IFPRI Discussion Paper 2443

September 2026

Tracking Agrifood Value Chain Transformation in India

A Tale of Two Approaches

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Abstract

Global experience suggests that as agrifood systems transform with economic development, non-farm activities rise in importance relative to primary agriculture owing to the expansion of processing, trade and distribution. Empirical work on the nature and distributional consequences of this transformation have followed two distinct but related methods that rely on Input-Output modelling, the "ERS-USDA Food Dollar approach" and the "IFPRI's AgGDP+ approach". So far, these have run parallel to each other. In this study, we offer a novel comparative perspective by applying both methods to a common dataset from India over the period 2011-12 to 2023-24. The Food Dollar estimates of the size of the Indian agrifood system remain consistently higher than that of the AgGDP+ approach but puts the share of "farm" lower- at around half of the consumer food rupee in the former in contrast to around two-thirds of agrifood-system value added under the latter approach. Our analysis suggests that these differences stem from identifiable differences in the questions they seek to answer and the way the data are processed. They must hence be viewed as complementary rather than competing approaches. Despite different vantage points, both methods suggest a coherent if surprising story of India's agrifood system transformation. First, primary agriculture appears to be central to the agrifood system, whether measured as a share of the consumer rupee or as a share of agrifood-system value added. Second, post-farm value is concentrated in trade and transport rather than in processing or food service. Third, a transformation of the system through the growth of services, input supply, and away-from-home consumption is underway but has so far been gradual.

Keywords: Agrifood system transformation; Food Dollar approach; AgGDP+ ; farm share;input–output analysis; supply chain; India

JEL Classification: Q11; Q13; Q18

Acknowledgments

We are deeply indebted to Chris Barrett, Pat Canning, and James Thurlow for encouraging us to undertake this study and to Shahidur Rashid for his support and inputs; special thanks are due to Pat Canning for his invaluable methodological guidance and insightful discussions. The paper has also benefited significantly from comments and feedback from participants at the 32nd International Conference of Agricultural Economists (ICAE 2024) in New Delhi, India, and an anonymous reviewer. This research was conducted as part of the CGIAR Science Program on Policy and Innovations. We sincerely thank all funders who support this research through their contributions to the CGIAR Trust Fund (https://www.cgiar.org/funders/). Any remaining errors or omissions are entirely our own.

1 Introduction

Globally, as countries develop and incomes increase, the share of agriculture in total Gross Domestic Product (GDP) goes down, accompanied by a decline in the the workforce employed in agriculture. This historical pattern of structural transformation, stylized in the Lewis Model (Lewis, 1954), has been both accepted and contested in equal measure (Gollin, 2014; Dorin et al., 2013; Timmer, 1988). Recent experience of developing countries suggests that there may be multiple pathways or kinds of structural transformation that defy the predictions of the Lewis Model, where the decline in employment share in agriculture may lag behind the pace of decline in the share of agriculture in GDP (Dorin et al., 2013; Chand, 2025; Sen, 2019). Notwithstanding this larger debate, the experience of most countries suggests that as agrifood systems transform with economic development, non-farm activities including processing, trade and services rise in importance relative to primary agriculture employing a substantial number of workers (Barrett et al., 2022).[1]

This transformation is propelled by several changes originating on the demand side. As incomes increase, the demand for a more diverse diet, following Bennett's Law is evident.[2] This is accompanied by a decline in home-based processing, a greater prevalence of eating away from home and a demand for more and sometimes highly processed foods. As the supply side responds to this demand, agrifood value chains may grow in geographical or spatial length, i.e., where produce travels longer distances, getting transformed along the way. In some cases, they may also grow in intermediational length, passing through many more hands before reaching the consumer. Upstream, the need to produce commodities for discerning consumers whose preferences are increasingly linked to specific attributes, whether in terms of varieties or production practices, such as organic, spurs transformation upstream as well. These collectively create a demand for more diverse inputs and products. Downstream too, this may lead to more processing, packaging, transporting, trading, for example. Retailing and food service too emerge as key segments in this context (Reardon and Timmer, 2007). This transformation of agrifood value chains, especially in developing countries, has

[1]The agrifood system covers the journey of food (for example, cereals, vegetables, fish, fruits and livestock) from farm to table – including when it is grown, harvested, processed, packaged, transported, distributed, traded, bought, prepared, eaten and disposed of (Food and Agricultural Organization, 2021). It also encompasses non-food products (for example forestry, animal rearing, use of feedstock, biomass to produce biofuels, and fibres) that also constitute livelihoods and all of the people as well as the activities, investments and choices that play a part in getting us these food and agricultural products.

[2]This statistical regularity was first highlighted in the Wheat Studies of the Food Research Institute, vols. 12 and 18, Stanford University, Stanford, California (1936, 1941).

been enabled and aided by a rapid proliferation of micro, small, and medium enterprises (MSMEs) across the value chain, i.e., upstream (with input supply), in the midstream segments (processing, wholesale, and logistics) and downstream (retailing, food service) activity - characterized as a "quiet revolution" in the "hidden middle" (Reardon, 2015; Reardon et al., 2014). These aspects of agrifood transformation have been somewhat less studied relative to changes and diversification of diets among consumers and of on-farm diversification and technology adoption, for example, among farmers.

Scholarship on agrifood transformation has just begun to catch up with these rapid changes. Traditionally, food supply chain analysis remained largely commodity specific and was limited to a few locations and value chains (Reardon et al., 2014). The dominant approach was to either track prices along the value chain to identify margins across segments of the value chain (Gardner, 1975) or value chain analysis, sometimes on a global scale, that map the actors that engaged in the transformation and movement of a product and its by-products (Gereffi and Fernandez-Stark, 2011). There is growing recognition that while useful, these do not offer an economy-wide perspective of agrifood transformation and the place of the agrifood system in the larger economy.

A variety of methods, some of which were developed several decades ago, have recently been adapted to document the extent and nature of these changes as well as the distributional implications of such transformation (Canning, 2011; Yi et al., 2021, 2025; Thurlow et al., 2025; Corong et al., 2024). Despite the proliferation of such studies, there remain important gaps in our understanding of different methods, how they compare with one another and their implications for research on agrifood systems.

This paper has two main goals. Our primary goal is to implement and generate insights on two popular methods that are commonly used approaches to investigate agrifood systems.

The first approach, the ERS-USDA (Economic Research Service, United States Department of Agriculture)'s "Food Dollar approach", seeks to trace the share of a consumer dollar spent across different segments of the agrifood value chains. It is an analytical method developed by the USDA to break down the value of each dollar consumers spend on food in the United States. It shows how much of that "consumer dollar" goes to various parts of the food supply chain — from farms to processors to retailers — and ultimately helps track where value is added. Mandated by the Agricultural Marketing Act of 1946 (7 U. S. Code 1622 (b)), the USDA routinely measures,

analyzes, and disseminate farm-to-retail price spread data each year. The Food Dollar series was developed to meet this mandate and underwent a methodological revision, now referred to the "New Food Dollar Series" (Canning, 2011).

This approach has been extended internationally as the Global Food Dollar (Yi et al., 2021), operationalised across 161 countries as an official statistical product in the FAOSTAT Food Value Chain Domain (Cerilli et al., 2024). Most recently, this approach has been augmented with labor decompositions that track employment and compensation across agrifood value chain segments (Yi et al., 2025). It has also been extended to incorporate exports (Yi et al., 2025). Country-level applications in Canada (Kelly et al., 2015; Aklilu et al., 2025), France (Boyer and Butault, 2014), Mexico (Zahniser, S., Ortega Díaz, A., Hernández García, V. H., Solís y Arias, J.V., and Gallegos, C., 2026) and a 20-country European comparison (Boyer and Butault, 2025) have shown that the farm share of the food dollar typically ranges from 8-23% across high-income economies and is sensitive both to the at-home versus away-from-home consumption mix and to relative agricultural price movements. At the global level, these demand-side decompositions reveal that farmers receive on average 27% of at-home food expenditures across 61 countries (Yi et al., 2021); this share falls systematically with income growth, and workers exiting primary production do not leave agrifood value chains altogether but migrate into downstream segments offering higher compensation, albeit with pronounced gender asymmetries in this reallocation (Yi et al., 2025). International trade and services further reshape these distributions: trade regimes that favour domestic processing raise the farm share, while increasing "servicification" of value chains shifts value addition toward downstream activities (Santeramo et al., 2024).

