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GROWTH AND STRUCTURAL CHANGE IN AGRICULTURAL GROSS VALUE ADDED IN INDIA: A SUB-SECTORAL DECOMPOSITION ANALYSIS

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Abstract: The structural composition of Indian agriculture has undergone a significant transformation over the past two decades, with allied sectors—particularly livestock and fisheries—emerging as critical drivers of agricultural Gross Value Added (GVA). This paper examines the growth dynamics and structural composition of agricultural Gross Value Added (GVA) in India at the sub-sectoral level during 2011-12 to 2022-23. Using data from the National Accounts Statistics published by NSO, the study employs the 2011-12 base year series, which provides a complete and internally consistent time series with full sub-sectoral disaggregation for the entire study period; the rationale for this choice vis-à-vis the recently released 2022-23 base year series is discussed. The analytical framework combines compound annual growth rate estimation, structural composition analysis, the Norm of Absolute Values index of structural change, and growth decomposition. Employing trend analysis, compound annual growth rate (CAGR) estimation, and structural decomposition methods, the study reveals that the combined share of livestock and fisheries in agricultural GVA has risen from approximately 28.4 per cent in 2011-12 to nearly 34.8 per cent in 2022-23 at current prices. Livestock alone contributed approximately 30.19 per cent of GVA from agriculture, forestry, and fishing in 2022-23, while fisheries accounted for about 6.5 per cent. The CAGR of livestock GVA (7.93 per cent at current prices) consistently outpaced that of the crop sector (5.84 per cent), indicating a discernible diversification trajectory. The paper discusses the implications of this structural shift for food security, rural livelihoods, employment

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generation, and agricultural policy design, and recommends targeted investments in allied sector infrastructure, value chain development, and institutional credit access to sustain this growth momentum.

Keywords: Agricultural GVA, Livestock, Fisheries, Allied Sectors, Structural Transformation, National Accounts Statistics, India

JEL Classification: Q10, Q13, Q14, Q22

1. INTRODUCTION

Agriculture remains the mainstay of the Indian economy, employing approximately 42.3 per cent of the total workforce and contributing about 18.3 per cent to the national Gross Domestic Product (GDP) at current prices in 2022-23 (Economic Survey, 2022-23). However, the characterisation of Indian agriculture as predominantly a crop-based enterprise is increasingly becoming an oversimplification. The broader agricultural sector, as defined in the System of National Accounts (SNA) and adopted by the National Statistical Office (NSO), India, encompasses four sub-sectors: crops, livestock, forestry and logging, and fishing and aquaculture. Among these, the allied sectors—primarily livestock and fisheries—have demonstrated remarkable dynamism in recent decades, consistently registering higher growth rates than the crop sector and progressively enhancing their share in total agricultural Gross Value Added (GVA).

The concept of Gross Value Added at basic prices, introduced following India's adoption of the 2008 SNA framework with the base year revision to 2011-12, provides a more accurate measure of sectoral economic contribution by accounting for production taxes net of subsidies. Under this framework, the GVA from agriculture and allied activities is disaggregated into crops, livestock, forestry and logging, and fishing and aquaculture, enabling precise analysis of structural shifts within the sector.

The growing significance of allied sectors is not merely a statistical phenomenon but reflects fundamental transformations in consumption patterns, dietary diversification, income growth, urbanisation, and policy orientation. India is the world's largest producer of milk (230.58 million tonnes in 2022-23, as per the Department of Animal Husbandry and Dairying), the second-largest producer of fish (175.45 lakh tonnes in 2022-23), and hosts the world's largest livestock population (approximately 536.76 million as per the 20th Livestock Census, 2019). Yet, despite these achievements, the academic

literature on the precise quantification and temporal analysis of allied sector contributions to agricultural GVA remains insufficiently developed, with most studies relying on aggregate GDP figures or production volume data rather than value-added metrics.

This paper addresses this research gap by undertaking a systematic and rigorous analysis of the contribution of livestock and fisheries to agricultural GVA in India over the period 2011-12 to 2022-23. The specific objectives of the study are: (a) to quantify the absolute and relative contribution of livestock and fisheries sub-sectors to total agricultural GVA at both current and constant (2011-12) prices (see Section 3.4 for justification); (b) to estimate the growth dynamics of these sub-sectors using compound annual growth rates and trend analysis; (c) to examine the structural shift in the composition of agricultural GVA over the study period; and (d), to discuss the policy implications of the observed trends for sustainable agricultural development and rural livelihood diversification.

The remainder of the paper is organised as follows: Section 2 presents a review of relevant literature; Section 3 describes the data sources and methodology; Section 4 presents the results and discussion; Section 5 offers conclusions and policy recommendations.

2. REVIEW OF LITERATURE

The structural transformation of agriculture—characterised by a declining share of crops and an increasing share of allied activities—has been documented in several studies across developing economies. Kuznets (1966) and Chenery (1979) established the theoretical foundations of structural change, arguing that economic development is invariably accompanied by sectoral reallocation of resources and output. In the specific context of Indian agriculture, several scholars have examined various dimensions of this transformation.

Chand *et al*. (2015) analysed the changing composition of agricultural output in India and observed that the share of livestock in agricultural GDP increased from 22 per cent in 1980-81 to about 26 per cent in 2012-13, attributing this shift to rising demand for animal-source foods driven by income growth and urbanisation. Their study, however, relied on the older GDP estimation methodology with base year 2004-05 and did not extend to the GVA framework adopted after 2015.

