

## Farm-Nonfarm Linkages in India: Multiplier Effects and Policy Implications

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In developing countries, as the agricultural sector moves on the path of modernization, its linkages with the non-agricultural sectors become increasingly interdependent. Modernization leads to an increase in agricultural productivity and output, ensuring a more reliable supply of raw materials to industries. This improvement in supply chains fosters growth in agriculture-based industries. Concurrently, the agricultural sector emerges as significant consumer of industrial products, such as fertilizers, pesticides, machinery, and equipment. The labor market also undergoes a shift from the farm sector to non-farm sectors. Furthermore, increased rural income results in a greater demand for processed foods and non-agricultural goods and services, stimulating non-farm economic activities. Consequently, the multiplier effects of these linkages can be significant, with the agricultural sector contributing to the expansion of the non-farm sector, and vice versa.

While there is notable interdependence between the agricultural and non-agricultural sectors, empirical evidence regarding the extent of this interdependence remains limited. In the 1970s, an increase of one rupee in agricultural income was estimated to contribute Rs. 0.87 to the rural industries and service sectors through production and consumption linkages.<sup>1</sup> In the early 1980s, the value of this multiplier on rural nonfarm income was 0.91, including rural towns.<sup>2</sup> In the aftermath of the economic reforms initiated in the early 1990s, an additional one-rupee exogenous expenditure in

agriculture increased manufacturing output by Rs. 0.89 in 1997-98, Rs. 0.81 in 2003-04, and Rs. 0.77 in 2006-07.<sup>3</sup>

In this brief, we examine the evolution of farm-nonfarm linkages over the past two decades, estimating income and employment multiplier effects of agriculture on the overall formal manufacturing sector and the agro-processing industries<sup>4</sup>, and vice versa. We evaluate the multiplier effects using a panel dataset across 20 major Indian states over a 20-year period, from 2002-03 to 2022-23. This dataset integrates information from various sources: gross domestic product (GDP) and gross value added (GVA) from the National Accounts Statistics, and value added in the formal manufacturing sector and agro-processing industries from the Annual Survey of Industries (ASI). The data were adjusted to 2011-12 prices using GDP/GVA deflators specific to each industry. Annual data on the workforce in manufacturing and agro-processing industries were obtained from ASI and on agricultural workers from the decennial population census, and were linearly interpolated to generate annual estimates.

We employ a 2-Stage Least Squares technique to estimate the income and employment multipliers, following Hazell and Haggblade (1991). Gross Value Added and Employment in formal manufacturing and agro-processing industries are modelled to be determined by infrastructure, population density, and agricultural income per capita, whereas the feedback effect of influence of manufacturing GVA and employment on agriculture is captured by treating agriculture income as endogenous. This approach distinguishes between

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<sup>1</sup> The estimate 0.87 is income multiplier. See Hazell, P.B.R. and Ramasamy, C. (1991). *The green revolution reconsidered: The impact of the high-yielding rice varieties in South India*. The Johns Hopkins University Press, Baltimore and London.

<sup>2</sup> Hazell, P.B.R. and Haggblade, S. (1991). Rural-urban growth linkages in India. *Indian Journal of Agricultural Economics*, 46(4): 515-529.

<sup>3</sup> Mythili, G. and Harak. (2013). Sectoral linkages, multipliers, and the role of agriculture. In: Mahendra Dev, S. (Ed.), *India Development Report 2012/13* (pp. 95-115) Oxford University Press. New Delhi.

<sup>4</sup> Formal sector account for 84% of total manufacturing output. The food industry encompasses milled grains, vegetable and animal oils and fats, dairy products, animal feeds, beverages, fruits and vegetables, meat, and fish. Agro-industry encompasses manufacturers of wood, textiles, leather, paper, and rubber and related products, in addition to the food industries.



partial effects, which exclude feedback from the manufacturing sector to the agricultural sector, and total effects, which incorporate this feedback. Separating these effects provides a more granular understanding of how changes in one sector affect the other, allowing for a more accurate assessment of the impact of various interventions or policy changes.

