

COMPARING AFRICAN COUNTRIES AND INDIAN STATES

Lessons for promoting agricultural growth, employment and food security

What may be learned from Africa and India on how they transform their food and agriculture sectors to provide affordable and healthy diets for all? And what are potential insights that may inform future strategic directions in food system strategies? These are the questions behind a food and agriculture policy research program reported here.

In 2020, India and Africa constituted around 35 percent of the world population and three-quarters of the world's poor (World Bank, 2020). In 1980 population growth in India was 2.3 percent but came down to 1 percent in 2020, whereas in Africa it was 2.8 percent and only reduced to 2.5 percent. Africa's population is expected to surpass India's in 2022. The African agriculture sector needs to grow sufficiently to address the fast growing demand for food with diversified diets.

Comparing the agriculture sectors of India and Africa at an aggregate level would not be meaningful. Sectoral characteristics – such as natural resource endowment, production potential, agro-climatic zones, farming systems, the contribution of agriculture to GDP and the share of the workforce employed in agriculture – vary substantially within India and across Africa. Therefore, a **comparison between Indian states and African countries may offer opportunities to study distinct agricultural growth trajectories**. This analytical approach may help to identify lessons for mutual learning between and across India and Africa for the pathways towards sustainable and higher growth trajectories for improved food and nutrition security.

Common patterns in India and Africa

Five clusters of Indian states and African countries can be identified using a range of economic, agricultural and social indicators within the framework of a cluster analysis. The different clusters are characterized by similarities in economic structures, comparable malnutrition and poverty rates, and different levels of agricultural growth (i.e. growth in gross value of

KEY FINDINGS:

- Five clusters of Indian states and African countries can be identified that share similar agricultural, economic, and social characteristics, thus allowing for state-country comparisons.
- Almost all Indian states and African countries have experienced substantial agricultural growth since 2000, but also saw the typical patterns of sectoral transformation, i.e. declining of shares of agricultural GDP and employment in the overall economy.
- The drivers of agricultural growth differed: Agricultural intensification was the main driver of India's agricultural output growth, while many African countries made use of agricultural area expansion to increase agricultural output.
- Gains in productivity and progress in structural transformation, rather than pure intensification, proved essential to achieve sustained impacts on food and nutrition security.
- Agricultural productivity has increased for all and roughly doubled in many Indian states and African countries, while following different growth strategies.
- Agricultural diversification played a significant role for agricultural growth and nutrition improvements in both India and Africa. A high share of livestock in agricultural output has provided a profitable avenue to empower small and marginal dairy farmers and created jobs along the dairy value chain.
- In addition to output growth, nutrition outcomes are driven by many interconnected factors. Nutrition-sensitive (agricultural) policies should not only reduce micronutrient deficiencies but also create synergies between related sectors, including water and sanitation as well as women's education.
- An enabling policy environment is needed to take advantage of multiplier effects from inter-sectoral linkages. Nutrition-sensitive policies in India and Africa, like biofortification and targeted social programs, should be replicated when their effectiveness was proven.



RESEARCH METHODOLOGIES

This study identifies and discusses growth patterns and development pathways of African countries and Indian states that show pronounced similarities, thus facilitating cross-continental analyses to inform policy and investment decisions. The findings are based on the following components:

1. Creation of a unique **data set of Indian states and African countries**, permitting comparisons of structures and dynamics.
2. **Cluster Analysis** to identify typologies among Indian states (20) and African countries (24). Hierarchical clustering was done for Indian states based on Principal Component Scores. Indian states were then matched with African countries based on one-to-one nearest neighbour matching.
3. **Drivers of agricultural growth (measured by the growth in gross value of agricultural output) in Africa and India:** Dynamic Regression Models using panel data of Indian states (27) and African countries (24) covering the periods from 2000/2001 to 2016/2017. Explanatory variables include agricultural input, rural infrastructure (road, power, digital services), price incentives, agricultural area and agricultural diversification.
4. **Linkages between structural transformation and nutrition outcomes:** Panel regression model of Indian states (27) and African countries (41) since 2000 to explain prevalence of stunting and underweight.

agricultural output), agricultural productivity (i.e. gross value of agricultural output per ha) and structural transformation (see Figure 1 and Table 1 for a summary of the clusters and their main common characteristics). The identification and characterization of such clusters allows for a comparison of opportunities for agricultural transformation and the pathways to sustainable and nutritious diets.

