

**EVALUATION OF FIVE DECADES OF LIVESTOCK DEVELOPMENT  
IN MAHARASHTRA AND THREATS AND OPPORTUNITIES  
IN WTO REGIME**

**Deepak Shah**

**GIPE-RP  
002**

**AGRO-ECONOMIC RESEARCH CENTRE  
GOKHALE INSTITUTE OF POLITICS AND ECONOMICS  
(DEEMED TO BE A UNIVERSITY)  
PUNE 411 004**

**NOVEMBER 2009**

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## FOREWORD

In view of the strategic importance of livestock sector in the agricultural development of our economy, its systematic and well conceived development becomes the pre-condition for successful agricultural policy. Technological changes in agriculture associated with the green revolution have brought about significant changes not only in the structure of milk production but also in the size and composition of animal draught power in several areas of the country. The approach to livestock development has varied widely from region to region in India, especially with respect to consumption of milk and milk products. The state of Maharashtra is not an exception to this phenomenon and it assumes considerable importance in India as it not only boasts to have significant share in total milk production of India but also with respect to a host of other livestock based products, besides having the largest strength of dairy cooperatives in the State. It is in the light of these facts that the present investigation comprehensively evaluates various issues relating to livestock sector of the State, especially in respect of changing structure in livestock production, changes in size and composition of availability of draught animal power, extent of farm mechanization and its impact on draught animal power and changes in policies governing development of livestock sector in Maharashtra in terms population and production dynamics and infrastructure development, aside from assessing prospects of developing livestock sector in WTO regime.

The study shows that the intensity and spread of mechanization is operating at low level in Maharashtra, and, therefore, its impact on displacement of work animals is likely to be low. It also shows a steady increase in adult female bovine population in the State over time in the face of stable adult male bovine population, implying a rapid shift in the sex ratio of bovines in favour of females. In order to boost livestock production in Maharashtra, one of the observations of the study is that a medium term strategy that can realize the underutilized production potential of animals will be more conducive than a strategy based on capital intensive and high production technology. As for the prospects of livestock sector in the era of WTO regime, it is observed that low ruling international prices may lead to fall in the domestic prices of milk following the decision to import milk products at these prices. Since supply of milk is highly price elastic, this situation will lead to adverse affect on milk production in states like Maharashtra, Gujarat, Tamil Nadu, W. B. and Uttar Pradesh. It is observed in the report that the Indian dairy sector would be competitive only if the export subsidies on dairy products are abolished by developed countries.

I hope the findings of the report would assume increasing significance, especially with growing concern for livestock development and food and nutritional security in our country.

Gokhale Institute of Politics and Economics  
(Deemed to be a University)  
Pune 411 004

Rajas Parchure  
Professor and Offg. Director

## PREFACE

The National Agricultural Policy (NAP) document released in July 2000 relies heavily on 6-8 per cent growth rate in Animal Husbandry sector to achieve the targeted growth rate of 4 per cent for the Agriculture sector as a whole. The 10<sup>th</sup> Plan Approach Paper also stresses on the significance and importance of food and nutritional security through diversification of agriculture towards animal husbandry and fishery sectors. With a view to meet commitment to enhance food production in the country and achieve all round development of animal husbandry sector, government calls for rapid increase in the production of livestock products. However, the current trend shows a slowing down in the growth of livestock population in India, especially between 1992 and 2003. Even the production of products from livestock origin have shown a significant deceleration in their growth in more recent times in majority of the states of India, which raises concerns about our ability to meet the domestic requirements in the near future.

The state of Maharashtra assumes considerable importance in India since it not only boasts to have significant share in total milk production of India but also with respect to a host of other livestock based products, besides having the largest strength of dairy cooperatives in the State. In fact, technological changes in agriculture associated with the green revolution have brought about significant changes in the structure of milk production and also in the size and composition of animal draught power in several areas of the country. The state of Maharashtra is not an exception to this phenomenon. It is in the light of these facts that the present investigation comprehensively evaluates various issues relating to livestock sector of the State, especially in respect of changing structure in livestock production, changes in size and composition of availability of draught animal power, extent of farm mechanization and its impact on draught animal power and changes in policies governing development of livestock sector in Maharashtra in terms population and production dynamics and infrastructure development, aside from assessing prospects of developing livestock sector in WTO regime.

The study shows that the intensity and spread of mechanization is operating at low level in Maharashtra, and, therefore, its impact on displacement of work animals is likely to be low. It also shows a steady increase in adult female bovine population in the State over time in the face of stable adult male bovine population, implying a rapid shift in the sex ratio of bovines in favour of females. In order to boost livestock production in Maharashtra, one of the observations of the study is that a medium term strategy that can

realize the underutilized production potential of animals will be more conducive than a strategy based on capital intensive and high production technology. As for the prospects of livestock sector in the era of WTO regime, it is observed that low ruling international prices may lead to fall in the domestic prices of milk following the decision to import milk products at these prices. Since supply of milk is highly price elastic, this situation will lead to adverse affect on milk production in states like Maharashtra, Gujarat, Tamil Nadu, W. B. and Uttar Pradesh that account for more than 40 per cent share in total milk production of India. It is observed that the Indian dairy sector would be competitive only if the export subsidies on dairy products are abolished by developed countries.

At the initial stage of this study, I had fruitful discussions with Mr. Ashish Sharma, former Commissioner, Animal Husbandry Department, Government of Maharashtra, Pune and other senior officers of the Department. I am extremely grateful to them for providing inputs for this study. I am equally grateful to Mr. D.S. Zagade, present Commissioner, Animal Husbandry Department, Dr. Vasant Govind Ramteke, Additional Commissioner, Dr. M.G. Gacche, Deputy Commissioner, Dr. C.G. Dande and Dr. R.G. Kulkarni, Assistant Commissioners, Mr. Subhash Patil, Co-operative Commissioner, Mr. Rajkumar A. Kharat, Special Auditor, Mr. R.L. Kolhar, Research Officer and Mr. S.B. Pardeshi, Deputy Manager of the Department for not only supplying the requisite information but also extending all possible help during the conduct of this study.

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October, 2009

Deepak Shah

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# CHAPTER – I

## INTRODUCTION

### 1.1 Background

The livestock has been well knit with the socio-economic fabric of our rural economy and played an important role in the employment and income generation. The developed countries of the world have already well recognized the importance of livestock for employment and income generation and have devolved around their agriculture a prosperous, progressive and forward looking livestock enterprise. The major components through, which livestock contributes to the agricultural income are milk and milk products, meat and eggs. These products contribute about one-sixth of the calories and one-third of the proteins in the per capita food supplies of the world; the balance comes from vegetable products (Sarma and Patrick, 1985). The per capita consumption of livestock products is, however, four to five times higher in the developed countries than in the developing countries. In the developing countries, the income elasticity of demand for livestock products is high as compared to cereals. It is also high as compared to the developed economies. This implies that with rising per capita income, the demand for these products would rise faster in the Third World countries.

Although India has huge livestock population, in terms of trade it stands insignificant in the world trade of livestock products. However, it is to be noted that India has tremendous potential to produce and export various livestock products. The high potential of the domestic market coupled with marketing opportunities abroad under WTO regime now render India to an enviable position to cater to the huge global market of livestock products, particularly dairy products. The emergence of India as an exporting nation of livestock products in the era of liberalization is sure to upset the traditionally exporting block of nations in these products. It is also widely believed that with the ushering in of the agricultural policy reforms in major industrial countries, the demand for livestock products from developing countries, like India, will get a real boost

In fact, the livestock production in this country is based on the average produce of millions of small-uninformed farmers who are still unaware of modern scientific ways of livestock farming. This is perceived as a major handicap, as the industry is unable to attain the quality requirements to compete in the world market. Therefore, technologies should be adopted to make livestock production system viable and sustainable to usher in

an era of quality consciousness to compete internationally. The moot point to consider over here is whether this is achievable with the kind of animals and resources our poor livestock farmers have at their disposal. Undoubtedly, despite several limiting factors, livestock industry of India has undergone considerable transformation in due course of time mainly due to the application of scientific production techniques by medium and large farmers and greater importance being given to the development of dairy cooperative infrastructure that has contributed in no small measure towards substantial growth in milk production since the early seventies. The investment, effort, innovation and energy of our farmers and industry have seen India moving from insignificant to becoming a major player in the world dairy scene. It is heartening to note that India today ranks as the world's largest milk producer and the value of output through dairying is the largest as compared to any other agricultural commodity. The gross value of output from livestock sector at current prices has grown more than ten folds from Rs.10,599 crores in 1980-81 to Rs.1,39,981 crores in 2000-01 and further to Rs.1,64,509 crores in 2003-04 (CSO, 2005). Further, although milk production in India has shown a rising trend ever since the inception of 'Operation Flood (OF)' programme in 1970-71, the Indian dairy industry acquired substantial growth from 8<sup>th</sup> Plan onwards with rise in milk production from 58 million tonnes in 1992-93 to 88.1 million tonnes in 2003-04. This has not only placed Indian dairy industry on the top of the world but also led to sustained growth in the availability of milk and milk products for the burgeoning population of the country. Dairying of late is considered as the secondary source of income for millions of rural households. The credit for this goes to OF.

