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Kenya's Agrifood System

Structure and Drivers of Transformation

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EXECUTIVE SUMMARY

This analysis is composed of two parts. The evolving structure of Kenya's agrifood system (AFS) and its contribution to national development is assessed using a series of Social Accounting Matrixes (SAMs) for Kenya for the period 2009–2019. Economic performance is also assessed at subsector level to better understand the contributions of different agrifood value chains to Kenya's development and economic transformation in recent years. The analysis reveals that the effects of AFS transformation stretches well beyond primary agriculture, creating jobs and income opportunities throughout the economy. In fact, the off-farm components of the AFS have grown more rapidly than primary agriculture, although differences in market structure and internationally tradable status contributed to varied patterns of growth across value chains. The analysis further reveals that it is the domestic market, not exports, that has driven the recent growth in Kenya's AFS. Rapid urbanization and increased income-generating opportunities in the rural nonfarm sector are causing dietary patterns to shift, which will continue to shape the transformation of the AFS in Kenya.

A forward-looking analysis using IFPRI's Rural Investment and Policy Analysis (RIAPA) model – an economywide modeling framework – assesses the potential impacts of future value chain growth on development outcome indicators. The findings reveal that value chains differ considerably in their effectiveness in achieving various development outcomes. Promoting only one value chain may also result in trade-offs across these development goals. For example, the coffee and tea value chains are highly effective at raising off-farm employment in the AFS, but they have weak impacts on diet quality. Likewise, cattle and dairy have strong off-farm GDP effects within the AFS, but are relatively ineffective at reducing poverty. By promoting and investing in several value chains simultaneously, policymakers can leverage synergies and mitigate trade-offs across development outcomes associated with specific value chains. The RIAPA analysis here suggests that joint promotion of the pulses and oilseeds, fruits and nuts, and cattle and dairy value chains will be most effective at impacting the full spectrum of development outcomes tracked in the model, including poverty, growth, jobs, and diets. However, the final value chain selection may change depending on the importance policymakers attach to the respective development outcomes.

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1 INTRODUCTION

The 2010s were a decade of significant economic development in Kenya. Gross domestic product (GDP) – an indicator of the economy’s size – expanded by an average of five percent per year (KNBS 2022). This exceeded population growth and helped raise household incomes, leading to a decline in poverty rates, and more importantly, a decline in the absolute number of poor people for the first time in at least three decades (World Bank 2022). Agriculture played an important role. The sector grew alongside the rest of the economy, despite facing many challenges, including climate variability (Ochieng et al. 2020), weak rural infrastructure (Benin and Odjo 2018), falling farm sizes (Jayne et al. 2016), and inaccessibility of farm inputs combined with poor agronomic management (Worku et al. 2020). Agriculture, which is just one part of the broader agrifood system (AFS), also contributed to growth in downstream or off-farm sectors of the AFS and helped cushion the economic damages from COVID-19 in 2020 (Pauw et al. 2021a). After a decade of rapid development, it is important to consider how Kenya’s AFS is transforming and how it is contributing to national growth and structural change.

Agrifood systems are expected to evolve as countries develop. Eventually, they come to comprise far more than just traditional or primary agriculture (Diao et al. 2010; Timmer 1988). Subsistence farming typically dominates agriculture during the earliest stages of development, but as agricultural productivity rises, farmers start to supply surplus production to markets, thus creating job opportunities for workers in the off-farm economy (Haggblade et al. 2007). Rising rural incomes generate demand for more diverse products, leading to more processing, packaging, transporting, trading, and other nonfarm activities. In the early stages, agriculture serves as an engine of rural, and even national, economic growth. Eventually, urbanization, the nonfarm economy, and nonagricultural incomes play more dominant roles in development, with urban and rural nonfarm consumers creating most of the demand for agricultural outputs via value chains connecting rural areas to towns and cities (Dorosh and Thurlow 2013). The nature of this agricultural transformation varies across countries because of the diverse structure of their economies and the unique growth trajectories of their various agrifood and nonfood subsectors.

This report describes the current and changing structure of Kenya’s AFS and evaluates the potential contribution of different value chains to driving faster and more inclusive agricultural transformation in the future. Section 2 introduces a conceptual framework of the AFS and its application to Kenyan data. Section 3 compares Kenya’s AFS to those of other countries at different stages of development. Section 4 disaggregates Kenya’s AFS across value chains taking into consideration their different market structures. Section 5 examines how Kenya’s AFS has contributed to the broad economic transformation, and Section 6 evaluates the performance and structural change within the AFS in the recent years. Section 7 then uses a forward-looking economywide model to assess the diverse contributions of value chain development to broad development outcomes. We conclude by summarizing our findings and outlining an agenda for further research in Section 8.

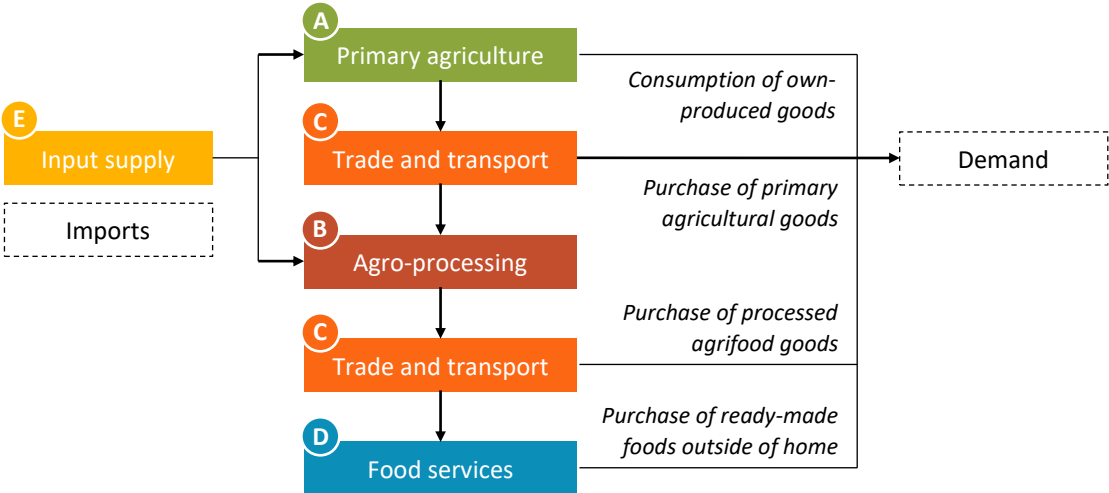
2 KENYA’S AGRIFOOD SYSTEM

A Conceptual Framework

There are many ways to conceptualize an agrifood system (AFS). The AFS is a complex network of actors, connected by their differing roles in supplying, consuming, and governing agrifood products and jobs. Our objective is to define an AFS that is measurable by economywide and household survey data

so that the performance and evolution of the system can be assessed. A simple conceptual framework is presented in Figure 1, in which an AFS is characterized by five distinguishable components (A to E). This framework can be applied to our analysis using available economic time series and household survey data that allow us to estimate the total size of the AFS and its various components, on both the supply and demand sides of the economy.

Figure 1. Components of an agrifood system



Source: Thurlow et al. (forthcoming)

Primary agriculture (A) is the first component of an AFS and includes the supply and demand of all agricultural products that are often grouped as crops, livestock, fishing, and forestry. *Agroprocessing (B)* is part of the broader manufacturing sector and includes only those manufacturing subsectors associated with processed foods and other agriculture-related nonfood products. For example, yarn and timber are the immediate downstream agroprocessing subsectors linked to the primary cotton farming and forestry sectors, respectively.

Input supply (E) is the portion of intermediate inputs used directly in agricultural and agroprocessing production (e.g., fertilizers and financial services). Inputs that are produced by farmers and processors themselves are excluded in the measure to avoid double-counting, since they are already captured in the above components. Only the portion of inputs generated by local firms are included, and the portion is calculated as a share of agriculture and processing’s input demand in total economywide demand for that input. For example, if farmers and processors use a third of all petroleum in the economy, then a third of the petroleum sector is considered part of the AFS. If all petroleum is imported, then this input does not contribute to input component of the AFS.

Trade and transport services (C) consider only the portion of such services associated with transporting, wholesaling, and retailing of agrifood products between farms, firms, and final points of sale (i.e., either domestic markets or the country’s border for exported and imported goods). Trade and transport sectors that are included in national accounts data do not distinguish their services to the AFS from the rest of economy, and so the agrifood component is estimated using product-level data on transaction cost margins. Transaction costs are the main source of demand for trade and transport services, and so a portion of trade or transport sectors can be attributed to the AFS based on the total share of trade margins on agrifood products relative to the total margins on all marketed products.

Finally, *food services* (D) is associated with food services in production and consumption, plus a portion of the hotels and accommodation sector. Producers of food services (i.e., meals prepared outside the home) run standalone operations (e.g., restaurants or stalls), whereas hotels often operate restaurants in addition to providing accommodation. The portion of hotels and accommodation sector that is assigned to the AFS is based on the share of agrifood inputs in the sector's overall intermediate inputs. This is a conservative approach that may slightly underestimate the part of hotels and accommodation GDP that is associated with the AFS.

Our measures of the five components of Kenya's AFS are based on a series of annual Social Accounting Matrices (SAMs) constructed for the period 2009 to 2019. Each SAM has the same structure to facilitate comparisons of AFS GDP and employment over time. SAMs require a wide range of datasets to construct. They are further constructed to be fully consistent with national accounts data, including estimates of GDP at market prices and factor costs, and the various components of GDP at market prices. National accounts data are obtained from a country's national statistical agency, i.e., in this instance the Kenya National Bureau of Statistics (KNBS 2022).

SAMs further provide a detailed picture of the sectoral structure of an economy. This information is primarily obtained from Supply and Use Tables (SUTs), which capture the interlinkages across sectors as far as their input and output relationships are concerned. We further draw on agricultural and industrial surveys, time series data of agricultural production from the Food and Agriculture Organization (FAO), and time series data of export and import data from the United Nations COMTRADE system to build a detailed picture of AFS production and trade patterns.

