



A Holistic Study of Livestock Dynamics and Dairy Trade in India

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Livestock provides livelihood to two-third of rural masses and employs about 8.8 per cent population of India. While dairying alone ensures the livelihood for 70 million farm families. The present study is based on secondary data and the analytic techniques like compound growth rate analysis (CAGR), Cuddy-Della Valle Index (CDVI), coefficient of variation (CV), percentages, averages were used to analyse the data. The total livestock population consisting of cattle, buffalo, Sheep, goat, pig, horse and pony, mules, donkey, camel, mithun and yak in the country was 535.78 million numbers in 2019. Cattle accounted for 37.28 per cent of the total livestock population, for which the highest contribution was from Madhya Pradesh (10.27%), followed by Uttar Pradesh (10.24%) and West Bengal (8.65%). The share of value of milk and milk products in total livestock output is highest. The share of livestock products export in agricultural exports decreased from

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8.31% in 2011-12 to 8.37% in 2021-22, and in agricultural GVA from 1.01% to 0.78%, suggesting a slight decline in the importance of livestock product exports. Uttar Pradesh and Maharashtra emerge as the leading states in livestock products exports, contributing 45.51% and 29.00%, respectively, to the total livestock products exports in 2021-22. The share of value of milk and milk products in total livestock output is highest in India followed by meat (23.13 %), eggs (5.98 %) and milk (5.84 %) and the value of output from livestock sector grew by 5.84 per cent during 2011-12 to 2020-21. The compound annual growth rate (CAGR) of livestock GVA is 7.63 per cent is much higher than that of agriculture and allied sector (3.64 %). This is a clearly indication of growing importance of livestock sector in the overall agricultural development in the country.

Keywords: GVA; CAGR; livestock; exports; cattle population; livestock products.

1. INTRODUCTION

Agriculture is considered as an important pillar to support Indian economy providing livelihood support to large proportion of population in the country. The total share of agriculture to the economy is 18.8 per cent in 2022-23. The agriculture sector employs the highest number of workers. The share of workers engaged in agriculture has risen marginally to 45.5 per cent in 2021-22 from 42.5 per cent in 2018-19 (Ministry of Agriculture and Farmers Welfare, 2022). India is the second-most populous country in the world. Therefore, there is always a constant need for a supply of food to feed such a huge population.

Livestock provides livelihood to two-third of rural masses and employs about 8.8 per cent population of India. While dairying alone ensures the livelihood for 70 million farm families. Livestock contributed 16 per cent to the income of small farm households as against 14 per cent for all rural households [1-3]. The economic survey 2022-23 also highlighted another important trend of increasing contribution of the livestock sector to agriculture GDP [4,5]. The livestock sector grew at a compound annual growth rate of 7.38 per cent during 2014-15 to 2022- 23 (at constant prices). The livestock sector contributes 5.3 per cent to Indian Gross Domestic Product (GDP) and shares 30.1 per cent of the total agriculture GDP [6,7].

The livestock industry is playing an essential role in the socio-economic development of millions of rural households. Livestock keeping an integral component of agriculture in India and make multifaceted contributions to the growth and development of the agricultural sector [8-10]. The country is one of the largest stock of buffaloes and cows and contributes to 24.64 per cent of global milk production, and has an annual growth rate of 5.29 per cent. The country had achieved

annual milk production of 230.58 million tonnes during 2022-23 with per capita availability of 459 grams per day (Department of Animal Husbandry, Dairying & Fisheries, GoI, 2023) which is greater than the average milk availability in the world viz., 321 grams per day. At current prices, the value of output added by this group has increased from `3,27,767 crores in 2011-12 to `15,63,399 crores in 2021-22 [11-14].

An analysis of species-wise milk contribution in 2020-21 showed that the indigenous/ non-descript buffaloes contributes 45 per cent of milk production. Crossbred cows contributes 28 per cent of milk production while the contribution of indigenous/non- descript cows stood at 20 per cent. The contribution of both exotic cows and goats in total milk production was found to be 3 per cent each. Population growth, urbanization and increasing per capita income are driving the demand for milk in India.

2. METHODOLOGY

The present study is based on secondary data. The secondary data on livestock population, production of major livestock products and export of livestock products in terms of value were collected from various published sources like livestock census, Directorate of Economics and Statistics, various census reports of animal husbandry and from websites of FAOSTAT, APEDA, CMIE, DGCIS, etc. The analytic techniques like compound growth rate analysis (CAGR), Cuddy-Della Valle Index (CDVI), coefficient of variation (CV), percentages, averages were used to analyse the data to draw meaningful policy implications.

2.1 Compound Growth Rate Analysis

The growth rate of the population of major livestock species in India was calculated using the CAGR method. Further the compound

growth rate analysis was carried out. The compound growth function was specified in the following formula.

$$Y_t = AB^t U_t \dots\dots\dots (1)$$

Where,

Y_t = number/production/productivity in the year t

A = Intercept indicating Y in the base period ($t=0$)

$B = 1 + g$

t_i = Time period

U_t = Error term

g = Compound annual growth rate

Equation (1) was converted into the logarithmic form in order to facilitate the use of linear regression. Taking logarithms on both sides,

$$\ln Y_t = \ln A + t (\ln B) + \ln U_t \quad (2)$$

Or

$$Q_t = a + bt + ut$$

Where,

$$Q_t = \ln Y_t$$

$$a = \ln A$$

$$b = \ln B$$

$$t = \text{Time}$$

$$U_t = \ln U_t$$

The values of 'a' and 'b' were estimated by using Ordinary Least Square estimation technique. Later, the original 'A' and 'B' parameters in equation (1) were obtained by taking anti-logarithms of 'a' and 'b' values as;

$$A = \text{Anti Ln } a$$

$$B = \text{Anti Ln } b$$

Compound annual growth rate was calculated as;

$$B = 1 + g$$

$$g = B - 1$$

2.2 Instability Analysis

In this study, the instability was estimated by using Cuddy-Della Valle Index (CDVI). Though coefficient of variation (CV) is commonly used for estimating the dispersion for comparison across various units, it cannot be used in case of time series data characterized by time trend [15]. Any measure of instability needs to exclude the deviations in the data series that may arise due to secular trend or growth. CDVI was originally developed by John Cuddy and Della Valle for measuring the instability in time series data that is characterized by trend. The estimable form of the equation is as follows:

$$CV \times \sqrt{1 - R^2}$$

Where, CV is coefficient of variation; R^2 is coefficient of determination from time trend regression adjusted by number of degrees of freedom.