At present, the efforts of the government is to promote dairy related activities in non-operation flood areas with emphasis on building up efficient cooperative infrastructure, rejuvenation of sick dairy cooperative federations and creation of infrastructure in the States for production of good quality milk and milk products (GOI, 2005). In this context, an Integrated Dairy Development Programme in Non-Operation Flood, Hilly and Backward areas was launched during the 8<sup>th</sup> Plan, which continued in the 9<sup>th</sup> as well as in 10<sup>th</sup> Plan with a total outlay of Rs.175 crores as a Centrally Sponsored Plan Scheme with 100 per cent grants in aid basis to the States. Since the inception of the scheme, 53 projects with the total outlay of Rs.292.19 crores have been sanctioned covering 149 districts in 23 States and one U.T. (GOI, 2005).

The National Agricultural Policy (NAP) document released in July 2000 relies heavily on 6-8 per cent growth rate in Animal Husbandry sector to achieve the targeted

growth rate of 4 per cent for the Agriculture sector as a whole since the present rate of growth in crop production is less than 2 per cent (GOI, 2004). The 10<sup>th</sup> Plan Approach Paper also stresses on the significance and importance of food and nutritional security through diversification of agriculture towards animal husbandry and fishery sectors. With a view to meet commitment to enhance food production in the country and achieve all round development of animal husbandry sector, government calls for rapid increase in the production of livestock products.

It is in the light of above background that this study attempts to assess the development of livestock sector in the state of Maharashtra as this State assumes considerable significance in total livestock production resources of the country. It also examines significance of livestock sector in the national economy, besides evaluating the likely impact of trade liberalization under WTO regime on the domestic market in general and the livelihood of farming community of India in particular.

## **1.2 Key Achievements in Dairy Development**

The history of India shows a number of other programmes that drew primary attention of the government and gave significant importance to cattle development projects. For instance, Key village scheme was introduced as long back as in 1951. Intensive Cattle Development Project (ICDP) was launched in 1964. In addition, Integrated Rural Development Programme (IRDP) launched in 1978-79, also included dairying as one of the important components for supplementing income of the farmers.

Notably, India's economic efficiency, as a milk producer is essentially a product of the Indian milk production system. It is a subsidiary activity in the rural economy closely intertwined with crop-agriculture and low cost feed and labour. At the farm level, technical efficiency as measured by yield remains low (Shah, 2001). There is, therefore, ample scope for further improvement in the efficiency of Indian dairying to make it globally more competitive. There is also every indication that the rate of growth of dairy industry is likely to gather further momentum due to cost-push effect and the consequent higher returns to the milk producers. Nonetheless, before going into the details of such issues it is essential to delve into the development of this sector in the country.

India's dairying scene has witnessed certain major changes in the last 25-30 years. Government outlay on development of livestock sector rose dramatically from a mere 905 million rupees in the Third Plan (1961-66) to the Sixth Plan (1980-85) total outlay of 3,966 million rupees on animal husbandry and dairying, of which 2,983 million rupees was meant for expenditure on dairying alone. During the Seventh Plan (1985-90), 3,028

million rupees was earmarked for dairying out of a total outlay of 4,679 million rupees for animal husbandry and dairy. Expenditure on dairying increased sharply during the Eighth Plan (1992-97). Of the total outlay of 13,000 million rupees for animal husbandry and dairying, the expenditure on dairying was nearly 63 per cent (Table 1.1). Nonetheless, though outlay on development of livestock sector increased to 15,456 million rupees in the Ninth Plan (1997-2002), only 30 per cent of the total outlay was earmarked for dairying and the remaining for the development of various other animal husbandry activities. The outlay for dairying in the Ninth Plan was substantially lower than the outlay for dairying in Eighth Plan but higher than the outlay for dairying in the Seventh Plan. Such increased allocation in plan outlay, leaving Ninth Plan aside, is a reflection of the importance of dairying in government's overall policy encompassing country's agricultural economy. Since dairying has already turned into viable and well developed sector, efforts of the government are now fully geared to strengthen other activities of livestock sector.

**Table 1.1: Outlay and Expenditure of Central and Centrally Sponsored Schemes under Animal Husbandry and Dairying in India**

(Rs. crores)

Plan	Period	Total Plan Outlay	Animal Husbandry		Dairying		Total		Expd. on Animal Husbandry to Total Outlay (%)	Expd. on Dairying to Total Outlay (%)
			Outlay	Expd.	Outlay	Expd.	Outlay	Expd.		
First	1951-56	1960.0	14.19	8.22	7.81	7.78	22.0	16.00	37.36	35.36
Second	1956-61	4600.0	38.50	21.42	17.44	12.05	55.94	33.47	38.29	21.54
Third	1961-66	8576.5	54.44	43.40	36.08	33.60	90.52	77.00	47.95	37.12
Annual	1966-69	6625.4	41.33	34.00	26.14	25.70	67.47	59.70	50.39	38.09
Fourth	1969-74	15778.8	94.10	75.51	139.00	78.75	233.10	154.26	32.39	33.78
Fifth	1974-78	39426.2	-	178.43	-	-	437.54	232.46	40.78	-
Sixth	1980-85	97500.0	60.46	39.08	336.10	298.34	396.56	337.42	9.85	75.23
Seventh	1985-90	180000.0	165.19	102.35	302.75	374.43	467.94	476.78	21.87	80.02
Annual	1990-91	-	43.71	36.18	79.67	41.43	123.38	77.61	29.32	33.58
Annual	1991-92	-	57.97	43.28	97.49	77.99	155.46	121.27	27.84	50.17
Eighth	1992-97	434100.1	400.00	305.43	900.00	818.05	1300.0	1123.5	23.49	62.93
	1992-93	80771.0	56.54	43.85	99.76	136.69	156.30	180.54	28.06	87.45
	1993-94	100120.1	78.26	54.59	257.74	216.44	336.00	271.03	16.25	64.42
	1994-95	112197.1	98.28	60.64	224.43	185.09	322.71	245.73	18.79	57.35
	1995-96	128590.0	94.00	66.66	250.00	179.67	344.00	246.33	19.38	52.23
	1996-97	-	103.94	81.04	155.98	100.29	259.92	181.33	31.18	38.58
Ninth	1997-2002	859200.0	1076.12	-	469.52	-	1545.6	-	-	-
	1997-98	-	160.15	94.84	39.00	29.24	199.15	124.08	47.62	14.68
	1998-99	-	170.40	53.03	50.60	23.97	221.00	77.00	24.00	10.85
	1999-2000	-	160.08	97.26	73.90	16.45	233.98	113.71	41.57	7.03
	2000-01	-	124.90	85.10	51.00	39.59	175.90	124.69	48.38	22.51
	2001-02	-	156.49	115.61	37.45	37.60	193.94	153.21	59.61	19.39
Tenth	2002-07	1525639.0	13.84.00	-	361.00	-	1745.00	-	-	-
	2004-05	-	284.38	348.73	51.62	63.66	336	412.39	-	-

Source: Basic Animal Husbandry Statistics, 2006, Department of Animal Husbandry and Dairying, Ministry of Agriculture, Government of India, New Delhi



Interestingly, when share of agriculture in total GDP of India declined steadily from 34.72 per cent in 1980-81 to 25.43 per cent in 1997-98 and further to as low as 17 per cent in 2004-05, livestock sector has shown a rising trend in terms of share in agricultural GDP, which increased from 13.88 per cent to 25.55 per cent during this period (Table 1.2). Dairying of late is considered as the secondary source of income for millions of rural households. It is the most preferred activity among small and marginal farmers and even landless due to low capital intensity, higher dependence on common grazing and forest land, short operating cycle with steady returns emanating throughout the year. With 70 million households holding a total 98 million cows and buffaloes, around 22.5 per cent of the total rural household income in India comes from dairying activity (Raju, 2004).

