INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE
IFPRI

CGIAR INITIATIVE ON Foresight

CGIAR INITIATIVE ON National Policies and Strategies

July 2023

AGRIFOOD SYSTEM DIAGNOSTICS
COUNTRY SERIES

Transformation of Rwanda's Agrifood System
Structure and Drivers

Xinshen Diao, Mia Ellis, Karl Pauw, Gracie Rosenbach, Serge Mugabo, Karl Pauw, David Spielman, and James Thurlow

International Food Policy Research Institute

This diagnostic analysis was conducted by IFPRI with financial support from USAID and funders of the CGIAR Research Initiative on Foresight. Additional financial support was provided by the Bill and Melinda Gates Foundation through its funding to IFPRI, and by the International Growth Centre (IGC) and the European Union through their funding to the Rwanda Strategy Support Program, a joint initiative of the Ministry of Agriculture and Animal Resources (MINAGRI) and IFPRI. Support for developing and updating the Rwanda SAM and CGE model used in this analysis was provided by the Deutsche Gesellschaft für Internationale Zusammenarbeit Gmb (GIZ).

IGC

FEED THE FUTURE
The U.S. Government's Global Hunger & Food Security Initiative

USAID
FROM THE AMERICAN PEOPLE

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

Four Parts to the Diagnostics

2019

- **Current structure**
  What does Rwanda's food system look like today?
- **Decomposing value chains**
  How are different products contributing to the broader agrifood system?

2009-2019

- **Growth and market structure**
  How is Rwanda's agrifood system growing and transforming?

2019+

- **Future drivers of inclusive agricultural transformation**
  Which value chains could be most effective?

Summary

Rwanda's agrifood system (AFS) diagnostic results

Rwanda's AFS has been transforming with rapid economic growth

- The off-farm component of AFS has grown faster than primary agriculture GDP
- But AFS is still dominated by primary agriculture, which is more than twice the size of off-farm components of AFS in GDP and 10 times the size of off-farm components in employment

AFS growth has been mainly driven by domestic-market-oriented value chains

- Domestic-market-oriented value chains, not the exportable ones, have grown more rapidly, contributing to close to 80% of AFS growth during 2009–2019

Looking forward, the structure of AFS growth will be crucial in driving development outcomes…
(e.g., poverty, dietary improvement, employment creation, and growth)

…but no single value chain is the most effective at driving all these development outcomes

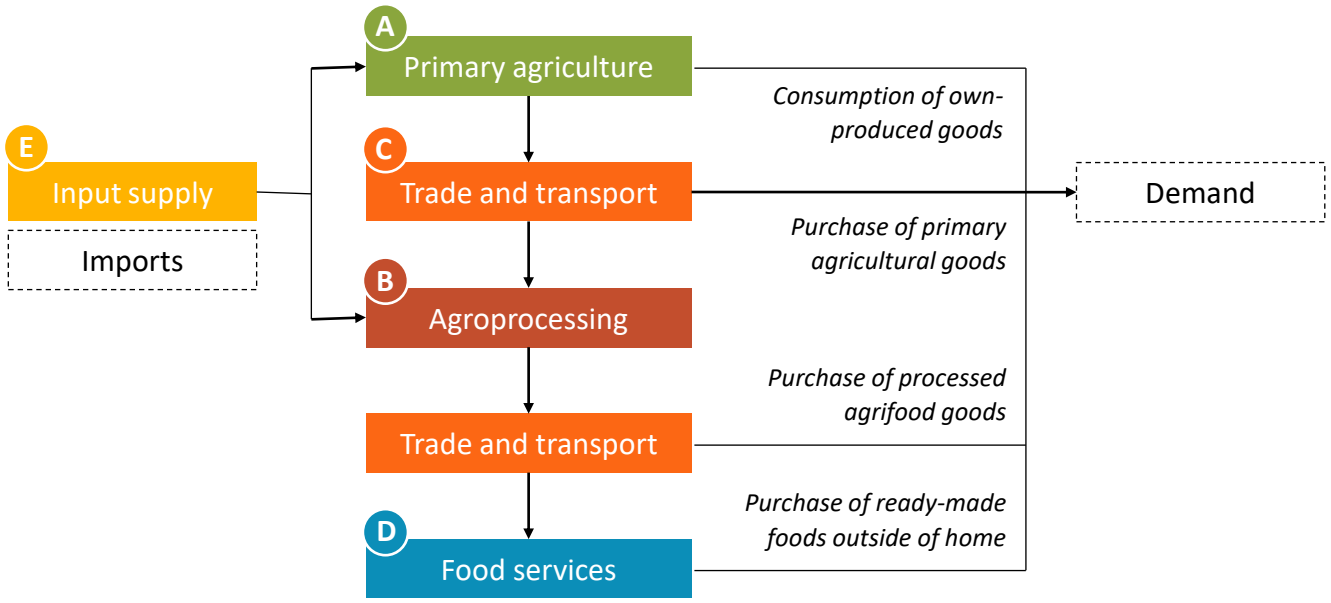
- Three cereal value chains are most effective **at reducing poverty**; groundnuts, beans, and vegetables are best for improving **diet quality**; soybeans, groundnuts, and export crops have strong **employment effects**; and cereal crops and soybeans have large **growth multipliers**