Kumar *et al*. (2017) examined the growth performance of the livestock sector using National Accounts Statistics data and reported that livestock GVA grew at a CAGR of 5.5 per cent (at constant 2011-12 prices) between 2011-12 and 2015-16, significantly higher than the crop sector growth of 1.7 per cent during the same period. They highlighted the counter-cyclical nature of livestock income, which provides resilience to agricultural households during crop failures.

Birthal *et al*. (2019) provided a comprehensive analysis of structural change within Indian agriculture using unit-level data from the Situation Assessment Surveys and National Accounts Statistics. They found that diversification towards high-value commodities, including livestock products and fish, was positively associated with farm income growth and poverty reduction. Their findings underscored the role of market access, infrastructure, and institutional support in facilitating this diversification.

In the context of fisheries, Datta *et al*. (2018) documented the rapid growth of the aquaculture sub-sector, which grew at over 10 per cent annually in value terms during 2004-05 to 2016-17. They noted that the fisheries sector's contribution to agricultural GDP had risen from about 4 per cent in the early 2000s to over 6 per cent by 2016-17, driven largely by the expansion of inland aquaculture and export-oriented shrimp farming.

Rao *et al*. (2019) examined the employment dimensions of allied sectors and found that while the crop sector's employment elasticity had turned negative, livestock and fisheries continued to generate incremental employment, particularly for women, landless households, and small and marginal farmers. This labour absorption capacity was identified as a key welfare attribute of allied sector growth.

The National Statistical Office's methodology for estimating GVA from livestock and fisheries has been documented in the "Sources and Methods" publication (CSO, 2012; NSO, 2019). For livestock, the estimation involves computing the value of output from milk, meat, eggs, wool, dung, increment in stock, and other products, net of intermediate consumption (feed, veterinary services, etc.). For fisheries, the value of fish catch (marine and inland) is estimated using landing data, aquaculture production statistics, and fish prices, net of input costs.

The Government of India's National Livestock Mission (2014-15), Rashtriya Gokul Mission, Blue Revolution (Neel Kranti Mission), and the

Pradhan Mantri Matsya Sampada Yojana (PMMSY, 2020) represent major policy interventions aimed at enhancing productivity and value addition in allied sectors. The economic impact of these interventions on sectoral GVA, however, remains inadequately assessed in the peer-reviewed literature.

The present study contributes to this literature by providing an updated, comprehensive, and methodologically rigorous analysis of allied sector contributions to agricultural GVA through 2022-23, employing the current base year (2011-12) estimates and disaggregating the analysis across livestock and fisheries sub-sectors.

3. DATA AND METHODOLOGY

3.1. Data Sources

The study relies on secondary data obtained from the following official sources: National Accounts Statistics (various issues) published by the National Statistical Office (NSO), Ministry of Statistics and Programme Implementation (MoSPI), Government of India; the Press Notes on Advance Estimates and Provisional Estimates of National Income published by NSO; the Basic Animal Husbandry Statistics published by the Department of Animal Husbandry and Dairying (DAHD); the Handbook on Fisheries Statistics published by the Department of Fisheries; and the Economic Survey (various years) published by the Ministry of Finance.

The GVA data at both current prices and constant (2011-12) prices have been extracted for the period 2011-12 to 2022-23. The sub-sectoral disaggregation follows the National Industrial Classification (NIC) 2008 framework, where Section A (Agriculture, Forestry, and Fishing) is divided into: Division 01 (Crop and Animal Production, Hunting, and Related Service Activities), Division 02 (Forestry and Logging), and Division 03 (Fishing and Aquaculture). Within Division 01, the NSO provides separate estimates for crops and livestock.

3.2. Analytical Framework

The methodology employs the following analytical tools:

***Structural Composition Analysis*:** The percentage share of each sub-sector (crops, livestock, forestry and logging, fishing and aquaculture) in total agricultural GVA is computed for each year as:

$$S_{it} = \frac{GVA_{it}}{GVA_{At}} \times 100$$

Where,

S_{it} denotes the share of sub-sector i in year t

GVA_{it} is the Gross Value Added of sub-sector i in year t, and

GVA_{At} is the total GVA from Agriculture, Forestry, and Fishing in year t.

Compound Annual Growth Rate (CAGR): The CAGR is estimated using the exponential growth model:

$$\ln(GVA_t) = \alpha + \beta t + \epsilon_t$$

Where β represents the instantaneous growth rate, and the CAGR is computed as ($e^{\beta} - 1$). The semi-log model is estimated using Ordinary Least Squares (OLS), and the statistical significance of the growth rate is tested using the t-statistic.

Structural Change Index: To measure the overall magnitude of structural change, the study employs the Norm of Absolute Values (NAV) index:

$$NAV = \frac{1}{2}\sum_{i=1}^{n} | S_{iT} - S_{i0} |$$

Where,

S_{iT} represents the share of sub-sector i in the terminal period, and

S_{i0} represents the share of sub-sector i in the base period,

The NAV index ranges from 0 (no structural change) to 100 (complete structural change).

***Growth Decomposition*:** The contribution of each sub-sector to overall agricultural GVA growth is decomposed as:

$$C_i = \frac{S_{i0} \times g_i}{g_A} \times 100$$

Where,

C_i is the percentage contribution of sub-sector i to total agricultural GVA growth,

S_{i0} is the initial share of sub-sector i,

g_i is the growth rate of sub-sector i, and

g_A is the growth rate of total agricultural GVA.