**Table 1.2: Trend in Share of Agriculture and Livestock Sector in GDP of India: At Current Prices**  
(in billion rupees)

Year	GDP	GDP (Agriculture Sector)		GDP (Livestock Sector)		
		Rupees	% Share of total GDP	Rupees	% Share of total GDP	% Share of Agriculture GDP
1980-81	1224	425	34.72	59	4.82	13.88
1985-86	2338	700	29.94	139	5.95	19.86
1990-91	4778	1352	28.30	308	6.45	22.78
1995-96	10733	2778	25.88	650	6.06	23.40
1996-97	12435	3340	26.86	747	6.01	22.36
1997-98	13901	3535	25.43	819	5.89	23.17
1998-99	15981	4065	25.44	911	5.70	22.41
1999-2000	17865	4097	22.93	935	5.23	22.82
2000-01	19254	4091	21.25	1030	5.35	25.18
2001-02	21002	4429	21.09	1088	5.18	24.57
2002-03	22653	4261	18.81	1080	4.77	25.35
2003-04	25494	4843	19.00	1144	4.49	23.62
2004-05	28559	4850	16.98	1239	4.34	25.55

Sources: CSO, 1990, 2003 and 2006, Planning Commission, New Delhi and 'Basic Animal Husbandry Statistics', 2006, Ministry of Agriculture, Government of India, New Delhi

As a result of concerted efforts towards total dairy development, dairy industry in India has moved from dependence to self-reliance with total annual output of milk touching nearly 100 million tonnes of late that is valued at much higher than any other agro-based commodity produced in India. It is to be further noted that at present among 12 groups of food consumption items in the country, milk and milk products rank 3<sup>rd</sup>, next only to fruits and vegetables and cereals, both at current prices and at 1993-94 prices (Table 1.3). Though Table 1.3 also shows a decline in share of cereals, fruits and vegetables and milk and milk products in total private final consumption expenditure in domestic market between 1993-94 and 2003-04, this decline in share is only marginal in the case of milk and milk products (from 8 per cent to 7 per cent) as well as for fruits and

vegetables (from 11 per cent to 10 per cent) as against cereals (from 14 per cent to 8 per cent), indicating not much effect on consumer expenditure on milk and milk products.

In fact, the National Commission on Agriculture (1972) in their Interim Report on milk production also recognized the importance of dairy sector and recommended that benefits of increasing demand for milk in large cities, towns and industrial area should go to small and marginal farmers and landless labourers. In India, landless labourers account for 21 per cent of total rural households. Nonetheless, they own 12 per cent of the milch animals and provide 16 per cent of all rural-produced milk. It stands to reason that dairying is a paying proposition for these poor rural people (Bedi, 1987). Hence efforts should be made to promote as much milk production as possible involving this segment of rural population. The commission suggested an integrated rural development approach based on a system of 'Kaira District Co-operative Milk Producers' Union Limited' commonly known as 'AMUL' in Anand of Gujarat (Jain, 1979).

**Table 1.3: Private Final Consumption Expenditure By Object in India**

(Rs. crores)

Sr. No.	Item	At Current Prices			At 1993-94 Prices		
		1993-94	2000-01	2003-04	1993-94	2000-01	2003-04
1.	Food, beverages & tobacco	315243 (54.85)	643300 (47.30)	778072 (44.06)	315243 (54.85)	387447 (47.27)	435865 (45.17)
	Share in Private Consumption (%)						
	1.1 Food	50.60	42.23	38.26	50.60	42.48	39.33
	1.1.1 Cereals & bread	13.97	10.06	8.20	13.97	9.30	8.71
	1.1.2 Pulses	2.09	1.26	1.18	2.09	1.15	1.21
	1.1.3 Sugar & gur	3.51	2.93	2.02	3.51	3.39	2.75
	1.1.4 Oils & oilseeds	4.04	2.02	2.46	4.04	3.14	2.89
	1.1.5 Fruits & vegetables	10.89	9.97	9.73	10.89	9.72	8.47
	1.1.6 Potatoes & other tubers	1.08	0.77	0.67	1.08	0.95	0.80
	1.1.7 Milk & milk products	8.11	7.74	6.93	8.11	7.87	7.21
	1.1.8 Meat, egg & fish	3.78	3.75	3.51	3.78	3.61	3.78
	1.1.9 Coffee, tea & tobacco	1.02	0.66	0.47	1.02	0.72	0.66
	1.1.10 Spices	1.39	2.25	2.28	1.39	1.84	2.04
	1.1.11 Other food	0.74	0.81	0.79	0.74	0.79	0.82
	1.2 Beverages, pan & intoxicants	1.03	1.40	1.59	1.03	1.31	1.87
	1.2.1 Beverages	0.51	0.87	1.19	0.51	0.81	1.37
	1.2.2 Pan & other intoxicants	0.52	0.83	0.40	0.52	0.49	0.50
	1.3 Tobacco & its products	2.14	2.26	2.74	2.14	1.98	2.32
	1.4 Hotels & restaurants	1.07	1.40	1.47	1.07	1.50	1.65
2.	Clothing & footwear	34999	62609	77764	34999	43035	46037
3.	Gross rent, fuel & power	68239	155285	202049	68239	88674	97237
4.	Furniture, appliances, service, etc.	17610	40987	51256	17610	30123	34804
5.	Medical care & health services	19543	99338	146374	19543	41213	56596
6.	Transport & communication	64993	192876	274420	64993	122910	165427
7.	Recreation, education & cult. service	17626	48429	59549	17626	31100	37207
8.	Miscellaneous goods & services	36519	117194	176365	36519	75135	91692
	Private Final Consumption Expenditure in Domestic Market	574772	1360018	1765849	574772	819637	964865

Source: Computations are based on figures Compiled from National Accounts Statistics, Central Statistical Organisation, Ministry of Planning and Programme Implementation, Government of India, 2005

Note: Figures in parentheses are percentages to the private final consumption expenditure in domestic market.

The success of the Kaira Union gave birth to other milk producer Unions in Gujarat. These milk producer Unions subsequently inspired the formation of 'National Dairy Development Board (NDDB)' in 1965 and provided all the impetus and resources required for its creation. Further, in view of several positive features in favour of milk co-operatives in Gujarat, it was finally decided by the government of India to extend institutional support in order to industrialize and organize all the dairy efforts in entire rural India, through co-operatives. In 1970-71 the NDDB drew up an all-encompassing programme known as 'Operation Flood', to replicate the Anand Pattern Dairy Co-operatives in 18 areas of the country. The major objective of the operation flood programme was to build a viable and self-sustaining national dairy industry on co-operative lines. Total system approach was adopted for dairy development, which encompassed production, procurement, processing and marketing of milk. The efforts made by government towards development of this important sector of agriculture has paid rich dividends so far in terms of generating adequate employment and income to milk producers, and also in terms of value addition to the national economy.

### **1.3 Value Added by Livestock**

In the current context of liberalization and increasing global integration of economies, it would be unfair on Indian dairy industry to compare it with that obtaining in most of the vastly modern and technologically far advanced western bloc countries in terms of a produce that is globally competitive. It should be realized that in India, the dairy industry is dependent on millions of small farmers who produce only a litre or two of marketable surplus and, it is this multitude of teeming million who eventually contribute to the overall flood of milk. The situation is entirely different in modern milk states. In most western countries, for instance, each of thousands of dairy farmers produces tonnes of milk. The sheer size and volume of production indulged in by milk producers in these countries makes it amenable for them to adopt meaningful scientific and technological means towards improving both quality and productivity (Shah, 2001). In contrast, the milk produced by our individual dairy farmers is so minimal that it is often very difficult to change their attitude in favour of modern animal husbandry practices that will make their produce cost effective as well as remunerative. An abysmally low production volume handled by our dairy farmers means introduction of any amount of technological innovation will not appreciably improve their income. Thus, mere technological innovation is not likely to transform the subsistence level dairy farmer

into a market savvy commercial milk producer (Shah, 2001). Only real economic incentives and inducements can coerce and compel such farmers to change in favour of more profitable scientific farming. However, despite several weaknesses in terms of adoption of improved technique, the share of livestock in gross output of agriculture and allied activities has been showing a growing trend due mainly to dependence of millions of farmers on this secondary remunerative source of agricultural income.

The development of animal husbandry and dairying over time has resulted in significant expansion in value of livestock products in relation to value of agricultural products produced in India. The estimates relating to value of agricultural products and livestock products at different points of time encompassing the period between 1970-71 and 2003-04 are provided in Table 1.4.

