices due to quality differentiation & absence of standards & traceability. Reasonable margins are realised.
Beef	Zimbabwe	Labour in slaughterhouses & butchers is mainly male; informal retail on local markets by women.	Occupational health & safety concerns; low environmental impact.	Co-existence communal & commercial system; labour-intensive processing; acceptable working conditions.	Sales of mixed meat bags through informal vendor at reasonable prices. Market control through auctions and permits.
Green Beans	Kenya	Strong employment generation in packing and canning; women are 80% of the workforce.	Health risks due to pesticide residues; 30-40% rejection rate & post-harvest losses; high airfreight footprint.	Difficult of GLOBALG.A.P. standards compliance; respect on labour rights; no evidence of child labour; high wage differentials.	Fresh food availability at local markets; education, healthcare & housing facilities for permanent workers; compliance with legal norms.