3.3. Estimation Procedures

All monetary values are expressed in lakh crore (₹) or crore (₹) as appropriate. Growth rates are estimated for the full period (2011-12 to 2022-23) and for two sub-periods: Period I (2011-12 to 2016-17) and Period II (2017-18 to 2022-23), to capture possible acceleration or deceleration in growth. Real growth is assessed using constant (2011-12) price data to eliminate the confounding effect of price changes, while nominal growth at current prices captures the combined effect of volume and price changes.

3.4. Justification for the Use of Base Year 2011-12 Series

It is pertinent to note that the National Statistical Office undertook a comprehensive revision of the national accounts base year from 2011-12 to 2022-23, with the new series officially released in May 2026 (NSO, 2026). The present study, however, employs the 2011-12 base year series throughout. This methodological choice is deliberate and is justified on the following grounds.

- First, at the time of finalisation of this manuscript, the new base year (2022-23) series released by NSO provides estimates only for a limited number of recent years. The complete back-series spanning 2011-12 to 2021-22 under the new base has not yet been officially published in its entirety with full sub-sectoral disaggregation for agriculture (crops, livestock, forestry and logging, and fishing and aquaculture separately). The NSO's standard practice during base year revisions involves releasing forward estimates initially, followed by back-series estimates at a later stage after extensive reconciliation and validation. Until the official back-series is released with the requisite level of sub-sectoral disaggregation, any attempt to reconstruct the entire time series under the new base would require splicing techniques that introduce additional estimation uncertainty.
- Second, the 2011-12 base year series offers a complete, internally consistent, and fully validated time series for the entire study period (2011-12 to 2022-23), with all estimates having undergone the full cycle of advance, provisional, quick, first revised, second revised, and third revised estimation stages (up to 2019-20). This maturity of estimates ensures a higher degree of reliability compared to the

nascent 2022-23 base series, where even the initial estimates for recent years remain subject to future revisions.

- Third, the methodological documentation—including the detailed "Sources and Methods" compendium—for the 2011-12 base year series is comprehensively published and widely available in the academic domain, enabling full transparency and replicability of the analysis. The corresponding methodological documentation for the new 2022-23 base year, detailing any changes in estimation procedures, data sources, coverage, classification frameworks, and deflation methods for agricultural sub-sectors, is expected to be published progressively over the coming months. In the absence of this complete documentation, interpreting the new series estimates—particularly the constant price (real) growth figures which depend critically on the deflation methodology and the choice of price indices—would be methodologically premature.
- Fourth, the fundamental analytical conclusions of this study—concerning the direction, magnitude, and structural character of the shift towards allied sectors—are unlikely to be materially altered by a base year revision. A change in base year primarily affects the absolute level of constant-price GVA estimates (by rebasing the price vector) and may modestly alter year-to-year growth rates (due to updated weighting structures and improved data inputs), but it does not typically reverse the direction of observed structural trends. The current price estimates, which form the basis of the structural composition analysis (percentage shares), are affected by base year revisions only to the extent that methodological improvements lead to re-estimation of output volumes or input costs—such changes tend to be marginal for well-established sub-sectors like crops, livestock, and fisheries. Indeed, preliminary indications from the initial new-base estimates released by NSO suggest that the broad structural story—of rising allied sector share and declining crop sector share in agricultural GVA—is preserved, and may in fact be more pronounced under the new methodology due to improved coverage of previously under-enumerated livestock and fisheries activities.

- Fifth, comparability with the existing body of literature is an important consideration. The overwhelming majority of published studies on Indian agricultural GVA structure that cover any part of the 2011-12 to 2022-23 period employ the 2011-12 base year series. Using the same base facilitates direct comparison of the present study's findings with prior research, enabling a cumulative and coherent scholarly discourse, and
- Sixth, from an analytical perspective, using 2011-12 as both the base year for deflation and the starting year of the study period provides an elegant methodological symmetry: the base year values are identical in current and constant price series, providing a clean and unambiguous reference point for measuring both real growth and structural change over the ensuing eleven years.

It is acknowledged that once the complete back-series under the 2022-23 base year is officially released with full sub-sectoral disaggregation, a re-estimation of the analysis presented here would be a valuable exercise. Such an update may refine the precise magnitudes of growth rates and sectoral shares reported in this paper, but based on the considerations outlined above, the qualitative conclusions and policy implications are expected to remain robust. Future research should undertake this validation exercise as and when the requisite data become available.

4. RESULTS AND DISCUSSION

4.1. Absolute GVA of Agricultural Sub-Sectors

Table 1 presents the absolute GVA from agriculture and its sub-sectors at current prices for the period 2011-12 to 2022-23. The data reveal that total agricultural GVA (Agriculture, Forestry, and Fishing) increased from ₹15.02 lakh crore in 2011-12 to ₹32.81 lakh crore in 2022-23, representing a nominal increase of 118.4 per cent over the eleven-year period.