## Performance of agricultural sector

Over the past two decades, the agricultural sector has seen significant growth, with inflation-adjusted GVA more than doubling from Rs.10,283 billion in 2002-03 to Rs. 23,060 billion by 2022-23 (Table 1). The GVA of agriculture, including crops and livestock, has increased by 123%. Notably, the fisheries subsector experienced the most dramatic expansion, with a 264% increase in GVA. This led to an increase in the share of fisheries in agricultural GVA, from 4.4% to 7.2%. The share of agriculture decreased slightly, from 85.2% to 84.7%.

**Table 1. GVA and employment in agricultural sector in India**

Sector	2002-03	2012-13	2022-23
GVA (Rs. billion at 2011-12 prices)			
Agriculture	8,763	13,282	19,525
Forestry	1,064	1,247	1,875
Fisheries	457	714	1,660
Total	10,283	15,243	23,060
Workforce (million number)	250	221	253

On the other hand, the workforce in primary agricultural production remained relatively stable, albeit with some fluctuations. Between 2002-03 and 2012-13, the agricultural workforce decreased by 11.6% from 250 million to 221 million. However, this was followed by recovery, with a 14.5% increase from its 2012-13 low. This trend can be attributed to increased mechanization and rural-urban migration. Nonetheless, the stark contrast between growth in agricultural GVA and workforce suggests significant improvements in labor productivity in agriculture.

## Performance of manufacturing sector

During the same period, the GVA of the manufacturing sector increased by 276%, from Rs. 3,846 billion to Rs 14,459 billion (Table 2), which is more than double the increase in the agricultural sector. The agro-processing industry as a whole, which accounts for one-fourth of the manufacturing GVA, increased by 250% despite a slight decrease in its contribution to the manufacturing sector. Notably, this growth was driven by industries such as rubber, apparel, wood, and leather segments, which together contribute 36% to agro-processing GVA. Meanwhile, the share of food processing industry in agro-processing GVA decreased from 39% to 34%, yet it expanded by 212%. The textile industry, contributing

18% to the agro-processing sector's GVA, expanded by 144%.

**Table 2. GVA in formal manufacturing (Rs. billion at 2011-12 prices)**

Sector	2002-03	2012-13	2022-23
Food & beverages	387	742	1,209
Tobacco	97	118	138
Textiles	263	547	642
Wearing apparel	62	181	386
Leather & related products	23	61	119
Wood & wood products	8	24	46
Paper & paper products	70	100	240
Rubber & plastics products	92	298	724
Total agro-processing	1,003	2,070	3,504
Total manufacturing	3,846	9,389	14,459

**Table 3. Employment in formal manufacturing ('000 numbers)**

Sector	2002-03	2012-13	2022-23
Food & beverages	1,308	1,689	2,297
Tobacco	489	429	436
Textiles	1,179	1,409	1,723
Wearing apparel	336	923	1,320
Leather & related products	146	285	408
Wood & wood products	50	77	106
Paper & paper products	174	236	350
Rubber & plastics products	262	539	948
Total agro-processing	3,944	5,586	7,588
Total manufacturing	7,936	12,950	18,495

During this period, the agricultural sector experienced minimal, if any, expansion in workforce engaged in it. By contrast, the manufacturing sector witnessed a substantial increase in its workforce, growing from 7.94 million to 18.50 million (Table 3). Although the agro-processing industry experienced a reduction in its share of employment in the manufacturing sector from 50% to 41%, the overall workforce expanded, driven by the food and beverages, apparel, rubber and leather industries.

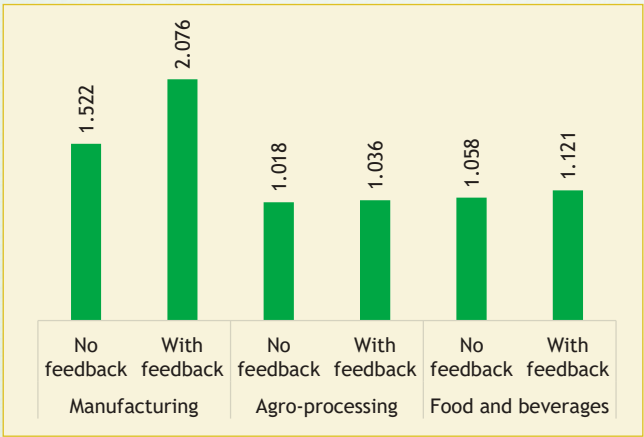
## Multiplier effects

Figure 1 presents the income and employment effects of the expansion of the agricultural sector on the manufacturing and agro-processing industries. The manufacturing sector responds significantly to agricultural growth. The partial effect of 1.522 indicates that a one-unit increase in agricultural GVA results in an additional 0.522 unit increase in manufacturing GVA. The effect of agriculture is more than double when accounting for feedback effects from the manufacturing industry i.e., 1.076. This is significantly higher than the values ranging between 0.77 and 0.89 corresponding to the period 1998-2007 reported by Mythili and Harak (2013). Our findings re-establish the presence of robust reciprocal linkages, wherein expansion of the agricultural



sector enhances manufacturing output, which in turn stimulates agricultural performance.

