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IDENTIFYING PRIORITY VALUE CHAINS IN TANZANIA

By

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EXECUTIVE SUMMARY

Value chain development is increasingly perceived as an important approach for agricultural development in developing countries. This paper uses a Rural Investment and Policy Analysis (RIAPA) model for the mainland Tanzania economy to identify the agricultural activities and value-chains whose expansion will be most effective at fostering economic development along four dimensions: generating economic growth in the agricultural-food sector of Tanzania; reducing national and rural poverty; generating employment; and improving nutrition by diversifying diets.

The results of scenarios run through the model suggests that there is no single value-chain that can achieve all of the policy objectives. Instead, a more balanced portfolio of value-chains would not only enhance agriculture's future contribution to poverty reduction and economic growth, but also promote faster rural transformation and dietary diversification, both of which are needed to create job opportunities and improve nutrition outcomes over the longer-term. The analysis suggests that vegetables, coffee, milk, cotton, nuts, and oilseeds should be considered as "priority" value-chains, because these are the most effective at achieving multiple policy objectives. Other value-chains that meet several of the development objectives considered include maize, fishing, wheat and barley, rice, cattle, and poultry and eggs.

TABLE OF CONTENTS

TABLE OF TABLES

TABLE OF FIGURES

TABLE OF TEXT BOXES

1. Introduction

The research reported on in this paper identifies for mainland Tanzania the agricultural activities and value-chains whose expansion will be most effective at generating economic growth; reducing national and rural poverty; creating jobs; and improving nutrition by diversifying diets. The Rural Investment and Policy Analysis (RIAPA) model is used to estimate how increasing production in different agricultural sectors leads to changes in national and household outcomes (Text Box 1). RIAPA captures linkages between sectors and rural-urban economies, as well as changes throughout the agriculture-food system (AFS). The sections below (1) situate agriculture within the national economy; (2) establish baseline expectations until 2025; (3) evaluate the impacts of promoting alternative value-chains; and (4) provide a final assessment of priority value chains.

Text Box 1: Rural Investment and Policy Analysis (RIAPA) computable general equilibrium model

RIAPA is a computable general equilibrium (CGE) model that simulates the functioning of a market economy, including markets for products 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. RIAPA provides a consistent "simulation laboratory" for quantitatively examining value-chain interactions and spillovers at national, sub-national and household levels.

RIAPA divides the economy into sectors and household groups that act as individual economic agents. Producers 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 unique combination of land, labor, machinery, fertilizer, and purchased seeds. Workers are divided by education levels, and agricultural capital is separated into crop and livestock categories. Labor and capital are in fixed supply, but less-educated workers are treated as underemployed. Producers and households pay taxes to the government, who uses these and other revenues to finance public services and social transfers. Remaining revenues are added to private savings and foreign capital inflows to finance investment, i.e., investment is driven by levels of savings. RIAPA is dynamic, with past investment determining current capital availability.

RIAPA tracks changes in incomes and expenditures for different household groups, including changes in food and nonfood consumption patterns. Poverty impacts are measured using survey-based microsimulation analysis. 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.

2. Agriculture in the National Economy

Agriculture forms only part of Tanzania's economy, and farming is only one source of income for rural households. RIAPA is an economy-wide model and its core database is a social accounting matrix (SAM) that captures all income and expenditure flows between all economic actors in the

country, including producers, consumers, government, and the rest of the world (Text Box 1). Tanzania's model uses a 2016 SAM and the 2011/12 Household Budget Survey to separate the whole economy into 86 sectors and 13 factors of production.[1] Table 1 describes the structure of the economy of Tanzania in 2016, which is the base-year production and trade structure for the application of the RIAPA model to the Tanzanian economy for this research.

Table 1: Structure of the national economy of Tanzania, 2016

	Share of total (%)					
	GDP	Employ-ment	Exports	Imports	Exports / output (%)	Imports / demand (%)
All sectors	100.0	100.0	100.0	100.0	9.2	14.0
Agriculture	29.1	66.7	18.7	1.7	10.8	1.5
Crops	16.0	52.9	18.7	1.7	18.5	2.5
Livestock	7.1	10.0	0.0	0.0	0.0	0.0
Forestry	4.0	2.2	0.0	0.0	0.0	0.0
Fishing	1.9	1.6	0.0	0.0	0.0	0.0
Industry	27.4	6.5	51.2	84.6	12.0	27.0
Mining	3.7	1.2	33.2	0.6	78.2	8.6
Manufacturing	5.6	3.0	18.0	84.1	10.8	46.2
Agro-processing	3.0	1.1	7.4	6.7	9.0	12.4
Other manufacturing	2.6	1.9	10.6	77.3	12.8	61.4
Other industry	18.2	2.3	0.0	0.0	0.0	0.0
Services	43.4	26.8	30.1	13.6	6.4	3.5
Trade and hotels	13.7	16.3	12.7	0.0	8.0	0.0
Transport services	7.0	3.4	12.7	10.6	12.5	12.3
Finance & business	10.5	1.2	4.7	3.1	4.6	3.6
Government services	11.0	3.0	0.0	0.0	0.0	0.0
Other services	1.2	2.8	0.0	0.0	0.0	0.0

Source: RIAPA CGE Model and SAM for Tanzania.
Notes: GDP is gross domestic product; employment is workers in primary jobs. The final two columns report the share of exports in total sectoral output and the share of imports in total commodity demand. Agro-processing includes beverages and tobacco, but not wood products; catering services includes food services (meals prepared away from the home); and transport includes communications.

