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**Spatiotemporal analysis of dairy sector in India**

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**Abstract:**

While dealing with Agricultural Economics there are profusion of study and documenting a magnitude of dimensions of crop sector and its production. But there is a gap in study of allied sector of India. The contribution of dairy sector to Indian agriculture is substantial. Indian dairy sector has gained reputation over the years which will help to keep momentum of growth in future. This is a pioneering attempt to analyze the state of the dairy sector in India and try to point out the problems to be tackled. This paper tries to analyze the data using the descriptive statistics. The analysis suggest that the Indian dairy sector is in an advantages position. The changing food pattern has brought new market for the Indian dairy products. The Indian buffaloes are more productive than the cattle. Further the northern region of the country is having high production. The dairy sector needs structural changes which will help equipping to maintain its consistency and competency in the global market.

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### **Introduction:**

Domesticated animals and agricultural exercises are co-existing since man started to develop his social life, it's reliant on each other. Livestock is an imperative part of agrarian economy and Indian economy in terms of income employment equity and foreign exchange earnings. It frames an employment opportunity to the Indian farmers and is a supplementary income and has an essential influence in the nourishment security. "Livestock act as a supplementary and complementary enterprise."

In India there prevails an economics and cultural nearness between the crop and cattle production. Shanti George (1985) critique of operation flood says that "In India, milk is a nutrient in a limited supply and a necessary food only for certain sub-groups. Obvious conclusion is that what milk is produced must be directed towards those whose body requires it the most...." In India in past consumption of liquid milk or using of Indian dairy products was not that common. In 1980's milk was an expensive source of protein comparing to the cereals and pluses, every families did not have the habit of drinking milk or tea with milk. Only young children and infants were

given milk, and cow's milk was next to mother's milk.

In the present Indian situation, the consumption pattern of the society has changed. As an influence of globalisation, India is trying replicate the consumption pattern or style of the rest of the world. Today in India milk is not only for consumption as in fluid form by there are many industries which uses milk for making dairy products like ice-cream, sweets, butter and so on. Thus, demand for milk is a derived demand. In India, milk has traditionally been consumed in the form of liquid milk, ghee, curd, butter and sweet. One important change that has taken place in the production of western type of products such as table butter, ice-cream, milk powder and cheese (Dr. RakeshSaxena, 1997).

### ***Purpose of this paper***

This paper focuses on the importance of dairy in the present Indian economy. It tries to point out and analyse the milk production and the top milk producing states and analyse the reasons for the high milk yield compared to other states. This paper also tries to analyse the importance of the dairy in the national income and constrains in the dairy farming.

### ***Research Methodology***

For this study, the data series was dependent on the secondary sources. The choice of data period is from 1992-2017. The data was taken from the National Accounts Statistics and Department of Animal Husbandry Dairying and Fisheries and ministry of Agriculture and processed food product export development authority. The entire data is analyzed with descriptive statistics.

### ***Research gap***

This paper analyses the present situation in the dairy sector of India. The study is done by dividing India into five zones based on administrative status and tries to find out the milk productivity and compare it. This paper brings out the high milk yielding states and find out which zone it belongs to. It also points out how buffalo plays an important role in the milk

### ***Present scenario:***

India is the world's largest producer of milk, with an annual output of 165.4 million tonnes during the year 2016-17. The per capita availability of milk was 355 grams per day during 2016-17. The share of milk to the total value of output has been increasing every year. "World milk production in 2017 is currently predicted to

productivity in the top milk producing states.

### ***Trends in Bovine population***

The major bovine population includes Cattle, Buffalo, Mithun and Yak. According to the livestock census the total bovine population in 2012 is 299.9 million. Bovine population is the main milk producing live stocks in India. Bovine forms an integral part of the commercial as well as mixed farming as they provide draught power for rural agricultural operations and milk. The bovine population is showing a continuous fall because the cattle population in the bovine population is falling continuously. According to the livestock census the density of bovine population is more in rural area than in urban area. The cattle population in rural is showing a negative growth rate in rural area by 3.45% and urban area by 18.34%.

grow by 12 million tonnes, or 1.4 percent, to 833.5 million tonnes. Output is seen to expand in Asia and the Americas, stagnate in Europe and Africa and decline in Oceania. Most of the global increase would originate in Asia, principally in India, where production is forecast to progress by nearly 4 percent to 169 million tonnes. Although localized floods have affected some dairying regions in the country, improved water

availability and generally normal monsoons have benefitted pasture growth, which should support milk output” (FAO, 2017)

In 2011-12 the share of milk group to Gross Value added of agriculture was 22 percent. In 2012-13 there was only a gradual progress in its share and in 2014-15 there was a leap from 23 percent to 25 percent. In 2015-16 the milk group alone in the livestock sector provided 26 percent of value of output to the total Gross Value Added of agriculture and allied sector. This it-self shows the importance of dairy sector in the Indian agricultural economy as well as the aggregate economy.

