

Agricultural innovations during economic transformation: Insights from SPIA country studies



Standing
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Key points

- “Transformation” is prominent in CGIAR’s 2030 Research and Innovation Strategy.
- As a small player in broader transformation processes, the CGIAR must ensure alignment between its agricultural research for development (R4D) strategy and target contexts.
- Reflecting on how specific innovations have aligned (or not) with context-specific transformation processes could catalyze institutional learning within the CGIAR.

Defining and measuring transformation¹

De Janvry and Sadoulet (2020) provide a framework for thinking about agriculture’s role in the structural transformation of economies. Economies move sequentially through five stages, from asset building for the poorest countries, through a green revolution type process of intensification of agriculture, and into three successive phases of economic transformation – agricultural transformation (irrigation, diversification); rural transformation (mechanization, growth of rural non-farm economy); and finally structural transformation (migration to cities and urban-based industrialization and services). While this is a simplified narrative of development processes, it is

nonetheless useful to consider countries’ positions in this process when designing their agricultural research for development (R4D) strategy.

IFPRI has developed an approach for tracking the process of transformation across countries and over time. The Agricultural Transformation Index (ATI; Diao et al, 2024) uses publicly available data to capture four indicators that broadly map onto the middle stages (green revolution through to rural transformation) of this framework. See Fig 1. for a visualization of the average scores for each of SPIA’s phase 1 countries (Uganda, Ethiopia, Bangladesh and Viet Nam) and Fig 2. for a time-series of ILO estimates on agriculture’s share of employment in the same four countries. These two independent measures of transformation both point to the same ranking of our four countries.

As a middle-income country, Viet Nam has achieved the greatest degree of transformation. Bangladesh has undoubtedly benefitted from substantial productivity gains over the past two decades. Indeed, in Diao et al.’s analysis of all the countries in the Feed the Future initiative, none has transformed more completely or faster than Bangladesh.² Ethiopia has moved up substantially from a very low starting position two decades ago³.

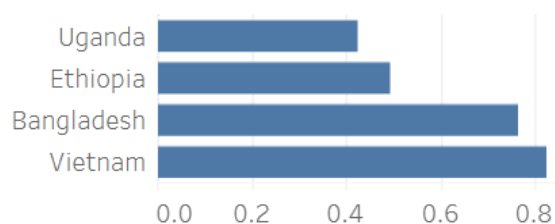
¹ We pull together the following, developed in the period 2018–2024: a) the framework based on structural transformation of economies by Alain de Janvry and Elisabeth Sadoulet (2020), and used by the Agricultural Technology Adoption Initiative (ATAI) to organize insights from their first decade of results; b) the effort to develop metrics for quantifying agricultural transformation with publicly available data (Diao et al., 2024); and c) the first phase of SPIA country studies for Ethiopia, Uganda, Viet Nam and

Bangladesh on estimating the national-level adoption of CGIAR-related innovations.

² The Feed the Future Initiative focuses on 20 countries: 16 in Africa, plus Bangladesh, Nepal, Guatemala and Honduras.

³ A note of caution about the accuracy of Ethiopian official statistics is warranted: <https://www.economist.com/middle-east->

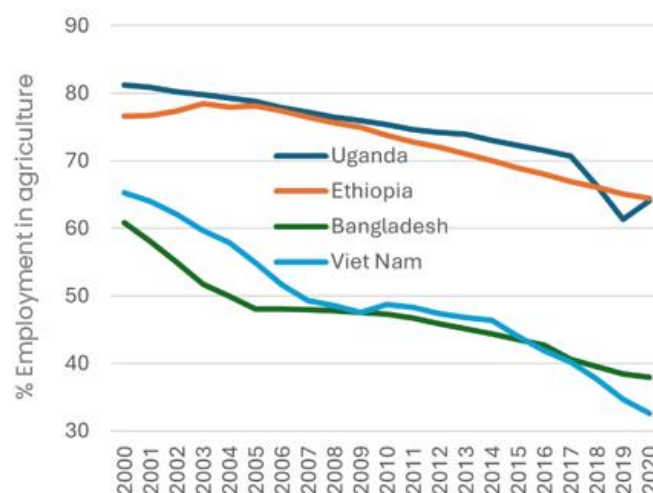
Figure 1. IFPRI's agricultural transformation index for SPIA's Phase 1 countries (from Diao et al., 2024), where 1 represents a state of having been structurally transformed



Source: Agricultural Transformation Index (ATI)

In contrast, Uganda is not progressing through these phases of transformation; Diao et al.'s analysis suggests Ugandan agriculture has regressed over the past two decades, dragged down by declines in productivity owing to the challenging conditions outlined in the SPIA Uganda study (Ilukor et al, 2025).