The second approach, the AgGDP+ method, was developed and popularized by researchers at the International Food Policy Research Institute (IFPRI) (Thurlow et al., 2025). The premise of this approach is that agrifood systems are larger than the agriculture sector itself and agricultural GDP (agGDP) therefore often understates the true importance of agriculture, especially in developing economies. Many economic activities related to agriculture are typically counted as part of the industrial or service sectors, rather than agriculture; this may lead policy makers for example, underinvest in rural development. This approach was developed to measure agriculture's "true" contribution to an economy by estimating the GDP generated across agrifood value chains within the economy (Thurlow et al., 2025; Diao et al., 2010; Pal et al., 2026). This approach thus builds up

the analysis from the production side, aggregating GDP (and employment, if relevant) contributions across all on-farm and off-farm components of the agrifood system. As per this approach, the global agrifood system GDP stands at $11.7 trillion in 2021, 12.8% of the world economy, with primary agriculture contributing roughly one-third and off-farm activities two-thirds of this total (Thurlow et al., 2025). In high-income countries the off-farm to on-farm ratio exceeds six to one. This supply-side perspective has been complemented by the Organization of Economic Cooperation and Development (OECD)'s trade-in-value-added framework, which uses inter-country input-output tables to measure backward and forward global value chain participation in disaggregated agro-food sectors (Greenville et al., 2017, 2019); similarly, using this approach, FAO estimates place global agrifood system employment at 1.23 billion workers (Davis et al., 2023).

Much of the recent literature in the field is aligned with one of these two approaches - the Food Dollar works backwards from consumer food expenditures, in contrast to AgGDP+ which works forward from agricultural value added. Although these two approaches have gained in popularity, there has been no systematic attempt so far to compare these. Ostensibly, both approaches rely on the same data and tools such as Input-Output (I-O) tables or Supply Use tables (SUT) that are publicly available for several countries. Both approaches are also similar in spirit, attempting to situate the the agricultural sector in the larger economy while explicitly recognizing that agrifood value chains straddle secondary and tertiary sectors of the economy. The question remains therefore whether the Food Dollar approach and the AgGDP+ approach are two ways of analyzing the same thing. If not, what are these differences and what do we learn from one that we do not learn from the other? In our paper, we implement both methods for the same country, India, using a common data source, allowing for a comparison that hitherto has not been attempted. This is our primary goal.

Our secondary goal is to shed light on the Indian experience. In some ways, India, the most populous country in the world, is the archetypal developing country. Ever since 1991, when the country embarked on wideranging reforms that removed a restrictive licensing regime that governed most private activity and liberalized external trade, India has seen rapid economic growth; the agricultural sector's contribution to the GDP has been shrinking consistently since. At the same time, India also has its own specific characteristics of transformation that make it seem atypical. For example, the share of workers in the agricultural sector has not declined at a pace commensu-

rate with the decline in agriculture's share in the GDP. Although much has been written on the transformation of the Indian economy itself, there is less written about the structure and nature of transformation of the agrifood system that leverage macro data. In this study, we are able to fill this gap by drawing on both the Food Dollar and the agGDP+ approaches and appraise the nature and extent of agrifood transformation in India.[3].

The paper is organized as follows. We start with a broadbrush picture of agrifood value chains in India. We then turn to a description of the two methods we seek to explore, and the data we use to be able to implement both methods. Thereafter, we discuss our findings and then conclude with a discussion of the implications of this study.

2 Agrifood value chains in India

India is in the midst of a rapid change in the structure of the economy, a process that became especially pronounced after economywide reforms in the early 1990s, that liberalized trade, allowed for greater private involvement in economic activity, notably in manufacturing and services. Yet, it is now widely acknowledged that the nature of structural transformation is far from "typical" (Chand, 2025; Dorin et al., 2013; Binswanger-Mkhize, 2013; Narayanan, 2026). The contribution of agriculture sector in India' Gross Value Added (GVA) has declined from 27% to 14.5% between 1990 and 2023, while the share of service sector grew from 42% to 56.9% during the same time (Government of India, 2025). It is now well recognized that India's structural transformation process did not transform the labor market significantly. The share of agriculture in total employment has not fallen as fast and continues to employ half of the workforce; 73% of whom are male. The early "bottling" up of labor in rural areas has given way to apparent labor shortages in agriculture, with the non-farm in rural and urban, especially the latter, being the preferred destination. At the same time, much of the growth in non-agricultural sectors in India has been characterized as "jobless". The precarious nature of work and limited off-farm opportunities restrict the extent to which agricultural workers and farmers fully exit agriculture.

Against this background, India has witnessed several well-recognized aspects of transformation of agrifood systems. A rapid growth in the demand for diverse diets, high value processed goods,

[3]For convenience, we refer to our exercise for India as the Food Dollar approach when discussing the method, referring to the Indian rupee only when we discuss with our data, process or findings.

eating away from home have an unprecedented influence on shaping what is grown and how food is handled, processed and transformed (Kishore and Gupta, 2025; Pingali et al., 2019). Growing incomes, urbanization and connectivity have also integrated agrifood markets spatially. This has led to a burgeoning segment of post-harvest enterprises. Existing estimates suggest that in 2015–16, 21 million small and medium enterprises engaged in the business of manufacturing, trading, retailing, and serving food linked India's 146 million farmers to its nearly 1.3 billion consumers, employing 35 million people (Gupta et al., 2023).

The AgGDP+ has recently been used to make sense of this transformation. Pal et al. (2026) find that in 2017-18 the agrifood system in India contributed an estimated 31% of Gross Value Added, with 59% from primary agriculture and the rest from off-farm activities like agro-processing. The share of off-farm agrifood system activities is correlated positively with state income, reflecting markers of structural transformation. Studies using the global food dollar approach estimate that in India, the farm share in the consumer dollar spent on food at home declined from 37.48% to 33.99% over the years 2005-17 (Yi et al., 2021; Cerilli et al., 2024). The farm share in Food Away from Home was estimated to have declined from about 35% in 2005 down to approximately 26% in 2017, with a notable drop between 2010 and 2011 (from about 32% to approximately 23%) likely due to a change in the base year.

Thus far, these efforts to investigate the structure and transformation of agrifood systems, including for India, have run parallel to each other. Our study attempts to build on these efforts by applying both approaches as part of an integrated effort working off the same dataset that allows a comparison of these strands of work.

3 Data and methods

In this section, we first outline the two approaches and then focus on how we apply these two approaches to Indian data. We foreshadow our discussion by noting that (a) neither the Food Dollar nor the AgGDP+ approach can be directly applied to the data available for India and these data need to be processed in specific ways (b) we tailor a workflow that we believe can be routinely implemented by the Indian statistical system with minimal additional expertise or data. We describe these in this section and share the tools as part of Online Supplementary Materials.

Both approaches, the Food Dollar and AgriGDP+, start from the same premise: agriculture's role in the economy extends well beyond the farm gate. Agrifood value chains span input supply, primary production, processing, trade, transport, and food service. Standard GDP accounting allocates many of these activities to "industry" or "services," rendering invisible the place of agriculture in the larger economy. The two methods address this from complementary angles. The Food Dollar approach asks: of every dollar (in our case, rupee) a consumer spends on food, at home and away, how much goes to the farmer, the processor, the trader, the transporter, and so on? It decomposes consumer food expenditure into value-added shares across segments of the food supply chain. The AgGDP+ approach asks: how large is the total GDP generated by the agrifood system, including segments that national accounts classify under industry or services? It estimates the full GDP footprint of agriculture-linked activities. Both rely on Input-Output modelling using Supply-Use Tables (SUTs). Both typically partition the economy into "food supply chain" and "non-food supply chain" sectors. Yet, they differ in the precise questions they answer and therefore in how they handle and process these data.

3.1 Application to Indian data

This section focuses on the data and approach, unpacking the commonalities and differences between the Food Dollar approach and AgGDP+ approach step by step. We restrict our discussion here to providing an overview with limited technical details, relegating the details to Online Supplementary Materials.

India's Supply Use Tables

Both methods draw on India's Supply and Use Tables (SUTs), published annually by the Ministry of Statistics and Programme Implementation (MoSPI). The Ministry of Statistics and Programme Implementation (MoSPI), Government of India, publishes Supply-Use Tables annually covering 66 activities (industries) and 140 commodities (products). The SUT comprises a Supply Table, recording domestic production by industry and commodity together with imports, product taxes, and trade and transport margins, and a Use Table, recording intermediate consumption by industry and commodity alongside final demand (private and government final consumption, capital formation, changes in stocks, and exports) and gross value added by factor type. MoSPI has released SUTs

annually with 2011-12 as the base year. Until 2021-22 these tables distinguished 140 commodities and 66 industries; the revised 2022-23 and 2023-24 tables, with a 2022-23 base year, distinguish 155 commodities and 67 activities. To maintain a consistent classification across years, we aggregate the newer framework to match the older 140-commodity, 66-industry classification, giving a uniform and consistent series from 2011-12 through 2023-24.

Transforming SUTs into Input-Output table at producer prices

The SUT comprises a Supply Table in **basic** prices, showing domestic production by industry and commodity, imports, product taxes, and trade and transport margins; and a Use Table in purchaser prices, showing intermediate consumption by industry and commodity, final demand components (PFCE, GFCE, GFCF, changes in stocks, valuables, exports), production taxes, and Gross Value Added (GVA) by factor type.