Today India stands first in the milk production in the world, with the help of prudent policy interventions. Dairy has become an important secondary source of income to millions of rural populations. In 1987-88 milk occupied the first position among the agricultural commodities even higher to rice. This only goes to show the importance of milk production enterprises in the India agricultural system and national economy in general. (R.K. Patel, 1991).

#### ***Milk production and productivity:***

When India is taken the annual output of milk in India during 2016-17 was 165.4 million Tonne, but the value of output is not uniform in every state. The

distribution of bovine population differed significantly in different regions of the country. The factors which influences the milk production also differ in different areas of the country. These factors include, productivity of milch animals, the total breedable milch population, feed and fodder, animal health cover and artificial insemination. These will help in understanding the regional imbalances in milk production.

In this paper India classied into the states into 4 region Northern, Southern, Eastern and Western and Union territories. Northern region which include the seven northern states contributes more than 40 percent of the milk. The southern region includes the four southern states contributes around 20 percent, eastern region include all the eleven states in the eastern side of India contributes around 11 to 12 percentage and western region includes five western states and it together contribute more than 20 percent. The union territory includes all the union territories in India and its contribution to milk production is only less than 1 percent. However, the overall milk production in the country is increasing at an increasing rate. The compound annual growth rate of milk production or dairy sector is 5.23 percent. Considering the above table, we can say that the major part of the

milk production is in the northern region of the country. It plays the major role in the dairy sector of India.

The contribution of Northern region is decline at a low rate from 44.3 percent in 2010-11 to 44.0 percent in 2013-14 however, in 2014-15 there is increase in the percentage, the percentage increased 44.4 percent and it again increased to 44.9 percent in 2016-17. The percentage share of southern region to total production from 2010-11 to 2012-13 was around 21 percent and it decline to 20.8 percent in 2013-14 and the production is clustering around 20 percent from 2013-14 to 2016-17. The eastern region also shows a decline in percentage of contribution. The percentage has decline from 12 percent to 11.8 percent from 2013-14 to 2014-15. The western region show continues growth in milk production over these years. It was 21.3 percent in 2010-11 and it increased to 23 percent in 2016-17. The union territories are contributing only less than 1 percentage and there is continues decline in its share. In 2010-11 the share of union territory was 0.5 percent and it has declined to 0.2 percent in 2016-17.

In 2016-17 the per capita availability of milk in Uttar Pradesh is 348 (gm/day), while the per capita availability of milk in all India is 355 (gm/day). The

progressive increase in the share of milk production in Western region can be because of the increasing per capita availability of the states in this region. In 2016-17 Gujarat have a per capita availability of 563 gm/day, Madhya Pradesh have 468 gm/day, and Maharashtra have an availability of 243 gm/day. These high yielding states show a forward moving or increasing rate in per capita availability of milk.

When analysing the production of milk, in Northern region, it has the highest share of milk in India and the first to top milk producing states are in this region. When we analyse the bovine population in Uttar Pradesh, total population according to livestock index 2012 is 24501('000) and the female buffalo population over 3 years is 15,432 ('000) and cow population is 9,069 ('000) which are highest of all the state. In Rajasthan, the second largest state in milk production, is the state that have largest number of female buffalo (over 3 years) 6,933('000), after Uttar Pradesh. The population of bovine in Rajasthan is 13,403('000) and cows is 6,470('000). The other northern region state Punjab and Haryana also have high number of female buffalo population. Thus, in aggregate the northern region has more female buffalo population compared to other regions. In these region goats also play a vital role in

increasing milk production. Here arises the question of productivity

It can infer that Indian buffaloes have higher productivity than the indigenous cows. Cross bred cows, however, have higher milk production and yield compared to indigenous cows and buffaloes. Milk productivity of cross bred cows is highest in Maharashtra followed by Uttar Pradesh and Rajasthan respectively. While average yield of cross bred is high in Punjab (12.72). In the case of indigenous cows highest productivity is seen in Rajasthan, followed by Uttar Pradesh and Madhya Pradesh respectively. In the case of indigenous cows also Punjab have highest average yield per day (6.59). Uttar Pradesh accounts for having highest milk productivity of buffaloes. Rajasthan comes the second in buffalo's milk productivity and per day average milk yield is highest in Punjab (8.21).