3. RESULTS AND DISCUSSION

The livestock population and its growth rate (Table 1) in different census periods showed an increasing trend in cattle population from 1951-92 onwards primarily due to cross breeding and various developments and extension programmes implemented from time to time. However, cattle population witnessed declining trend during 1992-97 (-0.56 %) and 1997-03 (-1.18 %). Although there was an increase during the period 2003-08, it declined marginally during 2007-12 (-0.84 %). The reason for the decrease in cattle population from early 1990s might be the continues declining trend in the availability of common property fodder resources and grazing lands due to expanding urbanization, change in life style, dwindling dry fodder availability as a result of increase use of agriculture mechanization, decreased labour, land division, nucleus families and producer shifting to two few high productive bovines by disposing huge number of low productive indigenous ones. Another reason for declining cattle population is low focus on veterinary extension.

Buffalo population was 43.10 million in 1951, which continuously increased to reach 108.70 million in 2012. The growth rate was found to be the highest (2.08 %) during the period 1987-92.

It can also be realized that the growth rate ranged from one to two per cent in all the inter-census periods, except during the study periods 2007-12 and 2012-17. which recorded very slower growth rates of 0.63 per cent and 0.21 per cent, respectively. These appreciable growth rates in buffalo population could be attributed to the farmer's preference to rear more buffaloes, for they yielded milk with higher fat content which fetched better price for them.

The almost continuous increase in the growth of sheep population might be the result of increasing demand for the much preferred meat. *i.e.*, mutton among the consumers, especially due to changed lifestyle increasing awareness and preference for high protein foods and the absence of religious restrictions on the consumption of mutton. Prabu et al. [16] attributed the reasons for the positive growth in goat population in India to the increase in demand for chevon due to high preferences for chevon among consumers, easy manageability of goats and high remunerative price for chevon. The continuous decline in pig population in the recent past attributed to frequent disease outbreaks which had serious zoonotic issues and religious taboos against its consumption [17-20].

Poultry is one of the fastest growing segments of the livestock sector in India and it had undergone a paradigm shift in structure and operation which transformed it from a mere backyard activity into a major commercial industry over a period of four decades. Higher growth rates of 5.86, 5.79 and 5.32 per cent were also found in the years 1997-03, 1982-87 and 1951-56, respectively [21-23]. Chatterjee and Rajkumar (2015) also revealed similar facts. This rapid expansion of poultry population is attributed to a series of technological changes in poultry sector and increasing scale of production units.

In nutshell, all the species of livestock population had shown negative growth, except buffalo during this period, possibly because of dwindling feed and fodder resources. agricultural mechanization although animal power is used for some specific operations and farmer's preference to rear high productive stock. However, the total livestock had appeared to have regained its growing momentum, during 2017 census.

It was observed that that 13.42 per cent of total livestock population was found in Uttar Pradesh followed by Rajasthan (11.27%) and Andhra

Pradesh (10.96%). Cattle accounted for 37.28 per cent of the total livestock population, for which the highest contribution was from Madhya Pradesh (10.27%), followed by Uttar Pradesh (10.24%) and West Bengal (8.65%). Uttar Pradesh contributed 28.17 percent to total buffalo population in the country, followed by Rajasthan (11.94%), Andhra Pradesh (9.77%) and Gujarat (9.55%).

Assam had the highest pig population (15.89 %), followed Uttar Pradesh (12.96 %) and Jharkhand (9.35 %) The leading poultry producing states were Andhra Pradesh (22.12 %), Tamil Nadu (16.09 %) and Karnataka (7.33 %) in Southern region, Maharashtra (10.67 %), in Western region, West Bengal (7.25 %) in Eastern region, and Haryana (5.87 %) in Northern region.

The results show that (Table 2) nearly 75 per cent of total cattle in the country are milking cows a clear sign of dairy farmer's preferences for milk yielding cattle along with bullocks for agriculture purpose. This also gained momentum in the past couple of years due to the government's assistance in terms of providing artificial insemination (AI), with semen of high-yielding bulls for free of cost at farmers' doorstep.

The highest livestock population found in East region of India followed by North region of India. and due to sharp increase in crossbred cattle and higher indigenous cattle population various development schemes and extension programmes implemented by the state departments in those states with focus on breeding of high yielding ones. Assam had the highest pig population (15.89 %), followed Uttar Pradesh (12.96 %) and Jharkhand (9.35 %). Sulabh et al [24]. Kumaresen et al [25] found that pig was concentrated in the North Eastern region, with 40 per cent of countries pig population being reared there.

The leading poultry producing states were Andhra Pradesh (22.12 %), Tamil Nadu (16.09 %) and Karnataka (7.33 %) in Southern region, Maharashtra (10.67 %), in Western region, West Bengal (7.25 %) in Eastern region, and Haryana (5.87 %) in Northern region. In 1987 and 1992 livestock census the states namely Andhra Pradesh, Tamil Nadu, West Bengal and Bihar are leading in poultry population as also being reported in the study conducted by Vetrivel and Chandra kumarmangalam [26]. This was a result of increased demand for cost effective poultry products including meat demand.

Table 1. Livestock population and its growth across livestock census in India

(In million no.)