The first substantive preparatory step, common to both methods, is to construct a consistent basic-price use table. This is required because the published Use Table records many transactions at purchaser prices, which reflects three things: the basic value of the commodity as it leaves the farm or factory gate, the trade and transport margins added to move and sell it, and net taxes on the product. For input-output analysis, these must be separated, so that the cost of moving and selling food is credited to the trade and transport activities that perform that function rather than remaining concealed in the price of the food. For each commodity, we estimate trade-and-transport-margin and net-product-tax coefficients relative to total supply at purchaser prices and apply them across intermediate use, private and government consumption, capital formation, and exports. The result is a Use Table in which intermediate inputs are valued at producer prices, the extracted margins are reassigned to the trade and transport rows, and product taxes net of subsidies are separated out. This step is especially important for comparing the Food Dollar and AgGDP+ approaches because trade and transport are supply-chain activities themselves. Next, we transform the asymmetric SUTs into a symmetric input-output table (IO), wherein the row and column dimensions match and supply-use values balance systematically across the economy. A schematic layout of this symmetric IO framework is illustrated in Table 1.

The Input-Output (IO) table thus derived contains "hotels & restaurants" as a single, combined activity/commodity. However, to isolate the farm share of consumer food expenditures, we split

Table 1: **Schematic structure of the Supply-Use table at purchaser and basic prices**

<table>
<tr><th></th><th>Industry/Commodity</th><th>Margin Commodity (trade & transport)</th><th>Final Use</th><th>Output</th></tr>
<tr><td>Industry/ Commodity</td><td rowspan="2">Inter-industry use at Producer price (Estimated from Use Table)</td><td rowspan="2">Receipt to the margin industries at producer price (estimated from Supply Table)</td><td>Final use at Producer price (estimated from Use Table)</td><td rowspan="5">Total supply of output including margin output at Producer price (estimated from Supply Table)</td></tr>
<tr><td>Margin Commodity (trade & transport)</td><td>Margin payments for final use</td></tr>
<tr><td>Value Added</td><td colspan="3">Value added at factor cost (basic price) (obtained from Use table)</td></tr>
<tr><td>Product taxes less subsidy</td><td colspan="3">Commodity sales tax net of subsidies (obtained from Supply Table)</td></tr>
<tr><td>Import</td><td colspan="3">Import of commodities at C.I.F price</td></tr>
<tr><td>Output</td><td colspan="3">Total supply of output including margin output at Producer price (estimated from Supply Table)</td></tr>
</table>

this aggregate activity into two distinct categories: "food away" (the food commodity itself) and "food service" (the preparation and service component).

Generating Input-Output multiplier model

From this table, we form the input-output coefficient matrix A (each column rescaled by total output). An implicit assumption is that a commodity has the same input structure regardless of the industry that produces it. We then invert it to obtain the familiar Leontief inverse $L = (I-A)^{-1}$ (Leontief, 1986; Miller and Blair, 2009). The Leontief inverse is the heart of the method. Each element L_{ij} represents the total output of sector i required, directly and indirectly via its linkages across other sectors. This allows value generated anywhere in the economy to be traced back to the food it ultimately serves - for example, the fuel that a firm transporting food buys, the refining that fuel needs, the crude used to produce the refined fuel, and so on. This inverse is computed once and is the shared foundation for both approaches (see the Online Supplementary Materials). This single data block then forms the basis of both the Food Dollar and the AgGDP+ calculations.

Further, the Food Dollar method analyzes the supply chain, and traces the market value of total food expenditures back to the sources of value added. In the Leontief IO accounting framework, the market value of all final market sales, including all food expenditures, is exactly equal to the sum of all value added by every activity that is either directly or indirectly linked to the commodity supply chain. To estimate value added contributions from both food and non-food supply chain

activities corresponding to consumer expenditure on food we use the value added multiplier method using the Leontief inverse matrix. Where IO tables of a country consists of 400 industries or more, the Food Dollar method suggests partitioning Leontief inverse matrix between supply chain and non-chain activities by adopting matrix reduction procedure described in Leontief (1986) (Canning, 2011). However, in our case, we consider all commodities of the Leontief inverse matrix as part of the food supply chain. Hence, we rely on a simple value-added multiplier to estimate value added contribution from supply chain activities. For the sake of reporting however, we aggregate and group all 141 activities of IO table into seven supply chain activities that comprise primary agriculture (including crops, livestock, forestry, and fishing), food processing (including grain milling, beverages and tobacco), transport, storage, trade, and hotels and restaurants and other input supply chain activities. In contrast, to analyze agrifood value chain through AgGDP plus approach we aggregate and group 141 IO activities into five components for reporting. A detailed mapping between these supply chain activities is given below (Table 2). Aggregation to a small number of reporting categories is thus performed only at the reporting stage, after the analysis.

Table 2: **Mapping between aggregated supply chain commodities and 141 IO activities**

A. Aggregation scheme for food dollar approach	
Aggregate supply chain activities	**IO activities**
Primary agriculture	Activity serial no. 1 – 29
Processing	Activity serial no. 41 – 56
Trade	Activity serial no. 117
Food Service	Activity serial no. 119 – 120 (including both "food away" and "food service")
Fertilizer & fuel	Commodity serial no. 71, 75, 76
Transport	Commodity serial no. 121 – 126
Other input	Commodity serial no. 30–40, 57–70, 72–74, 77–113, 118, 127–141.
B. Aggregation scheme for AgGDP+ approach	
Aggregate supply chain activities	**IO activities**
Farm (AGR)	Activity serial no. 1 – 29
Processing (PROC)	Activity serial no. 41 – 56
Trade & Transport (TRAD)	Activity serial no. 117, 121 – 126
Food Service (FSV)	Activity serial no. 119 – 120 (including both "food away" and "food service")
Input supply (INP)	Commodity serial no. 30–40, 57–70, 71, 75, 76, 72-74, 77–113, 118, 127–141.

Note: Detailed description of IO activities is given in Appendix A

Treatment of imports

In a standard Input-Output (I-O) accounting framework, imports are typically recorded as negative entries within the final demand section. This adjustment prevents the double-counting of foreign-made products already embedded within inter-industry transactions and final expenditures, ensuring that row totals accurately reflect only domestic gross output.

In contrast, this study accounts for imports valued at c.i.f. (cost, insurance, and freight) as a positive entry in a dedicated import row of the symmetric table, rather than as a negative item in final demand. Consequently, the column totals of the commodity-by-commodity table reflect total composite supply (the sum of domestic and imported goods), while imports appear as a distinct primary-input row alongside value added and net product taxes. This alternative approach allows us to enforce the strict accounting identity where, for every commodity, total intermediate and final use equals the sum of intermediate inputs, value added, net taxes, and the imports utilized in its

production.

The two methods then use imports differently, in line with the questions they answer. For the Food Rupee decomposition, we trace only the share of food final demand met by domestic production: we scale the food final-demand vector by commodity-specific domestic shares $(1 - m_c)$, where m_c is the import share in total supply of commodity c, so that value paid to foreign suppliers is not attributed to any domestic supply-chain segment. The farm and post-farm shares we report are therefore shares of the domestically supplied food rupee. For AgGDP+, which sums domestic value added generated by the agrifood system, imported intermediates contribute no domestic value added by construction and so do not enter any component; imports matter only insofar as they substitute for domestic supply and thereby reduce the output, and hence the value added, attributed to domestic agrifood activities. Since the import adjustment is applied to the same final-demand vector and the same Leontief inverse used by both methods, the two approaches treat imports on a common basis, and any difference in their results reflects the different objects they measure rather than a different handling of imported goods.

3.2 The two approaches

We provide details of each in the Online Supplementary Materials but summarize the two approaches here.

The Food Dollar approach

The Food Dollar approach, developed by the Economic Research Service of the USDA, decomposes consumer food expenditure into the shares received by each segment of the food supply chain. The key question it seeks to answer is: What is the average share of domestic consumer food purchases received over a calendar year by farmers from the sale of agricultural commodities (excluding farm-to-farm transactions) produced to accommodate those purchases (Yi et al., 2021; Aklilu et al., 2025). It begins from final demand for food and traces that demand backward through the supply chain or network using the shared Leontief inverse: the gross output, and hence the value added, required at every stage to satisfy food demand is recovered and expressed as a share of the total (See Appendix B). Intra-agricultural (farm-to-farm) sales are netted out to avoid double-counting. Two summary measures follow directly. The farm share is the portion of food expenditure that

reaches primary producers at the farm gate. The complement, or the remainder of the food dollar represents the share captured by the post-farm gate agrifood supply chain - collectively termed "marketing services". The *value-chain decomposition* distributes the remainder across processing, trade, transport, food service, and the input-supply activities that serve the chain. Because food consumed at home and food consumed away from home pass through different chains, the method distinguishes them on the demand side. Imports are handled by reducing the food demand vector by commodity-specific import shares, so that only domestically produced food is traced through the system.

The ERS-USDA's Food Dollar approach yields three distinct series - "industry group shares" or "value-added" or "factor shares" that reflect who earns what portion of each dollar spent on food. The Marketing Bill Series divides the food dollar into two main parts: farm share, i.e. the portion that goes to the farmer and the marketing share, i.e. portion that goes to all post-farmgate activities (processing, transportation, retail, etc.). The farm share can be defined as the value of raw agricultural commodities produced by the farmer as a proportion of total consumer food expenditures. The industry group series breaks down the marketing share across 10 industry groups, in its original formulation (Canning, 2011). Each group's contribution to the final food dollar is measured based on value-added. A primary factor series shows how the food dollar is split by inputs: labor, property income (e.g., profits, rents), taxes and answers the question: Who earns what type of income from the food dollar?