⇨ ***Jointly promoting groundnuts, soybeans, and cereals would offer an effective way to achieve multiple development outcomes***

Framework | Agrifood Systems (AFS)

Includes agriculture, plus all upstream/downstream sectors

- Five major components (A to E)
- Same format as standard economywide datasets (e.g., national accounts)
- Allows us to measure AFS structure and performance using actual data



Agrifood System GDP (AgGDP+)
Total value added that is generated by all agricultural value chains (in constant dollars)

Agrifood System Employment (AgEMP+)
Total number of workers who are primarily employed in an agricultural value chain

Structure $_{2019}$ | Rwanda's Agrifood System Today

- **Part 1** focuses on the **current size and structure** of the national agrifood system
  - Latest AgGDP+ and AgEMP+ estimates
  - Decomposed into five AFS components
  - Situates AFS within the broader economy
- Uses **official data** sources
  - GDP from national accounts
  - Employment from various sources (i.e., population census, labor force surveys, ILO, etc.)
- **Rwanda estimates** indicate that
  - AFS makes up more than one-third of total GDP (≈ $3.4 billion)…
  - … and two-thirds of total employment (≈ 4.3 million workers)
  - Primary agriculture (A) is large, but off-farm components (B–E) are also important (close to one-third of AgGDP+, but less than 10% of AgEMP+)

GDP and employment in Rwanda's agrifood system (2019)

	GDP ($ billions)		Employment (millions of workers)	
Total economy	**9.5**	**100%**	**6.3**	**100%**
Agrifood system	**3.4**	**35.9%**	**4.3**	**67.7%**
Primary agric. (A)	2.4	25.7%	3.9	62.3%
Off-farm AFS	**1.0**	**10.2%**	**0.3**	**5.4%**
Processing (B)	0.5	5.6%	0.2	2.6%
Trade & transport (C)	0.2	2.2%	0.1	2.2%
Food services (D)	0.2	1.9%	0.0	0.4%
Input supply (E)	0.0	0.5%	0.0	0.1%
Rest of economy	**6.1**	**64.1%**	**1.7**	**32.3%**

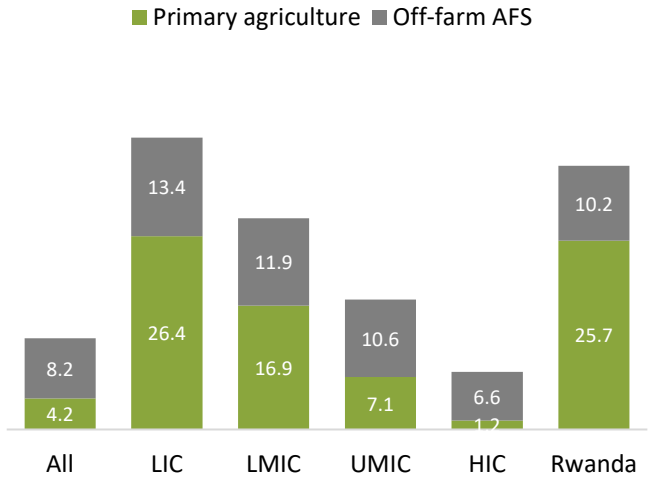
Structure $_{2019}$ | Comparing to Other Countries

- **Importance and structure of the AFS varies at different stages of development**