Agriculture in Tanzania generates 29 percent of national GDP, 67 percent of total employment, and 19 percent of total export earnings. Crops dominate the agricultural sector, although livestock and fisheries are also important sources of employment. Major agricultural exports include the range of traditional field crops (e.g., tobacco, tea, coffee, sugarcane and cotton) as well as cashew nuts, oilseeds (e.g., sesame) and pulses (e.g., pigeon peas and chickpeas). Some agricultural output is supplied to downstream processing, but these sectors generate only 3 percent of GDP, 1 percent of employment, and 7 percent of exports. Major processed exports include fish and oilcakes (e.g., cotton and sunflower seeds). Tanzania imports most nonagricultural manufactured goods, such as fertilizer, machinery, and vehicles. More than two-fifths of national GDP is generated by services, which are dominated by trade and business services.

[1] The Social Accounting Matrices (SAM) used with the RIAPA CGE model follow standard "Nexus Project" data definitions and estimation procedures. The Nexus Project is a collaboration between IFAD, IFPRI, other international organizations, and national research and statistical agencies. Tanzania's 2016 SAM was built by IFPRI using data supplied by the National Bureau of Statistics of the government of Tanzania.

Table 2. Tanzania's agriculture-food system GDP and employment, 2016

	Share of national total (%)	
	GDP	Employment
National economy	**100.0**	**100.0**
Agriculture-food system	**38.7**	**73.3**
Direct production	**32.4**	**68.0**
Agriculture	29.1	66.7
Agro-processing	3.2	1.3
Input production	**0.9**	**0.5**
Agriculture	0.4	0.2
Agro-processing	0.4	0.2
Trade and transport	**5.5**	**4.8**
Agriculture	3.0	2.6
Agro-processing	2.5	2.2
Food services	**0.5**	**1.5**

Source: RIAPA CGE Model and SAM for Tanzania.
Notes: GDP is gross domestic product; employment is workers in primary jobs. Agro-processing includes foods, beverages, tobacco, paper products, cotton yarn, and basic word products; and food services includes meals prepared away from the home.

Agriculture's role in the economy extends beyond the sector itself, with many industrial and service sectors forming parts of the AFS. Table 2 uses the national SAM to estimate the share of total GDP and employment in Tanzania's AFS. Agriculture and agro-processing together account for 32 percent and 68 percent of GDP and employment, respectively. These sectors use domestically-produced inputs, such as seeds and animal feed, whose production creates additional value-added and jobs within the AFS. An even larger AFS component is moving agriculture-related products between farmers, processors and markets. Households also consume food services or meals prepared outside the home, such as at restaurants or from street vendors. In total, the AFS accounts for 39 percent and 73 percent of national GDP and employment, respectively. Most of the economy, population and workforce therefore depend on agriculture, either directly or indirectly.

RIAPA is used to evaluate different agricultural value-chains. Table 3 provides summary production statistics for the 22 primary product categories analyzed. Appendix Table 1 lists the detailed agricultural products included in each category. Maize is the dominant staple crop and is grown by most smallholder farmers (11 percent of agricultural GDP). Tobacco, oilseeds and nuts are the three main agricultural exports, and together they account for a similar share of GDP as maize (almost 10 percent). Other major food crops include rice, pulses, potatoes, and bananas/plantains (about 21 percent together). Livestock and fisheries are also large subsectors – mainly cattle and milk, and capture fisheries, respectively. Finally, forestry is the single largest sector in the table, accounting for more agricultural GDP than either maize or cattle.

Table 3. Agricultural production statistics for Tanzania, 2016

	Agriculture GDP share (%)	GDP per worker (USD)	Cultivated hectares ('000)	Hectares per worker	Crop yield (mt per hectare)
Agriculture	**100.0**	**900**	**17,871**	**0.8**	-
Maize	11.4	968	4,146	0.4	1.6
Sorghum, millet	1.3	870	1,136	0.2	1.0
Rice	4.1	1,033	957	0.5	2.7
Wheat, barley	0.4	671	158	0.5	1.5
Pulses	4.6	546	2,068	0.5	0.9
Groundnuts	1.9	586	1,620	0.3	1.0
Oilseeds	4.8	599	3,444	0.3	1.1
Cassava	3.1	512	800	1.0	6.2
Potatoes	4.1	513	928	1.1	5.7
Vegetables	2.8	641	401	1.4	6.8
Nuts	3.9	406	440	2.8	0.4
Bananas	5.4	621	816	1.4	4.6
Fruits	2.4	647	159	3.0	9.8
Sugarcane	1.0	499	54	4.5	51.4
Cotton	0.5	392	349	0.4	0.8
Coffee	0.9	433	160	1.6	0.3
Cattle	12.0	1,766	-	-	-
Milk	8.0	1,145	-	-	-
Poultry, eggs	1.8	1,950	-	-	-
Goats, sheep	1.8	1,498	-	-	-
Forestry	13.8	3,739	-	-	-
Fishing	6.9	2,493	-	-	-
Other crops	2.4	472	236	2.7	1.0
Other livestock	0.7	1,181	-	-	-