The AgGDP+ approach

The AgGDP+ approach measures the broader GDP contribution of the agrifood system. It is not a decomposition of consumer food expenditure. Instead, it starts from value added in agriculture and adds the portions of processing, trade, transport, food services, and input supply that are attributable to agrifood activity.

The methodology identifies the following conceptual components (Table 3 and Figure 1): A is primary agriculture GDP, including crops, livestock, forestry, and fisheries; B is food processing GDP; C is implicit GDP in trade and transport linked to the food system; D is food service, hotels, and restaurants; and E is input supply linked to agriculture and food processing. The total

AgGDP+ measure can therefore be written schematically as:

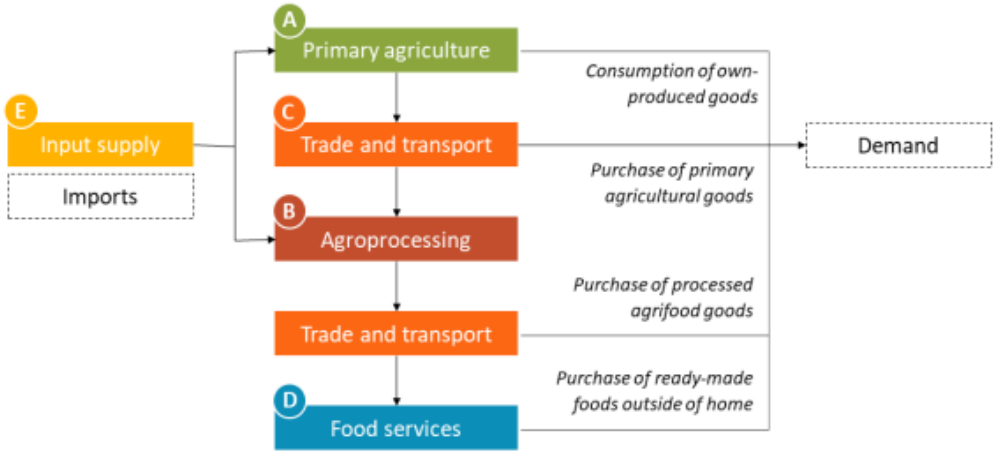
$$AgGDP+ \quad = \quad A + B + C + D + E \tag{1}$$

where each component is estimated as the relevant direct or implicit value added associated with agrifood-system activity.

Table 3: **Components of the agrifood system as per AgGDP+**

Component	Description
A	Primary agriculture GDP, including crops, livestock, forestry, and fisheries
B	Food processing GDP, including milling, dairy/meat processing, other food, and beverages
C	Implicit GDP in trade and transport linked to the food system
D	Hotels, restaurants, accommodation, and food services
E	Input-supply activities linked to agriculture and food processing

Figure 1: Conceptual framework of the agrifood system



Source: Thurlow et al. (2025)

3.3 Departures from the Global Food Dollar and AgGDP+ methods

We noted earlier that neither the Food Dollar approach nor the AgGDP+ approach can be directly applied to Indian data. We now explicitly describe how our exercise differs from each of the established methods - the Global Food Dollar approach and AgGDP+, as they have been applied for India. These differences have implications for the comparability of results with other work on

India.

Contrast with the Global Food Dollar

Our Food "Rupee" exercise is a national implementation of the approach that Yi et al. (2021) develop as the Global Food Dollar, but it differs in some ways. Yi et al. (2021) construct a standardized series spanning 61 countries over 2005-2015, harmonizing the underlying input-output and expenditure data so that farm and post-farmgate shares are comparable across different national accounting systems. India enters as one country within that harmonized panel, and the approach has since been operationalized as an official statistical product in the FAOSTAT Food Value Chain Domain (Cerilli et al., 2024). It is likely that the harmonized data are not at the same resolution as in the national accounts. We build directly on India's own MoSPI Supply-Use Tables, which lets us distinguish food at home from food away from home, separate the food sold in restaurants from the service of preparing it, and trace value through the Indian production structure as the national accounts actually record it. We also use a harmonized series that accounts for the change in the base year from 2011-12 to 2022-23.

A second difference is in the treatment of imports. The official Supply and Use Tables (SUT) do not explicitly disaggregate the flow of imported goods across specific industries and final consumers. Instead, imports are embedded within inter-industry transactions and final expenditures. While we utilize the average import share in total composite supply to isolate imports from private food consumption, the Input-Output coefficients and the resulting multiplier matrix still include imported commodities used as intermediate inputs. Furthermore, the utilization of imports is rarely uniform; certain commodities are used exclusively as intermediate inputs, while others are destined solely for final consumption. Consequently, applying a uniform average import share across all commodity supply may be an inadequate method for splitting imports from total composite consumption.

These differences can potentially result in estimates that differ from Yi et al. (2021). In general, we sacrifice the ability to make our analysis compatible with these prior efforts in the interest for being able to estimate farm shares in the consumer rupee and AgGDP+ over time using Indian data.

Contrast with the AgGDP+ approaches

AgGDP+ approaches have been applied to Indian data using two methods. In the first method, SUTs are integrated with a country level Social Accounting Matrix (SAM) that capture the flow of income and expenditure across various sectors and institutions. By integrating data from SUTs and SAMs, it is possible to trace the full scope of agriculture-related economic activities. Pal et al. (2026) draw on Thurlow et al. (2025). Pal et al. (2026), for example, and build on a state-level Social Accounting Matrix (SAM) for India for 2017-18. (Pal et al., 2020). They decompose the agrifood-system value added across states with particular attention to female and youth employment in state-specific value chains; their study is, in effect, a sub-national accounting of the agrifood system that exploits the SAM's representation of institutions, factors, and households. A second method is the standard AgGDP+ method that obtains primary agriculture, processing, and food-service value added directly from the national accounts and recovers the trade-and-transport and input-supply components by proportional allocation from the Supply-Use Tables - attributing to the agrifood system the share of each supporting sector's value added that corresponds to its food-related demand, without passing those flows through a multiplier (Thurlow et al., 2025).

Our implementation aligns more with the latter approach, but not fully. First, we work from the national MoSPI SUTs rather than a SAM, and at the national rather than the state level, so we do not capture the income-expenditure and institutional linkages that a SAM represents. Second, and more consequentially, we recover the trade, transport and input-supply components through the same IO table used in our Food Rupee calculation (from the Food Dollar method), rather than by the proportional allocation of the standard method. This means our AgGDP+ figures are not a direct replication of the Pal et al. (2026) or Thurlow et al. (2025) numbers and should not be expected to coincide with them.

This departure away from standard AgGDP+ implementation step allows internal comparability between our two approaches, the primary aim of our paper. We implement both approaches on the consistent 2011-12 to 2023-24 SUT series for India.

4 Findings and discussion

We organize the findings of our analysis based on both approaches around three results. First, we present the total size of the agrifood system, i.e. the value added in the agrifood related activities in India between 2011-12 and 2023-24. This offers a first view of the comparability of the two methods. Second, we present the "farm" share, in its various forms, to see what these two approaches reveal about the relative importance of the "farm" sector. Third, we focus on the the composition of the food value chain, examining the results from both approaches the trends and patterns of off-farm components of value added withing the agrifood system. Thereafter we focus on what these results tell us about agrifood system transformation in India.

4.1 Size of the AFS

Figure 2 shows the estimated size of the agrifood system in India in nominal terms over the period 2011-12 and 2023-24 as estimated via the two approaches. As of 2023-24, the size of India's agrifood system is US$ 3429 billion and US$ 3171 billion respectively in nominal prices. Estimates from the Food Dollar approach are consistently higher than that from the AgGDP+ approach. The extent to which it remains higher is about 6% in the first two years and has since remained remarkably stable at 8-9%. At first glance, this may seem surprising since the AgGDP+ covers both food and non-food commodities. Yet there is a specific reason for this.

The Food Dollar approach applies an Input-Output (IO) multiplier framework to estimate the value-added contribution from each industry within the supply chain. This value-added multiplier captures both direct and indirect value-added contribution due to the production in supply chain industry. The direct value-added contribution is the initial value added created during the production in the supply chain industries directly benefiting from the food demand. The indirect value added is the secondary value added created when supply chain industry purchases inputs from the non-supply chain industries (Canning, 2011).). As the Yi et al. (2025) show, indirect impacts increase disproportionately as incomes rise and economies increasingly specialize. In contrast, the AgGDP+ method isolates only the direct value-added contributions from core agrifood value chain activities. While this method includes input supplies from non-agrifood sectors to primary agriculture and agro processing, it excludes primary agricultural outputs used as inputs in non-processing

industries. Consequently, the estimated size of the Agrifood System (AFS) under the AgGDP+ method is consistently smaller than that generated by the Food Dollar method.