Estimating employment within the AFS also requires various data sources, including population census and household budget and labor force survey data. For Kenya, these datasets are also from KNBS, including the 2009 and 2019 population censuses (KNBS 2009; 2019) and household budget and labor force surveys (KNBS 2017). Various international databases (e.g., De Vries et al. 2021; ILO 2020) are also used to refine our country-level estimates of employment. Household budget survey data is also used for disaggregating household consumption across commodities.

In summary, SAMs combine and reconcile information from these multiple – and often disparate – data sources in a systematic way to provide a detailed picture of the structure of an economy that is consistent with macroeconomic aggregates from a country's national accounts data. Estimates of AFS GDP and employment can be obtained by summing over the five components of the AFS as described earlier (see Figure 1). IFPRI also maintains a global dataset – the Agrifood System Database – which includes AFS estimates for around 200 countries. This allows us to compare Kenya's AFS with those of other countries or regions.

Current Structure of Kenya's Agrifood System

The size and structure of Kenya's AFS across its five components is shown in Table 1, focusing on GDP and employment. AFS GDP (or AgGDP+) and AFS employment (or AgEMP+) are estimated by summing GDP and employment estimates across the individual components. Formal definitions of AgGDP+ and AgEMP+ are provided in Thurlow et al. (*forthcoming*). Kenya's total AgGDP+ in 2019 was equal to \$31.1 billion, of which, \$20.9 billion came from primary agriculture. This means that for every dollar of GDP generated on-farm, an additional 49 cents of GDP are generated off-farm within Kenya's AFS. AgGDP+ accounts for about 34 percent of total GDP, with around two-thirds of that from primary

agriculture and one-third from the off-farm components of the AFS. About 50 percent of off-farm AgGDP+ is from agroprocessing.

Table 1. Kenya’s agrifood system (2019)

	GDP		Employment	
	Value (\$ bil.)	Share of total (%)	Workers (mil.)	Share of total (%)
Total economy	92.0	100	18.7	100
Agrifood system	31.1	33.8	10.2	54.7
Primary agriculture (A)	20.9	22.7	8.1	43.3
Off-farm agrifood system	10.2	11.1	2.1	11.4
Agroprocessing (B)	4.7	5.1	0.5	2.5
Trade and transport (C)	3.6	3.9	1.1	6.2
Hotels and food services (D)	0.8	0.9	0.4	2.2
Input supply (E)	1.1	1.2	0.1	0.6
Non-agrifood system	60.9	66.2	8.5	45.3

Source: Authors’ analysis using IFPRI’s 2019 Kenya SAM.

Notes: A to E correspond with the five agrifood system components from Figure 1.

On the employment side, AgEMP+ accounts for 54.7 percent of total employment, and most AFS jobs are in primary agriculture. Specifically, primary agriculture accounts for four-fifths of employment in the AFS and more than two-fifths (43.3 percent) of total employment in Kenya. Within the off-farm components of the AFS, there are more jobs in trade and transport and fewer in agroprocessing sectors, which is an indication that agroprocessing is relatively more capital intensive and is characterized by a higher level of labor productivity measured in terms of GDP per worker.

3 COMPARING KENYA’S AGRIFOOD SYSTEM WITH OTHER COUNTRIES

IFPRI’s Agrifood System Database contains estimates of AgGDP+ and AgEMP+ for 206 countries covering 96 percent of global GDP and 94 percent of the global population (see Thurlow et al., *forthcoming*). Figure 2 shows weighted estimates across the World Bank’s country income groups and compares these to Kenya’s own estimates. The figure shows the importance and composition of countries’ AFSs at different stages of development, as proxied by Gross National Income (GNI) per capita.

Figure 2. Decomposing the agrifood systems across country income groups (2019)



Source: IFPRI's Agrifood System Database (Thurlow et al. Forthcoming) and IFPRI's 2019 Kenya SAM.

Notes: LIC are low-income countries; LMIC are lower-middle income; UMIC are upper-middle income; and HIC are high income.

Panel (a) shows the importance of primary agriculture for developing countries, and how agriculture's share of the economy is much smaller at later stages of development. On average, primary agriculture is 27.4 percent of total GDP for low-income countries (LIC), but only 1.4 percent for high-income countries (HIC). However, the contribution of the overall AFS to the economy remains large, even in the most developed countries. In Hong Kong, for example, where agricultural GDP is virtually zero, the AFS still accounts for around eight percent of total GDP. The relative size of Kenya's AFS and its breakdown across farm and off-farm components fits in between LICs and lower middle-income country (LMICs) in the Panel (a). Considering Kenya only recently reached LMIC status, this positioning is expected.

Panel (b) in the Figure 2 shows the contributions of farm and off-farm components of the AFS to total AgGDP+, i.e., this is a different representation of the information in Panel (a). At around \$4,000 per capita, which is close to the threshold for attaining upper middle-income country (UMIC) status, the value-added generated off the farm exceeds what is generated on the farm. At \$40,000 per capita, which is roughly the median income for high-income countries, about four dollars of GDP is generated off the farm for each dollar on the farm. Kenya has a larger on-farm orientation than lower-income countries on average, although this is well within the range of estimates across countries at a similar stage of development.

Panel (c) decomposes the off-farm AgGDP+ component into its four subcomponents. Higher income countries typically generate less value-added from trading and transporting products, and more from food services (e.g., restaurants). A larger share of Kenya's off-farm AgGDP+ comes from agroprocessing, which reflects the processing requirements of its large livestock and tradable crop sectors (see discussion in following sections). Kenya has a relatively small food services sector, which is consistent with the structure of AFSs in other developing countries. Kenya's population is also less urbanized than many other developing countries, which may explain the lesser importance of food services, which tend to be more concentrated in urban centers.

Panel (d) decomposes the input supply and trade and transport components of the AFS according to primary agriculture and agroprocessing. This distinction is useful because during the early stages of agricultural transformation we expect more value-added associated with primary products than with processed products. This is supported by the figure, which shows how more off-farm value-addition is generated for primary products in LICs, but the opposite is true for HICs. Kenya generates a larger share of value-added from processed products than expected considering its stage of development.

Overall, Kenya's AFS shares many of the characteristics of developing countries at a similar stage of development. However, not all countries have grown as rapidly as Kenya has over the last decade. This warrants a closer look at Kenya's agricultural and structural transformation (see Section 5). Before that, we consider the farm- and off-farm composition of Kenya's AFS value chains in more detail in Section 4.

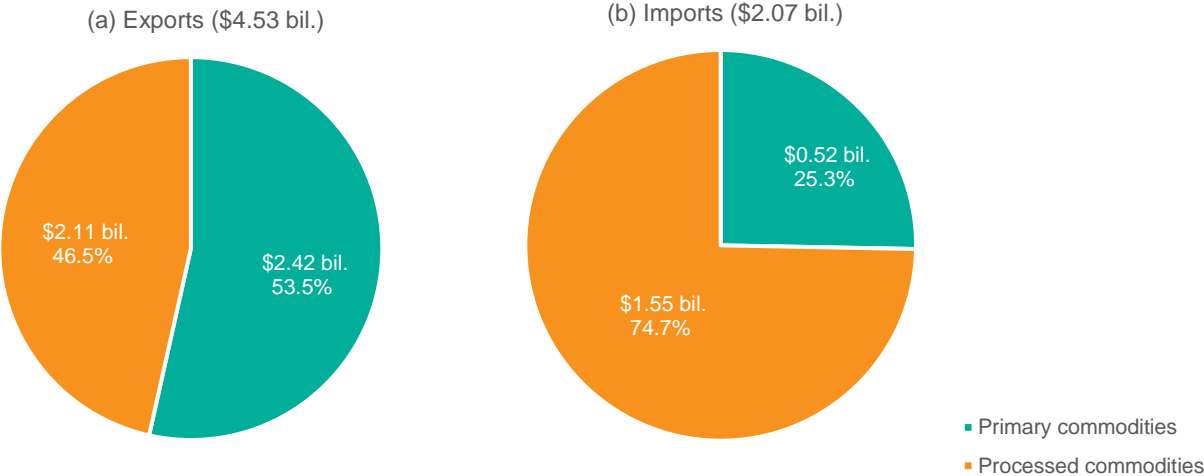
4 DISAGGREGATING THE AGRIFOOD SYSTEM ACROSS VALUE CHAINS

The Kenya SAMs for 2009 to 2019 each include 36 sectors (activities) and products (commodities) in the agricultural sector and 19 in agroprocessing, which forms part of the manufacturing sector. By decomposing the AFS across major value chains and product groups, important information about the performance and changing structure of the AFS can be gathered. Of course, a country's AFS is not only determined by supply-side factors. Patterns of demand are also important in shaping the structure of its AFS. For example, if a large share of agricultural products is consumed directly by farmers without being processed by agroprocessing firms, primary agriculture will likely dominate the AFS. However, with urbanization and increased non-farm opportunities in rural areas, a larger share of agricultural products is sold in the market, resulting in the off-farm components of the AFS becoming relatively larger over time.

International trade is another important factor shaping the structure of the AFS. As a country's AFS becomes more export-oriented, more processing and export-related trade services may be required,

which increases the relative size of the off-farm component of the AFS. Agrifood imports into developing countries are also more likely processed (e.g., milled rice, cooking oils, or dairy products) than primary products (e.g., paddy rice, oilseeds, or raw milk). Figure 3 shows a breakdown of traded agrifood products into primary and processed products. Agrifood exports were valued at \$4.53 billion and imports at \$2.11 billion in 2019. Therefore, in value terms, Kenya is a net exporter of agrifood products at both primary and processed product levels. Almost half of agrifood exports undergo some form of processing; hence, the capacity and efficiency of processing and logistical services are important for agrifood exports. Three-quarters of agrifood imports, on the other hand, are processed food products. This indicates that the structure of the AFS may look different from the demand-side than from the supply-side.