Source: RIAPA CGE Model and SAM for Tanzania.
Notes: Table A1 in appendix lists the crops or products included in each value-chain category. mt = metric ton

RIAPA contains 15 representative household groups, separated into rural and urban consumption quintiles, with rural households separated into farm and nonfarm groups. Table 4 describes aggregate income and consumption patterns. Tanzania's population of 55.6 million people consume, on average, US$549 of goods and services per person each year (at market exchange rates unadjusted for purchasing power parity). Consumption levels are lower in rural areas and amongst the poor. Poor households spend more of their earnings on food, and less on processed products. Starches from cereals and roots dominate the consumption patterns of the rural poor, whereas nonpoor and urban households consume more dairy, meat, fish and eggs, as well as more meals prepared outside of the household. Finally, poor rural households, on average, rely more on incomes from farming and less-educated labor, suggesting that agriculture and the rural nonfarm economy play key roles in the livelihoods of the poorest households.

Table 4. Household incomes and consumption for the population of Tanzania, 2016

	National	Rural	Rural poor	Urban
Population (millions)	55.6	39.6	19.4	16.0
Consumption per capita (USD)	549	404	239	910
Food consumption as share of total consumption (%)	64.3	73.9	81.3	53.8
Food consumption share (%)	100.0	100.0	100.0	100.0
Cereals and roots	31.8	37.0	42.8	23.9
Vegetables	4.3	4.3	4.7	4.3
Fruits	1.6	1.5	1.5	1.6
Meat, fish and eggs	21.2	20.8	18.6	21.9
Milk and dairy	5.3	7.0	5.7	2.8
Pulses and oilseeds	10.9	11.3	13.2	10.3
Prepared meals	8.6	4.8	2.9	14.4
Other foods	16.3	13.3	10.6	20.8
Processed food share (%)	36.6	31.8	28.9	43.9
Total household income (%)	100	100	100	100
Crop land returns	8.4	15.6	19.2	2.0
Labor remuneration	37.3	34.4	36.0	39.8
Less-educated workers	23.3	28.1	35.0	19.1
Better-educated workers	13.9	6.3	1.0	20.6
Capital profits	47.5	38.5	33.4	55.5
Other sources	6.8	11.5	11.3	2.8

Source: RIAPA CGE Model and SAM for Tanzania.
Notes: Food consumption excludes meals prepared outside the household. Processed foods excludes products processed and consumed within the household. Better-educated workers are those who have at least completed primary schooling. Capital income includes gross operating surplus. Other income sources include social and foreign transfers. Table A1 in appendix lists the crops or products included in each value-chain category.

3. Future Outcomes Under Current Trends

RIAPA first establishes a baseline scenario for 2018-2025 assuming recent trends continue. Table 5 summarizes this "business-as-usual" scenario. Initial values are for 2018, which is the simulated base year for the analysis derived by imposing trends on the model. Total population and labor supply grow at 2.8 percent per year, whereas crop land area expands slightly faster than the rural population. Productivity growth is adjusted to replicate broad trends in sectoral GDP. The table's final two columns compare model outcomes to observed trends. Agricultural GDP continues to grow more slowly than industry and services. Overall, national GDP grows at 6 percent per year, which is faster than the population, implying rising GDP per capita.

Table 5. Baseline "Business-As-Usual" scenario results, 2018-2025

	Initial value, 2016	Average annual change (%)	
		Baseline scenario	Observed trends
Total population (1000s)	57.1	2.8	3.0
Total GDP (%)	100.0	6.0	6.2
Agriculture	28.4	3.5	3.7
Industry	27.7	6.4	8.0
Agro-processing	3.0	5.9	n/a
Services	43.9	7.1	6.0
Labor employment (thousands)	21.7	1.8	1.8
Crop land ('000 hectares)	18.2	2.0	2.0
Capital stock (index)	59	4.4	n/a
Consumption per capita (USD)	551	1.6	2.9
Rural households	411	2.0	n/a
Urban households	897	1.2	n/a
Poverty headcount rate (%)	27.3	-4.2	-3.9
Poverty-growth elasticity	-	-1.4	-1.4
Semi-PGE	-	-0.3	-0.4

Source: RIAPA CGE Model and SAM for Tanzania.
Notes: Observed population, GDP and employment trends are for 2005-2015; poverty and PGE is for 2007-2012. Poverty headcount rate is the share of the population with consumption below the official poverty line. The poverty-growth elasticity (PGE) is the percentage change in the poverty headcount rate per one percent increase in GDP per capita, whereas the semi-PGE uses the percentage point change in the poverty rate.

RIAPA measures how the pace and sectoral pattern of GDP growth affects household incomes and consumption levels. This is based on sectors' differing resource demands and households' factor endowments and consumption patterns. Poor households are often more dependent on incomes from less-educated workers, and so expanding production in sectors that employ these workers more intensively is more likely to benefit the poor. Similarly, expanding production and lowering prices of products that poor households consume can also raise their total consumption and move some households to levels above the poverty line.