Figure 1. Income multipliers



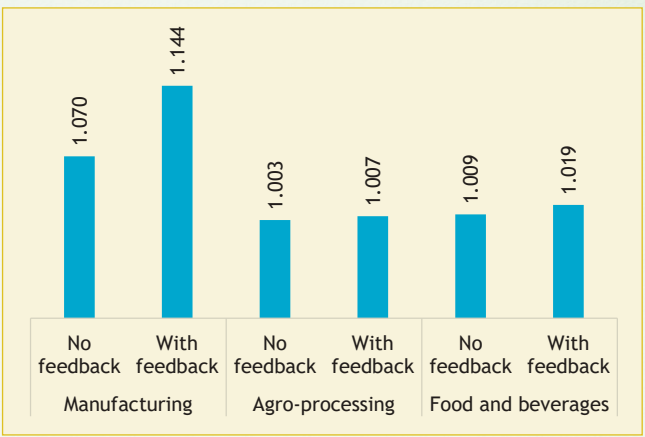
Conversely, the relatively smaller multipliers, both partial and total, for the agro-processing industries indicate a need to strengthen the backward and forward linkages of the agricultural sector. The partial effect for the agro-processing industry as a whole suggests that each rupee increase in agricultural GVA results in an increment of only Rs 0.018 in the GVA of agro-processing. However, when considering the spillover effects from agro-processing, the total effect is nearly double the partial effect. Notably, compared to the overall agro-processing industry, the food processing industry exhibits a more significant effect, with a coefficient of 1.121. These findings underscore the necessity for targeted interventions in both agriculture- and agriculture-based industries to promote growth in both sectors.

The employment multiplier effects of agricultural expansion have a limited impact on overall manufacturing employment (Figure 2). The partial effect of 1.070 suggests a minimal initial influence, which increases slightly to 1.144 when the feedback effects are considered. Furthermore, the employment multipliers for the agro-processing and food processing industries are even lower than those observed in the broader manufacturing sector. This suggests that these industries, which are more directly linked to agricultural output, do not generate as much employment as expected.

These findings suggest that, while agricultural growth stimulates industrial output through increased demand for inputs, machinery, equipment, and processed agricultural food and non-food products, this expansion does not proportionally create employment opportunities. The reasons for this phenomenon include the growing automation in processing industries and economies of scale that allow for increased production without a corresponding increase in employment.

Furthermore, there may be a shortage of the skills necessary for these industries.

Figure 2. Employment multipliers



We also project both income and employment multipliers, assuming that the historical economic and demographic trends will continue (Figures 3&4). There are improvements across all the industries. This positive trend is expected to be driven by a shift in the agricultural portfolio towards high-value commodities in response to their rising demand due to income growth and urbanization, which in turn stimulates economic growth and job creation throughout the supply chain. Improved post-harvest management