**Table 1.4: Value Added from Agriculture and Allied Activities in India: Current Prices**

(Rs. crores)

Sr. No.	Items	At current prices				
		1970-71	1980-81	1990-91	2000-01	2003-04
1.	Value of Output	20730	56875	170698	518693	635104
	1.1 Agriculture	17531	46278	128657	378712	470595
	1.2 Livestock	3199	10597	42041	139981	164509
	<i>Share (%)</i>					
	a. Milk Groups	67.75	64.96	65.43	67.50	66.92
	b. Meat Groups	9.20	12.25	15.48	15.43	15.99
	c. Hides & Skins	2.29	2.36	1.66	1.84	1.83
	d. Eggs	6.63	3.31	3.11	3.17	2.93
	e. Wool & hair	0.61	0.46	0.34	0.23	0.18
	f. Dung	9.99	12.76	10.25	8.38	7.97
	g. Other Products	1.60	1.49	2.06	1.09	1.30
	i. Increment in Stock	1.93	2.41	1.67	2.36	2.88
2.	Less Inputs	4089	15247	38971	107020	127365
3.	Gross Domestic Product	16778	42466	135162	423523	521538
4.	Less Consumption of Fixed Capital	424	2418	7903	22083	27293
5.	Net Domestic Product	16354	40056	127259	401440	494245
6.	Share in Value of Output					
	- Agriculture	84.57	81.37	75.37	73.01	74.10
	- Livestock	15.43	18.63	24.63	26.99	25.90
7.	Percent increase of 1.1 over					
	- 1970-71	-	163.98	633.88	2060.24	2584.36
	- 1980-81	-	-	178.01	718.34	916.89
	- 1990-91	-	-	-	194.36	265.77
	- 2000-01	-	-	-	-	24.26
8.	Percent increase of 1.2 over					
	- 1970-71	-	231.26	1214.19	4375.77	5042.51
	- 1980-81	-	-	296.73	1220.95	1452.41
	- 1990-91	-	-	-	232.96	291.31
	- 2000-01	-	-	-	-	17.52

Source: Estimates are based on figures Compiled from National Accounts Statistics, Central Statistical Organisation, Ministry of Planning and Programme Implementation, Government of India, 1982, 1996 & 2005

At current prices, the value of livestock products produced in the country in 2003-04 was estimated at Rs.1,64,509 crores with milk and milk products accounting for 67 per cent share in this value. It is to be noted that the value of livestock products produced in the country has been steadily growing over the past three decades. The increase in this

value was estimated at about 231 per cent between 1970-71 and 1980-81, 297 per cent between 1980-81 and 1990-91, 233 per cent between 1990-91 and 2000-01 and about 18 per cent between 2000-01 and 2003-04. Not only this, the share of livestock products in total value of agriculture and allied activities was also estimated to be growing steadily from 15 per cent in 1970-71 to 26 per cent in 2003-04. Even at constant prices, the value of livestock products in relation to total value of agriculture and allied activities has grown up over time. The constant price estimates show the share of livestock products in total value of agriculture and allied activities to grow from 19 per cent in 1980-81 to 28 per cent in 2003-04. Both at current and constant prices, the increase in value of agricultural products produced in the country has been slower than increase in value of livestock products. This is an indication of growing importance of livestock sector in overall agricultural development in the country.

#### 1.4 Livestock Population in India

During the last four to five decades, the livestock economy of India witnessed a number of changes in terms of its size, composition and productivity. The size of livestock herd increased from 307 million in 1956 to 445 million in 1987 and to 485 million in 2003, indicating a significant slowing down in growth of livestock population between 1987 and 2003 as against 1956 and 1987. The slowing down in growth of bovine population between 1987 and 2003 as against 1956 and 1987 has been much sharper compared to total livestock population. The total bovine population in India increased from 204 million in 1956 to 276 million in 1987, and further to only 283 million in 2003, showing, thereby only 0.16 per cent annual increase in the same between 1987 and 2003 as against 0.98 per cent rise between 1956 and 1987 (Table 1.5).

**Table 1.5: Changing Trends in Livestock population in India: 1956-2003**

Species	1956	1966	1987	1997	2003	(million no.)		
						ACGR (%)		
						1956-1987	1987-2003	1956-2003
Total cattle	158.7	176.2	199.7	198.9	185.2	0.74	-0.47	0.33
- Adult female cattle	47.3	51.8	62.1	64.4	-	0.88	-	-
Total buffaloes	44.9	53.0	76.0	89.9	97.9	1.71	1.60	1.67
- Adult female buffaloes	21.7	25.4	39.1	46.8	-	1.92	-	-
Total bovines	203.6	229.2	275.8	288.8	283.1	0.98	0.16	0.70
Sheep	39.3	42.4	45.7	57.5	61.5	0.49	1.87	0.96
Goat	55.4	64.6	110.2	122.7	124.4	2.24	0.76	1.74
Others	8.2	7.5	13.6	16.2	16.0	1.65	1.02	1.43
Total livestock	306.5	343.7	445.3	485.4	485.0	1.21	0.54	0.98
Bovines in livestock (%)	66.4	66.7	61.9	59.5	58.4	-0.23	-0.36	-0.27
Poultry	94.8	115.4	275.3	347.6	489.0	3.50	3.66	3.55
Livestock density@	2.3	2.5	3.3	3.4	3.5	-	-	-

Source: Basic Animal Husbandry Statistics, 2002, Department of Animal Husbandry and Dairying, Ministry of Agriculture (MOA), Government of India, New Delhi, and Government of India, 2005, Annual Report 2004-05, Department of Animal Husbandry and Dairying, MoA, New Delhi;

Note: @- Livestock density in per hectare net sown area; ACGR = Annual Compound Growth Rate

Though cattle population in India constituted about 70 per cent of the total bovine stock, the rise in buffalo population over time was much higher. Interestingly, the share of adult female cattle in total cattle population grew from 30 per cent in 1956 to 32 per cent in 1997. On the other hand, adult female buffaloes in total buffalo population showed an increase in share from 48 per cent to 52 per cent between 1956 and 1997. This was perhaps due to increasing farm mechanization in the country. The trend relating to rise in stock of female bovine population is desirable in the light of the growing economic opportunity for increasing milk production and for undertaking dairying as a commercial proposition.

### 1.5 Livestock Production in India

There is no iota of doubt that since the inception of Operation Flood programme the total milk production has been increasing in all the states of the country. The credit for this healthy scenario should also go to various development projects, which have been simultaneously undertaken to give a fillip to agriculture and dairy production. Though milk production in India has grown significantly over the last two decades, the period gone by is also marked with slowing down in growth of milk production, particularly during the period between 1991-92 and 2003-04 as against the period between 1980-81 and 1990-91 (Table 1.6). Similarly, there has also been slowing down in growth of egg production during the latter as against the former period. Nonetheless, the growth in egg production in India is much faster as compared to milk production. The growth in wool production in India has remained by and large constant over the past two decades.

**Table 1.6: Changing Trends in Livestock Production in India**

Product	TE 1982-83	TE 1992-93	TE 2003-04	ACGR (%)		
				1980-81 to 1990-91	1991-92 to 2003-04	1980-81 to 2003-04
Milk (million tonnes)	33.90	55.87	86.23	5.29	4.02	4.46
- per capita availability (gm./day)	134.33	178.67	228.67	3.10	2.28	2.46
Eggs (billion nos.)	10.80	22.00	41.32	8.80	5.82	6.08
Wool (million kgs.)	33.20	40.53	52.13	2.72	2.69	1.85

Source: Estimates are based on figures compiled from 'Government of India, 2005, Annual Report 2004-05, Department of Animal Husbandry and Dairying, Ministry of Agriculture, New Delhi'

@ - all growth rates are significant at 1 per cent level of probability

A critical evaluation of rates of growth in various livestock products reveals significantly high growth in milk production after 1973-74 with period between 1980-81 and 1990-91 exhibiting the highest growth in milk (5.48 per cent a year) production in India (Table 1.7). Among various plan periods, the 6<sup>th</sup> plan shows the highest growth (6.42 per cent a year) in milk production of India. This is an indication of the fact that

milk production in India substantially increased between 1980-81 and 1984-85 and thereafter a slowing down in growth of milk production took place. As for the egg production, 6<sup>th</sup>, 7<sup>th</sup> and 9<sup>th</sup> plans registered highest rate of growth. The growth in wool production was significantly high during 6<sup>th</sup> plan and in the 9<sup>th</sup> plan. Interestingly, during all the five-year plans beginning 5<sup>th</sup> plan, the growth in egg production was higher than milk production. The increasing demand for eggs could be one of the reasons for higher growth in production of eggs in India. Further, though annual milk production in India has grown sharply from 34 million tonnes during TE 1982-83 to 56 million tonnes during TE 1992-93, and further to 86 million tonnes during TE 2003-04, the per capita per daily availability of milk estimated at 229 gm during TE 2003-04 is still much lower than the minimum prescribed requirement of 280 gm as recommended by the Indian Council of Medical Research.