Figure 3. Shares of primary and processed commodities in agrifood trade (2019)

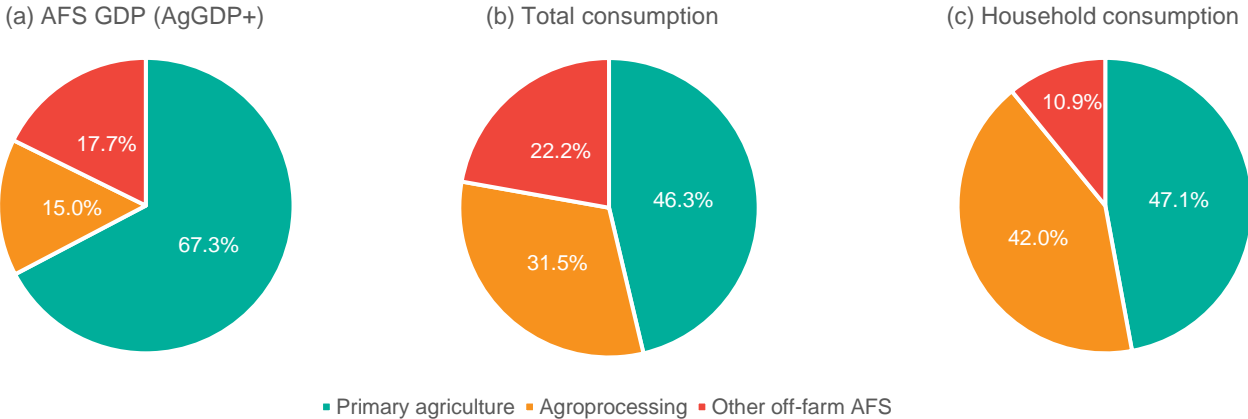


Source: Authors' analysis using IFPRI's 2019 Kenya SAM.

Notes: The total value of agricultural trade in 2019 (primary and processed commodities) was \$4.53 billion in the case of exports and \$2.07 billion in the case of imports.

Figure 4 compares the structure of the AFS from the supply-side, as measured by AgGDP+, against the structure of the AFS from the demand side, as measured by household agrifood consumption and total agrifood consumption, respectively. The latter includes use of intermediate inputs and final consumption by households. Panel (a) shows that around two-thirds of AgGDP+ in Kenya comes from primary agriculture (compare Figure 2, Panel (b)). On the demand side, however, primary agriculture accounts for only 46.3 percent of total agrifood consumption (Panel (b)) and 47.1 percent of household agrifood consumption (Panel (c)). These consumption patterns for agrifood products are consistent with the import structure displayed in Figure 3. This also highlights the potential role of shifting dietary patterns in shaping structural changes in the supply-side of the AFS. We return to this topic in the next section.

Figure 4. Agrifood system GDP and consumption of agrifood products (2019)



Source: Authors' analysis using IFPRI's 2019 Kenya SAM.
Notes: Total consumption includes both final and intermediate consumption.

For the value chain analysis, the 36 primary agricultural activities and commodities are aggregated into 15 groups representing key AFS value chains in Kenya. Agroprocessing activities and commodities are similarly mapped to those AFS value chains they are most closely associated with (e.g., processed dairy products are mapped to the cattle and milk value chain). Table 2 presents key statistics for each value chain. The first three columns report the contribution of each value chain to total AFS GDP (or AgGDP+), GDP on the farm (or agricultural GDP), and GDP in the off-farm components of the AFS. The last two columns show the ratio of exports to output (a measure of export intensity) and the ratio of imports to total consumption (a measure of import penetration) for each value chain. These estimates ratios account for trade in both primary and processed agrifood products but exclude the other off-farm components in value chain.

Value chains are further categorized into subgroups representing those producing export-oriented products, import-substitutable products, and less-traded products. Export-oriented value chains are those with export-output ratios exceeding 8.9 percent, the AFS sector-wide average, while import-substitutable are those with an import-consumption ratio of more than 4.3 percent (see Table 2). Only fruits and nuts and export crops (this value chain includes Kenya's traditional exports, i.e., tea, coffee, and cut flowers) fall in the export-oriented category, while four value chains are classified as import substitutable value chains (i.e., rice and wheat, oilseeds, poultry and eggs, and other crops, which includes sugar). The remaining value chains are all classified as less traded. This category includes some of Kenya's largest value chains, such as maize, root crops, vegetables, and cattle and milk, and accounts for almost two-thirds and AgGDP+. However, relative to their AgGDP+ share, these value chains have a relatively smaller share of GDP in the off-farm components AFS (56.7 percent). With the exception of cattle and milk, less traded value chains still generate most of their value-added on the farm, despite the growing importance of purchased and processed foods in Kenya (Tschirley et al. 2015).

Table 2. Agrifood system GDP decomposition and trade ratios by value chain (2019)

	GDP Shares (%)			Trade Ratios (%)	
	AFS GDP (AgGDP+)	Agricultural GDP	Off-farm AFS GDP	Exports/Output	Imports/Consumption
Total	100.0	100.0	100.0	8.9	4.3
<u>Export-oriented</u>	<u>16.5</u>	<u>19.1</u>	<u>11.3</u>	<u>45.2</u>	<u>2.7</u>
Fruits & nuts	7.8	9.2	4.9	11.6	3.2
Export crops	8.7	9.9	6.3	65.0	2.0
<u>Import substitutable</u>	<u>15.8</u>	<u>11.5</u>	<u>24.5</u>	<u>3.3</u>	<u>12.9</u>
Rice & wheat	3.2	1.7	6.4	0.5	15.4
Oilseeds	3.3	2.1	5.7	5.8	21.9
Other crops	6.8	5.0	10.6	4.8	9.4
Poultry & eggs	2.4	2.7	1.9	0.3	5.7
<u>Less traded</u>	<u>65.2</u>	<u>69.4</u>	<u>56.7</u>	<u>1.1</u>	<u>1.6</u>
Maize	10.5	13.4	4.6	0.2	2.3
Sorghum & other cereals	1.9	1.2	3.2	2.2	1.6
Root crops	8.9	12.2	2.2	0.0	0.3
Pulses	4.5	5.7	1.9	0.9	3.7
Vegetables	9.9	12.3	5.2	2.7	0.4
Cattle & milk	17.4	11.6	29.4	0.2	1.1
Other livestock	2.1	2.9	0.4	5.8	0.6
Fish	2.3	2.7	1.6	5.3	3.9
Forestry	7.6	7.3	8.1	0.9	3.6

Source: Authors' analysis using IFPRI's 2019 Kenya SAM.

Notes: The trade ratios in the final two columns are derived from primary agriculture and agroprocessing, two components of the AFS. Value chains with export/output and import/consumption ratios below the national average are categorized as less traded value chains. Those with import/consumption ratios higher than the national average are classified as import-substitutable, while export-oriented value chains are ones with export/output ratios higher than the national average.

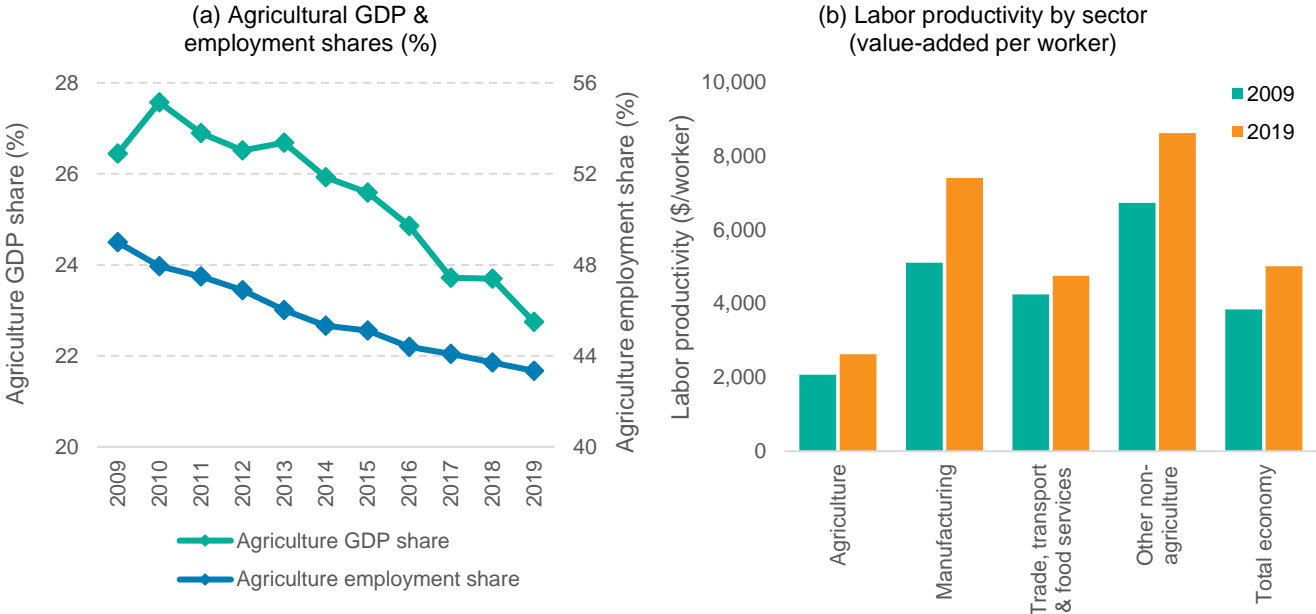
Import substitutable value chains, in contrast to less traded value chains, account for only 11.5 percent of on-farm GDP, but 24.5 percent of GDP in the off-farm components of the AFS. Policies that promote import substitution will therefore have a strong impact on agricultural transformation in that they will help shift value addition towards agroprocessing sectors. Export-oriented value chains have a slightly larger on-farm contribution than import substitutable value chains (19.1 percent), but their share of GDP in the off-farm components of the AFS is relatively small (11.3 percent). This suggests that agrifood exports from Kenya consist mostly of primary agricultural outputs, and that there may be room to increase domestic processing and retaining more of the value-addition domestically.

In summary, the decomposition of the AFS into distinct value chains, as well as their further categorization into export-oriented, import substitutable, and less traded value chains, reveals significant variation across value chains in terms of market structure, trade orientation, and contributions to GDP in the on- and off-farm components of the AFS. This analysis will be useful for interpreting modeling results on sources of agricultural growth, which is presented in Section 7. However, Sections 5 and 6 first examines the role of agriculture and the AFS in Kenya’s economic transformation.