Census year/ Species	Cattle	Buffalo	Sheep	Goat	Pigs	Total livestock	Poultry
1951	155.30	43.40	39.10	47.20	4.40	292.8	73.50
1951-56	158.70 (0.43)	44.90 (0.68)	39.30 (0.10)	55.40 (3.26)	4.90 (2.18)	306.6 (0.92)	94.80 (5.22)
1956-61	175.60 (2.04)	51.20 (2.66)	40.20 (0.45)	60.90 (1.91)	5.20 (1.20)	336.5 (1.88)	114.20 (3.79)
1961-66	176.20 (0.07)	53.00 (0.69)	42.40 (1.07)	64.60 (1.19)	5.00 (0.78)	344.5 (0.47)	115.40 (0.21)
1966-72	178.30 (0.24)	57.40 (1.61)	40.00 (-1.16)	67.50 (0.88)	6.90 (6.65)	353.2 (0.50)	138.50 (3.72)
1972-79	180.00 (0.19)	62.00 (1.55)	41.00 (0.50)	75.60 (2.29)	7.60 (1.95)	369.4 (0.90)	159.20 (2.82)
1977-82	192.45 (1.35)	69.78 (2.39)	48.76 (3.53)	95.25 (4.73)	10.07 (5.79)	419.6 (2.58)	207.74 (5.47)
1982-87	199.69 (0.74)	75.97 (1.71)	45.70 (-1.29)	110.21 (2.96)	10.63 (1.09)	445.2 (1.20)	275.32 (5.79)
1987-92	204.58 (0.49)	84.21 (2.08)	50.78 (2.13)	115.28 (0.90)	12.79 (3.77)	470.9 (1.12)	307.07 (2.21)
1992-97	198.88 (-0.56)	89.92 (1.32)	57.49 (2.51)	122.72 (1.26)	13.29 (0.77)	485.4 (0.61)	347.61 (2.51)
1997-03	185.18 (-1.18)	97.92 (1.43)	61.47 (1.12)	124.36 (0.22)	13.52 (0.28)	485.0 (-0.01)	489.01 (5.85)
2003-07	199.08 (1.83)	105.34 (1.84)	71.56 (3.87)	140.54 (3.10)	11.13 (-4.74)	529.7 (2.23)	648.88 (7.33)
2007-12	190.9 (-0.84)	108.7 (0.63)	65.1 (-1.88)	135.2 (-0.78)	10.3 (-1.76)	512.1 (-3.33)	729.2 (2.53)
2012-19	192.5 (0.16)	109.9 (0.21)	74.3 (2.68)	148.9 (1.98)	9.1 (-2.51)	535.8 (0.91)	851.8 (3.16)

Source: Animal husbandry, dairying and fisheries statistics 2019, Government of India.

Note: Figures in parentheses indicates growth rate (%) over census period

Table 2. Region and state wise distribution of livestock population as per 2019 census

(in '000)

Region	State	Cattle	Buffalo	Sheep	Goat	Pig	Poultry	Total
North	Punjab	2,428 (1.27)	5,160 (4.75)	129 (0.20)	327 (0.24)	32 (0.31)	16,794 (2.31)	8,117 (1.59)
	Haryana	1,808 (0.95)	6,085 (5.6)	363 (0.56)	369 (0.27)	127 (1.23)	42,821 (5.87)	8,819 (1.72)
	Uttar Pradesh	19,557 (10.2)	30,625 (28.17)	1,354 (2.08)	15,586 (11.53)	1,334 (12.96)	18,668 (2.56)	68,715 (13.42)
	Madhya Pradesh	19,602 (10.02)	8,188 (7.53)	309 (0.47)	8,014 (5.93)	175 (1.70)	11,905 (1.63)	36,333 (7.11)
	Share to total livestock population	43,395 (22.44)	50,058 (46.05)	2,155 (3.37)	24,296 (17.97)	1,668 (16.20)	90,188 (12.37)	1,21,984 (23.84)
South	Andhra Pradesh	9,596 (5.03)	10,624 (9.77)	26,396 (40.50)	9,071 (6.71)	394 (3.83)	1,61,333 (22.12)	56,099 (10.96)
	Tamil Nadu	8,814 (4.62)	780 (0.72)	4,787 (7.36)	814 (6.02)	184 (1.79)	1,17,389 (16.09)	22,723 (4.44)
	Karnataka	9,516 (4.98)	3,471 (3.19)	9,584 (14.70)	4,796 (3.55)	305 (2.96)	53,442 (7.33)	27,702 (5.41)
	Kerala	1,329 (0.71)	102 (0.09)	1 (0.001)	1,246 (0.92)	56 (0.54)	24,282 (3.33)	2,735 (0.53)
	Share to total livestock population	29,255 (15.34)	14,977 (13.77)	40,768 (62.56)	15,927 (17.2)	939 (9.04)	3,56,446 (48.87)	1,09,259 (21.34)
West	Maharashtra	15,484 (8.11)	5,594 (5.15)	2,580 (3.17)	8,435 (6.24)	326 (3.17)	77,795 (10.67)	32,489 (6.34)
	Gujarat	9,984 (5.23)	10,385 (9.55)	1,708 (2.62)	4,959 (3.67)	4 (0.04)	15,006 (2.06)	27,128 (5.31)
	Rajasthan	13,324 (6.98)	12,976 (11.94)	9,079 (13.9)	21,666 (16.03)	238 (2.31)	8,024 (1.10)	57,732 (11.27)
	Share to total livestock population	38,792 (28.68)	28,955 (26.64)	13,367 (19.69)	35,060 (25.94)	568 (9.48)	1,00,825 (13.63)	1,17,349 (22.92)
East	Bihar	12,232 (6.41)	7,567 (6.96)	232 (0.36)	12,154 (8.99)	650 (6.31)	12,748 (1.75)	32,939 (6.43)
	Jharkhand	8,730 (4.57)	1,186 (1.09)	583 (0.90)	6,581 (4.87)	962 (9.35)	13,559 (1.86)	18,053 (3.53)
	West Bengal	16,514 (8.65)	597 (0.55)	1,076 (1.65)	11,506 (8.51)	648 (6.29)	52,838 (7.25)	30,348 (5.93)