Most Indian states and African countries have witnessed substantial and sustained agricultural growth since 2000. Nigeria, Angola, Ethiopia and Algeria in Africa and Rajasthan, Gujarat and Jharkhand in India had the highest growth rates. Over the same period, the importance of the agriculture sector for employment and the overall economy dropped in all Indian states and African countries, highlighting an ongoing structural transformation process. With only two exemptions, agricultural productivity has increased for all Indian states and African countries and roughly doubled in many states and countries, most notably in Odisha and Jharkhand in India and Rwanda, Cameroon and Ghana in Africa.

Drivers of structural transformation and agricultural growth

Agricultural growth among Indian states and African countries was mainly driven by agricultural intensification, area expansion and diversification towards higher value agricultural activities. India moved from area expansion to intensification, whereas Africa has yet to achieve that critical change through

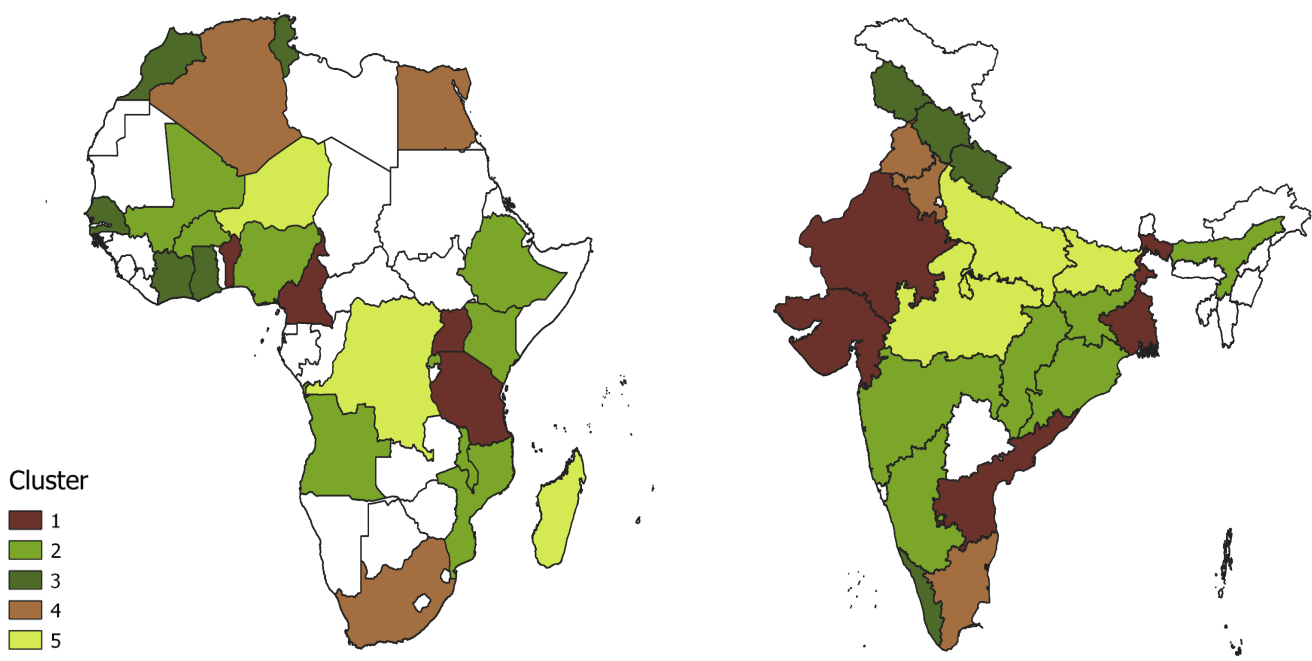


Figure 1: Clusters of comparable Indian states and African countries



Table 1: Characteristics of India-Africa clusters

CLUSTERS		Agricultural growth 2000-2016	Agri productivity (GVOA per ha)	Agri intensification (Access to Inputs, Irrigation)	Diversified Agri sector (high share of Livestock)	Malnutrition
1	Gujarat, Rajasthan, Andhra Pradesh, West Bengal Cameroon, Uganda, Benin, Tanzania	High	Mixed	Mixed	Mixed	High
2	Karnataka, Assam, Odisha, Chhattisgarh, Maharashtra, Jharkhand Burkina Faso, Rwanda, Mozambique, Mali, Malawi, Kenya, Ethiopia, Angola, Nigeria	High	High	Low	High	High
3	Himachal Pradesh, Uttarakhand, Jammu and Kashmir, Kerala Cote d'Ivoire, Senegal, Morocco, Tunisia, Ghana	Moderate	High	Low	Mixed	Low
4	Tamil Nadu, Punjab, Haryana Algeria, South Africa, Egypt	Low	High	High	High	Moderate
5	Madhya Pradesh, Bihar, Uttar Pradesh Democratic Republic of Congo, Niger, Madagascar	Low	Low	Mixed	Low	High

Note: The variables used in the cluster analysis include per capita agricultural GDP, employment in agriculture, population, irrigation ratio, GVOA per hectare, share of agriculture in GDP, share of livestock in GVOA, underweight, poverty

innovations and technological change. In view of the high population growth in Africa, relying largely on area expansion may not be a sustainable strategy in the medium to long run. The importance of each driver varies across states and countries in India and Africa today. It is also related to structural differences in population density, the supply of labour and land, as well as the returns to agricultural intensification.