**Table 1.7: Annual Growth Rates of Production of Major Livestock Products – All India**

Period	Milk	Eggs	Wool
(per cent)			
During pre-and post 'Operation Flood' periods			
1950-51 to 1960-61	1.64	4.63	0.38
1960-61 to 1973-74	1.15	7.91	0.34
1973-74 to 1980-81	4.51	3.79	0.77
1980-81 to 1990-91	5.48	7.69	2.32
1990-91 to 2000-01	4.11	5.67	1.62
During five year plan periods			
5 <sup>th</sup> Plan (1975-76 to 1979-80)	2.91	3.5	1.49
6 <sup>th</sup> Plan (1980-81 to 1984-85)	6.42	8.40	2.67
7 <sup>th</sup> Plan (1985-86 to 1989-90)	4.37	7.23	1.88
8 <sup>th</sup> Plan (1992-93 to 1996-97)	4.41	4.58	0.80
9 <sup>th</sup> Plan (1997-98 to 2001-02)	4.08	7.09	2.20

Source: Basic Animal Husbandry Statistics, 2002, Department of Animal Husbandry and Dairying, Ministry of Agriculture, Government of India, New Delhi

Undoubtedly, the programme initiatives undertaken by NDDDB and various development projects have led to rise in productivity levels of animals over time. Nevertheless, still there are wide variations in terms of number of bovines (in-milk) and productivity of milch animals across states. And, as a result of this the milk production is seen to vary considerably across different states of the country. Among various states, though Uttar Pradesh ranks first in terms of total milk production in India, her share is seen to have stagnated at around 18 per cent over the past two decades (Table 1.8). A similar pattern is seen in the case of Gujarat, Karnataka, Kerala, Punjab, Tamil Nadu and West Bengal with marginal ups and downs in their share in total milk production of India between 1980-81 and 2003-04. On the other hand, Maharashtra and Andhra Pradesh have shown a growing trend in terms of their share in total milk production of India,

particularly after 1990-91. The states like Madhya Pradesh and Rajasthan in general and Bihar in particular have shown a fall in their share in total milk production of India between 1980-81 and 2003-04. Bihar has shown a steep fall in her share in total milk production of India from 6 per cent in 1980-81 to as low as 3 per cent in 2000-01 with a marginal increase in the same after the 2000-01 period. Interestingly, while in 1980-81 Bihar ranked higher than Maharashtra in terms of her share in total milk production of India, her share in this respect was found to be one among the lowest in 2003-04. In 2000-01, Bihar showed the lowest share in total milk production of India. On the other hand, in due course of time Maharashtra has overtaken several states in terms of total milk production.

**Table 1.8: Share of States in Total Milk Production of India**

State	1980-81	1985-86	1990-91	1995-96	2000-01	2001-02	2002-03	2003-04
Andhra Pradesh	6.4	6.4	5.3	6.4	6.8	6.9	7.6	7.9
Bihar	6.1	5.6	5.1	5.0	3.1	3.2	3.3	3.6
Gujarat	6.8	7.8	6.2	7.0	6.6	6.9	7.1	7.3
Haryana	6.9	5.9	6.3	6.1	6.0	5.9	5.9	5.9
Karnataka	4.5	4.4	4.4	4.8	5.7	5.7	5.3	4.4
Kerala	2.9	2.9	3.0	3.3	3.2	3.2	2.8	2.4
Madhya Pradesh	7.2	6.7	8.0	7.7	5.9	6.3	6.2	6.1
Maharashtra	5.6	5.7	6.8	7.5	7.3	7.2	7.2	7.2
Punjab	10.2	9.3	9.6	9.7	9.6	9.4	9.5	9.5
Rajasthan	10.3	9.4	7.3	8.2	9.2	9.2	9.0	9.1
Tamil Nadu	5.5	6.9	6.0	5.7	6.1	5.9	5.4	5.4
Uttar Pradesh	18.1	18.6	17.3	17.9	17.2	17.4	17.7	18.1
West Bengal	4.1	5.3	5.4	5.0	4.3	4.2	4.2	4.2
Others	5.4	5.1	9.3	5.7	9.0	8.6	8.8	8.9
Total Milk Production (million tonnes)	31.6	44.0	53.9	66.2	80.6	84.4	86.2	88.1

Source: Shares are computed from 'Basic Animal Husbandry Statistics, 1999, Department of Animal Husbandry and Dairying, Ministry of Agriculture, Government of India', and Government of India (2005), Annual Report 2004-05, Department of Animal Husbandry and Dairying, Ministry of Agriculture, New Delhi

Thus, a critical evaluation of Table 1.8 shows differing scenarios in terms of their contribution to total milk production of India between 1980-81 and 2003-04. In fact, poor growth in breedable bovine population coupled with lower productivity of bovines has greatly affected the milk output growth of several states in the country (Shah, 2002). The cumulative effect of these factors has led to downward slide in their share in total milk production of India over time. A time-scale deceleration in milk production growth caught up with most of the states during the period between 1991-92 and 2003-04 has led to overall deceleration in growth of milk production in India during this period as against the period between 1980-81 and 1990-91. The slowing down in milk production growth of majority of the states in more recent times has raised questions about our ability to meet the domestic requirements in the near future.



The foregoing observations clearly place Maharashtra as one of the important states of India since it not only boasts to have significant share in total milk production of India but also with respect to a host of other livestock based products. The state of Maharashtra also accounts for about 8 per cent share in India's total livestock population, besides having the largest strength of dairy cooperatives in the State, which is incomparable with any other state of India (Appendix 10). It is due to these facts that it becomes essential to evaluate development of livestock sector over the last five decades in the state of Maharashtra, with specific focus on mechanization of agriculture and its consequent effect on draught animal power availability, aside from evaluating structural changes in livestock production, size and composition of livestock population in the State. This study is an attempt in this direction and it addresses several concurrent issues that require attention insofar as livestock development of Maharashtra is concerned.

### **1.6 Need of the Study**

In India, livestock sector needs to be encouraged, but not at the cost of cereal production but of course by truly utilizing and exploiting the complementary, supplementary, synergistic and even symbiotic relationship of raising animals with crop production. Encompassing a wide geographical area and reflecting different political system, differing levels of economic development, social systems and changes in tastes, preferences and traditions, the approach to livestock development has varied widely from region to region in India, especially with respect to consumption of milk and milk products. Viewing our livestock spectrum in the light of these variabilities, it is pertinent to ask whether the future of our livestock will remain as bright as in the past. It is perceived that free world trade regime ushered in by the WTO not only poses many threats to India's livestock industry but also opens up many opportunities for the industry. This is certainly a point that needs to be investigated in the today's WTO regime, which has been marked with sustained dumping of cheap imports of dairy products on to the developing countries and which needs to be checked by taking stringent measures to revive tariff rates and quotas.

In view of the strategic importance of livestock sector in the agricultural development of our economy, its systematic and well conceived development becomes the pre-condition for successful agricultural policy. Technological changes in agriculture associated with the green revolution have brought about significant changes not only in the structure of milk production but also in the size and composition of animal draught power in several areas of the country. The state of Maharashtra is not an exception to this

phenomenon. The issues of increase in milk production and demand for and supply of inputs have acquired new dimension in the state of Maharashtra. Undoubtedly, therefore, for designing appropriate policies of livestock development and thereby giving a further boost to their contribution, it is extremely essential to focus on the nature and significance of changes taking place in the animal husbandry sector across various regions of the state. This study, thus, comprehensively evaluates various issues relating to livestock sector of the state, especially in respect of changing structure in livestock production, changes in size and composition of availability of draught animal power, impact of mechanization on draught power availability and changes in policies governing development of livestock sector in Maharashtra in terms population and production dynamics and infrastructure development, aside from assessing prospects of developing livestock sector in WTO regime.

### **1.7 Objectives of the Study**

The study has been conducted in the light of the following specific objectives:

1. To assess the changes in size, composition and availability of draught animal power in relation to mechanical power with a view to assess to extent of mechanization in the state of Maharashtra.
2. To examine the changes in the composition of bovine population over time and also to analyse growth of breedable female population vis-à-vis total stocks of bovines in the State.
3. To evaluate the structural changes in milk production and also to identify factors responsible for imbalances in milk production across different regions of the State.
4. To examine opportunities as well as threats to livestock sector in WTO regime.

### **1.8 Organization of the Study**

The study is organized in VII chapters. After this introductory Chapter I focusing on significance of livestock sector in national economy and various other concurrent issues coupled with need of the present study, etc., the methodology adopted for this study is elaborated in Chapter II, which not only includes time period of the study and various data sources used for this study but also various analytical techniques for estimating various parameters with a view to provide logical interpretations. The Chapter III evaluates variations in livestock population over time across various regions of Maharashtra, changes in size and composition of livestock, growth in breedable female bovine population, the extent of tractorisation and mechanization, ratio of milk to milch

animals and factors responsible for the adoption of advanced technology in the State. In Chapter IV, an attempt is made to provide an insight into the livestock production scenario of Maharashtra over the last two decades with focus on structural changes in milk, meat, wool and egg production across different districts and regions of the state, growth and instability in livestock production, productivity variations of milch animals, etc., besides identifying factors responsible for regional imbalances in livestock production. The Chapter V provides a broader insight into various livestock development policies, programmes and schemes that were initiated in the state of Maharashtra for improving the overall livestock resource base of the state. The Chapter VI is devoted to assessing the likely impact of trade liberalization under WTO regime on the domestic market in general and the livelihood of farming community of India in particular. The Chapter VI initially begins with analysing trade performance of India in livestock sector and subsequently traverses through other important issues relating to provisions made in terms of trade in livestock products in WTO regime. The Chapter VII summarises the key findings of the study with a synthesis of policy implications and conclusions arising out of the present investigation.