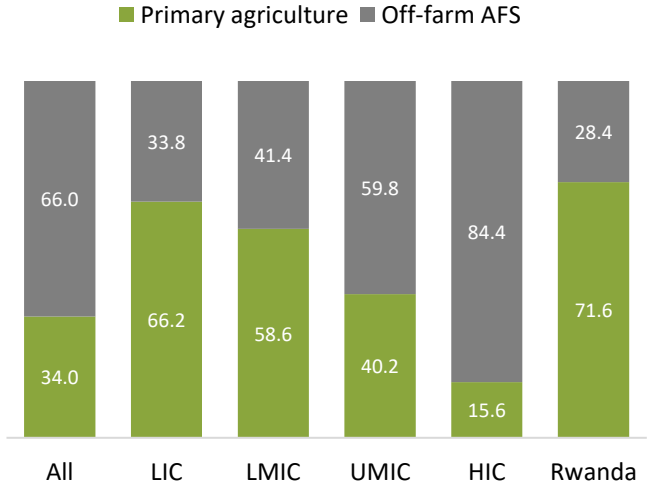
  Rwanda is a low-income country (LIC)

  - **A**: Rwanda's AgGDP+ share of total GDP is comparable with the LIC group, but also close to the lower-middle-income (LMIC) group
  - **B**: Rwanda's primary agricultural share of AgGDP+ is higher than the LIC average
  - **C**: Rwanda's agro-processing is larger than expected in the off-farm AFS GDP, while trade & transport services are smaller, possibly reflecting policies related to informal agricultural trade in urban areas or other factors

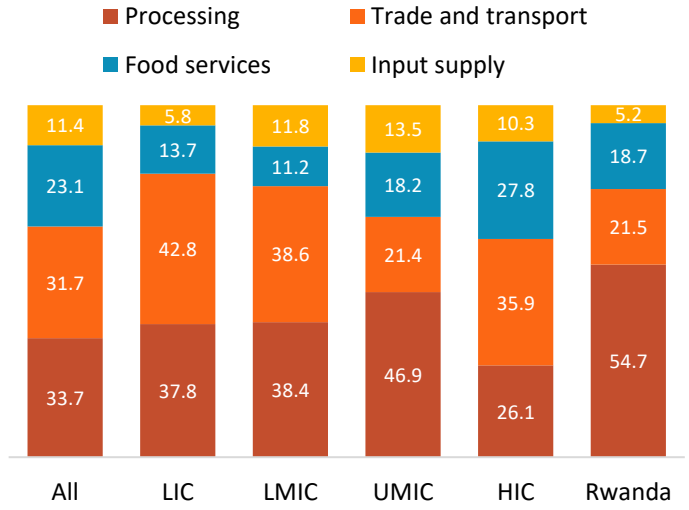
A **Share of total GDP (%)**



B **Share of AFS GDP (%)**



C **Share of off-farm AFS GDP (%)**



LIC = low-income countries | LMIC = lower-middle income | UMIC = upper-middle-income | HIC = high-income

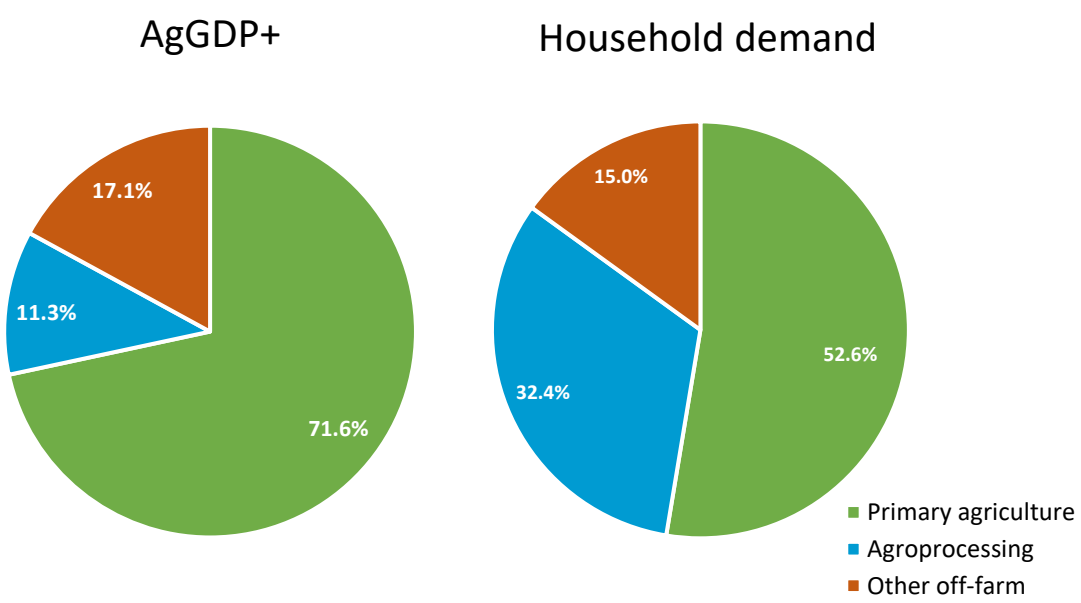
Source: IFPRI Agri-Food System Database

Structure $_{2019}$ | Supply vs. Demand Sides of the Agrifood System

- AgGDP+ defines the AFS on the **supply side**
- Household demand and trade (imports) capture AFS structure on the **demand side**
- Agrifood processing is more important on the demand side than the supply side in the AFS