5 KENYA’S RECENT ECONOMIC GROWTH AND TRANSFORMATION AND THE ROLE OF AGRICULTURE

This section assesses the performance of agriculture within the broader context of structural transformation in Kenya. Rapid economic growth is often accompanied by structural change, and this has characterized the Kenyan experience. As shown in Panel (a) of Figure 5, Kenya’s agricultural GDP and employment shares both declined between 2009 and 2019 as the economy expanded rapidly. Moreover, the percentage-point decline in the employment share (5.7 percentage points) was higher than decline in the agricultural GDP share (3.7 percentage points), which is indicative of rising labor productivity. This is confirmed in Panel (b), which shows the average agricultural labor productivity, measured in value-added per worker, increased from about \$2,072 to \$2,632 per worker (constant prices), or approximately 2.3 percent per annum.

Figure 5. Agricultural GDP and employment shares and labor productivity (2009–2019)



Source: Authors’ analysis using IFPRI’s 2009–2019 Kenya SAMs and employment database.

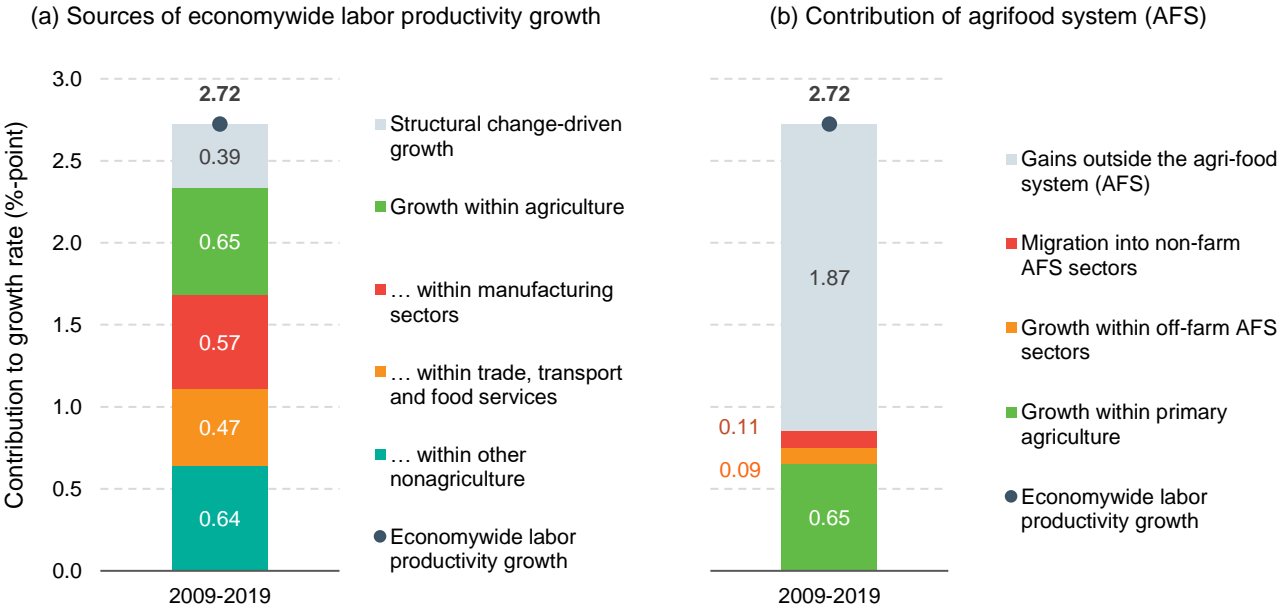
Notes: Note the agricultural GDP and employment shares are shown on different axes with different scales. Labor productivity is measured as value added per worker in constant dollars (\$) per worker (2019 prices). The non-agricultural sectors, i.e., manufacturing, trade, transport & food services, and other non-agriculture, include both sectors in the off-farm components of the AFS and sectors outside of the AFS.

Comparatively speaking, however, agriculture still has the lowest labor productivity in the economy. Productivity is significantly higher in manufacturing and other nonagricultural sectors. With this context, the contribution of agriculture to broad economic transformation can be assessed from two perspectives: first, agriculture can contribute directly to economic growth by raising agricultural productivity over

time; and second, agriculture can contribute indirectly when farm workers gradually move from agriculture into higher-productivity nonagricultural sectors. The latter process is often referred to as structural change-led growth (McMillan et al. 2014).

Figure 6 is a representation of structural change in the Kenyan economy, based on an approach proposed by McMillan et al. (2014). As shown in Panel (a), economywide labor productivity grew at 2.72 percent annually in 2009–2019. Most of this growth was driven by within-sector labor productivity gains. Growth within agriculture was one of the largest contributors, due to it being a large sector (i.e., 27 percent of total GDP in 2009) experiencing relatively fast labor productivity growth (i.e., 2.3 percent per year). Although manufacturing productivity also grew, its small share in the economy limited its contribution to economywide growth. Overall, the figure suggests that the within-sector productivity growth is comparable between agriculture and nonagricultural sectors. Moreover, structural change led growth, i.e., labor moving out of agriculture into nonagricultural sectors, contributed 0.39 percentage points of economywide labor productivity growth.

Figure 6. Decomposition of average annual labor productivity growth rate (2009-2019)



Source: Authors' analysis using IFPRI's 2009-2019 Kenya SAMs and employment database.

Panel (b) estimates the contribution of the whole AFS to the economywide annual labor productivity growth. The within-sector contribution from agriculture is the same in both panels, i.e., 0.65 percentage points. The migration of workers into the off-farm components of AFS accounted for about a quarter of the structural change-led growth (i.e., 0.11 percentage points out of a total 0.39 percentage points). This is in addition to the annual increase in labor productivity amongst workers that were already employed in the off-farm sectors. The AFS thus accounted for around 30 percent economywide labor productivity growth, with the remaining 70 percent driven by nonagricultural productivity growth and migration into nonagricultural sectors outside of the AFS.

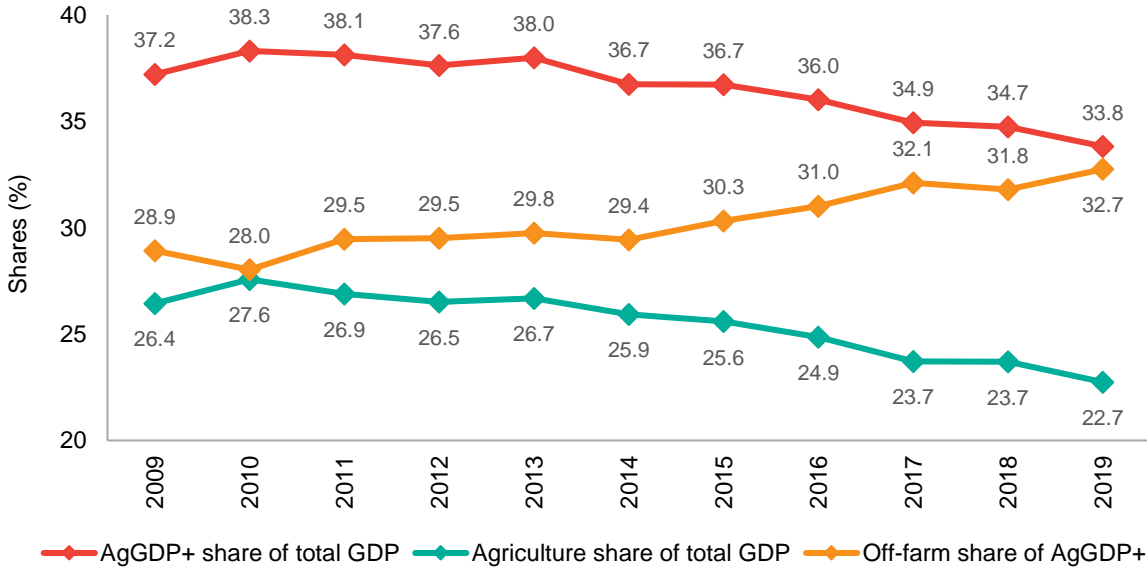
In summary, the rapid economic growth in Kenya is accompanied by a positive process of structural change. Still, most labor productivity growth has come from rising productivity within sectors rather than

a reorientation of employment towards more productive activities. Within this economywide process of growth and structural change, agricultural transformation is steadily proceeding, with faster GDP and employment growth within off-farm AFS. However, some workers migrated to the less productive components of AFS including trade, transport, and food services instead of more productive components such as agroprocessing (see Figure 5). These patterns of structural change in the AFS are consistent with the earlier stages of agricultural transformation. It has, however, limited the AFS's contribution to broad productivity growth at an economywide-level. Identifying sources of AFS growth across value chains that could accelerate the growth on and beyond the farm is therefore a priority for accelerating agrifood system and broad economic transformation. Section 6 turns to the assessment of Kenya's agrifood system performance and structural change in the last decade.

6 AGRIFOOD GROWTH AND MARKET STRUCTURE

Figure 7 reveals how the structure of Kenya's AFS has changed over the last decade. Primary agriculture's share of total GDP declined from 26.2 percent in 2009 to 22.7 percent in 2019. The AFS (AgGDP+) share of total GDP also declined, but at a marginally slower rate than primary agriculture. The implication is that the contribution of the off-farm components of AFS to overall AgGDP+ has increased over this period, i.e., from 28.9 to 32.7 percent. The cross-country data presented in Section 3 has shown that as countries move to higher levels of development, the off-farm components of their AFSs become relatively larger. The changing structure of Kenya's AFS is therefore consistent with a country undergoing such a transformation.

Figure 7. Agrifood system GDP shares (2009-2019)



Source: Authors' analysis using IFPRI's 2009-2019 Kenya SAMs.

Table 3 evaluates the growth performance across AFS value chains. As previously, value chains are grouped according to their trade status, i.e., export-oriented, import substitutable, and less traded. Nine value chains that achieved above-average growth during 2019–2019, i.e., more than 3.9 percent per annum over the period, are marked with an asterisk (*). Among the four value chains in the import substitutable group, three value chains (i.e., rice and wheat, oilseeds, and poultry and eggs) grew faster

than the national average. Five of the nine less traded value chains also achieved above-average growth (i.e., maize, sorghum and other cereals, pulses, vegetables, and forestry), while only one of the two export-oriented value chains, namely export crops, grew faster than the national average. In fact, fruits and nuts had a negative growth rate over this period, which has contributed to the very low growth rate for the export-oriented group of value chains.