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## CHAPTER – II

### METHODOLOGY

#### 2.1 Period of Study and Data Sources

The reference period of study for the changing dynamics of livestock population for Maharashtra and India is from 1951 to 2003. However, the pattern of livestock production with respect to Maharashtra state is evaluated encompassing the period between 1985-86 and 2005-06, as before 1985-86 the estimates for various livestock products, including milk, are not available consistently for various districts of the state. The data on livestock production for various states of India are collected for the period between 1977-78 and 2005-06, as before 1977-78 data on livestock products for various states of India are not systematically available. Efforts have been made to collect data on other important aspects of livestock development encompassing the last 4-5 decades.

Data used for this study were chiefly collected from various secondary sources. Data on livestock population for different districts of Maharashtra and at all-India level were collected from various livestock census report of Maharashtra and India viz. 'Livestock and Farm Equipment Census, Maharashtra State (various years), Directorate of Animal Husbandry and Dairying, Maharashtra State, Pune', 'India Livestock Census (various years), Summary Tables, Volume –II, Part –I, Directorate of Economics and Statistics, Department of Agriculture and Co-operation, Ministry of Agriculture, Government, of India', official websites of Department of Agriculture, Government of Maharashtra, Department of Agriculture and Cooperation, Ministry of Agriculture, Government of India, Department of Animal Husbandry, Dairying and Fisheries, Ministry of Agriculture, Government of India, etc. The major sources of data on livestock production were 'Report on Milk, Eggs, Wool and Meat Production and Livestock and Poultry Keeping Practices in Maharashtra, Directorate of Animal Husbandry, Maharashtra State, Pune', 'Statistical Diary, Statistical Cell, Directorate of Animal Husbandry, Government of Maharashtra, Pune', 'Statistical Handbook, Statistical Cell, Directorate of Animal Husbandry, Government of Maharashtra, Pune', 'Statistical Epitome, Statistical Cell, Directorate of Animal Husbandry, Government of Maharashtra, Pune', etc. The data on other related aspects on livestock development are collected from 'Statistical Abstract of India, Ministry of Statistics and Programme Implementation, Government of India', 'Districtwise Agricultural Statistical Information of Maharashtra,

Part-II, Office of the Commissioner Agriculture, Pune' and also from 'Bulletin on Food Statistics, Directorate of Economics and Statistics, Ministry of Agriculture, Government of India, New Delhi', 'Cooperative Movement at a Glance in Maharashtra, office of the Commissioner for Cooperation and Registrar of Cooperative Societies, Maharashtra State, Pune', 'National Accounts Statistics, Central Statistical Organisation, Ministry of Planning and Programme Implementation, Government of India', 'Basic Animal Husbandry Statistics, 1999, 2002, 2006, Department of Animal Husbandry and Dairying, Ministry of Agriculture, Government of India, New Delhi', 'Annual Report (various years), Department of Animal Husbandry and Dairying, Ministry of Agriculture, New Delhi', 'Season and Crop Report, Government of Maharashtra', 'Annual Reports of NDDDB' and various other secondary sources and official records of the state, government of Maharashtra.

## 2.2 Analytical Technique

In this study, exponential trend equations have been fitted to the time series data obtained for various parameters from various sources in order to compute compound rates of growth that were also tested for their significance by the student 't' statistics.

The equation fitted to analyse the trend is semi-log exponential form as follows:

$$y = e^{A+Bt}$$

$$\text{Log } y = A + B * t$$

The compound growth rates ( $r = (e^B - 1) \times 100$ ) were tested for their significance by the student 't' statistics.

In order to estimate annual compound growth in livestock population between census periods, the following formula was used:

$$\text{CGR} = [(P_n / P_0)^{1/n} - 1] \times 100$$

Where,  $P_n$  = Population in Current Period

$P_0$  = Population in Base Period;  $n$  = Number of Years

With a view to understand growth performance of various parameters better and in order to capture year to year fluctuation in the same over the given period of time, an index of instability as suggested by Coppock (1962) and subsequently used by Mitra and Shah (1998) was also incorporated in the analysis, which appeared to have taken care of the trend component in the time series data. The instability was also estimated with the help of computation of Coefficient of Variation (C.V.).

According to Coppock (1962), the annual instability index equals the anti-log of the square root of the logarithmic variance. The series is given in algebraic form as follows:

$$V \log = \frac{1}{N-1} \sum \left[ \log X_{t+1} - \log X_t - \frac{1}{N-1} \sum (\log X_{t+1} - \log X_t) \right]^2$$

$$V \log = \frac{\left[ \log \frac{X_{t+1}}{X_t} - m \right]^2}{N-1}$$

or

Where, N = Number of years ; X = Value of the parameter  
m = Mean value of the logarithmic first difference

Coefficient of Variation is computed using the following formula:

$$C.V. = (\text{Standard Deviation} / \text{Mean}) \times 100$$

$$C.V. = (\sigma / \mu) \times 100$$

The rank correlation coefficient between two different periods was also estimated to find out the changes in the ranking of the districts of Maharashtra with respect to various livestock products, including milk.

The rank correlation coefficient was estimated as follows:

$$R_{ij} = 1 - \frac{6 \sum D^2}{N(N^2 - 1)}$$

Where  $R_{ij}$  denotes rank correlation coefficient between period 'i' and 'j', and D refers to the difference of rank between paired items in two series and N stands of number of observation in the series.

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## CHAPTER – III

### LIVESTOCK POPULATION AND AGRICULTURAL MECHANIZATION IN MAHARASHTRA

This chapter mainly evaluates dynamics of changes in livestock population over time in the state of Maharashtra vis-à-vis India, variations in livestock population across various regions of Maharashtra, changes in size and composition of livestock, growth in breedable female population vis-à-vis total stocks of animals, trends in availability of draught animal and mechanical power over time in the state, the extent of tractorisation and mechanization of irrigation, the impact of farm mechanization on draught power availability, assessment of factors responsible for the adoption of advanced technology, etc. This chapter, thus, basically examines structural changes in livestock population over time owing to agricultural mechanization in Maharashtra.

#### **3.1 Dynamics of Changes in Livestock Population**

Indian agriculture is an economic symbiosis of crop and livestock production. Since livestock and agriculture are bound together by a set of mutual input-output relationship, livestock wealth is considered as the backbone as well as an integral part of the agricultural production system in the country. Although livestock rearing is a centuries old tradition and profession in India, the rural household behaviour has undergone significant changes in due course of time owing to gradual transition from subsistence to market oriented system, and also due to economic dimensions involved in livestock rearing. It is to be noted that more than two-thirds of the rural households in India generate supplementary income through livestock farming and, therefore, it is considered as the endeavor of small landholders. Interestingly, since rural women perform over 90 per cent activities relating to livestock management and farming practices, livestock keeping can be considered as gender sensitive and an enterprise of women folk in rural settings.

Although livestock in India are characterized by large number and low productivity, they have been playing an important role and making a significant contribution to the national economy and socio-economic development of millions of rural households in the country. This is evident from the fact that in rural India where 15-20 per cent families are landless and about 80 per cent of the land holders belong to the small and marginal category, livestock rearing becomes the main source of livelihood for

them (Hegde, 2006). Majority of the rural families belonging to socio-economically weaker sections of the society generally maintain various species of livestock to supplement their income since they not only lack fertile lands and assured irrigation facilities but also inadequate employment opportunities in the industrial and service sectors. Since cattle and buffalo rearing requires significant supply of feeds and fodder, these livestock are generally maintained by land holders. The other species of livestock like sheep, goat and poultry birds are reared by landless families, which do not require considerable dependence on supply of feeds and fodder grown by the farmers.

Livestock farming provides subsidiary occupation and significant potential for employment generation to a large section of the people living in the draught prone, hilly, tribal and other remote areas where generation of full employment potential to this section of the society in crop husbandry is seldom the case. According to the latest 61<sup>st</sup> round of the National Sample Survey (July 2004-June 2005), the estimated employment in the animal husbandry sector was 11.44 million in principal status and 11.01 million in subsidiary status, which constitutes 5.50 per cent of the total working population of the country. The estimates reported by NSSO's latest survey reveal that out of the 22.45 million population engaged in animal husbandry sector, 16.84 million are females, showing significant female participation in this sector. At current prices, the value of output from livestock and fisheries sectors was estimated at Rs.2,50,761 crores in 2006-07 (Rs.2,10,629 crores for livestock sector and Rs.40,132 crores for fisheries), which accounted for 31.7 per cent of the value of output of Rs.7,09,979 crores from agriculture and allied sector. The contribution of these sectors to the total GDP of India during 2006-07 was as much as 5.26 per cent. In fact, livestock are considered as the best insurance against the vagaries of nature like draught, famine and other natural calamities. The livestock sector not only provides essential proteins and nutritious human diet through milk, eggs, meat, etc. but also plays an important role in utilization of non-edible agricultural by-products.