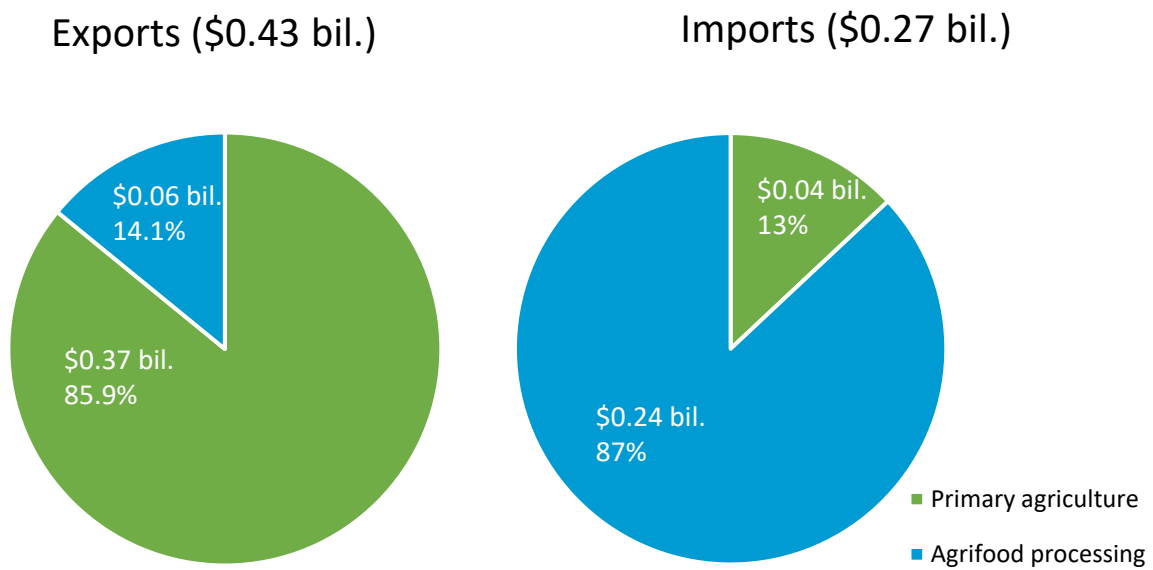
Agrifood GDP vs. consumption

Primary, processed, and other product shares (%)



Agrifood exports vs. imports

Primary and processed product shares (%)



Value Chains $_{2019}$ | Contributions & Trade Orientation

- **Part 2** decomposes the AFS across **broad value chain groupings**
- Classify value chains based on trade orientation
  - **Exportable** value chains have above-average export-output ratios (>8.8%)
  - **Importable** value chains have above-average import-demand ratios (>6.3%)
  - **Less-traded** value chains make up the rest

- Domestic-market-oriented (less-traded) value chains dominate AgGDP+ (50.2%); relatively smaller off-farm share (33.2%) and larger on-farm (primary) share (57.0% of total), with cattle & dairy a significant exception
- Exportable covers five value chain groups; only fruit value chain has larger off-farm share in total off-farm AFS than its on-farm share of total agriculture GDP
- Importable covers seven value chain groups; relatively larger share of off-farm GDP (30.7%) and smaller share of primary agriculture (11.5%)

⇨ *Promoting some importable value chains and cattle & dairy (less-traded) could be effective in driving agricultural transformation by boosting value added and employment in off-farm AFS*

Breakdown of Rwanda's agrifood system (2019)