Figure 3. Projected income multipliers by 2035-36

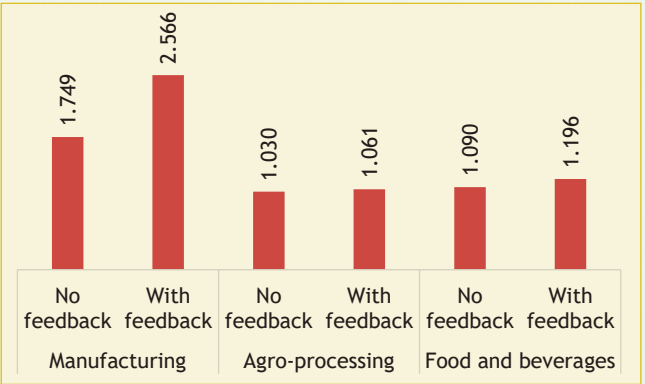
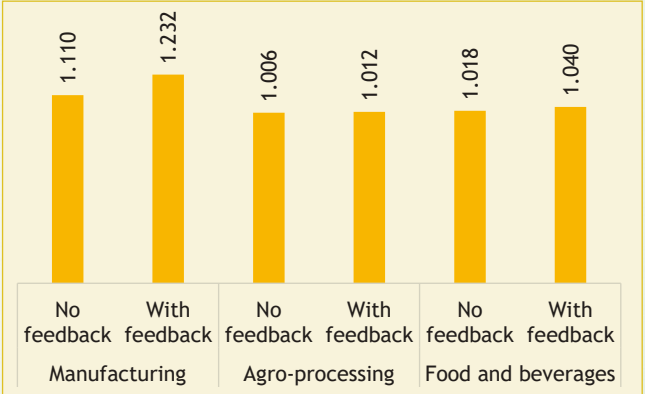


Figure 4. Projected employment multipliers by 2035-36





practices and advancements in logistics and supply chains contribute to reduced losses and improved market access for agricultural products. Additionally, the agro-processing sector is expected to gain in processing efficiency, while ongoing skill development initiatives are likely to enhance workforce quality and productivity.

## Policy implications

Over the past two decades, despite significant growth in agriculture and agriculture-based industries, their limited impact on income and employment indicates that their full potential is yet to be realized. To fully harness this potential, future policy and investment decisions must focus on reinforcing the factors that enhance linkages and effectively channel their benefits. Some of these issues are discussed below.

First, public expenditure in the agricultural sector has been inconsistent in the past three decades, varying from 2.4% to 5.6 % of total development expenditure.<sup>5</sup> Such volatile investment patterns discourage innovation that enhance the sector's resilience to economic shocks and climate challenges. A sustained investment in agriculture is imperative for long-term sustainability. In addition, prioritizing agricultural investment is essential for harnessing the growth potential of livestock, fisheries, and horticulture, which have emerged as drivers of agricultural growth in recent years. These subsectors provide higher returns on investment, and have the potential to create more diverse and lucrative opportunities for farmers and agribusinesses. However, public investment in these sectors is significantly lower than their socioeconomic contributions.

Second, India's agricultural policies have remained cereal-centric, which has inadvertently created a disincentive for crop diversification towards more lucrative crops such as fruits and vegetables, and private investment in specialized infrastructure for processing such crops. Notably, the fast-growing demand for fresh fruits and vegetables and their value-added products is increasing faster than that for cereals. Importantly,

the production of these crops is labor intensive. To unlock their income and employment potential, there is a need to reform agricultural policies that encourage crop diversification and promote private investment.

Third, the significant divergence between income and employment multipliers calls for greater focus on rural industrialization. Notably, most agro-processing units are located in urban and semi-urban areas, which restrict employment opportunities in rural areas. Collectives, such as Farmer Producer Organizations (FPOs), cooperatives, and agri-start-ups, have the potential to accelerate rural industrialization by investing in local processing facilities.

Fourth, the efficiency of the agro-processing industry is suboptimal. Enhancing credit flow for upgrading machines and equipment, investment in storage facilities, and strengthening supply can significantly improve processing efficiency. Skill development tailored to the needs of processing industries is crucial for improving processing efficiency and transmitting benefits upstream. Aligning education and training programs with industry demands can create a workforce better equipped to meet the evolving needs of these industries.

Fifth, improving rules and regulations to promote ease of doing business is critical for agro-industrialization. Streamlining administrative processes, reducing bureaucratic interventions, and creating a more transparent and efficient regulatory environment can encourage entrepreneurship and attract private investments.

Finally, adherence to good agricultural and manufacturing practices is essential for the long-term sustainability of agriculture and agriculture-based industries. Notably, global standards and regulations concerning food safety and environmental sustainability are becoming increasingly stringent. Implementing these practices across the value chain can help to gain access to new markets and build trust with international buyers.

<sup>5</sup> Birthal, P.S., Srivastava, S.K., Saxena, R., Godara, S., Chand, P., Kishore, P., Jumrani, J., Kandpal, A., Sharma, P. and Pant, D.K. (2025). *Indian Agriculture to 2047 – Reshaping Policies for Sustainable Development*, Policy Paper – 50, ICAR-NIAP, New Delhi.

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