Intensification was the main driver of India’s agricultural output growth. Agriculture policies in India gave priority to scaling of innovations and infusion of technological inputs, supported by incentives and institutional reforms to make India self-sufficient in food grain production as well as accelerate agricultural performance, especially since mid-1960s. As a result, today, fertilizer, irrigation technologies and tractors are more widely used in all Indian states than almost all African countries (with the exception of Egypt). Intensification policies in India were accompanied by large investments in rural infrastructure: road network to connect farm to market, irrigation facilities, and rural electrification. Different agro-ecologies and climate change do not facilitate copying the Indian trajectory in Africa 1:1, but some of these critical changes – keeping environmental sustainability in mind – are to be considered in many countries of Africa too, in particular expanding irrigation with innovative technologies (such as small-scale solar drip), seed systems and transformation of the dairy sector. Agricultural research

is critical for all of that; India spent about 0.58 percent of agricultural GDP on agricultural research and education (0.33 percent by the Union Government and 0.25 percent by the state governments) in 2018-19 while many African countries spend less than half of that. As a consequence, total factor productivity, that is the agricultural growth stemming from innovations, is significantly higher in India.

Agricultural diversification played a significant role in promoting agricultural output growth in both India and Africa. For instance, several Indian states (Rajasthan, Gujarat) and African countries (Uganda) have increased the share of livestock in agricultural output which has provided a profitable avenue to empower small and marginal dairy farmers and created jobs along the dairy value chain. To tap the potential of agricultural diversification towards high-value commodities requires major investments in market infrastructure, processing, and storage facilities coupled with a well-connected road network and digital information systems to build an efficient and reliable value chain. In many African countries the digital infrastructure (e.g. mobile money) is stronger than in Indian states, providing a good basis for diversification and market-based growth in small-scale production systems. High-value perishable and processed foods require warehouses facilities and cold chains that reduce food loss and waste. In both India and Africa, additional investments in such infrastructure and technological innovations are needed.



Nutrition effects of structural transformation and agricultural growth

Agricultural and rural growths matter for human development, incl. nutrition and health. Among Indian states and African countries, agricultural growth is positively associated with children's nutritional status (underweight, wasting and stunting), roughly at the same scale as overall economic growth (Figure 2). Given the high share of income derived from agriculture in India and Africa, agricultural development creates multiplier effects that can accelerate income and employment growth. However, the analyses show that agricultural growth can only fulfil this potential if it is accompanied by improvement in agricultural labour productivity. In many African countries agricultural labour productivity is higher than in Indian states, despite of higher input and capital use in India. This probably still originates from more area expansion in Africa.

Since 2000, Indian states and African countries have made progress towards improving the nutritional status of children. **Gains in productivity and progress in structural transformation, rather than pure intensification, proved essential to achieve sustained impacts on food and nutrition security.** For instance, several African countries (Ghana, Cote d'Ivoire, Tunisia, Senegal) and Indian states (Kerala, Himachal Pradesh, Uttarakhand) have made significant advances in higher per capita incomes and improved nutrition outcomes. The linkage between agricultural productivity growth and nutritional outcomes is stronger among Indian states than African countries. This could be related to inter-sectoral linkages between agricultural and non-agricultural sectors in India.

In both India and Africa, a greater diversification of agricultural output is strongly correlated with improvements in nutritional status. This trend could be explained by the changes associated with structural transformation in agriculture, i.e. a shift in agricultural production from common staples towards high-values of fruits and vegetables and protein-rich foods (e.g., meat, milk, and milk by-products). This shift can improve nutrition through greater dietary diversity, i.e. by increasing the number of food groups in household consumption and incomes to purchase legumes, vegetables, fruits, and animal sourced-products.