Region	State	Cattle	Buffalo	Sheep	Goat	Pig	Poultry	Total
	Odisha	11,621 (6.09)	26 (0.67)	1,581 (2.43)	6,513 (4.82)	280 (2.72)	19,891 (2.73)	20,723 (4.05)
	Chhattisgarh	9,815 (5.14)	1,391 (1.28)	168 (0.26)	3,225 (2.93)	439 (4.26)	23,102 (3.17)	15,043 (2.94)
	Assam	10,308 (5.40)	435 (0.40)	518 (0.81)	6,169 (4.56)	1,636 (15.89)	27,216 (3.73)	19,082 (3.73)
Share to total livestock population		69,220 (36.26)	9,942 (10.95)	4,158 (5.51)	46,148 (34.66)	4,615 (40.82)	1,49,354 (20.49)	1,36,188 (26.61)
Hills and 6 North-East states		7,195 (3.77)	1,880 (1.73)	3,292 (3.54)	4,188 (3.10)	2,387 (23.19)	22,357 (3.08)	17,303 (3.40)
Total		1,90,904 (100)	1,08,702 (100)	65,070 (100)	1,35,173 (100)	10,294 (100)	7,29,209 (100)	5,12,057 (100)
Share to total livestock		1,90,904 (37.28)	1,08,702 (221.23)	65,070 (12.71)	1,35,173 (26.40)	10,294 (2.01)	7,29,209 (0.37)	5,12,057 (100)

Source: Animal husbandry and fisheries statistics 2019, Government of India
 Note: Figures in parentheses indicates percentage share to total livestock population

Table 3. Change in livestock population by species over previous census (In Percentage)

Species	1956-61	1961-66	1966-1972	1972-1977	1977-82	1982-87	1987-92	1992-97	1997-2003	2003-07	2007-12	2012-19
Cattle	10.65	0.34	1.19	0.95	6.94	3.74	2.45	-2.79	-6.89	7.51	-4.12	1.34
Adult Female Cattle	7.82	1.57	3.09	2.25	8.42	4.90	3.70	0.00	0.16	13.18	5.07	9.81
Buffalo	14.03	3.52	8.30	8.01	12.58	8.88	10.79	6.77	8.90	7.56	3.23	1.06
Adult Female Buffalo	11.98	4.53	12.60	9.44	3.83	20.31	12.02	6.85	8.97	6.86	3.85	4.34
Sheep	2.29	5.47	-5.66	2.50	19.02	-6.35	11.16	13.19	6.96	16.42	-9.08	14.12
Goat	9.93	6.08	4.49	12.00	26.06	15.63	4.63	6.42	1.39	12.94	-3.77	10.15
Horses and Ponies	-13.33	-15.38	-18.18	0.00	0.00	-11.11	0.00	0.00	0.00	-25.00	0.00	-45.16
Mules	-100	0.01	0.00	0.00	0.00	0.00	100	0.00	0.00	0.00	-50.0	100
Camels	12.50	11.11	10.00	0.00	0.00	-9.09	0.00	-10.0	-33.3	-16.6	-20.00	-37.50
Pigs	6.12	-3.85	38.00	10.14	32.89	4.95	20.75	3.91	1.50	-17.7	-7.21	-11.95
Donkeys	0.00	0.00	-9.09	0.00	0.00	0.00	0.00	-10.0	-22.2	-42.8	-25.00	-62.50
Yak	NA	NA	NA	NA	NA	NA	NA	NA	0.00	0.00	0.00	0.00
Mithun	NA	NA	NA	NA	NA	NA	NA	NA	0.00	50.00	0.00	0.00
Total Livestock	9.75	2.38	2.53	4.59	13.59	6.10	5.77	3.08	-0.08	9.22	-3.32	4.82
Poultry	20.46	1.05	20.02	14.95	30.46	32.55	11.55	13.19	40.68	32.68	12.39	16.81

Source: Livestock Census, DAH&D, GoI.2019

Table 4. Output contribution by livestock sector in India (at Constant 2011-12 Prices)