Table 3. Agrifood system GDP and employment growth decomposition (2009-2019)

	Total agrifood system (AFS)	Primary agriculture only	All off-farm AFS components	Agro-processing only
Total	3.9	3.4	5.2	4.7
<u>Export-oriented</u>	<u>1.6</u>	<u>0.8</u>	<u>4.9</u>	<u>4.3</u>
Fruits & nuts	-0.8	-1.7	4.4	4.4
Export crops*	4.3	4.1	5.2	4.3
<u>Import substitutable</u>	<u>4.3</u>	<u>3.6</u>	<u>5.0</u>	<u>4.8</u>
Rice & wheat*	4.0	3.8	4.1	3.6
Oilseeds*	4.2	1.9	6.5	10.1
Other crops	3.0	1.8	4.5	4.4
Poultry & eggs*	10.2	11.1	7.9	4.4
<u>Less traded</u>	<u>4.5</u>	<u>4.1</u>	<u>5.5</u>	<u>4.7</u>
Maize*	6.5	6.6	5.7	5.1
Sorghum & other cereals*	5.9	5.9	5.8	5.5
Root crops	3.3	3.0	8.2	5.6
Pulses*	8.0	8.0	7.9	4.6
Vegetables*	5.5	4.9	9.0	4.3
Cattle & milk	3.1	1.6	4.5	4.6
Other livestock	2.5	2.4	3.7	4.0
Fish	3.3	2.4	7.0	4.4
Forestry*	4.8	4.3	6.0	4.7

Source: Authors' analysis using IFPRI's 2009-2019 Kenya SAMs.

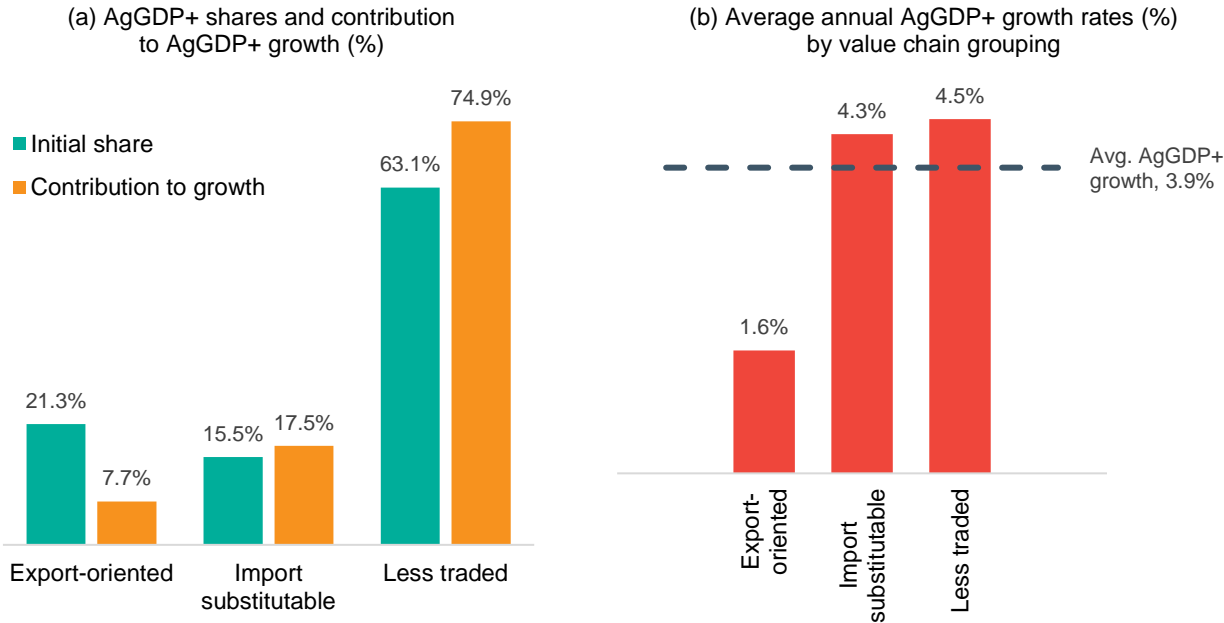
Notes: (*) Value chains that experienced above-average AgGDP+ growth over the period 2009–2019 (i.e., higher than 3.9 percent) are identified by asterisks.

It is further interesting to note that in most value chains, growth in the off-farm components was higher than in primary agriculture, regardless of the trade status of that value chain. This suggests that Kenya's agricultural sectors are becoming more market-oriented over time. Increased market orientation leads to increased demand for trade, transport, and processing and ultimately creates more off-farm value-addition within value chains. However, the last column shows that growth in processing

GDP is less than total off-farm GDP in most value chains, including the ones identified as having experienced above-average growth. This is consistent with the broader patterns of growth and structural change in Kenya’s nonagricultural sectors, which shows that growth in the manufacturing sector (3.5 percent) has been slower than growth in trade (6 percent) and transport services (5.5 percent) during 2009–2019.

Figure 8 summarizes some of these key findings. Specifically, Panel (a) reports initial shares of AgGDP+ by value chain grouping in 2009 and the contribution of value chain grouping to total AgGDP+ growth over the period 2009–2019. Panel (b), in turn, shows the average annual growth rates by value chain grouping relative to the overall AgGDP+ growth rate of 3.9 percent over the period 2009–2019. As highlighted previously, less traded value chains are the largest group, accounting for 63.1 percent of total AgGDP+ in 2009. This group also contributed a disproportionately large share to AgGDP+ growth during 2009–2019 (74.9 percent) given that it was the fastest growing group during this time (4.5 percent per annum). Import substitutable value chains also expanded at more than the national average (4.3 percent per annum), and hence its contribution to AgGDP+ growth over the period (17.5 percent) was also large relative to its initial size (15.5 percent). The export-oriented group of value chains performed worst (1.6 percent per annum), contributing only 7.7 percent to AgGDP+ despite its relatively large initial size of 21.3 percent.

Figure 8. AgGDP+ shares, growth rates, and contribution to growth, by value chain grouping (2009–2019)



Source: Authors’ analysis using IFPRI’s 2009-2019 Kenya SAMs.

Notes: The initial shares in Panel (a) are for 2009 and contributions to growth are over the period 2009–2019. AgGDP+ growth rates in Panel (b) are average annual rates over the period 2009–2019. The average annual growth rate for the whole AFS was 3.9 percent.

In summary, the growth diagnostic analysis in this section shows that domestic markets, not exports, is the driving force of growth and transformation in Kenya’s AFS. Thus, understanding the role of domestic demand in AFS transformation is important for prioritizing value chains and for making policy and other interventions more efficient. Growth in domestic demand for agrifood products is driven primarily by household income growth. With urbanization and growing rural nonfarm opportunities, patterns of

non-farm incomes and pace of their growth affect dietary patterns. This has created growth opportunities for many domestic market oriented agricultural value chains, allowing them to lead the growth in Kenya's AFS in the last decade. This pattern of growth is expected to continue in next decade, which provides an important backdrop for designing value chain growth scenarios. This is the focus of the next section.

7 FUTURE DRIVERS OF INCLUSIVE AGRICULTURAL TRANSFORMATION

IFPRI's Rural Investment and Policy Analysis (RIAPA) model is used to compare the potential contributions of economic growth led by different agricultural value chains to inclusive agricultural transformation. Inclusive agricultural transformation is proxied by outcome indicators derived from modeled changes in poverty, diet quality, and GDP and employment changes.

RIAPA Model

RIAPA comprises a series of interlinked datasets and models that are used to assess program impacts and inform policy and investment prioritization at country-level. At the core of RIAPA is an economywide computable general equilibrium (CGE) model that simulates the functioning of a market economy, including markets for products (or commodities) and factors (i.e., land, labor, and capital). RIAPA measures how impacts are mediated through prices and resource reallocations, and ensures that resource and macroeconomic constraints are respected, such as when inputs or foreign exchange are limited.

The RIAPA model is calibrated to the 2019 Kenya SAM that was used in the diagnostic analysis presented earlier. The SAM divides Kenya's economy into 90 sectors representing producers (or activities). Producers in each sector maximize profits and supply output to national markets, where it may be exported and/or combined with imports depending on relative prices, with foreign prices affected by exchange rate movements. Producers combine factors and intermediate inputs using sector-specific technologies. Maize farmers, for example, use a combination of land, labor, fertilizer, and purchased seeds, while maize millers use maize as intermediate input in combination with labor and capital for producing maize flour. Rural and urban labor markets are divided by workers' education levels, and rural workers can work in both farm and nonfarm activities. While agricultural capital is separated into crop and livestock categories, nonagricultural capital is jointly employed in agroprocessing and other off-farm components of the AFS and all other nonagricultural activities outside the AFS. Land, and different types of labor and capital are in fixed supply, while less-educated workers are considered underemployed with the possibility of increasing its total supply when the economy grows. The government collects taxes on products, households, and enterprises, and uses these revenues to finance public services and social transfers. Remaining revenues are added to private savings and foreign capital inflows to finance investment. RIAPA is a recursive-dynamic model, with current capital availability determined by past levels of investment.

RIAPA tracks changes in household incomes and expenditures, including changes in food and nonfood consumption patterns. The 15 household groups in RIAPA are defined by rural and urban consumption quintiles, with rural households further separated into farm and nonfarm groups. Table 4 describes aggregate household income and consumption patterns. Kenya's population of 47.6 million people consumed, on average, US\$1,718 of goods and services per person in 2019 (at market exchange rates

unadjusted for purchasing power parity). Consumption levels are much lower in rural areas and amongst the poor. Poor households spend more of their earnings on food consumption, and of that, a smaller share is spent on processed as opposed to primary or unprocessed foods. Cereals and roots dominate consumption patterns, although nonpoor and urban households consume more meat, fish, and eggs. Finally, poor households are, on average, more reliant on incomes from farming and less-educated labor.