4.2 Farm share

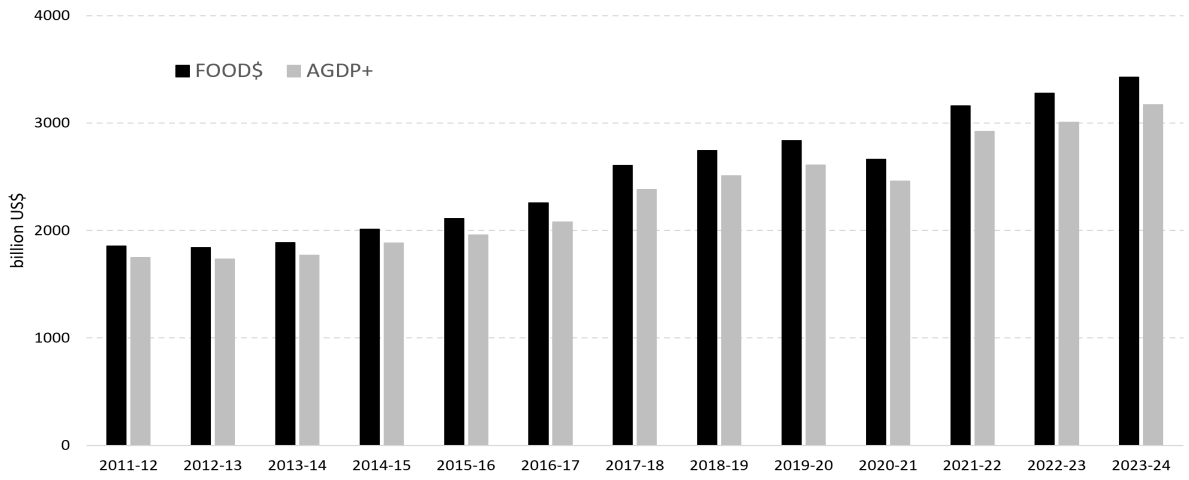
Because the two approaches share data and some methods, but differ in what they measure, the "farm" share figure means something different for each. We distinguish these below: first is the share of the consumer rupee reaching the farm gate in the Food Dollar approach. We present two series for consumer rupee spent on food at home and food away from home. Second, we present the share of agrifood system value added originating in primary agriculture in AgGDP+ which is a different notion of farm share. The two farm shares are therefore not expected to coincide. We also present for greater comparability a "value-added share" series generated via the Food Dollar approach. All of these are presented together in Figure 3.

Farm share of the consumer rupee

Under the Food Dollar approach, the farm share of the consumer food rupee in India is high by international standards and broadly stable, with a mild upward trend over the period (Figure 3). The farm share stands at 51.8% in 2011-12 and remains close to that level through the 2010s - 52.4% in 2013-14, 49.9% in 2015-16, 52.4% in 2016-17, and 53.0% in 2018-19 - before rising more noticeably in the most recent years, to 53.8% in 2019-20 and into the high-50s thereafter (58.2% in 2020-21, 60.0% in 2022-23, and 57.8% in 2023-24). A farm share around and above one-half is markedly higher than existing estimates most countries, especially high income countries. Yi et al. (2021), for example, report that farmers receive, on average, about 27% of at-home food expenditure across their 61 countries over the period 2005-15, falling within a 16-38% range for middle- and high-income economies

The contrast between food consumed at home and food consumed away from home is as expected. The share of expenditure accounted for by food away from home remains modest on the order of 10% in the early part of the period (10.3% in 2011-12, 11.6% in 2014-15), reducing to 7-9% range more recently (7.1% in 2019-20, 8.4% in 2022-23). Food away from home passes through longer chains, with restaurant preparation, service and associated trade absorbing value that would otherwise reach the farm.

Figure 2: **Size of the agrifood system: Estimates from the Food Dollar and AgGDP+ approaches**

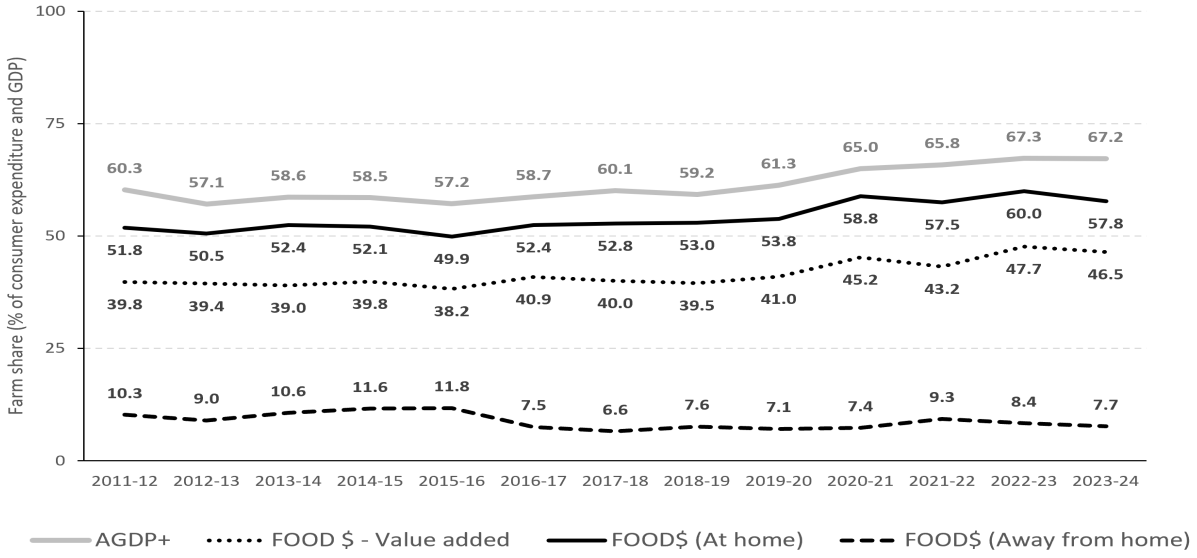


The composition of the food value chain

Decomposing the consumer food rupee across the eight supply-chain segments shows where the post-farm value accrues (Figures 4 and 5). Primary agriculture is the single largest segment throughout, accounting for about 40% of food value-chain value added in the 2010s (39.8% in 2011-12, 38.2% in 2015-16, 41.0% in 2019-20) and rising towards the mid-to-high 40s in the most recent tables (47.7% in 2022-23, 46.5% in 2023-24). Among the post-farm segments, trade is consistently the largest, at around 19-22% for most of the period (19.5% in 2011-12, rising to 22.2% in 2019-20) before dropping sharply in the revised tables (9.9% in 2022-23, 11.3% in 2023-24) - a discontinuity that coincides with the base-year revision and warrants caution in interpretation. Transport adds a further 10-11% throughout. Processing accounts for a relatively modest share, generally in the 6-10% range (8.6% in 2011-12, 6.0% in 2019-20, 9.2% in 2023–24). This figure is low relative to most high-income economies and consistent with a food system in which a large share of expenditure is still on minimally processed foods.

Two further patterns stand out. First, the segments associated with services and modern input supply grow over the period: the services input to the food chain roughly doubles, from 4.8% in 2011-12 to 7.5% in 2019-20 and 9.1% in 2023-24, reflecting the growing role of business, financial and logistics services in moving food from farm to table. Second, food service (the preparation-

Figure 3: **Farm share in consumer rupee and value added in the agGDP+**



and-service component, as distinct from food away from home on the demand side) remains a very small share of value added throughout, below 1%, underscoring that the away-from-home channel, while growing, is still a minor part of the overall food economy. Taken together, the picture is one of slow structural change, where primary agriculture remains dominant, trade and transport remain the main post-farm segments, and service-intensive segments are expanding but barely discernible in the larger scheme of things.