Particular												(in crore)	
	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	CAGR (%)	CV(%)	Instability Index(%)
Value of output from livestock sector	4,87,751	5,08,074	5,30,953	5,62,026	5,95,242	6,41,217	6,71,244	7,17,125	7,60,025	7,98,726	5.84***	17.26	25.89
Milk group	3,27,767	3,39,240	3,52,247	3,74,267	3,96,662	4,21,747	4,49,213	4,78,598	5,05,274	5,33,300	5.81***	17.22	25.83
Meat group	96,219	1,02,623	1,10,744	1,17,264	1,25,631	1,43,944	1,52,032	1,64,494	1,76,893	1,84,749	7.92**	22.94	34.42
Meat	88,469	94,428	1,02,444	1,08,543	1,16,698	1,34,362	1,42,251	1,54,070	1,65,717	1,72,966	8.17***	23.61	35.41
Beef	11,754	12,997	13,243	15,255	16,886	16,266	16,419	17,280	17,642	17,643	4.53**	13.76	20.64
Mutton	32,667	34,585	34,905	35,693	35,857	40,505	42,351	45,888	50,611	54,761	5.81**	18.45	27.68
Pork	4,465	4,376	4,615	4,475	3,889	4,526	3,985	4,070	4,185	3,790	-1.57***	6.90	10.35
Poultry meat	39,583	42,470	49,681	53,120	60,066	73,064	79,496	86,833	93,279	96,772	11.36***	31.48	47.22
Meat products	3,346	3,551	3,597	3,764	3,814	4,192	4,325	4,659	5,069	5,401	5.35**	16.51	24.76
By-products	4,404	4,644	4,703	4,957	5,119	5,390	5,456	5,765	6,107	6,383	4.09**	12.30	18.44
Hides	1,887	1,981	2,012	2,158	2,282	2,271	2,198	2,255	2,282	2,289	2.05***	6.86	10.28
Skins	1,189	1,249	1,259	1,290	1,296	1,437	1,517	1,632	1,782	1,917	5.40***	17.12	25.68
Other by-products	1,328	1,415	1,432	1,509	1,541	1,682	1,741	1,878	2,042	2,177	5.54***	16.95	25.42
Eggs	16,633	17,364	18,308	19,080	19,829	20,332	21,901	23,702	26,628	28,525	5.98**	18.64	27.96
Wool & hair	496	508	522	518	464	477	445	440	418	414	-2.57***	8.56	12.84
Wool	352	363	376	378	333	331	314	306	279	287	-3.15**	10.65	15.98
Hair & bristles	144	145	146	140	131	147	130	134	138	127	-1.19**	5.30	7.96
Dung	32,599	33,468	33,311	34,177	34,870	35,515	33,939	34,540	34,826	35,132	0.69***	2.67	4.00
Dung fuel	11,280	11,399	11,594	11,880	12,077	12,029	11,197	11,469	11,508	11,624	0.06**	2.60	3.90
Dung manure	21,318	22,069	21,717	22,296	22,793	23,486	22,742	23,071	23,318	23,507	1.01***	3.36	5.03
Silk worm cocoons & honey	4,326	4,507	4,718	4,768	4,830	4,996	5,273	6,365	6,498	6,577	5.07**	16.34	24.51
Increment in livestock	9,710	10,364	11,102	11,952	12,958	14,205	8,441	8,987	9,488	10,029	-1.41***	17.07	25.60

Source: National Accounts Statistics 2022, MoSPI, Gol. Note: *** - significant at 1%, ** - significant at 5% level of significance

Table 5. Region and state-wise value of output from livestock at constant prices (2011-12)

(` in crore)

Region	State / UT	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	CAGR(%)	CV(%)	Instability Index(%)
North	Punjab	26,660	27,416	28,555	29,247	30,454	31,924	33,637	35,455	37,313	4.31***	11.79	17.81
	Haryana	24,225	25,421	26,677	28,164	29,844	31,856	34,208	37,168	40,379	6.55***	17.81	26.89
	Uttar Pradesh	72,542	75,603	78,763	82,543	85,488	88,350	87,125	91,659	95,076	3.27**	8.85	13.36
	Madhya Pradesh	21,612	23,241	25,136	28,064	31,343	34,514	37,898	40,753	43,727	9.66***	24.92	37.62
Subtotal		145,039	151,681	159,131	168,018	177,129	186,644	192,868	205,035	2,16,495	5.12**	13.68	1.04
South	Andhra Pradesh	34,124	35,868	36,442	38,034	43,192	48,984	53,948	58,081	60,895	8.33***	22.57	34.08
	Tamil Nadu	33,214	35,352	40,627	45,342	49,998	60,606	64,514	69,593	72,931	11.24**	28.46	42.98
	Karnataka	18,936	19,623	20,199	21,031	21,740	22,518	23,624	26,276	30,382	5.39***	16.05	24.24
	Kerala	12,987	14,050	13,802	14,245	14,259	13,639	13,989	13,738	13,587	0.16**	2.85	4.31
	Goa	292	279	302	251	220	208	235	236	249	-3.02**	12.79	19.32
	Telangana	23,977	25,660	26,333	28,246	29,887	31,684	33,794	38,740	42,061	7.07***	19.62	29.62
Subtotal		123,530	130,832	137,705	147,149	159,296	177,639	190,104	206,664	2,20,105	7.82**	20.81	31.47
West	Maharashtra	37,617	38,743	39,185	40,042	42,124	46,212	49,641	52,257	53,688	5.02**	13.98	21.11
	Gujarat	31,109	32,429	34,658	36,425	37,917	39,419	40,054	42,363	44,430	4.42**	11.79	17.81
	Rajasthan	51,735	53,741	56,443	63,723	68,699	75,906	78,125	82,085	88,612	7.34**	19.25	29.07
Subtotal		120,461	124,913	130,286	140,190	148,740	161,537	167,820	176,705	186,730	5.90**	15.72	23.76
East and	Bihar	22,098	22,944	24,606	26,340	27,653	29,332	30,042	32,209	35,679	5.90**	15.91	24.02
7 North-	Jharkhand	7,758	7,485	7,648	7,851	8,082	8,474	8,942	10,168	10,881	4.53***	13.95	21.06
East states	West Bengal	28,875	30,106	30,353	30,506	31,089	32,229	35,076	37,566	40,153	3.95**	11.73	17.71

Continue...

Region	State / UT	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	CAGR(%)	CV(%)	Instability Index(%)
	Odisha	9,523	9,584	10,063	9,806	9,884	10,218	10,655	11,597	11,825	2.69**	8.16	12.32
	Chhattisgarh	4,910	5,119	5,311	5,404	5,565	5,996	6,192	6,530	6,898	4.26***	11.67	17.63
	Assam	5,173	5,412	5,428	5,614	5,785	5,966	5,932	6,006	6,226	2.18***	5.98	9.03
	Arunachal Pradesh	614	562	639	676	702	747	784	814	853	5.01**	13.68	20.66
	Manipur	708	721	730	729	718	732	756	763	793	1.16**	3.62	5.47
	Meghalaya	613	630	665	683	694	722	735	755	739	2.61**	7.18	10.85