Table 4. Household consumption and income patterns (2019)

	National	Poor	Nonpoor	Rural farm	Rural non-farm	Urban
Consumption per capita (\$)	1,718	514	2,521	921	1,532	2,904
Food consumption share of total consumption (%)	38.9	59.9	36.1	49.7	39.0	34.2
<u>Food consumption shares by food group (%)</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>
Cereals & roots	28.4	43.6	25.1	39.1	33.5	20.9
Vegetables	21.8	26.3	20.8	24.0	24.2	20.0
Fruits	11.1	8.5	11.7	12.0	10.9	10.6
Milk, dairy	11.0	10.5	11.1	11.4	11.9	10.5
Meat, fish & eggs	24.0	6.6	27.8	9.3	15.3	34.6
Added fats	3.7	4.6	3.5	4.2	4.2	3.3
Processed food share of food consumption (%)	51.7	35.3	55.4	38.3	46.3	61.6
<u>Household income shares by income source (%)</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>
Crop land returns	12.6	36.4	9.8	47.8	0.0	1.3
Labor remuneration	32.0	30.4	32.2	18.8	26.2	38.3
<i>Less-educated workers</i>	7.9	18.9	6.6	7.5	7.9	8.1
<i>Better-educated workers</i>	24.1	11.6	25.6	11.4	18.4	30.2
Capital profits	48.8	20.0	52.2	15.4	69.7	57.8
Other sources	6.6	13.2	5.8	18.0	4.0	2.6
Population (millions)	45.4	18.1	27.2	22.7	6.5	16.2

Source: Authors' analysis using IFPRI's 2019 Kenya SAM and RIAPA model.

Notes: Food consumption includes meals prepared outside the household. Better-educated workers are those who have at least completed primary schooling. Capital income is equivalent to gross operating surplus net of taxes and other corporate transfers. Other income sources include social and foreign transfers.

RIAPA tracks poverty and dietary impacts using survey-based microsimulation modules. Individual survey households map to the model's household groups. Estimated consumption changes in the model are applied proportionally to survey households, and post-simulation consumption values are

recalculated and compared to a poverty line to determine households' poverty status, or to the cost of a healthy reference diet to estimate food consumption gaps and assess diet quality. For a more detailed description of CGE model features and behavioral assumptions, see Diao and Thurlow (2012).

Comparing Growth Outcomes of Different Value Chains

RIAPA is used to simulate the system-wide and economywide effects of different agricultural value chains through agricultural productivity growth. In the simulations, total factor productivity growth in each value chain grouping is accelerated beyond baseline growth rates. As explained in more detail below, outcome indicators are assessed per unit of agricultural growth within the targeted value chain. However, since value chains are structurally different from one another, the induced impacts on other value chains or growth in downstream processing activities will vary across value-chain growth scenarios. Differences in the relationship between on- and off-farm components of AgGDP+ have already been discussed in previous sections.

Table 5 reports changes in four outcome indicators, namely poverty, diet quality, GDP growth, and employment. Indicators are used to assess the developmental impacts of growth led by different value chains. Columns 1–2 report outcome indicators based on the poverty headcount and poverty gap ratios, respectively. Poverty is measured against the international \$1.90 poverty line. Column 3 reports a diet quality outcome indicator, which is based on the Reference Diet Deprivation (ReDD) index (Pauw et al. 2021b). ReDD is a multidimensional measure of food consumption gaps relative to reference food intakes across six main food groups. The two poverty outcome indicators reported in Table 5 are elasticities that express the percentage-point change in the poverty measure per unit of agricultural GDP growth generated by the targeted value chain. Similarly, the diet quality outcome indicator is the percentage change in the ReDD index per unit of agricultural GDP growth generated by the targeted value chain.

Columns 4–7 report various GDP outcomes, including indicators for total GDP, AFS GDP (or AgGDP+), primary agricultural GDP, and GDP in the off-farm components of the AFS. The respective outcome indicators are multipliers that express the monetary changes in the relevant GDP measure (e.g., measured in US dollars) per unit increase in agricultural GDP generated in the targeted value chain, also measured in monetary terms. Columns 8–11 report the associated employment outcomes, including indicators based on changes in total or economywide employment, employment in the AFS (AgEMP+), employment in the agricultural sector (i.e., on-farm employment), and employment in the off-farm components of the AFS. The employment outcome indicators are also multipliers, and measure the change in number of jobs per unit of increase in agricultural GDP generated in the targeted value chain. As with the GDP indicators, the numerator is measured in monetary terms (e.g., US dollars).

Ten value chain growth scenarios are conducted, each representing a scenario where productivity growth is raised above baseline levels within a targeted value chain's agricultural production but kept at baseline levels in the other value chains. The ten targeted value chains are drawn from the set of 15 value chain groupings defined in the earlier diagnostic analysis (see Tables 2 and 3). Sorghum and other cereals, other crops, other livestock, and forestry are excluded, while pulses and oilseeds are combined to form a single representative value chain. Alongside each of the elasticities or multipliers reported in Table 5, a ranking appears in brackets.

Table 5. Impact of value chain growth on poverty, diets, GDP, and employment outcomes

	Poverty rate [1]		Poverty gap [2]		Diet quality [3]		Total GDP [4]		AFS GDP (AgGDP+) [5]		Agricultural GDP [6]		Off-farm AFS GDP [7]		Total employment [8]		AFS empl. (AgEMP+) [9]		Agricultural employment [10]		Off-farm AFS emp. [11]	
Maize	-0.58	(3)	-0.20	(1)	-0.27	(8)	1.43	(3)	1.49	(3)	1.39	(2)	0.10	(8)	0.06	(6)	0.03	(6)	0.00	(5)	0.02	(6)
Rice & wheat	-0.29	(7)	-0.07	(7)	-0.16	(9)	1.10	(7)	1.21	(6)	1.00	(6)	0.21	(4)	0.06	(5)	0.04	(4)	0.01	(3)	0.03	(4)
Pulses & oilseeds	-0.59	(2)	-0.19	(2)	-1.24	(3)	1.55	(2)	1.67	(2)	1.41	(1)	0.27	(3)	0.10	(3)	0.05	(3)	-0.01	(6)	0.05	(3)
Root crops	-0.13	(8)	-0.05	(8)	0.03	(10)	1.18	(5)	1.15	(8)	1.07	(5)	0.08	(9)	0.01	(9)	-0.03	(9)	-0.05	(8)	0.02	(7)
Vegetables	-0.04	(10)	0.00	(10)	-0.91	(6)	1.23	(4)	1.33	(4)	1.19	(4)	0.14	(7)	0.00	(10)	-0.03	(10)	-0.05	(7)	0.02	(8)
Fruits & nuts	-0.50	(5)	-0.18	(3)	-2.09	(1)	0.89	(10)	1.03	(10)	0.98	(9)	0.04	(10)	0.07	(4)	0.14	(2)	0.13	(2)	0.00	(10)
Coffee & tea	-0.42	(6)	-0.16	(5)	-0.29	(7)	0.89	(9)	1.16	(7)	0.99	(8)	0.17	(5)	0.19	(1)	0.29	(1)	0.28	(1)	0.02	(9)
Cattle & dairy	-0.09	(9)	-0.04	(9)	-2.08	(2)	1.81	(1)	2.11	(1)	1.30	(3)	0.81	(1)	0.18	(2)	-0.01	(8)	-0.22	(10)	0.21	(1)
Poultry & eggs	-0.54	(4)	-0.11	(6)	-1.09	(4)	0.96	(8)	1.11	(9)	0.95	(10)	0.16	(6)	0.06	(7)	0.04	(5)	0.01	(4)	0.03	(5)
Fish	-0.64	(1)	-0.17	(4)	-0.98	(5)	1.15	(6)	1.32	(5)	0.99	(7)	0.33	(2)	0.05	(8)	0.02	(7)	-0.08	(9)	0.10	(2)

Source: Authors' analysis using the results from IFPRI's Kenya RIAPA model.

Notes: The poverty rate is the share of the population with per capita consumption below the \$1.90 international poverty line. The poverty gap is the average gap between poor people's consumption levels and the poverty line. Diet quality is measured by the Reference Diet Deprivation (ReDD) index, a composite measure derived from food consumption gaps in six major food groups. The poverty and diet quality measures are elasticities expressed per unit agricultural GDP growth generated within the targeted value chain. The GDP and employment outcome indicators are multipliers that express the changes in GDP (in monetary terms, e.g., US dollars) or employment (number of jobs) per unit of increase in agricultural GDP in the targeted value chain (also in monetary terms, e.g., US dollars).

Poverty headcount rates focus on the share of people that live below the poverty line, whereas poverty gaps measure how far poor people are, on average, from that poverty line. Poverty gaps therefore better reflect the depth of poverty. A value chain that is effective at raising incomes of very poor people but not those of people just below the poverty line could conceivably reduce the poverty gap but not the poverty rate. Value chains may therefore differ in terms of their effectiveness in reducing the two poverty measures. The fish value chain emerges as the most effective in reducing the national poverty headcount rate, with a poverty-growth elasticity of -0.64, meaning that fish productivity growth reduces the national poverty headcount rate by 0.64 percentage points per unit of primary agricultural GDP growth in the fish value chain. However, fish only ranks fourth in terms of its effectiveness in reducing the poverty gap. In this instance the maize sector is most effective at reducing the poverty gap, with an elasticity of -0.20, meaning that the poverty gap declines by 0.2 percent per unit of primary agricultural GDP growth in the maize value chain.

The ReDD index measures the incidence, breadth, and depth of food consumption shortfalls across six food groups relative to a healthy reference diet, in this case the EAT-Lancet diet (Willett et al. 2019). A decrease in the ReDD index signals narrowing food consumption gaps and hence an improvement in diet quality. Most value chain growth scenarios are associated with an improvement in diet quality (i.e., negative diet-growth elasticities). The exception is root crops. Productivity growth in this value chain causes households to shift consumption away from other food groups towards root crops, which are already a dominant food group for poorer households. The fruits and nuts value chain emerges as the most effective at promoting diet quality in Kenya, with a diet-growth elasticity of -2.09, meaning that the ReDD index declines by 2.09 percent per unit of primary agricultural GDP growth in the fruits and nuts value chain.