	Share of total GDP (%)			Exports / output (%)	Imports / demand (%)
	Total AFS	Primary agric.	Off-farm AFS		
Total	**100**	**100**	**100**	**8.8**	**6.3**
Exportable	**28.3**	**31.6**	**20.1**	**31.1**	**1.9**
Beans	4.4	5.6	1.3	22.8	0.8
Irish potatoes	4.0	5.3	0.7	16.9	
Vegetables	3.0	3.7	0.9	28.2	2.0
Fruits	11.9	11.4	13.1	10.6	2.7
Coffee & tea	5.1	5.6	4.1	88.3	
Importable	**16.9**	**11.5**	**30.7**	**1.3**	**15.4**
Maize	2.3	2.6	1.6	1.0	11.1
Rice	2.9	2.2	4.9		10.9
Other cereals	2.2	1.9	2.9	2.1	9.8
Groundnuts	2.7	1.9	4.8	0.4	22.4
Soybeans	0.3	0.4	0.1		23.6
Other crops	5.2	0.9	16.1	2.2	17.4
Fish	1.2	1.5	0.4		27.4
Less traded	**50.2**	**57.0**	**33.2**	**1.0**	**1.7**
Other roots	17.6	20.9	9.1	0.5	0.6
Cattle & dairy	9.5	8.2	13.0	1.1	3.1
Other livestock	2.2	3.0	0.3		0.5
Forestry	20.9	24.9	10.7	0.3	3.8

Growth $_{2009\text{-}2019}$ | Agrifood System Performance

- **Part 3** analyzes structural change in the AFS and the contribution of different value chains to AFS growth

Rwanda's AFS has been transforming

- Shares of agriculture GDP in total GDP fell significantly during 2009-2019 (30.9% to 25.7%)
- Share of off-farm in AgGDP+ rose

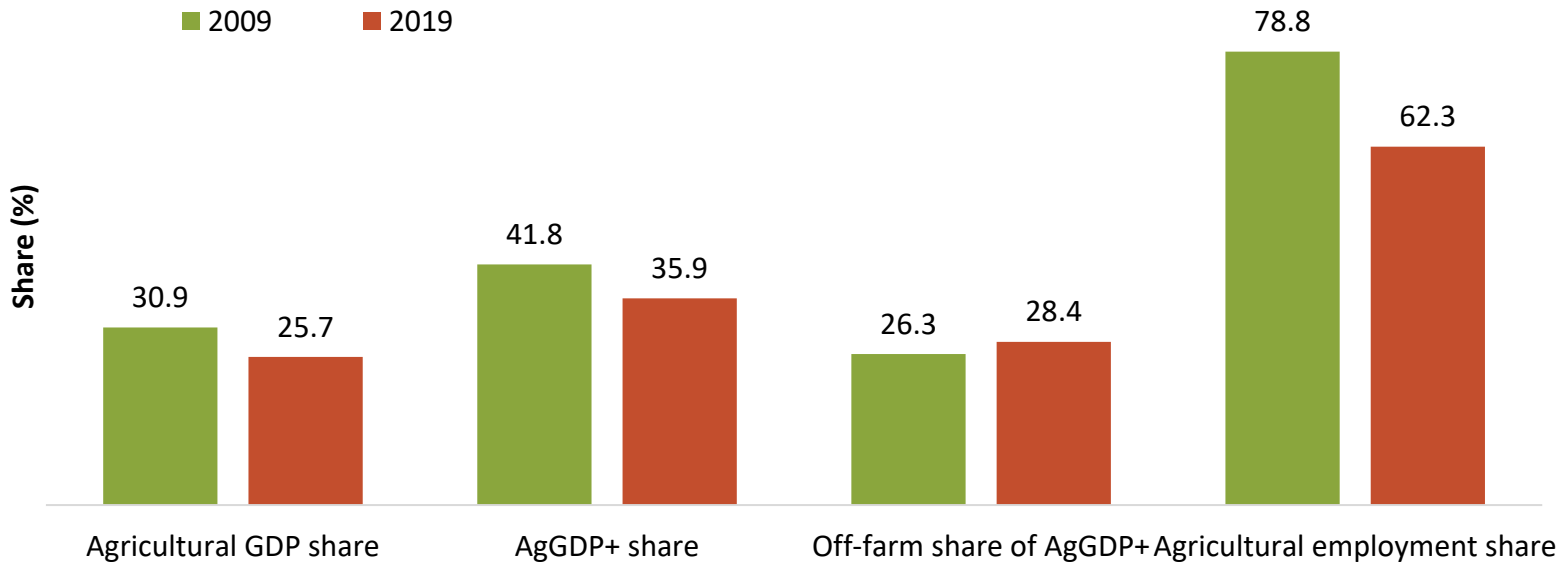
Share of agricultural employment fell more than the decline in agriculture GDP (78.8% to 62.3%)

- An indication of structural change in the economy and rising agricultural productivity