The poverty headcount rate falls in the baseline. This is the share of the population with consumption levels below the official poverty line. RIAPA's microsimulation analysis estimates that the national poverty rate would fall by 4.2 percent per year in the baseline scenario. Note that this is a percentage, not percentage point, change in the poverty rate. In absolute terms, the poverty rate falls from 28 percent in 2016 to 27 percent and 19 percent in 2017 and 2025, respectively.[2]

The pace of poverty reduction should be assessed in relation to economic growth. Text Box 2 describes RIAPA's main outcome indicators. The baseline poverty-growth elasticity (PGE) is –1.4, which means that a one percent increase in per capita GDP causes the poverty headcount rate to decline by 1.4 percent. This matches Tanzania's observed PGE for the period 2002-2013. An alternative measure is the semi-PGE, which indicates that a one percent increase in per capita GDP reduces the poverty rate by 0.3 percentage points, which is slower than what was observed in recent years, reflecting how the absolute pace of poverty reduction tends to decline as countries

[2] RIAPA is calibrated to a 2016 SAM, but the poverty module is benchmarked to the 2011/12 household survey.

develop. Overall, the baseline captures Tanzania's broad economic trends and growth-poverty relationships. The baseline provides a plausible reference scenario for evaluating the expanding production of different agricultural value-chains.

Text Box 2: Outcome indicators

Value-chains are compared based on their impacts on economic growth, employment, poverty, and nutrition. These headline outcome indicators are defined below.

Economic growth is measured by real GDP at factor cost, either for all sectors (total GDP) or for the agriculture-food system (AFS GDP) (see Table 2).

Employment is paid and unpaid work, including home enterprises. Workers may have multiple jobs, but only their primary job is considered and no adjustment is made for hours worked.

Poverty is measured by the poverty headcount or gap. The former is the share of the population with consumption below the poverty line, and the latter is the cumulative distance between poor people's consumption levels and the poverty line (i.e., depth of poverty).

Dietary diversity score is calculated for household groups using food expenditure shares. Diversity is estimated using a generalized entropy measure across seven food categories (cereals and roots; vegetables; fruits; meat, fish and eggs; milk and dairy; pulses and oilseeds; and meals prepared outside the household). A more diverse diet is assumed to be associated with better nutrition outcomes.

Poverty-growth elasticity (PGE) is the percentage change in the poverty rate divided by the per capita GDP growth rate. Semi-PGEs use percentage *point* changes in the poverty rate.

Dietary-diversity-growth elasticity (DDGE) is the percentage change in the dietary diversity score of poor households divided by the per capita GDP growth rate.

Economywide growth (employment) elasticity is the percentage in either total or AFS GDP (employment) divided by the percentage change in agricultural GDP.

Farmers include rural households earning any income from crops or livestock.

Female house is based on the *de jure* household head and includes rural and urban households.

4. Evaluating Alternative Value Chains

RIAPA is used to simulate the effects of expanding farm production within existing agricultural value-chains. Total factor productivity growth in each group of agricultural products is accelerated beyond baseline growth rates, such that, in each value-chain scenario, total agricultural GDP is one percent higher in 2025 than it is in the baseline scenario.[3] Expanding agricultural production increases supply to downstream processing activities and generates demand for agricultural trade and transport services. Agricultural subsectors differ in size, and so to achieve the same absolute increase in total agricultural value-added, it is necessary for smaller value-chains to expand more rapidly than larger ones. Table 3 listed the value-chains analyzed in this brief, including their initial

[3] The choice to target one percent increase in agricultural GDP is somewhat arbitrary, since results are largely unaffected by the magnitude of the target growth acceleration.

GDP shares. Wheat and barley is the smallest agricultural subsector on this list, and so these crops need large productivity gains to match the effects of even modest maize yield gains. While such rapid growth may be difficult to achieve, targeting the same absolute increase in agricultural GDP permits comparisons across scenarios.

Table 6 reports the estimated semi-PGEs for each scenario. Expanding maize production reduces the national poverty headcount rate by 2.8 percentage points for every one percent increase in agricultural GDP, making maize a "pro-poor" value-chain. In fact, maize has the largest elasticity of all value-chains considered here, implying that growth in the maize and downstream milling sectors are most effective at reducing national poverty (see ranking in parentheses). Maize also has strong linkages to rural poverty reduction, although growth in coffee and potatoes is even more effective at reducing rural poverty. Note that value-chain PGEs are often larger than the baseline's overall PGE, indicating that agricultural growth is generally more pro-poor than nonagricultural growth. Rural PGEs also tend to be larger than national PGEs, indicating that, as expected, agricultural growth favors the rural poor.