The GDP and employment results highlight the fact that although the simulations raise productivity growth within a value chain's primary agricultural component, a significant portion of the GDP growth and employment is generated outside of the primary component of the targeted value chain, either within the off-farm AFS components of the targeted value chain itself, along other AFS value chains, or outside of the AFS altogether. Raising productivity in one value chain may also hurt other AFS value chains or non-AFS sectors of the economy depending on relative price changes or competition for resources. For example, in the maize productivity scenario, the GDP growth multiplier is 1.43 and the AgGDP+ growth multiplier is 1.49. The latter can be further broken down into a multiplier for agriculture GDP growth (1.39) and a multiplier for growth in the off-farm component of the AFS (0.10). Thus, for every \$1 million maize value-added generated by maize productivity growth, total GDP grows by \$1.43 million and AgGDP+ by \$1.49 million. The larger multiplier for AgGDP+ indicates that some non-AFS sectors contract as they become relatively less productive, and resources are diverted away from them. Within the AFS, maize productivity growth stimulates an additional \$0.39 million growth in the on-farm components of non-maize value chains and \$0.10 million in the off-farm components of the AFS (including in the maize value chain).

Value chains with larger off-farm components typically generate larger growth multipliers within the AFS or for the whole economy. The cattle and milk value chain, for example, has a relatively large off-farm component (see Table 2) and accounts for 29.3 percent of total off-farm AFS GDP. Most livestock products require some processing before reaching consumers, e.g., to transform raw meat and milk into processed meat and dairy products. This generates downstream value-added which drives AFS growth beyond the farm. These attributes explain why the cattle and dairy value chain is the most effective at generating both total GDP and AgGDP+ growth, with multipliers of 1.81 and 2.11, respectively (Table 5).

It is further noteworthy that some value chains have GDP growth multipliers that are less than one. Promoting growth in such value chains – e.g., fruits and nuts, coffee, and poultry and eggs – may crowd out other economic activities within or outside the AFS as these value chains compete for resources, mainly labor, that are also demanded outside of the AFS. This leads to a decline in total GDP even though AgGDP+ still increases. This highlights the importance of considering the complex interlinkages within the AFS and between AFS and the rest of the economy when considering agricultural growth strategies. An economywide model like RIAPA is ideal for undertaking such analysis.

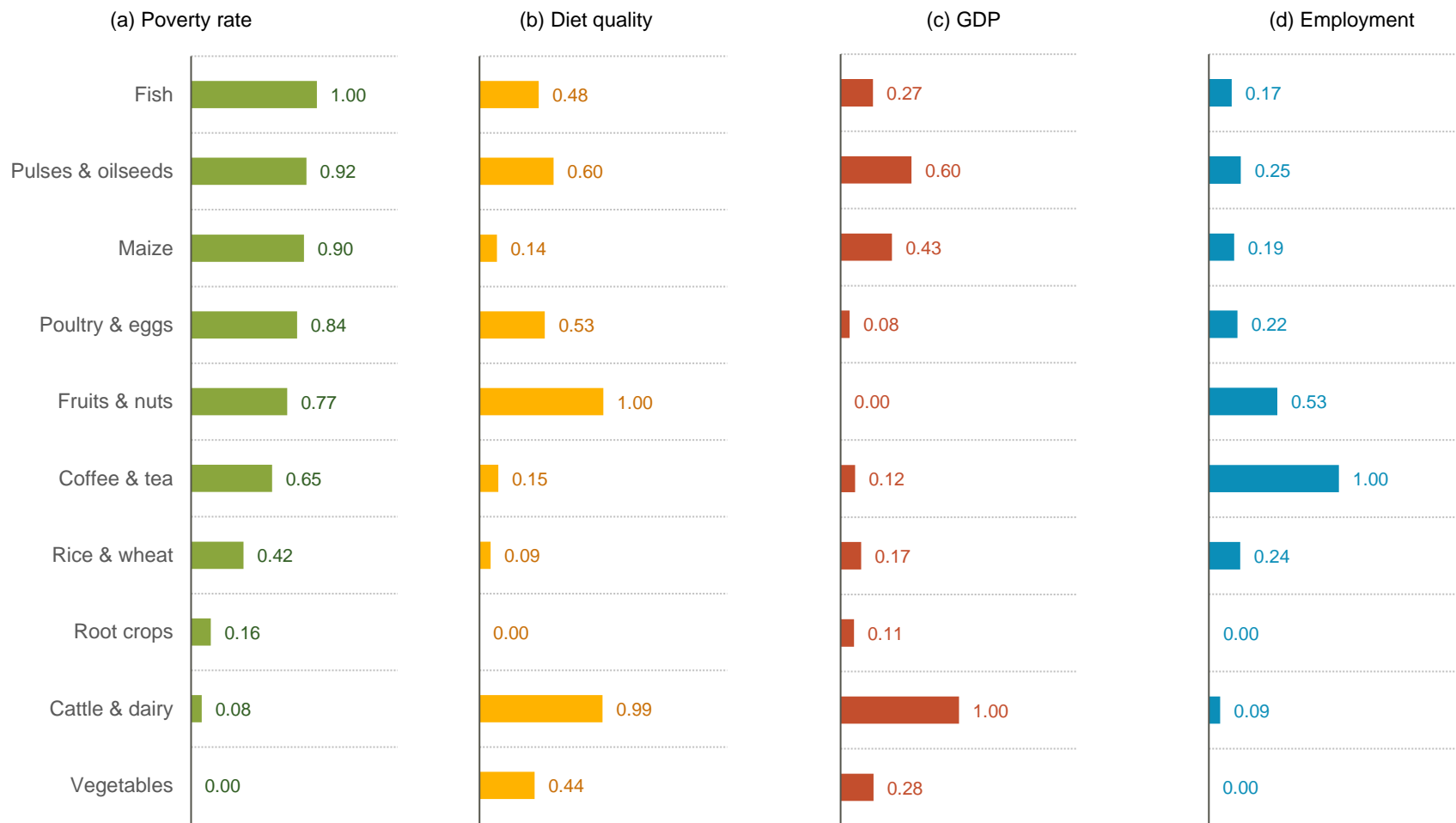
The final four columns of Table 5 measure the employment effects. Since agricultural productivity growth and economic transformation are often associated with job shedding in the agricultural sector, our interest is in job creation at an economywide level, and particularly within the off-farm components of the AFS, which would be indicative of a shift towards increased processing and value-addition of agrifood products. The employment multiplier results show the number of jobs associated with the increase in agricultural GDP in the targeted value chain. In the coffee and tea value chain, for example, for every \$1 million by which the agricultural GDP within the coffee and tea value chain expands, 290 new jobs are created within the broader AFS (i.e., a multiplier of 0.29), of which 200 jobs are in the off-farm components of the AFS. However, growth from this value chain leads to competition between the AFS and the rest of the economy, causing some job losses outside of the AFS. The economywide employment effect is therefore smaller than the AFS employment effect, with a net gain of 190 jobs per \$1 million increase in agricultural GDP in the coffee and tea value chain. Since export-oriented value chains supply their output in the world market, their output prices are less affected by domestic productivity gains, and hence they can compete more effectively with other sectors for workers, which explains this result.

Despite job losses in non-AFS sectors, the coffee and tea value chain still ranks highest overall in terms of its economywide employment effects. The cattle and milk value chain is the second most effective in terms of its economywide employment effects. Interestingly, productivity growth in this sector leads to a reorientation from on-farm employment to off-farm employment in the AFS, i.e., for \$1 million increase in agricultural GDP in the cattle and dairy value chain, 210 jobs are created in the off-farm components of the AFS, but 220 jobs are lost on other farms. However, the economywide employment effect is still positive, with a net gain of 180 jobs. These results are consistent with the longer-term trends in economic transformation in Kenya.

Comparing the Effectiveness of Value Chain Growth

Figures 9 and 10 present an approach for comparing the effectiveness of different value chains in achieving all development outcomes. A single outcome indicator is first selected for each development outcome. For poverty we use the headcount indicator. There is only one proposed indicator for diet quality, and hence no choice is required, although other indicators may be devised, e.g., based on dietary diversity or calorie availability. For GDP and employment, we use the AFS-level indicators, which is motivated by our interest in assessing impacts along the AFS. Since the elasticities and multiplier results in Table 5 have different underlying units, the next step is to normalize individual outcome scores. The values of each indicator are therefore scaled so that the most effective value chain is given a score of one and the least effective is given a score of zero. Normalization does not alter the relative effectiveness of value chains within each outcome category, and merely serves to facilitate comparisons across outcome indicators.

Figure 9. Normalized value chain scores for different outcomes



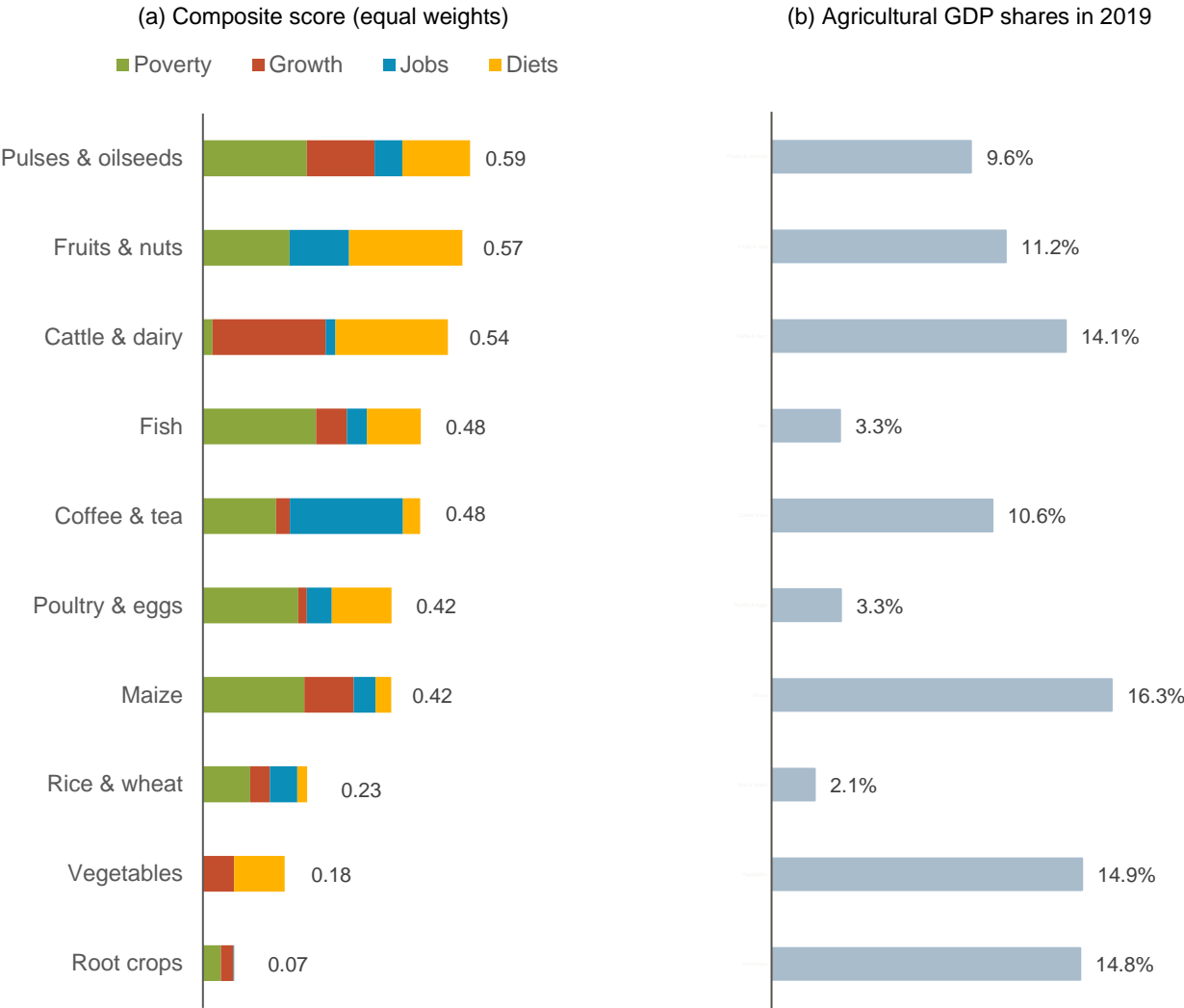
Source: Authors' analysis using the results from IFPRI's Kenya RIAPA model.