Figure 2. Agriculture's share of employment (%) by year



Source: ILO estimates; data.worldbank.org

Table 1: Phase 1 SPIA countries (Uganda, Ethiopia, Bangladesh, Viet Nam) in the process of structural transformation using the de Janvry and Sadoulet (2020) framework (first two columns)

Stages of transformation	Underlying processes	Uganda	Ethiopia	Bangladesh	Vietnam
1. Asset building	Access to land and human capital for the landless and for smallholder farmers				
2. Green Revolution	Adoption / diffusion of new seeds and fertilizers for staple crops	+ (maize)	+ (maize, wheat, beans)	+ (rice)	+ (rice, cassava)
		Very limited fertilizer	Fertilizer limited		- Too much fertilizer
3. Agricultural transformation	Access to water for irrigation	No	Limited	Rice	Rice
	Agricultural diversification toward higher-value crops	Limited: Oilseeds; Pork	Limited: Chicken; Flowers	Aquaculture	Aquaculture
	Development of value chains and contracting	No	No	Limited	Yes
4. Rural transformation	Mechanization and land concentration	Limited	Limited	Growing (as a service)	Yes
	Growth of the rural non-farm economy	No	No	Growing	Yes
5. Structural transformation	Rural-urban migration	Limited	Limited	Yes	Yes
	Urban-based industrialization and services				

Agricultural innovations during transformation

Uganda, Ethiopia, Bangladesh and Viet Nam are therefore at different points along distinct trajectories of structural transformation. These diverse contexts represent heterogeneous conditions for the CGIAR and its R4D mandate (Table 1), and each posing a different challenge. The recently released SPIA Country Reports provide a host of insights on these differences, a few of which we highlight below.

In Uganda, 70% of employment is in agriculture, productivity is low, the population almost doubled between 2000 and 2020, and land is becoming scarce, as evident in shrinking plot sizes and competition for grazing land. Extension and seed systems have long been compromised by political influence and corruption. Poorly functioning input markets limit farmers' trust in investing in new technologies; poorly functioning output markets offer little incentive for farmers to invest in quality or productivity. Consistent with this, we observe low overall penetration of improved varieties across six crops. Farmers obtain their planting material largely through informal sources. In such contexts, NGOs can play an important role in furthering development, but the lack of private incentives means that there are no guarantees of progress outside of specific projects. The disappointing results on sustained adoption of orange-fleshed sweetpotato are consistent with this diagnosis.

In Ethiopia as well, 70% of employment is in agriculture, but productivity is increasing. The past two decades have seen significant state-led development, particularly for infrastructure. There are signs that agricultural systems are becoming more resilient through the adoption of agricultural technology. In this context, we observe significant upticks in adoption of drought-tolerant maize and improved forage grasses for livestock between 2018/19 and 2021/22, despite the multiple shocks in the intervening years (COVID-19,

protracted civil conflict, and drought). In such a context of relatively high state capacity but a small private sector, the CGIAR would benefit from primarily partnering with government programs and institutions to scale innovations.

In Bangladesh, employment in agriculture has dropped steeply from 61% in 2000 to 35% in 2023. Poverty has declined along with this net transition out of agriculture and into manufacturing and services. Rice production still dominates agriculture and has enjoyed sustained steady growth in productivity over decades, but there has also been a four-fold increase in aquaculture production since 2000. In this context of developing dynamism in the rural economy, there are many opportunities for feeding innovations into a scaling pathway led by private sector actors. We see this with the rapid multiplication of the recent G3 Rohu release (the third generation of improved *Labeo rohita*, the most widely farmed carp in Bangladesh, developed in partnership with the World Fish Center), already being reared by 200,000 households and growing.

In Viet Nam, employment in agriculture has dropped even faster than in Bangladesh – down from 65% in 2000 to 29% in 2021 – moving the country from low-income to middle-income status within a generation. The agri-food system is industrialized, shifting the opportunities for CGIAR innovations. For example, Viet Nam is one of the largest producers of cassava starch, used in a range of industrial applications. The integrated nature of the value chain can ensure farmers access to new disease-resistant cassava⁴, so it may be possible for CGIAR to make large contributions to improving productivity, but effects on CGIAR impact areas may be transmitted beyond just household farms but through markets, to a broader set of consumers.

⁴ In stark contrast, Ugandan agri-industrial entrepreneurs we spoke with were frustrated with their failure to date at fomenting this kind of transition to industrial cassava.

Implications for CGIAR

Gollin (2023) explains how contemporary sub-Saharan Africa is different from Green Revolution Asia. No single commodity dominates, and the deep heterogeneity in agroecology means that agricultural technologies will need to be very specifically geographically targeted. Dietary shifts linked to trade in processed foods mean that Africa's cities are far less dependent on their own agricultural hinterlands, and so urban growth may not create the same strong backward linkages to rural areas. Finally, producers may not be looking to increase yields but rather may wish to reduce the labor demand from their own agricultural operations, to free them up to pursue other occupations. Over the past two decades there has already been a stagnation or decline in agricultural productivity across favorable African agricultural lands close to cities (Wollburg et al, 2024; Udry, 2024), driven by a withdrawal of farmers' own labor to their farms.

Despite these rich nuances, the structural transformation framework remains a useful descriptive, comparative tool. Its underlying principles closely relate to the stated philosophies and strategies of major CGIAR funders. Indeed, the overall logic is reflected in CGIAR's high-level strategy – the word "transformation" features 35 times in CGIAR's 2030 Research and Innovation Strategy. When prioritizing R4D investments within the CGIAR, we should collectively come to a common understanding of the concept of transformation to ensure a more potent alignment between innovations, scaling strategies, and the context in which impacts are targeted.

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