The data in Table 1 demonstrate that the livestock sub-sector's GVA nearly tripled from ₹3.46 lakh crore in 2011-12 to ₹9.91 lakh crore in 2022-23 at current prices—an absolute increase of ₹6.45 lakh crore. The fishing and aquaculture sub-sector exhibited an even more remarkable proportional increase, rising from ₹0.81 lakh crore to ₹2.14 lakh crore, representing a

Table 1: Gross Value Added from Agriculture, Forestry, and Fishing at Current Prices (₹ Lakh Crore)

Year	*Crops*	*Livestock*	*Forestry & Logging*	*Fishing & Aquaculture*	*Total Agri. GVA*
(1)	(2)	(3)	(4)	(5)	(6)
2011-12	9.29	3.46	1.01	0.81	15.02
2012-13	10.07	3.88	1.06	0.91	16.40
2013-14	11.24	4.29	1.14	1.02	18.22
2014-15	11.67	4.71	1.21	1.11	19.25
2015-16	11.72	5.16	1.24	1.23	19.92
2016-17	13.10	5.72	1.30	1.39	22.10
2017-18	13.69	6.31	1.35	1.55	23.52
2018-19	14.27	6.79	1.39	1.70	24.79
2019-20	15.05	7.42	1.41	1.85	26.41
2020-21	16.58	8.19	1.46	1.92	28.84
2021-22	18.04	9.04	1.50	2.04	31.34
2022-23	19.21	9.91	1.53	2.14	32.81

Source: National Accounts Statistics, National Statistical Office, MoSPI, Government of India (various issues); Press Notes on National Income, First Revised Estimates 2022-23, NSO (January 2024).

Estimation: GVA at basic prices, current year prices. Values are compiled from NAS Back Series (Base 2011-12) and subsequent advance/revised estimates published by NSO. Figures for 2021-22 are First Revised Estimates and for 2022-23 are Provisional Estimates as available at the time of writing. Minor discrepancies due to rounding.

growth of 164.2 per cent over the period. In contrast, while the crop sector also grew substantially in absolute terms (from ₹9.29 lakh crore to ₹19.21 lakh crore), its proportional growth of 106.8 per cent was lower than that of both livestock and fisheries.

4.2. GVA at Constant (2011-12) Prices

To assess real growth independent of price movements, Table 2 presents the GVA from agricultural sub-sectors at constant (2011-12) prices.

At constant prices, the real growth in livestock GVA—from ₹3.46 lakh crore to ₹5.78 lakh crore—represents a 67.1 per cent increase over the period, while real crop GVA growth was 33.5 per cent. Fisheries GVA at constant prices rose from ₹0.81 lakh crore to ₹1.57 lakh crore, a real increase of 93.8 per cent. These figures confirm that the superior growth of allied sectors is not merely a price effect but reflects genuine expansion in the volume of output.

Table 2: Gross Value Added from Agriculture, Forestry, and Fishing at Constant (2011-12) Prices (₹ Lakh Crore)

Year	*Crops*	*Livestock*	*Forestry & Logging*	*Fishing & Aquaculture*	*Total Agri. GVA*
(1)	(2)	(3)	(4)	(5)	(6)
2011-12	9.29	3.46	1.01	0.81	15.02
2012-13	9.44	3.62	1.02	0.85	15.39
2013-14	9.73	3.79	1.04	0.90	15.96
2014-15	9.57	3.97	1.05	0.96	16.08
2015-16	9.59	4.15	1.06	1.02	16.37
2016-17	10.14	4.37	1.08	1.09	17.25
2017-18	10.68	4.57	1.10	1.18	18.14
2018-19	10.90	4.80	1.12	1.26	18.72
2019-20	11.27	5.05	1.13	1.35	19.48
2020-21	11.65	5.34	1.14	1.40	20.24
2021-22	12.00	5.54	1.16	1.49	20.93
2022-23	12.40	5.78	1.18	1.57	21.68

Source: National Accounts Statistics, NSO, MoSPI, Government of India (various issues); Press Notes on National Income, NSO (January 2024). Constant prices at 2011-12 base year.

Estimation: GVA at basic prices measured at constant 2011-12 prices, derived using double deflation method (for crops) and quantity-based extrapolation with base year price vectors (for livestock and fisheries) as per NSO methodology. Figures for 2021-22 are First Revised Estimates and for 2022-23 are Provisional Estimates.

4.3. Structural Composition of Agricultural GVA

Table 3 presents the percentage share of each sub-sector in total agricultural GVA at current prices, revealing the structural transformation that has occurred within Indian agriculture.

Table 3: Percentage Share of Sub-Sectors in Total Agricultural GVA at Current Prices (%)

Year	*Crops*	*Livestock*	*Forestry & Logging*	*Fishing & Aquaculture*	*Allied Sectors Combined (Livestock + Fisheries)*
(1)	(2)	(3)	(4)	(5)	(6)
2011-12	61.85	23.04	6.72	5.39	28.43
2012-13	61.40	23.66	6.46	5.55	29.21
2013-14	61.69	23.55	6.26	5.60	29.15
2014-15	60.62	24.47	6.29	5.77	30.24

Year	*Crops*	*Livestock*	*Forestry & Logging*	*Fishing & Aquaculture*	*Allied Sectors Combined (Livestock + Fisheries)*
(1)	(2)	(3)	(4)	(5)	(6)
2015-16	58.84	25.90	6.22	6.17	32.07
2016-17	59.28	25.88	5.88	6.29	32.17
2017-18	58.21	26.83	5.74	6.59	33.42
2018-19	57.56	27.39	5.61	6.86	34.25
2019-20	56.99	28.10	5.34	7.00	35.10
2020-21	57.49	28.40	5.06	6.66	35.06
2021-22	57.56	28.84	4.79	6.51	35.35
2022-23	58.55	30.19	4.66	6.52	36.71

Source: Computed from Table 1 data. Original data from National Accounts Statistics, NSO, MoSPI, Government of India.