### **3.1.1 Government Programme Initiatives and Schemes**

The government has adopted several initiatives and policies as well strategies to improve the quality of livestock resources, which not only encompass up-gradation of genetic stocks, improved feed, fodder and nutrition management but also provision of improved health services, building of market infrastructure for livestock products to ensure better and remunerative prices to the primary producers and reasonable prices to the ultimate consumers. Various Central sector and Centrally sponsored schemes are



instrumental to achieve these objectives to certain extent. Further, the policies adopted by the State Animal Husbandry Departments such as extension of free breeding, vaccination and veterinary services and permission of free grazing on community lands have led to significant expansion of herd size of the farmers and, consequently, India has become one of the largest countries in terms of livestock population of the world.

### 3.1.2 India's Ranking in World Livestock Wealth

Since full exploitation of untapped potential of livestock sector is to be achieved yet, this sector of late has emerged as one of the key components of agricultural growth in India, especially when growth in crop husbandry is dismal and stagnant. Due to significant programme and policy initiatives undertaken by the government to develop livestock sector, India boasts to have become the richest country in the world in livestock wealth, both in terms of numerical strength and germplasm. It is heartening to note that India holds top position in some of the species of livestock resources of the world. This corroborated from the fact that in 2005, India ranked 1<sup>st</sup> in world buffalo population, 2<sup>nd</sup> in cattle and goat, 3<sup>rd</sup> in sheep, 4<sup>th</sup> in ducks, 5<sup>th</sup> in chickens and 6<sup>th</sup> in camel population of the world (Table 3.1).

**Table 3.1: Livestock Population in India and the World (Top Ranking Countries) - 2005**

(in million nos./heads.)

Livestock Population	World	India	India's Share in World (%)	India's Rank in the World	Top Ten Countries in Terms of Livestock Population and their Share (%) in World
Cattle	1345	185	13.8	2 <sup>nd</sup>	Brazil (14.3), India (13.8), China (8.6), USA (7.1), Argentina (3.8), Ethiopia (2.9), Sudan (2.9), Mexico (2.3), Australia (2.1), Colombia (1.9)
Buffaloes	174	98	56.4	1 <sup>st</sup>	India (56.4), Pakistan (15.1), China (13.1), Nepal (2.3), Egypt (2.3), Philippines (1.9), Vietnam (1.7), Myanmar (1.6), Indonesia (1.4), Thailand (1.0)
Sheep	1053	63	5.9	3 <sup>rd</sup>	China (16.2), Australia (10.1), India (5.9), Iran (5.1), Sudan (4.6), N. Zealand (3.8), U.K. (3.3), S. Africa (2.4), Turkey (2.4), Pakistan (2.4)
Goats	786	120	15.3	2 <sup>nd</sup>	China (24.9), India (15.3), Pakistan (7.2), Sudan (5.3), Bangladesh (4.7), Nigeria (3.6), Iran (3.4), Indonesia (1.7), Tanzania (1.6), Mongolia (1.6)
Horses	55	-	-	-	China (13.9), Mexico (11.4), Brazil (10.9), USA (9.7), Argentina (6.7), Colombia (5.0), Mongolia (3.7), Russian Fd. (2.7), Ethiopia (2.7), Kazakhstan (2.0)
Mules	12.4	0.3	2.4	7 <sup>th</sup>	China (30.2), Mexico (26.5), Brazil (10.9), Colombia (5.1), Morocco (4.2), Ethiopia (2.6), India (2.4), Peru (2.3), Pakistan (1.6), Argentina (1.5)
Asses	39.4	-	-	-	China (20.1), Pakistan (10.4), Ethiopia (9.6), Mexico (8.3), Egypt (7.8), Iran (4.1), Brazil (3.2), Nigeria (2.7), B. Faso (2.6), Morocco (2.5)
Camels	11.8	0.6	5.4	6 <sup>th</sup>	Sudan (27.9), Mauritania (11.0), Kenya (7.0), Pakistan (6.8), Chad (6.3), India (5.4), Mali (4.0), Ethiopia (4.0), Niger (3.5), Yemen (2.4)
Ducks (in '000')	1.0	0.03	3.2	4 <sup>th</sup>	China (69.3), Viet Nam (4.8), Indonesia (3.3), India (3.2), France (2.3), Ukraine (2.1), Thailand (1.6), Malaysia (1.5), Bangladesh (1.1), Philippines (1.0)
Chickens (in '000')	16.7	0.4	2.6	5 <sup>th</sup>	China (26.1), USA (11.7), Indonesia (7.5), Brazil (6.6), India (2.6), Mexico (2.5), Russian F (2.0), Turkey (1.8), Japan (1.7), Iran (1.7)

Source: FAOSTAT – Website year 2006

India accounts for as much as 56 per cent of the world buffalo population. India boasts to have a large genetic diversity of livestock containing 26 breeds of cattle, 8 breeds of buffaloes, 40 breeds of sheep, 20 breeds of goats and 7 breeds of camels. Despite the fact that India holds top position in buffalo population and 2<sup>nd</sup> in cattle and goat population of the world, she does not figure anywhere among top 10 nations of the world in terms of horses and asses population. Not only this, India ranks 17<sup>th</sup> in terms of world pig population. In fact, China ranks first with respect to several species of livestock of the world such as sheep, goats, horses, mules, asses, ducks and chickens. Even in the case of cattle and buffaloes, China ranks 3<sup>rd</sup> in the world next only to Brazil and India in the case of cattle and India and Pakistan with respect to buffalo population. It is only in the case of camel population that China does not find any place among the top 10 ranking nations of the world. As for camel, their population is noticed to be the highest in Sudan followed by Mauritania, Kenya, Pakistan, Chad and India, showing significant share in camel population of the world. Interestingly, India, Pakistan and China put together account for 85 per cent of the world buffalo population with other nations showing very low presence in the same. In terms of sheep and goat population, the important countries, other than China and India, having significant presence are Australia, Iran, Pakistan and Sudan. It is interesting to note that though India has been husbanding cattle for ages, yet Brazil occupies the first position in the world cattle population with China ranking 3<sup>rd</sup>, USA 4<sup>th</sup> and Argentina 5<sup>th</sup> in the world (Table 3.1). Despite significant variations in terms of livestock wealth across various nations of the world, India and China turn out to be the major countries of the world with significant presence of various species of livestock with the exception of horses and asses in India and camels in China.

### **3.1.3 Livestock Population Trends in India**

Livestock population in India has grown steadily over the past five decades. This is evident from the fact that India had 292.80 million livestock 1951, which increased to 344.10 million in 1966, and further to 369.00 million in 1977, 470.86 million in 1992 and 485.00 million in 2003, showing thereby 66 per cent rise in livestock population of India between 1951 and 2003 (Table 3.2 (a)). The 66 per cent rise in total livestock population of India over the past five decades encompassed 4.71 per cent rise in the same between 1951 and 1956, 9.39 per cent between 1956 and 1961, 2.60 per cent between 1961 and 1966, 2.76 per cent between 1966 and 1972, 4.36 per cent between 1972 and 1977, 13.71 per cent between 1977 and 1982, 6.13 per cent between 1982 and 1987, 5.74 per cent between 1987 and 1992, 3.19 per cent between 1992 and 1997, and -0.08 per cent

between 1997 and 2003. Thus, major increase in livestock population of India took place between 1977 and 1982 and also between 1956 and 1961. In fact, after 1982, there has been continuous deceleration in livestock population increase and consequently livestock population of India has rather declined by 0.08 per cent between 1997 and 2003. The increase in livestock population of India between 1992 and 1997 is noticed to be even lower than increase in the same between 1951 and 1956. Contrary to dismal livestock population trend obtainable in more recent times, the poultry population of India has increased by leaps and bounds over the last five decades. The rise in poultry population in India is noticed to be significant between 1997 and 2003.

**Table 3.2 (a): Trends in Livestock Population in India: 1951 – 2003**

(in million numbers)											
Species	1951	1956	1961	1966	1972	1977	1982	1987	1992	1997	2003
Cattle	155.30	158.70	175.60	176.20	178.30	180.00	192.45	199.69	204.58	198.88	185.18
Adult Female Cattle	54.40	47.30	51.00	51.80	53.40	54.60	59.21	62.07	64.36	64.43	64.51
Buffalo	43.40	44.90	51.20	53.00	57.40	62.00	69.78	75.97	84.21	89.92	97.92
Adult Female Buffalo	21.00	21.70	24.30	25.40	28.60	31.30	32.50	39.13	43.81	46.77	50.97
Total Cattle and Buffalo (Bovines)	198.70	203.70	226.80	229.20	235.70	242.00	262.36	275.82	289.00	288.80	283.10
Sheep	39.10	39.30	40.20	42.40	40.00	41.00	48.76	45.70	50.78	57.49	61.47
Goat	47.20	55.40	60.90	64.60	67.50	75.60	95.25	110.21	115.28	122.72	124.36
Horses and Ponies	1.50	1.50	1.30	1.10	0.90	0.90	0.90	0.80	0.82	0.83	0.75
Camels	0.60	0.80	0.90	1.00	1.10	1.10	1.08	1.00	1.03	0.91	0.63
Pigs	4.40	4.90	5.20	5.00	6.90	7.60	10.07	10.63	12.79	13.29	13.52
Mules	0.06	0.04	0.05	0.08	0.08	0.09	0.13	0.17	0.19	0.22	0.18
Donkeys	1.30	1.10	1.10	1.10	1.00	1.00	1.02	0.96	0.97	0.88	0.65
Yak	NC	NC	0.02	0.03	0.04	0.13	0.13	0.04	0.06	0.06	0.06
Total Livestock	292.80	306.60	335.40	344.10	353.60	369.00	419.59	445.29	470.86	485.39	485.00
Poultry	73.50	94.80	114.20	115.40	138.50	159.20	207.74	275.32	307.07	347.61	489.01
Dogs	NC	NC	NC	NC	NC	NC	18.54	17.95	21.77	25.48	29.03
Rabbits	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	0.48