Figure 4: Value chain shares using the Food Dollar approach

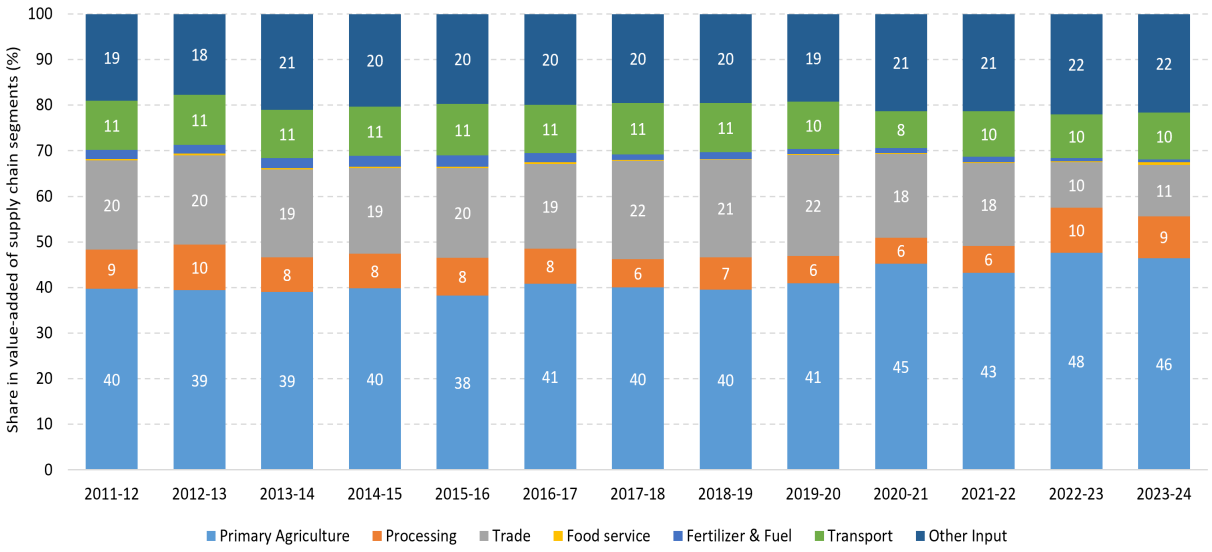
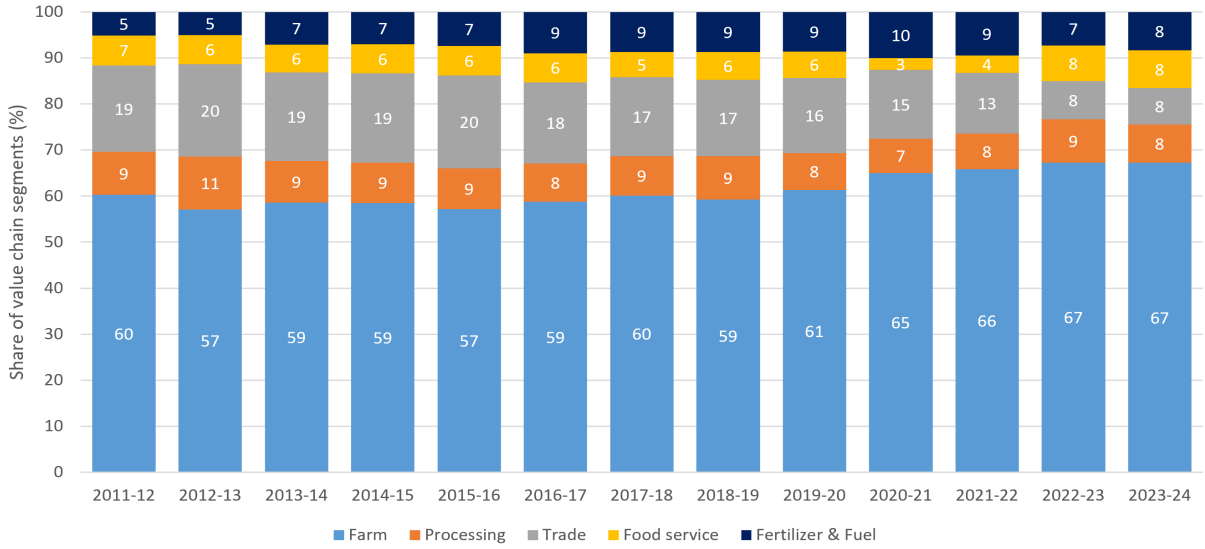


Figure 5: Value chain shares AgGDP+



The two approaches thus place the "farm" figure at different levels - around half of the consumer food rupee under the Food Dollar approach, and around two-thirds of agrifood-system value added under AgGDP+ (Figure 3). This is not because they use different data, but because they measure different things against different denominators. The Food Dollar farm share is bounded by what households spend on food and is reduced by every post-farm margin embodied in that spending; the AgGDP+ farm share is the primary-agriculture component of a production aggregate that, by construction, excludes much of the wider economy. Read together rather than against each other, the two results agree on a substantive point: primary agriculture remains unusually central to India's agrifood system, post-farm value is concentrated in trade and transport rather than in processing or food service, and the transformation of the system - through services, input supply, and away-from-home consumption - is under way but has so far been gradual.

4.3 The surprisingly slow transformation of India's agrifood system

Overall, these results sit oddly with the prevailing perception of a rapid transformation of India's agrifood system. The conventional story, echoing the global pattern, anticipates that as incomes rise the off-farm segments - processing, organized trade, food service - should expand briskly relative to primary agriculture, drawing value and labor beyond the farm gate (Barrett et al., 2022; Reardon and Timmer, 2007). Our estimates suggest that while these processes may be occurring, their

momentum has not been enough to shift the relative importance of primary agriculture: across both approaches, the farm and primary-agriculture shares are unusually high and stable, even rising over the period. Processing continues to remain a modest share of food value added and food service is apparently negligible. The channel representing food away-from-home, though growing, is still far from dominant. Whatever transformation is under way is gradual.

Our estimates from these two approaches describe the nature and trend of India's agrifood system and its components, but do not by themselves offer insights into why the structure should be so stable. It is plausible that the past decade has seen several disruptions, global conflicts, pandemics, etc., muddying trends over time. Beyond that, there is reason to believe that India is seeing an uneven, even a dual pattern of transformation. On the one hand, the food away-from-home channel is changing rapidly but from a base that is too small to reflect in aggregate numbers. On the other hand, the much larger at-home channel and the midstream that serves is transforming only slowly. We marshal evidence on each of these from existing literature that support this perspective.

A rapidly transforming but small away-from-home channel

The away-from-home segment in food consumption in India is widely perceived to be growing briskly. A key driver of this perception come from the food industry itself. Industry estimates suggest that India's food-services market is estimated to have grown from about INR 4 trillion in financial year 2020-21 to INR 7 trillion in financial year 2025-26, an 11-12% compound annual rate. Online food-delivery segment is deemed to be expanding at roughly 19% a year and the organized share of food services is purportedly rising from 36-41% to 47-52% over the same window (Investec Equities and Redseer, 2025). Yet, the same sources note, away-from-home food is estimated at only about 13% of total food consumption in India, considerably lower than the estimates for the United States and China for example, where they are estimated at 58-62% and 42-46% respectively (Investec Equities and Redseer, 2025).

This is consistent with decline we estimate in the farm share of food away from home (Section 4.2). The away-from-home chain may be lengthening mediationally and adding value along the chain, but because it accounts for under a tenth of food spending, its rapid internal change leaves has not dented the aggregate farm share, which continues to reflect the dominant share of food at

home spending. As eating out continues to grow, this channel will exert downward pressure on the aggregate farm share, but it has not yet done so.

A large at-home channel anchored in fresh or minimally processed food

The at-home channel, which dominates the aggregate, has changed far less than imagined, in the ways that would contribute to a lower farm share. The periodic nationally representative Household Consumption Expenditure Survey (HCES) conducted by the National Sample Survey Organization (NSSO) shows that the share of food in total household expenditure fell below half for the first time since independence to about 46.4% in rural and 39.2% in urban areas in 2022-23, from roughly 52.9% and 42.6% in 2011-12 (Ministry of Statistics and Programme Implementation, 2024c; Kapoor et al., 2024). Within this, the reallocation was mainly toward unprocessed or minimally processed, perishable, high-value items (milk and milk products, eggs, fish and meat, fresh fruits and vegetables) rather than toward highly processed or packaged products (Kapoor et al., 2024).

Further the nature of the shift in consumption patterns is noteworthy. There is a remarkable contrast between the *reach* and the *weight* of packaged processed food (PPF). The proportion of households consuming any PPF rose from 82.2% to 96.6% between 2011-12 and 2022-23, with biscuits and chocolates (69.5% to 86.8%) and packaged chips (7.4% to 44.2%) leading the increase (International Maize and Wheat Improvement Center (CIMMYT), 2024). Yet PPF's share of total monthly consumption expenditure rose only from 2.2% to 2.9% - an absolute gain of less than one percentage point in a decade - and remained concentrated among the richest households, the top decile alone accounting for roughly a fifth of all PPF spending (International Maize and Wheat Improvement Center (CIMMYT), 2024). Processed food has, in other words, become almost universal in reach but remains marginal in the budget and skewed toward affluent urban consumers - a pattern that unsurprisingly barely transforms off-farm value-added shares.

It would seem therefore that diet diversification has been occurring without a pronounced shift into high levels of processing, as suggested by the share of the processing sector and the slow movement in the AgGDP+ off-farm share (Section 4).

A large and growing midstream with thin margins

On the supply side, the midstream that should drive off-farm transformation is dominated by a dispersed mass of small, informal enterprises - the "quiet revolution" in the "hidden middle" (Reardon, 2015). In 2015-16, about 21 million post-farmgate food businesses - one-third of India's roughly 63 million unincorporated off-farm enterprises - linked some 146 million farmers to nearly 1.3 billion consumers, employing about 25.6 million men and 9.6 million women (Gupta et al., 2023). Between 2010-11 and 2015-16 the Gross Value Added of these post-farmgate businesses grew by about $16.3 billion (from $22.9 to $39.2 billion), an increment comparable in absolute terms to the $19.5 billion added by the primary-production sector. Yet, the the latter is nearly ten times larger (Gupta et al., 2023). These enterprises are, on average, smaller, more likely to be informal, and more dependent on non-institutional credit than their non-food counterparts: the midstream is growing in aggregate while remaining structurally unconsolidated, adding value incrementally across many marginal units rather than through the high-value processing and organized retail that would register as a sharp rise in off-farm shares.