Table 6. Poverty-Growth Elasticity (PGE) results, 2018-2025

Baseline or targeted sector within agriculture	Estimated Semi-PGE (sectoral rank in parentheses)									
	National headcount		Rural headcount		National gap		Rural farmer headcount		Female household headcount	
Baseline	-0.32		-0.39		-0.10		-0.41		-0.34	
Maize	-2.82	(1)	-3.63	(3)	-0.86	(1)	-3.77	(3)	-2.85	(2)
Sorghum, millet	-1.61	(7)	-1.98	(7)	-0.38	(8)	-2.09	(7)	-0.94	(9)
Rice	-0.94	(11)	-1.09	(13)	-0.12	(15)	-1.10	(13)	-0.40	(16)
Wheat, barley	-0.60	(16)	-0.70	(16)	-0.10	(16)	-0.50	(16)	-0.53	(11)
Pulses	-1.74	(6)	-2.23	(6)	-0.48	(6)	-2.30	(6)	-1.83	(4)
Groundnuts	-0.92	(12)	-1.20	(12)	-0.14	(13)	-1.27	(11)	-0.47	(13)
Oilseeds	-0.27	(21)	-0.25	(20)	-0.07	(20)	-0.19	(20)	0.54	(22)
Cassava	-2.21	(4)	-2.96	(4)	-0.57	(3)	-3.12	(4)	-1.92	(3)
Potatoes	-2.77	(2)	-3.66	(2)	-0.49	(5)	-3.80	(2)	-0.43	(15)
Vegetables	-2.15	(5)	-2.59	(5)	-0.62	(2)	-2.68	(5)	-3.12	(1)
Nuts	-0.73	(15)	-0.88	(14)	-0.17	(12)	-0.77	(15)	-0.43	(14)
Bananas	-0.29	(19)	-0.30	(18)	-0.08	(19)	-0.31	(18)	0.28	(21)
Fruits	-0.28	(20)	-0.29	(19)	0.01	(22)	-0.31	(19)	0.09	(19)
Sugarcane	-0.09	(22)	0.00	(22)	-0.01	(21)	0.00	(22)	0.10	(20)
Cotton	-0.77	(14)	-0.86	(15)	-0.17	(11)	-0.82	(14)	-0.77	(10)
Coffee	-2.72	(3)	-3.90	(1)	-0.55	(4)	-4.02	(1)	-1.29	(6)
Cattle	-0.42	(17)	-0.30	(17)	-0.10	(17)	-0.31	(17)	-0.97	(8)
Milk	-1.00	(10)	-1.40	(9)	-0.13	(14)	-1.48	(9)	-0.11	(18)
Poultry, eggs	-1.03	(9)	-1.52	(8)	-0.25	(9)	-1.60	(8)	-1.07	(7)
Goats, sheep	-0.85	(13)	-1.30	(11)	-0.45	(7)	-1.37	(10)	-1.47	(5)
Forestry	-0.29	(18)	-0.07	(21)	-0.09	(18)	-0.03	(21)	-0.38	(17)
Fishing	-1.18	(8)	-1.35	(10)	-0.19	(10)	-1.21	(12)	-0.52	(12)

Source: RIAPA CGE Model and SAM for Tanzania.

Notes: Semi-PGE is the percentage point change in the poverty rate per one percent increase in GDP per capita driven by GDP growth originating from within the targeted sector. Poverty headcount rate is the share of the national or rural population with consumption levels below the official poverty line. Poverty gap rate is the cumulative distance between poor people's consumption levels and the poverty line.

A value chain's impact on poverty depends on various factors, such as if poorer farmers engage in this activity (higher farm revenues); if poorer workers are employed in downstream processing and trading activities (higher wages); or if poorer households consume the final product (lower prices). The final poverty impact therefore depends on both income and price effects. Coffee, for example, is a high-value export-oriented crop whose growth benefits farmers more than

consumers. This explains why coffee is higher ranked than maize for rural farmers, but lower ranked for national poverty overall. The relative importance of different value chains is also different for female-headed households (see final column). Vegetables, for example, have the highest elasticity, whereas coffee and potatoes are less effective at reducing poverty for female-headed households than they are for households in general (i.e., comparing the first and final columns).

Poverty headcount rates focus on people living close to the poverty line, whereas poverty gaps measure how far poor households are from the poverty line. Poverty gaps better reflect the conditions of the poorest of the poor. These households may have different consumption patterns and asset endowments than the less poor, such as limited access to land, and so we do not expect value-chains to be equally effective at reducing poverty headcounts and gaps. In Table 6, there is a reranking of products depending on whether the outcome indicator is the poverty headcount (Column 2) or poverty gap (Column 3). Cassava, for example, is slightly more effective at reducing the poverty gap than the poverty headcount rate (relative to other value-chains). Results indicate that maize, vegetables and cassava have the largest poverty gap elasticities, indicating that their expansion benefits the poorest households. These three crops are also the most effective at reducing poverty amongst female-headed households.