Region	State / UT	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	CAGR(%)	CV(%)	Instability Index(%)
	Mizoram	369	362	376	409	451	784	801	831	937	14.99***	40.54	61.21
	Nagaland	1,024	952	931	924	599	580	541	528	517	-9.59**	29.55	44.62
	Sikkim	140	137	153	159	193	190	158	162	205	3.87**	14.48	21.86
	Tripura	697	759	872	941	915	1011	1019	1215	1295	7.38***	20.05	30.28
Subtotal		82,502	84,773	87,775	90,042	92,330	96,981	1,01,633	1,09,144	1,17,001	4.29**	12.08	18.26
Hilly zones	Himachal Pradesh	3,217	3,269	3,302	3,361	3,619	3,746	3,871	4,083	4,267	3.78***	10.48	15.83
	Jammu & Kashmir	5,857	5,829	5,844	6,350	6,985	7,355	7,486	7,722	7,626	4.33**	11.99	18.10
	Uttarakhand	4,098	4,314	4,509	4,587	4,825	4,936	4,994	5,156	5,229	3.02***	8.15	12.30
Subtotal		13,172	13,412	13,655	14,298	15,429	16,037	16,351	16,961	17,122	3.78***	10.26	15.52
UTs		3,047	2,461	2,398	2,329	2,317	2,380	2,467	2,616	2,574	-0.68**	8.99	13.58
All India		4,87,751	5,08,074	5,30,953	5,62,026	5,95,242	6,41,217	6,71,244	7,17,125	7,60,025	5.85**	15.68	23.68

Source: National Accounts Statistics 2022, MoSPI,
 Note: ***- significant at 1%, **- significant at 5% level of significance

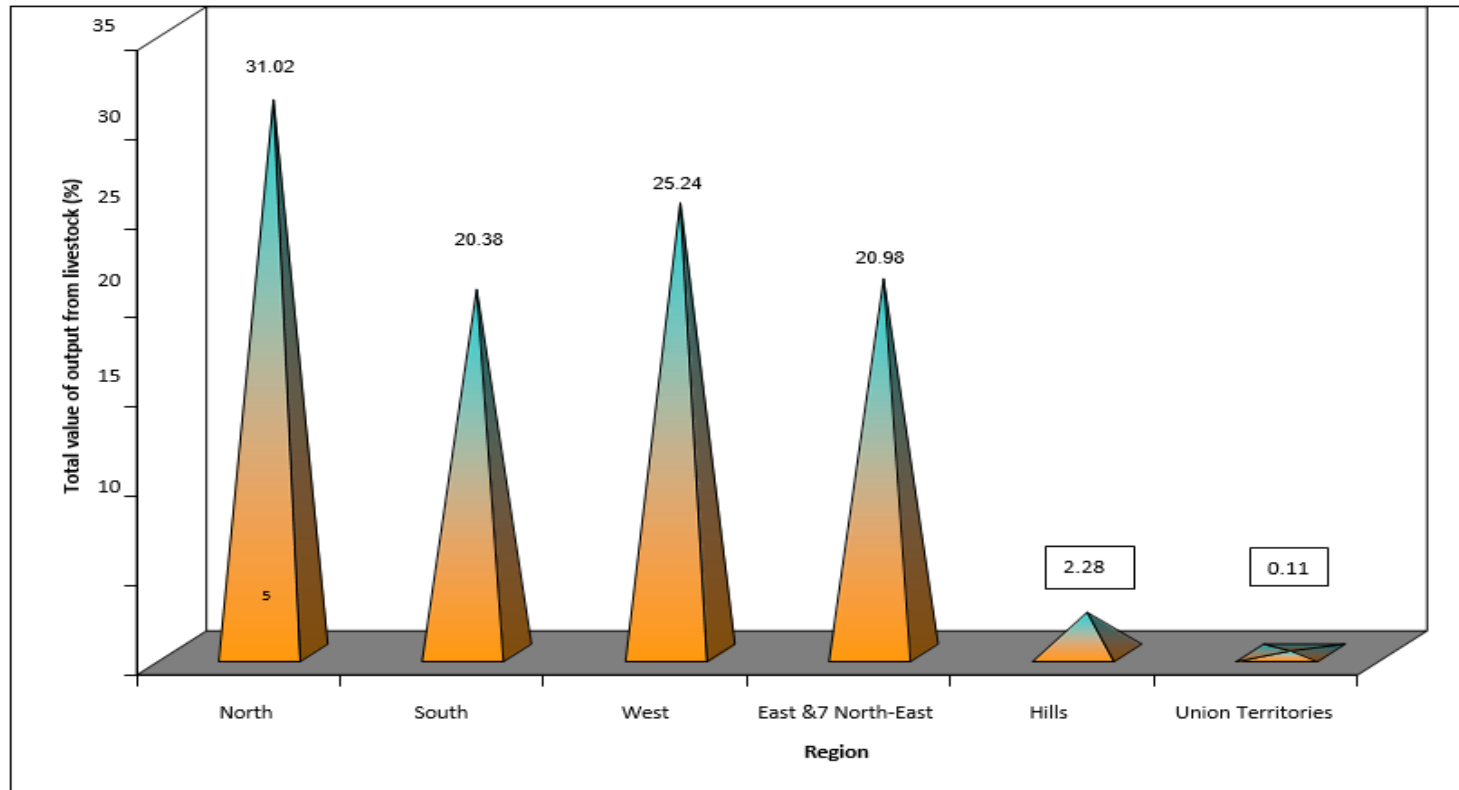


Fig. 1. Region-wise share of livestock sector in Indian economy in 2021-22



Fig. 2. Region-Wise value of Output from livestock at constant prices (2011-12)

3.1 Cost Effective Poultry Products Including Meat Demand

The total livestock population in the country was 536.76 million in 2019, has showed record increase about 4.82 per cent over the previous census (2012). The total milch animals have shown an increase of 6 per cent due to higher yields, foreign breeds constitute more than half the population of milch animals. The population of the total exotic/crossbred cattle has increased by 27 per cent. They provide milk, meat, draft purpose, hides and skin, manure and other valuable by product thereby significantly contributing to sustainable human nutrition and economy of the nation.