The Annual Survey of Unincorporated Sector Enterprises (ASUSE) records continued growth in establishment numbers, rising to about 65.0 million non-agricultural establishments in 2022-23 and by a further 12.8% in 2023-24, but this expansion has been driven disproportionately by own-account enterprises with no hired workers, with employment growing more slowly than the count of establishments and only about 8% of rural informal units (against 23% of urban units) hiring even a single worker (Ministry of Statistics and Programme Implementation, 2024b,a). The drift toward own-account units points to thinner, lower-productivity activity even as the midstream burgeons.

Processing seems to be concentrated in primary, low-value-addition activity. The unorganized segment accounts for roughly three-quarters of food-processing employment but only about a tenth of output, and overall value addition in food products has been assessed at under 10% (Kumar et al., 2022); in the National Accounts, unincorporated enterprises' share of manufacturing value added has held within a narrow 12-14% band for more than a decade (Data For India, 2025). Within registered food manufacturing, grain milling, edible oils, dairy, "other foods" and sugar together account for more than 74% of gross output, and grain milling - the single largest sub-sector by output - ranks only third by value added, confirming its low-value character (Kumar et al., 2022).

A processing sector this milling-heavy, unorganized, and low in value addition cannot lift off-farm shares quickly, and its character explains why rising at-home processed-food penetration does not translate into a sharp rise in the off-farm share we measure.

Our findings are surprising but by no means do these results imply that India's agrifood system is static. Rather, the transformation is real but uneven. In this sense too, India's agrifood system transformation may be atypical.

A final cautionary note on the interpretation of these numbers is worth highlighting. The shares estimated via both the Food Dollar and AgGDP+ approach do not represent welfare. A high farm share of the consumer rupee need not imply that farmers capture a correspondingly high net return once input costs are accounted for. It is also the case, that long, mediationally complex value chains (Barrett et al., 2022; Reardon et al., 2025; Reardon, Thomas and Minten, Bart, 2021) may reflect in a lower farm share but they may also leave the farmer with higher net returns than a low return, short value chain that is associated with a higher farm share.

5 Comparison of the two approaches

We started Section 4 by presenting estimates from both approaches together. We noted too that there were systematic differences between the two. In this section, we reflect on the possible reasons for these differences. It is tempting to treat the Food Dollar and AgGDP+ approaches as rival ways of measuring the same thing. However, they are best viewed as complementary and not competing approaches. Both methods rest on the same data, the same basic-price adjustment, the same commodity-by-commodity matrix, and the same Leontief inverse; both recognise that agrifood value chains straddle the primary, secondary and tertiary sectors. But they differ in what they derive from it. The Food Dollar approach is a demand-side decomposition: it begins from food expenditure, and its denominator is food expenditure, so a sector's share answers "how much of the food rupee does this segment receive?" The Food Dollar approach measures how the value of consumer food expenditure is distributed across supply-chain segments. AgGDP+ is a production-side aggregation: it sums value added across the system, and its denominator is GDP or value added, so a component's contribution answers "how much of the agrifood system's value added does this part generate?" AgGDP+ measures the level of value added generated by the agrifood

system.

This fundamental difference in framing means that the two methods can yield different estimates of the same sector's "importance" since one measures a share of expenditure and the other measures a level of GDP. Hence, the two can characterise the same sector differently without necessarily being inconsistent.Differences in their results reflect differences in the question asked, and are not on account purely of differing data or technique.

Thus, although the two methods are comparable in spirit and motivation and rely on the same basic data, the two approaches can produce different rankings or shares for the same sector because they are answering different questions. This should be expected. Trade provides a useful example. In the Food Dollar approach, trade can have a large share if a large part of consumer food expenditure pays for wholesale and retail services. In AgGDP+, trade's contribution depends on the agrifood-related part of trade-sector value added relative to total agrifood-system GDP. The same trade margin therefore enters both methods, but the denominator and interpretation differ. Food services are another example. Food away from home can be important in the Food Dollar if the consumption bundle includes restaurant expenditures. In AgGDP+, hotels and restaurants enter as a downstream component of the agrifood system, but their measured contribution depends on how much of the sector's value added is attributed to food-system activity In general, therefore, a sector may account for a large share of the consumer Food Dollar but a smaller share of agrifood-system GDP, or vice versa. We highlight some of these differences below.

5.1 Methodological differences

Object of measurement and denominator

This is the fundamental difference between the two approaches as implemented. The Food Dollar approach reasons backward from final demand: it begins with what households spend on food, traces that spending through the inverse to the value added it implies, and expresses each segment as a share of food expenditure. AgGDP+ reasons forward from production: it sums value added in agriculture and agriculture-linked activities and expresses each component as part of agrifood-system value added. The denominators differ accordingly-food expenditure in the first case, value added or GDP in the second - so a sector's "share" is simply not the same quantity across the

two methods, even for the same sector in the same year. This is why the two "farm" figures sit at different levels: about half of the consumer food rupee under the Food Dollar approach, against roughly two-thirds of agrifood-system value added under AgGDP+.

Boundaries of the agrifood system

A key difference between the AgGDP+ is that it includes all non-food components of agriculture as well. AgGDP+ begins from primary agricultural production and so includes the non-food components of agriculture - fibres, other non-food crops, etc. - alongside the food-related ones. The Food Dollar by definition tracks food expenditures and does not concern itself with final consumption expenditure on non-food items. Within this, the Food Dollar approach distinguishes between Food at Home (FAH), Food and Tobacco at Home (FTAH), and Food and Accommodation Away from Home (FAAFH), since each category has a different supply chain structure and hence a different decomposition. AgGDP+ does not make this distinction on the demand side; it works from production, summing GDP contributions regardless of where the food is ultimately consumed. Another source of difference is that the food dollar approach captures both the direct and indirect effects of an additional unit expenditure on food; this is not the case with the agGDP+ approach. While there is significant overlap between of what is included in the two approaches they are not identical. The gap between the two approaches may therefore matter more for activities that serve both food and non-food flows.

Treatment of the trade and transport margin

Both methods rely on the same basic-price reallocation of trade and transport margins, and both rely on the Leontief inverse, so the difference here is one of emphasis and detail rather than of fundamentally different technique. The Food Dollar approach treats trade and transport as supply-chain segments in their own right and reports their value-added shares as part of the consumer-rupee decomposition; trade typically emerges as the largest post-farm segment. AgGDP+ reports the food-serving portion of trade and transport as component C of agrifood-system value added, bounded by the food system as defined on the production side. The same underlying margin therefore enters both methods, but it is expressed against a different denominator and within a differently drawn boundary, which is why trade can be a large share of the consumer food rupee

yet a more modest, differently measured part of agrifood-system value added.

Table 4 summarizes the dimensions along which the two approaches agree and differ.

Table 4: **The Food Dollar (Food Rupee) and AgGDP+ approaches compared**

Dimension	**Food Dollar (Food Rupee)**	**AgGDP+**
Data source	*Shared*: MoSPI Supply-Use Tables	
Price basis	*Shared*: conversion to producer prices; margins reallocated to trade and transport	
Core matrix	*Shared*: commodity-by-commodity table; Hotels split into food-away and food-service	
Leontief inverse	*Shared*: a single $L = (I - A)^{-1}$, used by both	
Main question	Where does a rupee of food expenditure go?	How much value added does the agrifood system generate?
Starting point	Final food expenditure	Value added in agriculture and agriculture-linked activity
Denominator	Food expenditure / food final demand	GDP / value added
Core output	Shares of the food rupee by supply-chain segment	Size and composition of agrifood-system value added
System boundary	Food expenditure only; distinguishes at-home vs away-from-home; includes direct and indirect effects	Begins from primary agriculture; includes non-food agriculture; no demand-side split; includes only direct effects.
Trade & transport	Reported as supply-chain segments in the consumer-rupee decomposition	Reported as component C of agrifood-system value added
Best suited for	Consumer-facing value-chain decomposition; farm vs post-farm shares	Economy-wide footprint of the agrifood system; policy relevance of agriculture-linked value added
Imports	Food demand scaled by domestic share $(1 - m)$; only domestically supplied food traced.	Imported intermediates contribute no domestic value added; enter only via reduced domestic output.
Interpretation risk	A high share is a high share of *food spending*, not of value added	A large contribution is a level of value added, not a decomposition of the consumer rupee

5.2 Complementary rather than competing approaches

We propose that the two approaches have different strengths and each is more suited to answer some questions rather than others.

The Food Dollar approach is better suited for understanding how consumer expenditure flows through the value chain and for identifying where value is added along the chain. The Food Dollar approach is the natural choice when the question concerns the structure of food value chains from

the consumer's side: how much of food expenditure reaches farms, how large the post-farm-gate share has become, and which segments absorb the value of what households pay. Given its demand side anchoring and its ability to track food at home and food away from home expenditures explicitly, it offers an invaluable tool to study the distributional consequences of demand-led changes in the agrifood system. This also makes the Food Dollar approach more amenable to conducting simulation exercises to understand the distributional implications of demand side shocks, for example.