However, primary agriculture still dominates the AFS

- It is more than twice the share of off-farm components of AFS in GDP and 10 times their share in employment

Agricultural GDP, agrifood system GDP, and employment shares (2009–2019)



Growth $_{2009\text{-}2019}$ | Value Chain Performance

- AgGDP+ grew rapidly during 2009–2019 (5.4% p.a.)
- Less-traded value chains dominate AFS growth with their large size and above average growth (6.4%), contributing 61% of AFS growth
- Both exportable and importable value chains made modest contributions to AFS growth, as their total growth was below AFS average (3.9% and 4.4% respectively)
- Value chains with above-average growth (*)
  - Vegetables – exportable
  - Rice and other cereals – importable
  - Cattle & dairy, other livestock, forestry – less traded
  - Coffee & tea (in exportable) have growth rate close to AFS average (5.0%)
- **Off-farm growth is faster** for many fast-growing value chains
  - Agrifood processing, however, often grows more slowly than total off-farm AFS GDP

Value chain growth in Rwanda (2009-2019)

	Average annual GDP growth rate (%)			
	Total AFS	Primary agric.	Off-farm AFS	Process-ing
Total AFS	**5.4**	**5.1**	**6.2**	**4.7**
Exportable	**3.9**	**3.4**	**5.9**	**4.1**
Beans	3.8	3.5	7.7	
Irish potatoes	1.9	1.7	5.9	
Vegetables*	**6.9**	**6.5**	**12.5**	
Fruits	3.6	2.8	5.6	4.7
Coffee & tea	5.0	5.0	5.0	-0.8
Importable	**4.4**	**4.8**	**4.1**	**3.0**
Maize	3.4	2.6	7.5	7.3
Rice*	**6.2**	**8.1**	**4.4**	**3.1**
Other cereals*	**10.3**	**9.3**	**12.3**	**11.5**
Groundnuts	3.9	5.0	2.8	1.4
Soybeans	3.9	3.7	8.5	
Other crops	2.9	1.7	3.0	2.2
Fish	3.5	3.0	10.0	0.6
Less traded	**6.4**	**6.2**	**7.1**	**6.2**
Other roots	5.3	5.2	6.1	4.7
Cattle & dairy*	**6.8**	**6.8**	**6.9**	**6.0**
Other livestock*	**9.6**	**9.6**	**11.3**	
Forestry*	**6.9**	**6.6**	**8.4**	**8.0**