Table 7. Dietary-Diversity-Growth Elasticity (DDGE) results, 2018-2025

Baseline or targeted sector within agriculture	Estimated DDGE (sectoral rank in parentheses)					
	All households		Rural households		Poor rural households	
Maize	-0.40	(17)	-0.59	(18)	-0.66	(19)
Sorghum, millet	-0.52	(19)	-0.75	(20)	-0.90	(20)
Rice	-0.40	(16)	-0.50	(16)	-0.34	(16)
Wheat, barley	-0.13	(12)	-0.20	(13)	-0.27	(14)
Pulses	0.00	(9)	-0.07	(10)	-0.15	(12)
Groundnuts	-0.02	(10)	-0.10	(12)	-0.28	(15)
Oilseeds	0.03	(4)	0.09	(5)	0.08	(5)
Cassava	-0.61	(21)	-0.84	(22)	-1.06	(22)
Potatoes	-0.61	(22)	-0.80	(21)	-0.96	(21)
Vegetables	1.38	(2)	1.48	(2)	1.25	(2)
Nuts	0.00	(8)	0.00	(6)	0.00	(7)
Bananas	-0.56	(20)	-0.71	(19)	-0.47	(18)
Fruits	3.87	(1)	4.15	(1)	3.56	(1)
Sugarcane	0.02	(5)	-0.01	(7)	-0.02	(8)
Cotton	-0.02	(11)	-0.02	(9)	-0.02	(9)
Coffee	0.01	(7)	0.10	(4)	0.12	(4)
Cattle	-0.20	(13)	-0.09	(11)	0.01	(6)
Milk	1.18	(3)	0.88	(3)	0.80	(3)
Poultry, eggs	-0.26	(14)	-0.22	(14)	-0.09	(11)
Goats, sheep	-0.44	(18)	-0.53	(17)	-0.35	(17)
Forestry	0.01	(6)	-0.02	(8)	-0.03	(10)
Fishing	-0.32	(15)	-0.29	(15)	-0.19	(13)

Source: RIAPA CGE Model and SAM for Tanzania.

Notes: Dietary diversity score (DDS) measures the unevenness of the real value of consumption across major food groups (i.e., negative entropy distance from equality). DDGE is the percentage change in the DDS per one percent increase in GDP per capita driven by GDP growth originating within the targeted agricultural sector.

Table 7 reports dietary-diversity-growth elasticities (DDGE), which show how effective value-chains are at diversifying the dietary patterns of household groups. We focus on the diets of poor rural households (see Table 4). Diversity is measured by expenditures across seven food groups

(see Text). Cereals and roots are already the dominant food group, and so expanding these crops reduces dietary diversity (by increasing availability and reducing prices). Forestry and coffee do not produce foods and so expanding their production does not directly affect food availability and diets. Instead, these value-chains affect access to food by raising incomes, thereby indirectly affecting diets.[4] Overall, the value-chains that are most effective at promoting dietary diversity amongst poor rural households are fruits, vegetables, and milk.

Table 8 reports the growth and employment effects of expanding agricultural production in different value-chains. Although the scenarios are labeled by the names of the value-chains in which productivity growth originates, it does not imply that all growth and employment occurs only within these value-chains. Increasing maize productivity, for example, may allow farmers to diversify production by reallocating resources to other crops and activities, including nonfarm enterprises. Increasing value-chain workers' incomes also allows their households to purchase products from other sectors or value-chains, thereby generating economywide spillovers. The table reports economywide growth and employment elasticities for the total economy and for the AFS only. The former is an indicator of agriculture-led development, whereas the latter is an indicator of agricultural transformation.

Table 8. Economywide growth and employment linkages, 2018-2025

Targeted sector within agriculture	GDP growth elasticity (rank in parentheses)				Employment elasticity (rank in parentheses)			
	Total		AFS only		Total		AFS only	
Maize	0.32	(10)	0.83	(10)	-0.03	(14)	-0.15	(14)
Sorghum, millet	0.30	(12)	0.82	(12)	-0.05	(15)	-0.13	(12)
Rice	0.42	(5)	0.89	(7)	-0.03	(13)	-0.20	(18)
Wheat, barley	0.51	(1)	1.25	(2)	-0.09	(21)	-0.24	(20)
Pulses	0.36	(8)	0.82	(11)	-0.06	(19)	-0.21	(19)
Groundnuts	0.30	(11)	0.79	(14)	-0.05	(16)	-0.15	(15)
Oilseeds	0.27	(16)	1.26	(1)	0.11	(4)	0.27	(4)
Cassava	0.26	(17)	0.78	(16)	-0.01	(11)	-0.04	(10)
Potatoes	0.30	(13)	0.79	(15)	-0.05	(17)	-0.15	(13)
Vegetables	0.43	(4)	0.96	(5)	-0.14	(22)	-0.39	(22)
Nuts	0.28	(15)	0.87	(8)	0.38	(2)	0.63	(2)
Bananas	0.29	(14)	0.79	(13)	-0.03	(12)	-0.10	(11)
Fruits	0.37	(7)	0.83	(9)	-0.06	(18)	-0.24	(21)
Sugarcane	0.45	(2)	1.25	(3)	-0.09	(20)	-0.20	(17)
Cotton	0.33	(9)	1.09	(4)	0.17	(3)	0.33	(3)
Coffee	0.17	(21)	0.76	(19)	0.42	(1)	0.90	(1)
Cattle	0.24	(20)	0.72	(22)	0.09	(5)	0.10	(6)
Milk	0.26	(18)	0.73	(21)	0.03	(10)	0.02	(7)
Poultry, eggs	0.25	(19)	0.78	(17)	0.04	(8)	0.01	(8)
Goats, sheep	0.14	(22)	0.73	(20)	0.07	(7)	0.16	(5)
Forestry	0.45	(3)	0.77	(18)	0.09	(6)	-0.19	(16)
Fishing	0.39	(6)	0.91	(6)	0.03	(9)	-0.03	(9)

Source: RIAPA CGE Model and SAM for Tanzania.
Notes: AFS is agriculture-food system; total is the whole economy. GDP (employment) elasticity is the percentage increase in total or agriculture-food system GDP (employment) given a one percent increase in agricultural GDP.