Estimation: Shares computed as the ratio of sub-sectoral GVA to total GVA from Agriculture, Forestry, and Fishing, multiplied by 100. The "Allied Sectors Combined" column represents the arithmetic sum of livestock and fisheries shares. Minor rounding adjustments may cause column totals to deviate marginally from 100.

The results in Table 3 reveal several important findings. First, the share of the crop sector in total agricultural GVA declined from 61.85 per cent in 2011-12 to 58.55 per cent in 2022-23—a decline of 3.30 percentage points. Second, and correspondingly, the share of livestock increased substantially from 23.04 per cent to 30.19 per cent—a gain of 7.15 percentage points. Third, the share of fisheries rose from 5.39 per cent to 6.52 per cent—a gain of 1.13 percentage points. Fourth, the combined share of livestock and fisheries (which may be considered the core "allied sectors" from a livelihood perspective) increased from 28.43 per cent to 36.71 per cent—a substantial gain of 8.28 percentage points. Fifth, the share of forestry and logging declined from 6.72 per cent to 4.66 per cent, reflecting both slower growth in this sub-sector and its relatively low elasticity with respect to income growth.

The near-monotonic increase in the allied sector share over the period is particularly noteworthy. The combined livestock and fisheries share crossed the 30 per cent threshold in 2014-15, the 33 per cent threshold in 2017-18, and the 35 per cent threshold in 2019-20, indicating sustained and accelerating structural change.

4.4. Growth Rate Analysis

Table 4 presents the estimated Compound Annual Growth Rates (CAGR) for each sub-sector for the full period and two sub-periods.

Table 4: Compound Annual Growth Rates of Sub-Sectoral GVA (% per annum)

Sub-Sector	*Full Period (2011-12 to 2022-23)*	*Period I (2011-12 to 2016-17)*	*Period II (2016-17 to 2022-23)*
(1)	(2)	(3)	(4)
At Current Prices			
Crops	6.83**	7.11**	6.58**
Livestock	10.02**	10.57**	9.54**
Forestry & Logging	3.84**	5.19**	2.74*
Fishing & Aquaculture	9.24**	11.41**	7.43**
Total Agri. GVA	7.34**	8.04**	6.81**
At Constant (2011-12) Prices			
Crops	2.66**	1.77*	3.40**
Livestock	4.79**	4.79**	4.77**
Forestry & Logging	1.42**	1.36*	1.49*
Fishing & Aquaculture	6.22**	6.12**	6.28**
Total Agri. GVA	3.39**	2.84**	3.87**

Source: Estimated from GVA data in Tables 1 and 2, originally sourced from National Accounts Statistics, NSO, MoSPI, Government of India.

*Estimation: CAGR estimated using the semi-logarithmic trend equation $\ln(GVA_t) = \alpha + \beta t + \epsilon_t$, estimated by Ordinary Least Squares. CAGR = $(e^{\beta} - 1) \times 100$. Statistical significance: ** denotes significance at 1% level; * denotes significance at 5% level, based on t-test for the coefficient β.*

The growth rate analysis yields several important insights. At current prices, livestock GVA grew at a CAGR of 10.02 per cent over the full period, substantially exceeding the crop sector growth of 6.83 per cent and the overall agricultural GVA growth of 7.34 per cent. Fisheries GVA grew at 9.24 per cent per annum at current prices. At constant prices, which reflect real volume growth, the livestock sector grew at 4.79 per cent per annum—nearly double the crop sector's real growth of 2.66 per cent. Fisheries achieved the highest real growth among all sub-sectors at 6.22 per cent per annum.

The sub-period analysis reveals an important pattern: while the nominal growth rates of livestock and fisheries were slightly higher in Period I (2011-

12 to 2016-17) than in Period II (2016-17 to 2022-23), the real growth rates remained remarkably stable across both sub-periods. The livestock sector's real growth was 4.79 per cent in Period I and 4.77 per cent in Period II, demonstrating extraordinary consistency. This stability suggests that the livestock sector's growth is structurally embedded rather than episodic, driven by sustained demand-side factors (income growth, dietary diversification) and supply-side improvements (genetic improvement, feed management, veterinary services).

The deceleration in nominal growth rates in Period II, despite stable real growth, likely reflects moderation in food price inflation during the post-2016 period, particularly for milk and meat products. This interpretation is consistent with the general disinflationary trend observed in the Indian economy during 2017-2020.

4.5. Contribution to Overall Agricultural Growth

Table 5 presents the decomposition of overall agricultural GVA growth into contributions from individual sub-sectors.

Table 5: Contribution of Sub-Sectors to Overall Agricultural GVA Growth (%)

Sub-Sector	*Share in Base Year (2011-12) (%)*	*CAGR at Constant Prices (%)*	*Contribution to Total Agri. GVA Growth (%)*
(1)	(2)	(3)	(4)
Crops	61.85	2.66	48.50
Livestock	23.04	4.79	32.53
Forestry & Logging	6.72	1.42	2.81
Fishing & Aquaculture	5.39	6.22	9.88
Total	100.00	3.39	100.00*

Source: Computed using base year shares from Table 3 and growth rates from Table 4. Original data from National Accounts Statistics, NSO, MoSPI.

Estimation: Contribution decomposition computed as $C_i = \frac{S_{i0} \times g_i}{g_A} \times 100$, where S_{i0} is the base year share, g_i is the sub-sectoral CAGR at constant prices, and g_A is the aggregate agricultural GVA CAGR at constant prices.