Table 4 shows the per cent change in the livestock population by species over previous census. The population of cattle in the country have increased from 155.3 million in 1951 to 193.46 million during 2019. Similarly, the buffalo population in the country has increased from 43.4 million in 1951 to 109.8 million in 2019. The sheep and goat population has increased up to 2007 and a considerable slow in their population was noticed in 2012 further increased in 2019. The total livestock population in the country was 536.76 million in 2019, has recorded an increase of about 4.82 per cent over the previous census (2019). The total cattle, buffalo, sheep, goat, pigs, camels, mithuns and yaks, horses and ponies and mules and donkeys contributed nearly 36.04 per cent, 20.47 per cent, 13.83 per cent, 27.74 per cent, 1.69 per cent, 0.05 per cent, 0.08 per cent, 0.06 per cent and 0.04 per cent, respectively of the total livestock population as per 2019 census. In case of poultry population, it increased about 16.81 per cent over the previous census (2012). Another important feature of the livestock census 2019 is that camel, pig, yak, horses and ponies and donkey population decreased by about 37.50 per cent, 11.95 per cent, 25.00 per cent, 45.16 per cent and 62.50 per cent over 2012 census respectively. On the other hand, cattle, adult female cattle, buffalo, adult female buffalo, sheep and goat population has increased as per 2019 census.

The state-wise value of output from livestock is given in Table 5. It is seen that Uttar Pradesh, Rajasthan, Tamil Nadu, Andhra Pradesh and Maharashtra together accounted for 48.84 per cent of value of output of livestock sub-sector at constant prices during 2019-20. The output of Tamil Nadu (11.24%) has increased at a faster rate followed by Madhya Pradesh (9.66%),

Andhra Pradesh (8.33%) and Rajasthan (7.34%) during this period. However, change in share of output in Uttar Pradesh (3.27%) has decreased rapidly during the same period. Further, the value of output was growing more than the growth at national level in more than 9 states, including Mizoram and Tripura. Mizoram (14.99%) had highest growth rate in value of output from livestock sector followed by Tamil Nadu (11.24%), Madhya Pradesh (9.66%) and Andhra Pradesh (8.33%). Highest instability was found in Mizoram (61.21%) followed by Nagaland (44.62%) and Tamil Nadu (42.98%). The total output from livestock contributes highest from South part of India (2,20,105 crores). The highest growth rate was observed in South India (7.82%) followed by western states (5.90%).

Table 6 represents the trends in India's exports and imports of agricultural commodities including livestock products for the period 2011-12 to 2021-22. India has consistently maintained a trade surplus in agricultural commodities over the years, India's agri-exports increased from ` 1,82,801 crores in 2011-12 to ` 3,69,826 crores in 2021-22, grew at a CAGR of 2.81 per cent during the period, although in 2019-20, there was a slight drop in agri-exports by 8.5 per cent. The livestock exports also increased from ` 15,188 crores in 2011-12 to ` 30,953 crores in 2021-22, registered growth of 3.57 per cent which is higher than exports of agricultural commodities (2.81%). Likewise, the importance of agricultural products has also increased from ` 70,165 crores in 2011-12 to ` 2,37,913 crores in 2021-22, grew at a CAGR of 7.83 per cent.

During 2021-22, India's livestock products exports surged and reached the highest so far and this was possible due to farmers response and lots of of measures/ schemes, programmes initiated by the government of India and strengthening of institutions in dairy sector including promotion of farmer's producer organisations (FPOs) for export. During this period, the share of export of livestock products in total agri-exports has also increased from 8.31 per cent in 2011-12 to 13.99 per cent in 2015-16. Thereafter, it slipped from this peak and stood at 8.37 per cent in 2021.22 (Table 6). India has thus showed an impressive is milestone growth trajectory from food deficit country to a food sufficient and to a food surplus one now and as with respect to contribution to the country. All revolutions in agricultural production triggered by innovations, incentives and institutions have successfully made India net exporter of

agricultural produce (Vinod, 2021). During April – September 2022, increase in exports of poultry products (94.65 %), dairy products (67.68 %), processed meat (36.43 %), and sheep and goat meat (22.22 %) in comparison to the same period during 2021. The share of buffalo meat

Table 6. India’s share in imports and exports of principal agricultural commodities and livestock sector

Year	(in crore)							
	Agricultural Imports	Agricultural Exports	Livestock Products Exports	Net Agri Export Surplus (Agri-exports-agri-imports)	Agriculture GVA at Current Prices	Share of Agri-import in agri-GVA (%)	Share of Agri-export in agri-GVA (%)	Share of Livestock products export in agri-exports (%)
2011-12	70,165	1,82,801	15,188	1,12,636	15,01,9474.67	12.17	8.31	1.01
2012-13	95,719	2,27,193	20,778	1,31,474	16,75,1075.71	13.56	9.15	1.24
2013-14	85,727	2,62,779	32,289	1,77,051	19,26,3724.45	13.64	12.29	1.68
2014-15	1,21,3192	39,681	33,128	1,18,362	20,93,6125.79	11.45	13.82	1.58
2015-16	1,40,2892	15,396	30,141	75,107	22,27,5336.30	9.67	13.99	1.35
2016-17	1,64,7272	26,652	29,369	61,925	25,18,6626.54	9.00	12.96	1.17
2017-18	1,52,0952	51,564	29,814	99,469	28,29,8265.37	8.89	11.85	1.05
2018-19	1,37,0192	74,571	30,633	1,37,552	30,29,9254.52	9.06	11.16	1.01
2019-20	1,47,4462	52,976	26,384	1,05,530	33,58,3644.39	7.53	10.43	0.79
2020-21	1,57,8873	05,942	27,156	1,48,055	36,09,4944.37	8.48	8.88	0.75
2021-22	2,37,9133	69,826	30,953	1,31,913	39,80,0675.98	9.29	8.37	0.78
2022-23*	1,48,8652	07,227	16,446	NA	NA	NA	NA	NA
Average	1,38,2642	51,384	26,856	1,18,097	26,13,7195.28	10.25	11.02	1.13
CAGR(%)	7.83***	2.81**	3.57***	0.78**	9.63**			
Instability index(%)	19.94	17.39	23.69	27.53	4.52			

Source: Directorate of Economics and Statistics, APEDA and CMIE.