Even though goats are small ruminants they also contribute to the milk production. Goat's milk is used by many of the tribes and rural people and goat's milk is said to have more vitamins and protein than milk of cows and buffaloes. The highest milk production is in Rajasthan followed by Uttar Pradesh and Punjab has highest per day.

It can be inferred that Uttar Pradesh is having high milk production is because of its large number of female buffalo population and cow population. And the productivity of buffaloes is very high compared to other top milk producing states. The milk of buffalo is having high fats content than the milk of cows. Another factor that contribute to the milk productivity is the high yielding indigenous cows, Uttar Pradesh ranks second in milk productivity of indigenous breed. Even though Indian cows are generally low in milk production the indigenous breed in Uttar Pradesh have a good account of milk production. In case of cross bred also Uttar Pradesh rank second in milk production. Thus, it can be said that Uttar Pradesh ranks first in milk production because of the combination of cows buffalo and goats. Unlike Maharashtra which have high productivity in cross bred cows but lack in rest of the animals. Rajasthan also follows same pattern of Uttar Pradesh.

The Anand success in milk production, it is argued, has been based on the buffalo, and not the cross bred cow, and use indigenous cattle feed based on agricultural waste and not on high manufactured feed and green fodder" G. Parthasarathy. "Fortunately, India has a favourable economic advantage in milk

production. But this is confined to only small holder dairy production... (R.K. Patel, 1991).

Buffaloes produce milk by consuming roughage up to 90% of their intake, thus demonstrating their efficiency in converting coarse crops residues and grass into milk. This also reflected in the daily paid out cost per litre of milk which is lowest for buffaloes as against cross bred and for indigenous cows. (Dr. S. Bhide and S.K. Chaudhari, 1997).

### ***Constraints:***

Dairying is an integral part of present agriculture and one of the main agro based industry. The cross bred cows need more care compared to the indigenous cattle and buffaloes, even though the milk yield is very high. Health problems faced by cross breeds are very high, calcium deficiency is one such big problem. Farmer do not wish to keep more cross bred milch cows since it requires a full-time labour. Due to the many farmer are reluctant to have integrated farming. As mentioned above in cross breed animals the chance of getting disease is very high and if an animal is affected by disease the cost of treatment is also high. Even though the government have given insurance the farmers face difficulties in taking care of

these animals. These animals also need to be taken vaccination to get resistance from diseases.

Another important hindrance is the availability of green fodder, in India, cattle and buffaloes are raised mainly on feedstuffs which are unfit for human consumption. These includes rice straw, wheat straw, maize, sorghum and millet stoves and other crop by-products and waste material. India buffaloes and cattle need these dry foddors for milk production, but the high yield cross bred cattle require green fodder for high milk production. For this the farmers have to a lot a minimum area for fodder cultivation. The farmer who dependent on the monsoon rain for cultivation face difficulties in cultivation of fodder. Pricing policy is another hindrance in the development of dairy sector. The problem of pricing has to safe guard the interest of milk producers, processors and consumers. The producers face difficulties in balancing the cost of production. The real problem is in the determination of the cost of milk production and this should take into consider the type of animal (cross bred or indigenous or buffalo), herd size, technology used...etc. The dairy plants or cooperatives give is based on fat and SNF (solid non-fat) content of the milk. Buffalo have high fat milk, while cross bred cows don't have fat in the milk thus even if

there is high yield in milk the producers don't get the price.

### *Conclusion*

This purpose of this paper was to provide a preliminary assessment of the present status and potential of dairy in making impact on the economic development in the country. It is found that the milk production system prevailing in India has immense potential for economic development in the short run and long run. But changes in animal management and feeding practises should be instrumented for raising the milk yield in short run. However technological changes and better management system is needed in long run, since India do not have the western model commercial dairy farms. Most of the dairying belong to the subsistence or near subsistence category, they have high state in milk production. This is because dairy income is often supplement to farming and labour income.

There should be implementation to improve the stock of water buffaloes, which is the main source high quality of milk. The major milk producing states also accounts to have high population of buffaloes. The milk of buffaloes has high fat content than any other milk, and it is the high-quality milk in India.