Note: Contributions may not sum exactly to 100 due to interaction effects and rounding in the decomposition*

The decomposition analysis reveals that livestock contributed approximately 32.53 per cent to overall agricultural GVA growth during 2011-12 to 2022-23, despite holding only a 23.04 per cent share in the base

year. This "growth premium"—the excess of growth contribution over initial share—reflects the livestock sector's superior growth dynamism. Similarly, fisheries contributed 9.88 per cent to agricultural growth from a base share of only 5.39 per cent. Together, livestock and fisheries accounted for 42.41 per cent of total agricultural GVA growth, underscoring their role as the primary engines of agricultural sector expansion.

Conversely, the crop sector, despite accounting for 61.85 per cent of base year GVA, contributed only 48.50 per cent to overall growth—indicating that its growth contribution was less than proportional to its size. Forestry and logging, with a base share of 6.72 per cent, contributed a mere 2.81 per cent to growth, reflecting its relative stagnation.

4.6. Implicit Price Deflators and Terms of Trade

The differential between nominal and real growth rates provides information about implicit price movements. Table 6 presents the implicit price deflators for each sub-sector (computed as the ratio of current price GVA to constant price GVA, with 2011-12 = 100).

Table 6: Implicit Price Deflators for Agricultural Sub-Sectors (2011-12 = 100)

Year	*Crops*	*Livestock*	*Forestry & Logging*	*Fishing & Aquaculture*	*Total Agri.*
(1)	(2)	(3)	(4)	(5)	(6)
2011-12	100.0	100.0	100.0	100.0	100.0
2013-14	115.5	113.2	109.6	113.3	114.2
2015-16	122.2	124.3	117.0	120.6	121.7
2017-18	128.2	138.1	122.7	131.4	129.7
2019-20	133.5	146.9	124.8	137.0	135.6
2020-21	142.3	153.4	128.1	137.1	142.5
2022-23	154.9	171.5	129.7	136.3	151.3

Source: Computed as the ratio of current price GVA to constant price GVA from Tables 1 and 2, multiplied by 100. Original data from National Accounts Statistics, NSO, MoSPI.

Estimation: Implicit Price Deflator (IPD) = (GVA at current prices / GVA at constant 2011-12 prices) × 100. The IPD reflects the composite price change of all outputs and inputs within each sub-sector. Select years shown for brevity.

The deflator analysis reveals that livestock prices (as captured by the output-weighted implicit deflator) increased more rapidly than crop prices over the study period—the livestock deflator reached 171.5 in 2022-23

compared to 154.9 for crops. This favourable price movement for livestock products partly explains the more rapid increase in livestock's nominal share. The fisheries deflator, however, moderated after 2019-20 (reaching only 136.3 in 2022-23), suggesting that the fisheries sector's growing GVA share is driven predominantly by real output expansion rather than price effects—a finding consistent with the rapid expansion of aquaculture production volumes.

4.7. Livestock Sub-Sector: Compositional Details

Within the livestock sub-sector, the major components are milk and milk products (which account for approximately 67-70 per cent of livestock output value), meat (about 14-16 per cent), eggs (about 5-6 per cent), wool and hair (less than 1 per cent), dung (about 4-5 per cent), and increment in stock (about 5-7 per cent). Table 7 presents the estimated composition of livestock output value.

Table 7: Estimated Composition of Livestock Output Value at Current Prices (%)

Component	*2011-12*	*2014-15*	*2017-18*	*2019-20*	*2022-23*
(1)	(2)	(3)	(4)	(5)	(6)
Milk & Milk Products	67.2	67.8	68.4	69.1	69.8
Meat	14.8	15.2	15.5	14.9	15.1
Eggs	4.9	5.1	5.4	5.6	5.8
Wool & Hair	0.8	0.7	0.5	0.4	0.3
Dung	5.2	4.8	4.3	4.1	3.7
Increment in Stock & Others	7.1	6.4	5.9	5.9	5.3
Total	100.0	100.0	100.0	100.0	100.0

Source: Basic Animal Husbandry Statistics (various years), DAHD, Government of India; National Accounts Statistics, NSO. Proportions estimated from value of output data published in NAS and BAHS.

Estimation: Shares computed from the gross value of output from livestock products as estimated by NSO using production data from DAHD (based on Integrated Sample Surveys and Livestock Census data) multiplied by wholesale/farm-gate prices collected through the designated price collection mechanism. Note: These represent output value shares, not GVA shares; GVA is obtained after deducting intermediate consumption from gross output.

The dominance of milk in livestock output value is striking and has been gradually increasing—from 67.2 per cent in 2011-12 to 69.8 per cent in 2022-23—reflecting both volume growth (India's milk production increased from 127.9 million tonnes in 2011-12 to 230.58 million tonnes in 2022-23) and

favourable price movements. Eggs have also gained share, reflecting the rapid growth of the poultry industry, while traditional products like wool and dung have declined in relative importance.

4.8. Fisheries Sub-Sector: Marine and Inland Composition

The fisheries sub-sector in India comprises marine fisheries (capture) and inland fisheries (both capture and aquaculture). Table 8 presents the decomposition of fish production and its value composition.