Future Drivers $_{2019+}$ | Modeling Faster Growth

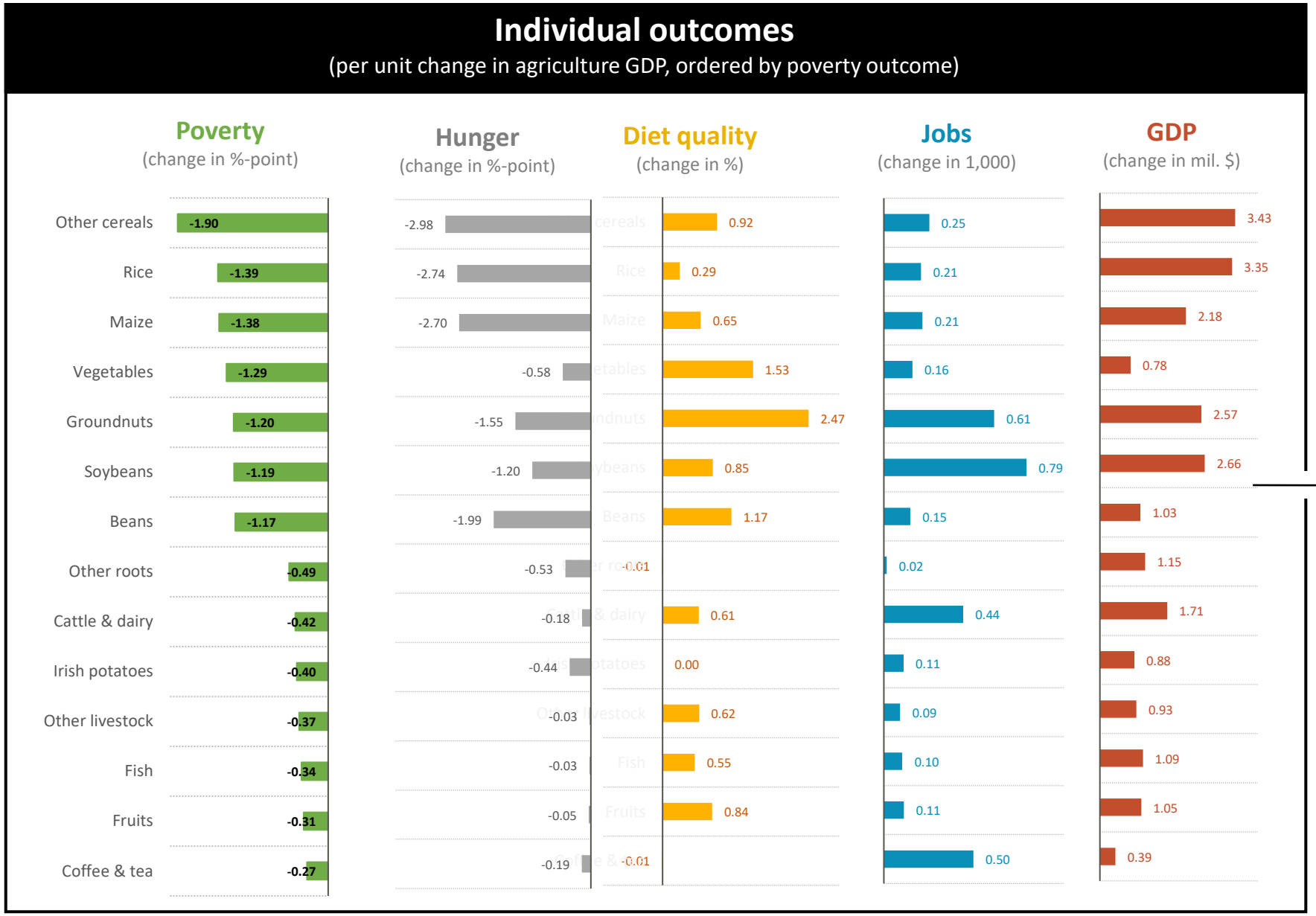
- IFPRI's **RIAPA model** is used to analyze different sources of agricultural growth

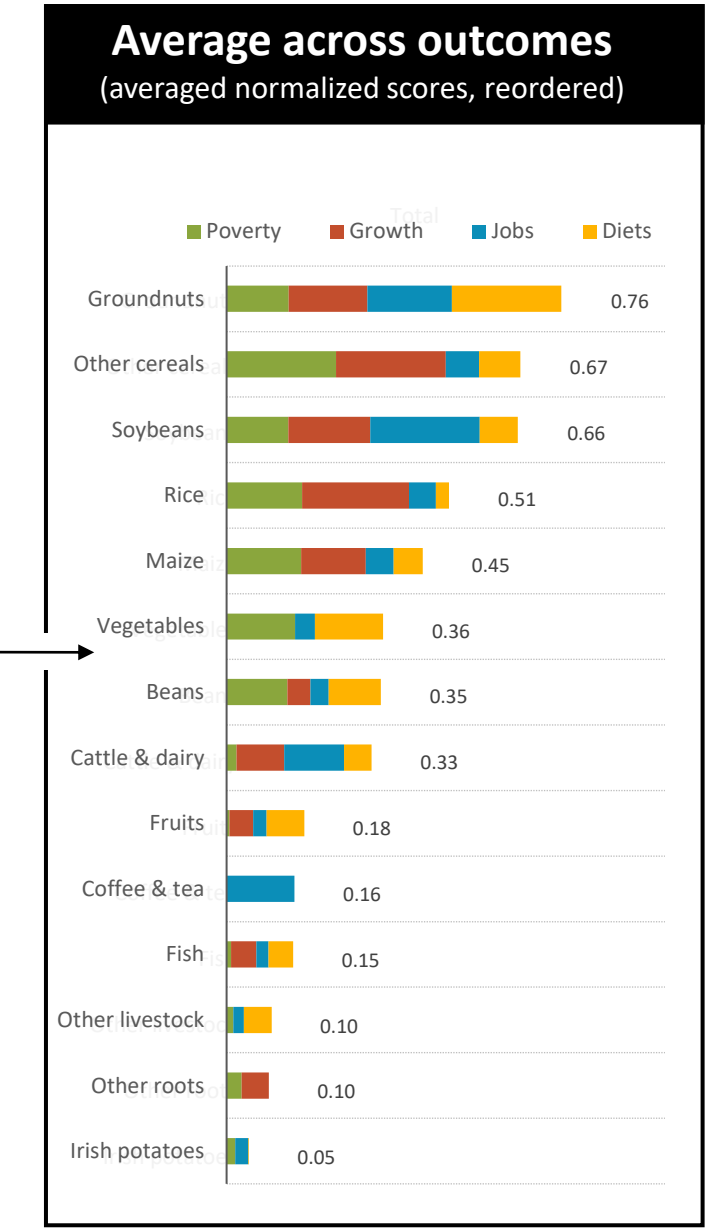
- **Expand production** in different value chains
  - Increase on-farm productivity growth rates in targeted value chains
  - Achieve same overall growth in agriculture GDP (e.g., 1.0%)
  - Track linkage effects within value chains and spillover effects to other value chains