Thus, there should be policies and scientific study for improving the quality of the Indian buffaloes. In the eastern region of the country the milk production is declining. On analysing it is found that the milk productivity of every bovine population is very low. Proper study should be conducted to find out reasons for low productivity.

There should be steps to reduce the cost of production of milk. The cost of inputs which includes feed, cultivation of fodder, medicines, etc... must be controlled. Producers even though have indigenous knowledge about cattle rearing, they must be educated about the special care that is needed to be given to the cross bred cows, also why they do not get price for the milk, how to maintain good breeds, how to use modern technologies which can reduce cost of production and every aspects related to the dairy farming so that the farmer will be reduce the risk of losses. Thus, it will help in make the Indian dairy a more commercial one. Introduction of new techniques like hydroponics can reduce the cost for fodder. And farmers should try to develop their own methodology for making feeds.

Thus comprehensive research is required to analyse the need of dairy sector for setting up measure that can facilitate development in in dairy sector.



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APPENDIX: 1

Species	1992	1997	2003	2007	2012
Cattle	<b>204584</b>	<b>198881</b>	<b>185181</b>	<b>199075</b>	<b>190904</b>
buffaloes	<b>84206</b>	<b>89918</b>	<b>97922</b>	<b>105343</b>	<b>108702</b>
Yaks	<b>58</b>	<b>59</b>	<b>65</b>	<b>83</b>	<b>77</b>
Mithun	<b>154</b>	<b>177</b>	<b>278</b>	<b>264</b>	<b>298</b>
Total bovine	<b>289002</b>	<b>289035</b>	<b>283446</b>	<b>304764</b>	<b>299981</b>
Source: Livestock census in thousands (000)					

APPENDIX: 2

Year Region	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Northern	54049 (44.3)	56431 (44.1)	58288 (44.0)	60536 (43.9)	65072 (44.4)	69254 (44.5)	74274 (44.9)
Southern	25793 (21.1)	27219 (21.2)	28276 (21.3)	28708 (20.8)	29827 (20.3)	31497 (20.2)	33497 (20.2)
Eastern	15423 (12.6)	16006 (12.5)	16344 (12.3)	16958 (12.3)	17700 (12.0)	18442 (11.8)	19185 (11.5)
Western	25968 (21.3)	27614 (21.5)	29112 (21.9)	31077 (22.5)	33311 (22.7)	35894 (23.0)	38056 (23.0)
Union Territories	611 (0.5)	632 (0.4)	413 (0.3)	407 (0.2)	402 (0.2)	400 (0.2)	391 (0.2)
All India	121844 (100)	127902 (100)	132433 (100)	137686 (100)	146312 (100)	155487 (100)	165403 (100)
('000) tonnes Source: Department of Animal husbandry, Dairying and Fisheries, Ministry of Agriculture and Farmers Welfare, Government of India							

APPENDIX: 3

<b>Production and Average yield per day in 2016-17</b>				
<b>State</b>	<b>Species</b>	<b>Milk production (‘000) tonnes</b>	<b>Average yield (Kg/day)</b>	<b>Total (‘000) tonnes</b>
Uttar Pradesh	Cross bred cows	3403.12	7.15	27770
	Indigenous cows	5360.18	2.99	
	Buffaloes	17691.89	4.44	
	Goat	1314.55	0.77	
Rajasthan *	Cross bred cows	2037.54	7.74	20850
	Indigenous cows	5648.33	4.32	
	Buffaloes	11115.81	6.16	
	Goat	2048.28	0.78	
Madhya Pradesh	Cross Bred cows	1536.54	8.35	13445
	Indigenous cows	5014.36	2.71	
	Buffaloes	6202.15	4.31	
	Goat	692.27	0.60	
Gujarat	Cross Bred cows	2868.52	8.96	12784
	Indigenous cows	2926.77	4.22	
	Buffaloes	6683.02	4.95	
	Goat	305.82	0.45	
Andhra Pradesh	Cross Bred cows	2957.30	7.78	12178
	Indigenous cows	909.13	2.67	
	Buffaloes	8308.18	5.65	
	Goat	3.33	0.12	
Punjab	Cross Bred cows	2922.06	12.72	11282
	Indigenous cows	236.58	6.59	
	Buffaloes	8063.20	8.21	
	Goat	60.12	1.12	
Maharashtra	Cross Bred cows	4734.22	8.62	10402
	Indigenous cows	1432.26	2.30	
	Buffaloes	4015.39	4.98	
	Goat	220.27	0.23	
*estimated data source: Basic Animal Husbandry and Fisheries statistics 2017				