Agricultural activities with downstream processing typically generate larger growth multiplier effects within the AFS. Sugarcane and oilseeds, for example, supply downstream refining and fats and oils sectors. Sugarcane's AFS growth elasticity of 1.25 implies that a one percent increase in

[4] Income elasticities are estimated for rural and urban households using the 2011/12 Household Budget Survey.

agricultural GDP driven by sugarcane productivity increases AFS GDP by 1.25 percent. In contrast, forestry is a major input into the furniture and construction sectors, and so forestry is more effective at raising GDP growth outside of the AFS.

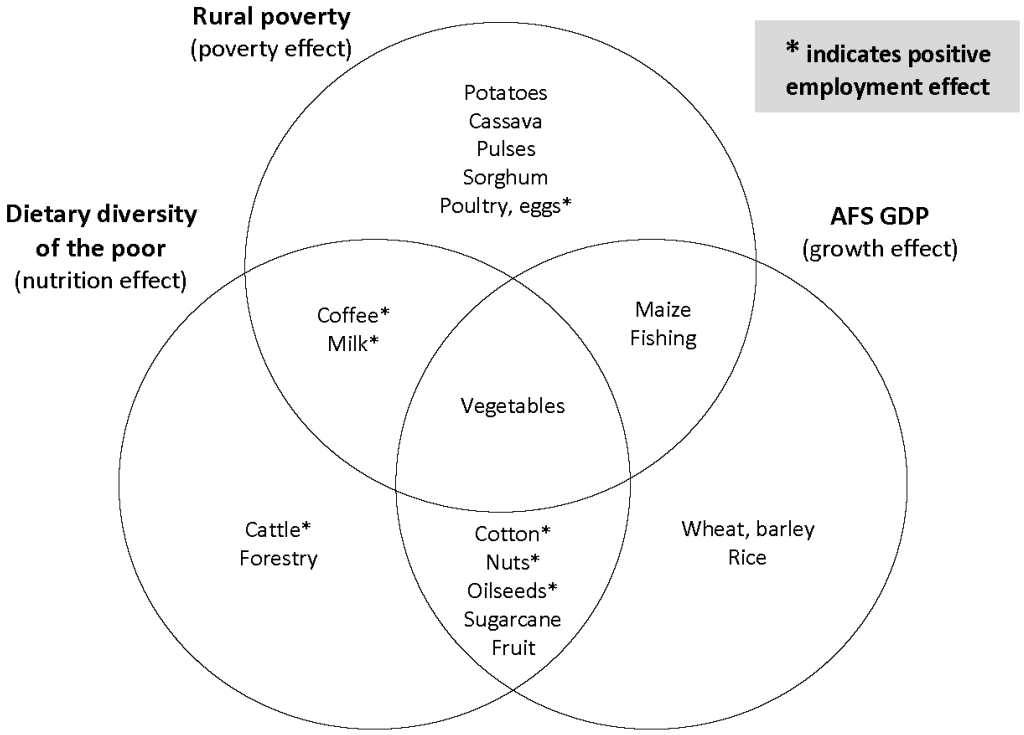
Coffee's AFS employment elasticity of 0.90 implies that a one percent increase in agricultural GDP driven by coffee farm productivity causes AFS employment to increase by 0.90 percent. Overall, the value-chains with the largest AFS growth effects are oilseeds, wheat/barley, and sugarcane, whereas the largest AFS employment elasticities are for coffee, nuts, and cotton. Differences between the rankings of growth and employment effects indicates a trade-off between the absolute number of jobs created and the "quality" or labor productivity of these jobs. Expanding coffee production may create many jobs, but AFS GDP per worker generated in these jobs is relatively low (mainly because most jobs are created on the farm).

Table 8 also shows how growth effects may differ when considering the whole economy rather than just the AFS. Oilseeds, for example, are one the most effective value-chains at generating AFS GDP, but are less effective at generating economywide growth. Export-oriented value-chains tend to have smaller economywide effects, because output does not directly benefit consumers, except for farmers and workers engaged in producing the export product. Expanding exports also appreciates the real exchange rate, relative to the baseline, making goods cheaper to import and other export products less competitive in foreign markets. In general, expanding one value-chain comes at the expense of another. This trade-off is especially pronounced for export-oriented activities due to their enclave nature and exchange rate effects.

5. Final Assessment

No single value-chain is most effective at achieving all policy objectives. Figure 1 shows the ten highest ranked value-chains across three selected outcomes: (1) reducing the rural poverty headcount rate; (2) diversifying poor rural households' diets; and (3) promoting AFS GDP growth. Only vegetables is in the top-ten on all indicators. Maize is effective at reducing poverty and generating growth, but it narrows rather than diversifies diets. Pulses and nuts diversify diets and reduce rural poverty, but have limited growth effects. Oilseeds promotes growth and its incomes help diversify diets, but overall oilseeds are less effective at raising poor households' consumption (either directly as a supplier of food or indirectly as a source of income). Of these value chains, those with positive employment effects are marked with an asterisk. Nuts is a strong job-creating value-chain, whereas vegetables is not.