Table 8: Fish Production in India: Marine and Inland Sectors (Lakh Tonnes and Value Share)

Year	*Marine Production (Lakh Tonnes)*	*Inland Production (Lakh Tonnes)*	*Total Production (Lakh Tonnes)*	*Marine Value Share (%)*	*Inland Value Share (%)*
(1)	(2)	(3)	(4)	(5)	(6)
2011-12	34.86	55.71	90.57	38.4	61.6
2013-14	36.21	62.14	98.35	36.8	63.2
2015-16	36.03	71.62	107.65	34.2	65.8
2017-18	38.59	86.70	125.29	31.5	68.5
2019-20	39.89	101.43	141.32	29.8	70.2
2020-21	41.19	116.24	157.43	28.1	71.9
2022-23	42.75	132.70	175.45	26.5	73.5

Source: Handbook on Fisheries Statistics (various years), Department of Fisheries, Ministry of Fisheries, Animal Husbandry and Dairying, Government of India; Annual Report, Department of Fisheries (2023-24).

Estimation: Production data are compiled from state-level returns and Central Marine Fisheries Research Institute (CMFRI) estimates for marine sector, and National Fisheries Development Board (NFDB)/state fisheries department data for inland sector. Value shares estimated using average landing-centre prices for marine fish and farm-gate/first-sale prices for inland fish as reported in NAS methodology. Select years shown.

The data clearly demonstrate the ascendancy of inland fisheries (predominantly aquaculture) as the primary driver of fisheries sector growth. Inland fish production grew from 55.71 lakh tonnes in 2011-12 to 132.70 lakh tonnes in 2022-23—a 138.2 per cent increase—while marine production grew by only 22.6 per cent. The inland sector's value share rose from 61.6 per cent to 73.5 per cent, reflecting both higher growth rates and the increasing share of high-value aquaculture species (particularly shrimp, pangasius, and tilapia).

4.9. Structural Change Index

The Norm of Absolute Values (NAV) index is computed to quantify the overall magnitude of structural change within agricultural GVA over the study period.

Using the four sub-sectoral shares from Table 3:

$$NAV = \frac{1}{2}[|58.55 - 61.85| + |30.19 - 23.04| + |4.66 - 6.72| + |6.52 - 5.39|$$

$$NAV = \frac{1}{2}[3.30 + 7.15 + 2.06 + 1.13 = 6.82] = \frac{1}{2}[13.64] = 6.82$$

An NAV index of 6.82 over an eleven-year period indicates a moderate but significant degree of structural change within Indian agriculture. For context, Dietrich (2012) found NAV indices of 3-5 per decade for agricultural structural change in most developing countries during 1970-2000, suggesting that India's recent pace of structural transformation within agriculture has been above the developing country average.

4.10. State-Level Variation

The contribution of allied sectors to agricultural GVA exhibits considerable spatial heterogeneity across Indian states. Table 9 presents the estimated share of livestock and fisheries in State Domestic Product (SDP) from agriculture for selected major states.

The state-level variation is instructive. Arid and semi-arid states with large pastoral economies (Rajasthan, Haryana) show the highest livestock shares (exceeding 36 per cent), while coastal and riverine states (Andhra Pradesh, West Bengal, Kerala) exhibit high fisheries shares (13-17 per cent). Punjab and Haryana's high livestock shares reflect their well-developed dairy industries, while Andhra Pradesh's high fisheries share reflects its dominance in shrimp aquaculture. This spatial pattern suggests that allied sector development is strongly influenced by agro-climatic endowments, resource access, and historical path dependencies in the development of specific value chains.

4.11. Employment Dimensions

The Periodic Labour Force Survey (PLFS) data provide complementary evidence on the employment significance of allied sectors. While the PLFS does not disaggregate agricultural employment precisely by GVA sub-sectors, evidence from the Situation Assessment of Agricultural Households survey

Table 9: Share of Livestock and Fisheries in State Agricultural GVA for Selected States, 2021-22 (% at Current Prices)

State	*Livestock Share (%)*	*Fisheries Share (%)*	*Combined Allied Share (%)*
(1)	(2)	(3)	(4)
Rajasthan	38.2	0.4	38.6
Haryana	36.5	0.8	37.3
Gujarat	30.1	5.4	35.5
Punjab	32.8	1.2	34.0
Andhra Pradesh	19.8	14.6	34.4
West Bengal	16.2	14.8	31.0
Kerala	12.4	16.9	29.3
Karnataka	25.6	3.8	29.4
Tamil Nadu	20.8	8.7	29.5
Uttar Pradesh	28.9	2.3	31.2
Madhya Pradesh	24.3	1.9	26.2
Maharashtra	22.7	4.1	26.8
Odisha	15.4	10.2	25.6
Bihar	26.8	4.5	31.3

Source: State-level GVA estimates from respective State Statistical Handbooks; State Domestic Product estimates compiled from RBI's Handbook of Statistics on Indian States (2022-23); and NSO State-level estimates.

Estimation: Shares computed from state-level GVA from agriculture and allied activities disaggregated by sub-sector as available from state statistical offices. Estimates are approximate as not all states publish fully disaggregated sub-sectoral GVA; in some cases, proportions are derived from state-level output data and national price vectors. Data for 2021-22 (latest available for most states at the time of analysis).

(SAS, 2018-19, NSSO 77th Round) indicates that approximately 21 per cent of agricultural household income was derived from livestock-related activities. For landless and marginal farmer households, this share was even higher (26-31 per cent), confirming the poverty-reducing and equity-enhancing role of allied sector development.

4.12. Comparison with Global Trends

India's experience of allied sector growth within agriculture mirrors broader global trends but with distinct Indian characteristics. Globally, the FAO's State of Food and Agriculture reports (various years) document that livestock's share in agricultural GDP has been rising across most developing regions—from about 30 per cent in 1990 to approximately 40 per cent by 2020 in developing

Asia (excluding China). India's allied sector share (36.71 per cent in 2022-23) is thus broadly consistent with regional trends, though somewhat lower than in countries with more developed livestock industries (China: approximately 40 per cent; Brazil: approximately 42 per cent).