AgGDP+ is better suited to questions about the economywide size of the agrifood system. It is the natural choice when the question concerns the weight of the whole agrifood system in the economy: how much value added agriculture and its linked activities generate, and how that total is distributed across primary production, processing, trade and transport, food service, and input supply. Its production-side construction makes it well suited to assessing the economy-wide footprint of the system and to supporting the case for investment in rural development, food infrastructure, and post-harvest enterprises. The AgGDP+ approach is better suited to track transformations in individual value chains. In contrast to the Food Dollar approach that starts with the final consumption of food, that represents a composite food basket, the AgGDP+ can track individual value chains and offer a comparative perspective of the type of linkages different value chains entail and the changes in these structures.

6 Conclusion

This paper aimed to offer a comparative perspective of two prominent and popular methods to examine the transformation of agrifood systems globally. So far these efforts have run parallel to each other making it difficult to compare these methodologies. Estimating both on a single, consistent Indian dataset allows us to do this.

The Food Dollar and AgGDP+ approaches are motivated by the same empirical problem. Conventional sectoral GDP accounts understate the economic role of agriculture and food because many activities that make food available to consumers are counted outside primary agriculture. Processing is counted in manufacturing; trade, transport, storage, and restaurants are counted in services; upstream input supply is spread across manufacturing, trade, and other sectors. Both

approaches therefore use an economy-wide SUT-based accounting framework to trace agrifood activity beyond the farm. The two approaches nevertheless measure different objects. The Food Dollar approach starts from consumer food expenditure and asks how the value of a rupee spent on food is distributed across farm and post-farm supply-chain activities. AgGDP+ starts from the agrifood system as a production system and asks how much GDP or value added is generated by agriculture and agriculture-linked activities. Put simply, the Food Dollar is demand and expenditure-centered, while AgGDP+ is production and GDP-centered.

This distinction is important for interpretation. A sector's Food Dollar share tells us how much of consumer food spending is embodied in that sector's value added. A sector's AgGDP+ contribution tells us how much that sector contributes to the economy through agrifood system activity. These quantities may move together, but they need not be equal because they have different denominators and different system boundaries. The two are therefore best read together as complementary approaches to understanding the agrifood system.

Despite these differences in vantage points and methods, a coherent story of agrifood system transformation of India emerges. Primary agriculture is unusually central to the agrifood system, whether measured as a share of the consumer rupee or as a share of agrifood-system value added; post-farm value is concentrated in trade and transport rather than in processing or food service; and the modernisation of the system, through services, input supply, and away-from-home consumption, is under way but has so far been gradual. The findings of this paper suggest that constraints to agrifood-system transformation in India, as elsewhere, may well lie outside the agrifood system itself, for example, in changes in consumer preferences, productivity and structural change in the nonfarm economy. These are themselves shaped by broader processes of economic transformation so that the agrifood system both contributes to and is at the same time constrained by the broader economic transformation.

We view our paper as a first exploration comparing these approaches, but by no means the last. There remains much to unpack in terms of our understanding of the differences across source data and finer distinctions across various methods. Our paper is an invitation to researchers to strengthen this line of inquiry.

Appendix

A A description of IO activities

Sr. No	IO activities	Sr. No	IO activities
1	Paddy	71	Petroleum products
2	Wheat	72	Coal tar products
3	Coarse cereals	73	Inorganic chemicals
4	Gram	74	Organic chemicals
5	Arhar	75	Fertilizers
6	Other pulses	76	Pesticides
7	Groundnut	77	Paints, varnishes and lacquers
8	Rapeseed and mustard	78	Drugs and medicine
9	Other oil seeds	79	Soaps, cosmetics and glycerin
10	kapas	80	Synthetic fibres, resin
11	jute, hemp and mesta	81	Other chemicals and chemical products
12	Sugarcane	82	Cement
13	Coconut	83	Non metallic mineral products
14	Tobacco	84	Iron and steel Ferro alloys
15	Tea	85	Iron and steel casting and forging
16	Coffee	86	Iron and steel foundries
17	Rubber	87	Non ferrous basic metals (including alloys)
18	Fruits	88	Hand tools, hardware
19	Vegetables	89	Miscellaneous metal products
20	Other food crops	90	Tractors and other agricultural implements
21	Milk	91	Industrial machinery for food and textile industry
22	Wool	92	Industrial machinery (except food and textile)
23	Egg and poultry	93	Machine tools
24	Other livestock products	94	Other non electrical machinery
25	Industry Wood	95	Electrical industrial machinery
26	Firewood	96	Electrical cables, wires
27	Other forestry products	97	Batteries
28	Inland Fish	98	Electrical appliances
29	Marine Fish	99	Communication equipment
30	Coal and Lignite	100	Other electrical machinery
31	Natural Gas	101	Electronic equipment including T.V
32	Crude petroleum	102	Medical precision, optical instrument
33	Iron ore	103	Watches and clocks
34	Manganese ore	104	Ships and boats
35	Bauxite	105	Rail equipment
36	Copper ore	106	Motor vehicles
37	Other Metallic minerals	107	Motorcycles and scooters
38	Limestone	108	Bicycles, cycle-rickshaw
39	Mica	109	Aircrafts & Spacecrafts
40	Other non metallic minerals	110	Other transport equipment
41	Processed poultry meat & poultry meat products	111	Gems & jewellery
42	Processed other meat & meat products	112	Miscellaneous manufacturing
43	Processed fish & fish products	113	Construction and construction services
44	Processed fruits & Processed Vegetables	114	Electricity
45	Dairy products	115	Gas
46	Edible Oils and Fats	116	Water Supply
47	Grain Mill products, starch and starch products	117	Trade
48	Sugar	118	Repair & Maintenance of Motor Vehicle
49	Bread & Bakery products	119	Food away from home

(continued)

Sr. No	IO activities	Sr. No	IO activities
50	Miscellaneous food products	120	Food service
51	Alcoholic beverages	121	Railway transport
52	Non-alcoholic beverages	122	Land transport
53	Tea processed	123	Air transport
54	Coffee processed	124	Water Transport
55	Tobacco Products	125	Supportive and Auxiliary transport activities
56	Cotton Yarn and Cotton Textiles	126	Storage and warehousing
57	Synthetic yarn and synthetic textiles	127	Communication services
58	Wool yarn and woolen textiles	128	Financial services
59	Silk yarn and silk textiles	129	Insurance services
60	Carpet weaving	130	Ownership of dwellings
61	Ready made garments	131	Real estate services
62	Misc. textile products	132	Renting of machinery & equipment
63	Leather footwear	133	Research & Development Services
64	Leather and leather products except footwear	134	Legal services
65	Wood and wood products except furniture	135	Other Business services
66	Paper, Paper products and newsprint	136	Computer related services
67	Publishing, printing and allied activities	137	Public administration and defence
68	Furniture & Fixtures	138	Education services
69	Rubber products	139	Human health and social care services
70	Plastic products	140	Community, social and personal services
		141	Recreation, entertainment and radio & TV broadcasting and other services

B Estimate farm share using I-O multiplier model

Let us assume

- C_{AG} be the set of agriculture commodities
- C_{NA} be the non-agriculture commodity
- $\mathbf{A}_{C\times C}$ be the Leontief I-O coefficient matrix
- $\mathbf{L}_{C\times C}$ be the I-O inverse matrix or multiplier matrix
- $\mathbf{YFD}_{C}$ be the column vector of final demand all commodities "C" or final food bill
- $\mathbf{SFM}_{C}$ be the column vector that contains share of import in final demand
- $\mathbf{X}_{C}$ be the commodity output vector.
- $\mathbf{XAG}_{C_{AG}}$ be the vector for agriculture commodity output
- $\mathbf{ONE}_{C,C}$ identity matrix whose diagonal elements are "1" and off diagonal elements are "0".

$$\mathbf{A}_{C\times C} = \mathbf{INTP}_{C,C} \times \text{diag}(\mathbf{X}_{C})^{-1} \tag{2}$$

$$\mathbf{L}_{C\times C} = (\mathbf{ONE}_{C,C} - \mathbf{A}_{C,C})^{-1} \tag{3}$$

Using Eq. 3 the gross output of agricultural activities (C_{AG}) linked to food expenditures is measured as:

$$\mathbf{XAG}_{C_{AG}} = \mathbf{L}_{C_{AG},C} \times \mathbf{YFD}_{C_{AG}} \tag{4}$$

Intra-industry (agriculture-to-agriculture) sales amount to double counting, so must be deducted as follows:

$$\mathbf{YFDnet}_{C_{AG}} = \mathbf{YFD}_{C_{AG}} - (\mathbf{A}_{C_{AG},C_{AG}} + \mathbf{A}_{C_{AG},C_{AN}} \times \mathbf{L}_{C_{NA},C_{AN}} \times \mathbf{A}_{C_{AN},C_{AG}}) \times \mathbf{YFD}_{C_{AG}} \tag{5}$$

The farm share is obtained as follows:

$$\textit{farm share} = (\mathbf{UNIT}_{C} \times \mathbf{YFDnet}_{C_{AG}}) \times (\mathbf{UNIT}_{C} \times \mathbf{YFD}_{C_{AG}})^{-1} \tag{6}$$

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