However, it would be too simplistic to associate nutrition only with agricultural growth and structural transformation, given that **nutrition outcomes are driven by many interconnected factors.** For instance, stunting among Indian children is still significantly higher than among African children. Better nutritional status also requires improved access to safe drinking water, good hygiene practices, access to improved sanitation facilities, improving maternal nutrition, and promoting the health care systems to prevent and control childhood illnesses. In addition, female education, an area in which several Indian states made significant progress since 2000, was a key determinant for improved nutrition outcomes. Last, nutrition-sensitive technologies, such as food fortification with vitamins and nutrients and biofortification (such as zinc-rich wheat and rice in India and orange-fleshed sweet potato in Africa for Vitamin A-rich food), and nutrition-sensitive social programs, such as targeted transfer programs for pregnant and lactating women, are required for further improvements in children's nutrition.

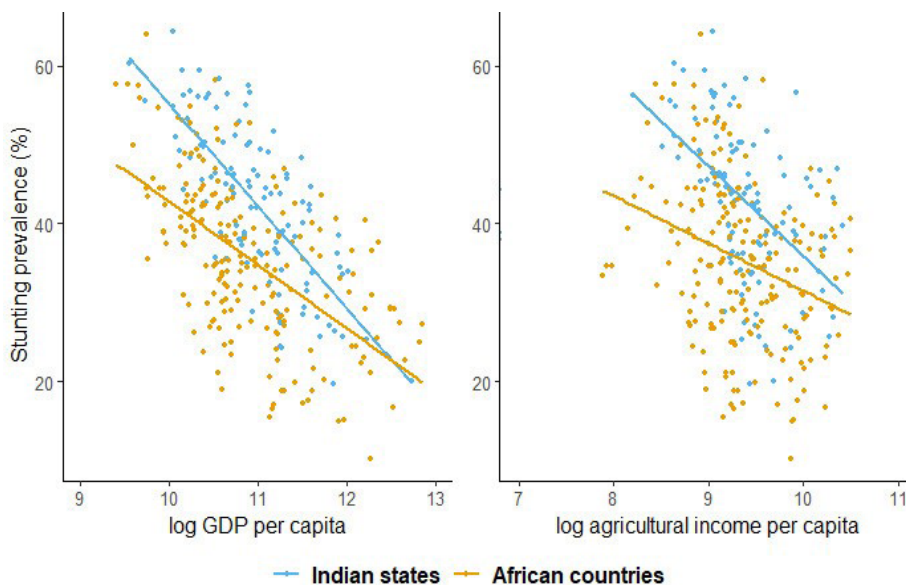


Figure 2: Associations between indicators of structural transformation and stunting among Indian states and African countries



Moving forward – future opportunities for India – Africa cooperation

Population pressure in African countries is going to be much more severe in the next three decades than in India, and very soon an area expansion approach towards food production may reach its limits. In that situation, African countries must move forward to attain food security with much more attention to innovation and sustainable intensification. In India too, from 1947 to the mid-1960s, agricultural growth was primarily derived from area expansion. But the Green Revolution (intensification) since the late 1960s saved millions from starvation, and today India is the largest exporter of rice. However, this intensification over the years, had a cost. The Green Revolution belt (Punjab, Haryana, western Uttar Pradesh) experienced environmental problems with receding water tables, methane and nitrous oxide emissions, and stubble burning of paddy straw. Africa needs to avoid this type of environmental degradation by science-based approaches, given due consideration to ecological vulnerabilities with a particular focus on water management innovations. Given the scarcity of irrigation in Africa in relation to Indian states, innovations to maximise agri-output from every drop of water will be critical, for instance through drip irrigation and fertigation. Even recycling of urban waste water, after due treatment, wherever possible, can be used for peri-urban agriculture in African countries.

Climate shocks need much more consideration in food systems policy design now than even 30 years ago. Higher frequencies of droughts and of extreme weather events with floods are already and will most probably be a challenge for both Africa and India. Strengthening resilience of food systems is critical. Cooperation in the science systems of India and Africa and mutual learning from best practice policy programs will be an important component of mutual resilience strengthening. Increasing food trade among the two areas also facilitates climate change resilience.

The Covid-19 pandemic has revealed the need to re-consider the relations between food and health systems. In the field of food systems and health, India and Africa can facilitate mutual learning. The whole set of externalities that lead to diversion between the current food costs and the true costs of food – environmental and health costs – need to be considered more on the way forward. Approaches of “One Health” – i.e. the health of people, animals and the environment – for strengthening nutrition by food value chain improvements, sanitation and services is a field where the experiences gained in India and in Africa will matter.

This Policy Brief is based on the ZEF-ICRIER studies „Drivers of Agriculture Growth in Africa and India: Lessons from India’s Agricultural Policies“ and „Structural Transformation in Agriculture and Nutrition Impacts in Africa and India: The linkage between agricultural growth with food and nutrition security“ as well as cooperative research of ZEF with the Forum for Agricultural Research in Africa (FARA).

The studies will be available at www.r4ai.org.

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