Notes: Scores for each outcome category are normalized such that the value chain whose growth is most effective at improving that outcome has a score of one, while the least effective value chain has a score of zero. The orders in Panels B-C are according to ranks of value chains in Panel A.

The value chains in Figure 9 are ranked based on their poverty scores, with fish appearing at the top of the poverty score in Panel (a) with a value of one. However, while fish is the most effective at reducing poverty, it is much less effective at achieving other outcomes. Conversely, the coffee and tea value chain is most effective at AFS employment growth, but much less effective at reducing poverty. This variation across development outcomes highlights the trade-offs that may exist in prioritizing individual value chains, i.e., there is no single value chain that is the most effective at achieving every development objective. Promoting a few value chains jointly will not only diversify agricultural growth but may also be more effective at achieving multiple development objectives simultaneously.

One way of narrowing the set of prioritized value chains is to compute a composite score for each value chain across the four outcome indicators. Such a score can be a simple average which assumes each outcome indicator is equally weighted, or it can be a weighted average score where policymakers attach greater weights to the outcomes they deem more important in the context of their country's development agenda. Figure 10 presents an example of a simple, unweighted composite score. Value chains are now reranked based on the composite score, with each of the components in the bars showing the relative contribution of each outcome indicator in the final score. Although the pulses and oilseeds value chain is not the highest ranked value chain in any of the four individual outcome indicators, this value chain consistently ranks in the top three, which ensures that it emerges as the top-ranked value chain based on its composite score. Cattle and dairy, a value chain with a top rank for diet quality and GDP but low ranks for poverty and AFS employment, and fruits and nuts, a value chain ranked second in diet quality and AFS employment but with a low rank for GDP and poverty, enter into the second and third positions, respectively.

Figure 10. Composite score and final ranking based on equally weighted outcomes



Source: Authors' analysis using the results from IFPRI's Kenya RIAPA model.

Notes: The composite score is a simple average (equally weighted) of the normalized scores for the four focus outcome indicators (see Figure 9).

The final selection of value chains may change for different combination of outcome indicators (e.g., selected from the possible set of indicators shown in Table 5). It is also possible to assign different weights to outcome indicators to reflect the importance policymakers or society attached to those outcomes. Table A2 in the appendix shows alternative value chain rankings under different weighting schemes.

In summary, agricultural growth in Kenya is generally pro-poor and it also contributes to broad economic development and job creation. However, the source or pattern of agricultural growth matters for the pace and inclusiveness of agricultural transformation, and this underscores the need for ensuring a better designed policy and investment portfolio of value chains to drive future AFS growth.

8 CONCLUSION

Kenya's economy grew rapidly during 2009-2019 and this helped reduce the absolute number of poor people for the first time in decades. In this report, we used a series of Kenyan SAMs to assess the current and evolving structure of the agrifood system (AFS) and its contribution to national development. We also assess the performance of individual AFS value chains and structural differences across them. Our analysis shows that the effects of agricultural productivity growth stretch well beyond primary agriculture, creating jobs and income opportunities throughout the economy. The development pathways of more advanced economies suggest that linkages between the on- and off-farm components of the AFS will become even more important over time.

We further find that successful transformation of Kenya's AFS will require growing contributions to growth from agroprocessing so that more value-added and jobs in the AFS can eventually be generated off the farm. Already we see evidence that the off-farm components of the AFS, although relatively small, are starting to grow more rapidly than primary agriculture. However, there are sectoral differences in growth patterns, driven in part by market structure, but also by the extent to which sectors are engaged in world trade. Specifically, we find that growth in Kenya's AFS has been predominantly led by domestic market-oriented value chains, and less so by sectors that are export-oriented. This domestic market orientation means an understanding of the domestic demand system and evolving dietary patterns in Kenya is important for projecting future patterns of growth in the AFS. At present, Kenya's AFS is still dominated by primary agriculture rather than agroprocessing, which suggests AFS transformation is still at an early stage. And although off-farm AFS growth has been faster, many jobs are being created in less productive components of the off-farm AFS, which could ultimately slow the pace of AFS transformation.

With the diagnostic analysis of the past performance of the AFS as background, the forward-looking economywide analysis of the effects of agricultural growth on development outcomes highlights how value chains differ considerably in terms of their effectiveness in achieving different development goals. There are also significant trade-offs among different development goals associated with promoting a specific value chain. For example, value chains that are effective at generating growth or employment might not be as effective at reducing poverty or improving diet quality. The implication is that policymakers should ideally prioritize several value chains that can jointly achieve a broader set of development goals. Developing several value chains would not only foster agricultural diversification but will also create synergies across value chains and development outcomes, and ultimately make for a more sensible development strategy. Based on a proposed scoring strategy, our model results suggest that the cattle and dairy, pulses and oilseeds, and fruits and nuts value chains might be prioritized in Kenya.

While this report has examined the past performance and future impacts of agricultural growth, thus providing a quantitative assessment of trade-offs and synergies across development outcomes associated with prioritizing growth across different value chains, the sources of agricultural growth have not been extensively assessed. Further research is required to assess the growth potential as well as the constraints to achieving such growth targets. Significant public and private investments may be required to unlock the growth potential of value chains. Additional research of demand systems and the effects of evolving dietary patterns on the AFS is also required. Nevertheless, our analysis of historical patterns and drivers of AFS growth and transformation lays a strong foundation for a more structured understanding of the AFS and consideration of the policies required to facilitate continued transformation of the AFS.

9 APPENDIX

Table A1. Agricultural products mapped to value chain groups

Value chain group	Individual products in the SAM & Share of group's agriculture GDP
Maize	Maize 100.0%
Rice & wheat	Rice 33.1% Wheat 66.9%
Sorghum & other cereals	Sorghum 94.0% Other cereals 6.0%
Pulses	Pulses 100.0%
Oilseeds	Groundnuts 51.0% Other oilseeds 49.0%
Root crops	Cassava 10.1% Irish potatoes 64.1% Sweet potatoes 24.4% Other roots 0.7% Plantains 0.7%
Vegetables	Leafy green vegetables 55.2% Other vegetables 44.8%
Fruits & nuts	Nuts 5.1% Bananas 40.7% Other fruits 54.2%
Export crops	Leaf tea 71.4% Coffee 17.0% Cut flowers 11.7%
Other crops	Sugarcane 37.4% Tobacco 2.7% Cotton & fibers 6.2% Other crops 53.7%
Cattle & milk	Cattle meat 38.1% Raw milk 61.9%
Poultry & eggs	Poultry meat 77.5% Eggs 22.5%
Other livestock	Small ruminants 46.8% Other livestock 53.2%
Fish	Aquaculture 12.8% Capture fisheries 87.2%
Forestry	Forestry 100%

Source: Author's analysis using IFPRI's 2019 Kenya SAM.

Table A2. Value chain rankings under different outcome weighting schemes

	Outcome-biased rankings				
	Equal weights	Poverty bias	Diet quality bias	GDP bias	Employment bias
1	Pulses & oilseeds	Pulses & oilseeds	Fruits & nuts	Cattle & dairy	Coffee & tea
2	Fruits & nuts	Fish	Cattle & dairy	Pulses & oilseeds	Fruits & nuts
3	Cattle & dairy	Fruits & nuts	Pulses & oilseeds	Maize	Pulses & oilseeds
4	Fish	Maize	Fish	Fish	Cattle & dairy
5	Coffee & tea	Poultry & eggs	Poultry & eggs	Fruits & nuts	Fish
6	Poultry & eggs	Coffee & tea	Coffee & tea	Coffee & tea	Poultry & eggs
7	Maize	Cattle & dairy	Maize	Poultry & eggs	Maize
8	Rice & wheat	Rice & wheat	Vegetables	Vegetables	Rice & wheat
9	Vegetables	Vegetables	Rice & wheat	Rice & wheat	Vegetables
10	Root crops	Root crops	Root crops	Root crops	Root crops

Source: Results from IFPRI's Kenya RIAPA model.

Notes: In each of the biased rankings, the focus outcome is given a 50 percent weight, and the remaining outcomes equally share the remaining 50 percent (i.e., 16.7 percent each). Under the default equal weighting scheme pulses and oilseeds, fruits and nuts, and cattle and dairy occupied the top-three spots. When a greater weight is attached to poverty, the fish value chain moves into the top spot, while when employment is favored, the coffee and tea value chain moves into the top spot. Both these changes are at the expense of the cattle and dairy value chain, which drops out of the top-three ranking. The cattle and dairy value chain maintains its top-ranked spot when diet quality and GDP outcomes are favored.

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