Note: CAGR was calculated for the period 1990-91 to 2021-22. (*) April-September 2022.

***- significant at 1%, **- significant at 5% level of significance

Table 7. State-wise exports of livestock products

State	(in crore)						
	Uttar Pradesh	Maharashtra	Haryana	Tamil Nadu	Gujarat	Other States	Total
2011-12	4,032.66	9,122.33	995.94	476.06	66.35	494.90	15,188.24
2012-13	6,387.47	10,043.35	2,070.92	763.26	100.15	1,413.06	20,778.21
2013-14	11,570.07	14,439.05	2,463.27	1,071.73	472.70	2,271.74	32,288.56
2014-15	12,509.21	14,672.78	2,894.58	864.18	182.85	2,004.70	33,128.30
2015-16	11,706.89	11,401.70	2,524.06	2,173.23	154.39	2,180.78	30,141.05
2016-17	10,157.59	11,875.20	3,441.26	1,681.62	171.04	2,042.58	29,369.29
2017-18	13,260.73	8,920.04	3,553.25	1,587.40	196.61	2,295.65	29,813.68
2018-19	13,619.55	8,306.73	3,162.97	2,157.77	371.77	3,014.19	30,632.98
2019-20	12,182.19	7,660.15	2,530.24	1,655.80	256.76	2,098.84	26,383.98
2020-21	13,527.61	7,222.72	2,909.74	1,111.59	198.84	2,185.07	27,155.57
2021-22	14,087.68	8,976.68	3,331.96	839.09	664.03	3,053.86	30,953.30
Average	10,442.41	9,914.48	2,548.98	1,232.32	242.41	1,980.422	26,361.04
CAGR (%)	9.22**	-4.17**	7.54***	6.72**	13.67**	10.99***	3.57**
Share in 2021-22 (%)	45.51	29.00	10.76	2.71	2.15	9.87	100
Instability index(%)	12.51	24.38	13.87	34.54	53.48	16.56	12.37

Source: www.apeda.gov.in; Note: ***- significant at 1%, **- significant at 5% level of significance

was 6.19 per cent in total agricultural exports. During last two decades, APEDA was more focussed on export promotion of meat. It may be concluded that despite COVID-19 pandemic, the exports in the livestock sector were performed impressive growth.

State-wise exports of livestock products monitored by APEDA has been presented in Table 7. It is clear from the table that Uttar Pradesh has exported the highest livestock products in value term with a worth of ₹14,087.68 crore in 2021-22 followed by Maharashtra (₹8,976.68 crore), Haryana (₹3,331.96 crore), Tamil Nadu (₹839.09 crore) and Gujarat (₹664.03 crore). These five states, together, accounted for 90.13 per cent of the total exports of livestock products under APEDA. Overall export of livestock products from all the states has grown at 3.57 per cent over the years from 2011-12 to 2021-22. The main drivers of increase in livestock exports in 2021-22 were buffalo meat, dairy products, poultry products, goat and sheep meat and other meat. Growth trend analysis of exports of livestock products suggest that almost all the products showed the positive trend during 2008-09 to 2021-22. It was varying at the rate of 12.37 per cent over the years as it indicates the export of livestock products was highly stable. The study also revealed that despite impact of COVID-19 pandemic on dairy sector and performance of KMF decreased the consumption in local markets during last two and half years, livestock exports registered an impressive growth of 13.98 per cent in 2021-22 and 16.97 per cent in the first half of 2022-23 as compared to the same period in the previous year(2021-22). The rise in agricultural exports including livestock products is the outcome of the centres' initiatives such as organising business to business exhibitions in different countries, exploring new potential markets through product-specific and general marketing campaigns by the active involvement of Indian Embassies. Vinod Kumar [27], stated that during 2018-19, India's export of Animal Products was Rs.30632.81 crore which include the major Products like Buffalo Meat, Sheep/ Goat Meat, Poultry Products, Dairy Products, Processed Meat, Albumin (Eggs & Milk), Natural Honey, etc.

4. CONCLUSION

Livestock is an integral component of agriculture in India and make multifaceted contributions to the growth and development of the agricultural

sector. India is ranked 1st in world milk production and it contributes 23 per cent of global milk production. It registered a positive growth of 5.80 per cent showing an increase from 198.4 million tonnes in 2019-20 to 210.0 million tonnes in 2020-21. The total milch animals have shown an increase of 6 per cent due to higher yields, foreign breeds constitute more than half of the milch animal population. The state wise distribution of livestock in the country was analysed. State-wise share of livestock sector in Indian economy was observed that Uttar Pradesh, Rajasthan, Madhya Pradesh, Andhra Pradesh and Gujarat, together account for 53 per cent of milk production in the country. The increase is mainly driven by a sharp increase in crossbred cattle and higher female indigenous cattle population. The productivity of local cow is low as compared to cross bred. We need to develop the breeding improvement policy for indigenous breeds. The total output from livestock contributes highest from South region of India (2,20,105 crores). The highest growth rate was observed in South India (7.82 %) followed by western states (5.90 %). The share of value of milk and milk products in total livestock output is highest in India followed by meat (23.13 %), eggs (5.98 %) and milk (5.84 %) and the value of output from livestock sector grew by 5.84 per cent during 2011-12 to 2020-21. The compound annual growth rate (CAGR) of livestock GVA is 7.63 per cent is much higher than that of agriculture and allied sector (3.64 %). This is a clearly indication of growing importance of livestock sector in the overall agricultural development in the country.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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