Figure 1. Agricultural value-chains in Tanzania with strong poverty, nutrition, economic growth, and employment effects



Source: RIAPA CGE Model and SAM for Tanzania.
Notes: Poverty effect uses rural headcount PGE (column 2 in Table 6); nutrition effect uses poor rural households' DDGE (column 3 in Table 7); and growth and employment effects are for AFS only (columns 2 and 4 in Table 8).

A portfolio of value-chains is needed to achieve all policy objectives. Figure 1 does not convey value-chains' relative strengths across outcome indicators. For example, fruits are far more effective at diversifying diets than the next best value-chain, vegetables (see Table 8). Such a strong effect might outweigh concerns about this value-chain's weaker employment effects. One approach to evaluating such trade-offs is to combine growth, poverty and nutrition outcomes into a normalized composite indicator. Table 9 reports the final prioritization of value chains using different weighting schemes. The first column assigns equal weights across outcomes, whereas the other columns give greater weight to each normalized indicator (i.e., attributing half of the weight to one outcome and a quarter to the other two, thus creating a bias towards specific outcomes). The final analysis suggests that vegetables, edible oils and maize should be "priority" food-related value chains, since these are highly-ranked irrespective of how outcomes are weighted. Coffee and cotton are highly-ranked export-oriented crops.

Table 9. Final rankings of agricultural value-chains for Tanzania under different weighting schemes

Rank	Equal weights	Poverty Bias	Nutrition Bias	Growth Bias	Jobs Bias
1	Coffee	Coffee	Fruits	Oilseeds	Coffee
2	Oilseeds	Maize	Coffee	Wheat, barley	Nuts
3	Cotton	Potatoes	Vegetables	Sugarcane	Oilseeds
4	Vegetables	Vegetables	Oilseeds	Cotton	Cotton
5	Nuts	Cassava	Cotton	Vegetables	Goats, sheep
6	Wheat, barley	Pulses	Nuts	Coffee	Maize
7	Maize	Cotton	Milk	Nuts	Milk
8	Fruits	Nuts	Sugarcane	Fishing	Fishing
9	Sugarcane	Sorghum, millet	Wheat, barley	Maize	Cassava
10	Potatoes	Oilseeds	Maize	Fruits	Wheat, barley
11	Fishing	Fishing	Fishing	Rice	Potatoes
12	Cassava	Milk	Pulses	Potatoes	Poultry, eggs
13	Pulses	Wheat, barley	Poultry, eggs	Pulses	Sugarcane
14	Milk	Poultry, eggs	Potatoes	Cassava	Fruits
15	Poultry, eggs	Goats, sheep	Goats, sheep	Sorghum, millet	Vegetables
16	Sorghum, millet	Fruits	Rice	Poultry, eggs	Cattle
17	Goats, sheep	Rice	Cassava	Milk	Pulses
18	Rice	Groundnuts	Cattle	Groundnuts	Sorghum, millet
19	Groundnuts	Sugarcane	Groundnuts	Goats, sheep	Rice
20	Cattle	Cattle	Sorghum, millet	Bananas	Groundnuts
21	Bananas	Bananas	Forestry	Forestry	Bananas
22	Forestry	Forestry	Bananas	Cattle	Forestry

Source: RIAPA CGE Model and SAM for Tanzania.
Note: Rankings based on weighted sum of outcome indicators. Equal weighting is one-quarter each; biased weighting favors one indicator (one-half) at the expense of others (equal shares of remaining half).

In conclusion, Tanzania's dominant agricultural activity – maize – contributes positively to national pro-poor growth. However, our analysis suggests that a more balanced portfolio of value chains would enhance agriculture's contribution to poverty reduction and economic growth, while also promoting faster rural transformation and dietary diversification, both of which are needed to create job opportunities and improve nutrition outcomes over the longer-term.

Appendix

Appendix Table 1. Composition of value-chain product categories for Tanzania

Category	Detailed agricultural products in the product category or value-chain
Maize	Maize
Sorghum, millet	Sorghum; millet
Rice	Rice
Wheat, barley	Wheat; barley
Pulses	Beans; pigeon peas; chick peas; cow peas; dry peas; dry lentils; other pulses
Groundnuts	Groundnuts
Oilseeds	Soybeans; sunflower seeds; other oilseeds
Cassava	Cassava
Potatoes	Irish potatoes; sweet potatoes
Vegetables	Tomatoes; cabbages and other brassicas; onions; other vegetables
Nuts	Cashew nuts; other nuts
Bananas	Plantains; bananas
Fruits	Mangoes; guavas; other fresh, citrus and tropical fruits
Sugarcane	Sugarcane
Cotton	Cotton
Coffee	Coffee
Cattle	Cattle
Milk	Milk; dairy
Poultry, eggs	Poultry; eggs
Goats, sheep	Small ruminants
Forestry	Raw timber; other forestry products
Fishing	Aquaculture; capture fisheries
Other crops	Tea, cut flowers; chilies, peppers and spices
Other livestock	Bees and honey; pigs; game meat; other livestock products

Source: RIAPA CGE Model and SAM for Tanzania.