- **Assess outcomes**
  - **Poverty** – Poverty-growth elasticity in percentage points based on $2.15-a-day
  - **Hunger** – Hunger-growth elasticity in percentage points based on prevalence of undernourishment
  - **Diet** – Diet quality to growth elasticity in % derived from Reference Diet Deprivation index (REDD)
  - **Jobs** – Employment multiplier in thousand employed persons associated with US$1 million growth in targeted value chain
  - **GDP** – GDP growth multiplier in US$ millions associated with US$1 million growth in targeted value chain

- **Average across outcomes**
  - The value of outcome indicators (elasticity or multiplier) is expected to differ across value chain growth; not all value chains are equally effective at achieving all outcomes
  - Normalizing the individual outcome scores
    - The values of each outcome indicator are scaled so that the most effective value chain is given a score of one and the least effective is given a score of zero. A value chain with adverse impact is also given a score of zero.
  - An average score with equal weights is used to measure the total impacts across all value chains

Future Drivers $_{2019+}$ | Prioritizing Agricultural Growth





Future Drivers $_{2019+}$ | Key Messages

AFS growth is **pro-poor**

- Growth led by all value chains reduces poverty, but the three cereal value chains are most effective

AFS growth is effective in improving **food security (hunger)** and **diet quality**

- Most value chains reduce hunger; the three cereal value chains are most effective
- Most value chains improve diet quality; beans, groundnuts, and vegetables are most effective

Agricultural growth creates **jobs** but not necessarily on-farm

- Most value chains are associated with an increase in total employment, but AFS jobs are mainly created off-farm
- Groundnuts, soybeans, and export crops are the most effective value chains in creating jobs in the overall economy

Agricultural growth has strong **growth** multiplier effects that generate income beyond agriculture

- Cereal value chains and soybeans have stronger growth multiplier effects for both AFS income and total GDP growth

In conclusion, **promoting multiple value chains can achieve broad impact**

- No single value chain group is the most effective in achieving all the outcomes we consider
- Groundnuts, cereals, and soybeans rank highly in the combined outcome scores for poverty, diet, jobs, and growth. Some of them are currently identified and prioritized by PSTA 4 (Strategic Plan for Agriculture Transformation 2018–24), and further promoting these value chains would offer an effective way to achieve broad-based outcomes

Note: Value Chain Groups and Agricultural Sectors in Individual VC Groups

Value chain group and their share of AFS GDP	Individual products and their share of group's agriculture GDP
Maize (2.3%)	Maize 100%
Rice (2.9%)	Rice 100%
Other cereals (2.2%)	Sorghum & millet 93.5% | Wheat & barley 3.5% | Other cereals 3.1%
Groundnuts (2.7%)	Groundnuts 100%
Soybeans (0.3%)	Soybeans 100%
Beans (4.4%)	Beans 100%
Irish potatoes (4.0%)	Irish potatoes 100%
Other roots (17.6%)	Cassava 49.7% | Sweet potatoes 23.4% | Cooking bananas 14.3% | Cooking bananas 12.4%
Vegetables (3.0%)	Leafy green vegetables 27.9% | Other vegetables 72.1%
Fruits (11.9%)	Nuts 2.4% | Sweet bananas 57.8% | Other fruits 37.8%
Export crops (5.1%)	Coffee 61.1% | Tea 37.4% |Cut flowers 1.5%
Other crops (5.2%)	Sugarcane 82.0% | Tobacco 6.3% | Other crops 11.7%
Cattle & raw milk (9.5%)	Cattle meat 45.6% | Raw milk 54.4%
Other livestock (2.2%)	Poultry meat 27.8% | Eggs 18.8% | Small ruminants 35.8% | Other livestock 17.6%
Fish (1.2%)	Aquaculture 15.5% | Capture fisheries 84.5%
Forestry (20.9%)	Forestry 100%