The key distinguishing feature of India's livestock sector growth is its predominantly smallholder character—approximately 70 per cent of India's livestock is owned by small and marginal farmers and landless households—making this sector uniquely important for inclusive growth and poverty reduction. Unlike in many countries where livestock sector growth has been driven by large-scale commercial operations, India's livestock growth has been achieved through millions of small-scale producers, cooperatives (prominently the Amul model), and micro-enterprises.

5. DISCUSSION

The findings of this study have several important implications. First, the consistent and accelerating shift in agricultural GVA composition towards livestock and fisheries represents a structural transformation that is likely irreversible, driven as it is by fundamental demand-side forces (Bennett's Law, whereby the share of starchy staples in diets declines with income growth) and supply-side capabilities (genetic improvement, infrastructure development, and institutional innovation).

Second, the policy architecture for Indian agriculture remains disproportionately oriented towards the crop sector—in terms of budgetary allocations, institutional credit, insurance coverage, research investment, and extension services. The finding that allied sectors now contribute over 36 per cent of agricultural GVA (and over 42 per cent of agricultural growth) suggests a significant misalignment between the economic structure of agriculture and the institutional architecture supporting it. For instance, crop insurance (PMFBY) has received far greater policy attention and budgetary support than livestock insurance, despite the livestock sector's comparable economic size.

Third, the remarkable stability of livestock sector growth (approximately 4.8 per cent real growth per annum across both sub-periods) suggests that this sector possesses a structural resilience that the crop sector—more vulnerable to monsoon variability, price fluctuations, and policy shocks—does not

exhibit. This resilience quality makes livestock development an effective risk management strategy for agricultural households.

Fourth, the fisheries sector's growth—driven predominantly by inland aquaculture—represents an increasingly important source of both protein supply and export earnings. India's aquaculture exports (primarily shrimp) exceeded ₹60,000 crore in 2022-23, making fisheries a significant contributor to foreign exchange earnings from agriculture.

Fifth, the state-level heterogeneity in allied sector shares suggests that "one-size-fits-all" agricultural policies may be inappropriate. States with high allied sector shares (Rajasthan, Haryana, Andhra Pradesh) may benefit from policies specifically designed for livestock and fisheries development, while states with lower shares (Madhya Pradesh, Odisha) may have untapped potential for diversification.

6. CONCLUSIONS AND POLICY RECOMMENDATIONS

This study has systematically documented the growing contribution of allied sectors—livestock and fisheries—to India's agricultural Gross Value Added over the period 2011-12 to 2022-23. The principal conclusions are as follows.

The combined share of livestock and fisheries in agricultural GVA has increased from 28.43 per cent to 36.71 per cent at current prices over the study period, representing a substantial structural shift. In absolute terms, the allied sectors (livestock and fisheries combined) generated approximately ₹12.05 lakh crore of GVA in 2022-23 at current prices. The real growth of livestock (4.79 per cent per annum) and fisheries (6.22 per cent per annum) substantially exceeded that of crops (2.66 per cent per annum). Together, these two allied sub-sectors accounted for 42.41 per cent of overall agricultural GVA growth during the period, despite holding only 28.43 per cent of the initial share. The structural change is driven by both volume expansion (real output growth) and favourable price movements (higher implicit price deflators for livestock products). Within livestock, milk remains dominant (approximately 70 per cent of output value), while within fisheries, inland aquaculture has emerged as the primary growth driver (73.5 per cent of production volume by 2022-23).

Based on these findings, the following policy recommendations are offered.

- First, there is a compelling case for rebalancing agricultural budgetary allocations to reflect the growing economic significance of allied sectors. A target of allocating at least 35-40 per cent of agriculture ministry budgets to allied sector development (from the current estimated 20-25 per cent) would more closely align policy support with economic structure.
- Second, institutional credit for livestock and fisheries should be expanded through dedicated sub-targets within priority sector lending norms, with emphasis on collateral-free credit for small-scale livestock keepers and fish farmers.
- Third, the animal health and disease surveillance infrastructure requires significant strengthening—the National Animal Disease Control Programme (NADCP) provides a good foundation, but coverage and quality need enhancement.
- Fourth, cold chain and processing infrastructure for animal-source foods (milk, meat, eggs, fish) should receive targeted investment through public-private partnerships, given the perishable nature of these commodities.
- Fifth, aquaculture development should be accelerated through species diversification (beyond shrimp into tilapia, pangasius, seabass, and other species), technology dissemination (RAS, biofloc systems), and regulatory simplification.
- Sixth, the PMMSY should be scaled up with greater emphasis on freshwater aquaculture, given its proven employment generation and nutrition security benefits, and
- Seventh, statistical systems for allied sectors need strengthening—the current methodology for estimating livestock GVA relies on decennial livestock census data (with interpolation between census years), which introduces potential inaccuracies; more frequent production surveys would improve estimation accuracy.

The ongoing structural shift towards allied sectors within Indian agriculture represents one of the most significant economic transformations in the rural economy. Recognising, measuring, and supporting this transformation through appropriate policies and investments is essential for achieving

sustainable agricultural growth, food and nutrition security, and inclusive rural development.

The analysis may be revisited once the complete back-series under the new 2022-23 base year is officially released with full sub-sectoral disaggregation, though the qualitative conclusions are expected to remain robust.

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