Source: Ministry of Agriculture, Government of India

The bovine population of India has followed a trend similar to livestock population of the country. The bovine population of India rose sharply during the period between 1951 and 1992 and thereafter it declined. The increase in bovine population of India between 1951 and 1992 was about 45 per cent and the decline in the same between 1992 and 2003 stood at 2.04 per cent. Among bovines, cattle in particular showed a declining trend in their population increase after 1992 in the face of increasing buffalo population during the same period. In fact, buffalo population of India kept increasing steadily ever since 1951 when the seventh livestock census took place in the country. The increase in buffalo population of India was 94 per cent between 1951 and 1992 in the face of only 32 rise in cattle population of India during the same period. Even during the period 1992 and 2003, the buffalo population of India increased by 16 per cent, whereas there was a 10 per cent decline in cattle population of India during the same period.

A critical analysis drawn from Table 3.2 (a) clearly shows that it is only because of significant decline in cattle population in India after 1992 that total livestock population of the country declined marginally between 1997 and 2003. Although the population of horses and ponies, camels, mules and donkeys also declined between 1992 and 2003, this decline was not as sharp as the decline in cattle population in India during this period. In fact bovines in India accounted for 68 per cent of the total livestock wealth of the country in 1951, which declined to 67 per cent in 1966 and further to 66 per cent in 1977, 61 per cent in 1992 and 58 per cent in 2003. These estimates are concomitant of the fact that there has been steady decline in share of bovine population in total livestock wealth of the country, especially after 1977. On the other hand, the population of sheep, goats and pigs has steadily grown over time so much so that it increased by 57.21 percent for sheep, 163.47 per cent for goats and 207.27 for pigs during the period between 1951 and 2003. The poultry population of India has grown over six folds during the last five decades. The poultry population of India was estimated at only 73.50 million in 1951, which increased to 115.40 million in 1966, and further to 207.74 million in 1982, 307.07 in 1992, 347.61 million in 1997 and 489.01 million in 2003. This shows that the increase in poultry population of India between 1997 and 2003 was as much as 40 per cent.

As for growth in livestock population of India, the foregoing analysis underscores the fact that the last five decades witnessed mixed trends. The annual growth in livestock population of India was nearly 1 per cent during 1951-56, which increased to 1.81 per cent during 1956-61, but declined to 0.51 per cent during 1961-66 and increased further to 0.55 per cent during 1966-72 and 0.86 per cent during 1972-77 (Table 3.2 (b)). The livestock population in India increased substantially during 1977-82 when it registered an annual growth of 2.60 per cent. However, a deceleration in livestock population growth was caught up with after 1982 and livestock population in India grew at the rate of 1.20 per cent per annum during 1982-87, 1.12 per cent per annum during 1987-92, and at 0.61 per cent per annum during 1992-97. During the period between 1997 and 2003, there was a negative growth in livestock population in India when it declined at the rate of 0.01 per cent per annum.

Among various livestock species, bovine population in India increased at the rate of 0.43 per cent per annum during 1951-56, 2.18 per cent per annum during 1956-61 and 1.63 per cent per annum during 1977-82. During the other periods under consideration, there was less than 1 per cent annual growth in bovine population in India. The annual growth in bovine population in India was negative all through the period between 1992

and 2003 with period between 1997 and 2003 showing much sharper decline in bovine population of the country. The annual growth in cattle population was noticed to be lower than annual growth in livestock population of the country throughout the period between 1951 and 2003. Though cattle population in India grew substantially during 1956-61, the annual growth in the same remained very marginal between 1961 and 1977. During 1977-82, cattle population in India grew at the rate of 1.35 per cent per annum but thereafter its population kept decelerating so much so that there was negative growth in cattle population in India between 1992 and 2003 with period between 1997 and 2003 showing much sharper decline in the same. However, adult female cattle population in India did not show negative growth during the period 1956 to 2003, though the growth in the same kept decelerating during this period and consequently there was hardly 0.02 per cent annual growth in adult female cattle population in India between 1992 and 2003.

**Table 3.2 (b): Annual Livestock Population Growth Rates in India: 1951 – 2003**

Species	(in million numbers)									
	1951-56	1956-61	1961-66	1966-72	1972-77	1977-82	1982-87	1987-92	1992-97	1997-2003
Cattle	0.43	2.04	0.07	0.24	0.19	1.35	0.74	0.49	-0.56	-1.18
Adult Female Cattle	-2.76	1.52	0.31	0.61	0.45	1.63	0.95	0.73	0.02	0.02
Buffalo	0.68	2.66	0.69	1.61	1.55	2.39	1.71	2.08	1.32	1.43
Adult Female Buffalo	0.66	2.29	0.89	2.40	1.82	0.76	3.78	2.29	1.32	1.44
Total Cattle and Buffalo (Bovines)	0.49	2.18	0.21	0.56	0.53	1.63	1.01	0.94	-0.01	-0.33
Sheep	0.10	0.45	1.07	-1.16	0.50	3.53	-1.29	2.13	2.51	1.12
Goat	3.26	1.91	1.19	0.88	2.29	4.73	2.96	0.90	1.26	0.22
Horses and Ponies	0.00	-2.82	-3.29	-3.93	0.00	0.00	-2.33	0.50	0.17	-1.59
Camels	5.92	2.38	2.13	1.92	0.00	-0.37	-1.53	0.59	-2.40	-5.92
Pigs	2.18	1.20	-0.78	6.65	1.95	5.79	1.09	3.77	0.77	0.28
Mules	-7.79	4.56	9.86	0.00	2.38	7.63	5.51	2.25	3.07	-3.74
Donkeys	-3.29	0.00	0.00	-1.89	0.00	0.40	-1.21	0.21	-1.88	-4.95
Yak	0.00	0.00	8.45	5.92	26.58	0.00	-21.00	8.45	-0.34	1.52
Total Livestock	0.93	1.81	0.51	0.55	0.86	2.60	1.20	1.12	0.61	-0.01
Poultry	5.22	3.79	0.21	3.72	2.82	5.47	5.79	2.21	2.51	5.85
Dogs	-	-	-	-	-	-	-0.64	3.93	3.20	2.20

Source: Ministry of Agriculture, Government of India

Unlike cattle population, buffaloes registered a significant and positive annual growth in its population during the entire period between 1951 and 2003. This held true not only for overall buffalo population but also adult female buffalo population. However, the growth in buffalo population in India remained highly fluctuating during the period between 1951 and 2003. For instance, buffalo population in India grew at the rate of 0.68 per cent per annum during 1951-56, which increased to 2.66 per cent per annum during 1956-61 but declined to 0.69 per cent per annum during 1961-66, and again increased to 1.61 per cent per annum during 1966-72 with a decline in the same to 1.55 per cent per annum during 1972-77. The buffalo population in India again showed a

substantial annual growth rate of 2.39 per cent per annum during 1977-82 with a decline in the same to 1.71 per cent per annum during 1982-87 and a further increase in this rate at 2.08 per cent per annum during 1987-92. During 1992-97 and 1997-2003, the annual rate of growth in buffalo population of India was estimated at 1.32 per cent and 1.43 per cent, respectively. The adult female buffalo population showed a trend similar to the growth in overall buffalo population during the period between 1951 and 2003 with the only aberration of period between 1977 and 1982 when overall buffalo population registered annual growth of 2.39 per cent as against only 0.76 per cent annual growth in adult female buffalo population. This trend reversed during 1982-87 when adult female buffaloes registered an annual growth rate of 3.78 per cent as against only 1.7 per cent annual growth in overall buffalo population. The annual growth in overall buffaloes and adult female buffaloes remained by and large same after 1987 as both registered an annual growth in their population at 1.4 per cent during 1997-2003 and 1.32 per cent during 1992-97.

The growth in sheep population in India was much more fluctuating than bovine population in India. The population of sheep remained highly unstable between 1951 and 1972. It was only during the period between 1972 and 2003 that it registered a substantial annual growth with an exception of the period 1982-87 when the population of sheep declined at an annual rate of 1.29 per cent. On the other hand, goat population in India increased substantially at the rate of 3.26 per cent per annum during 1951-56 with a deceleration in this growth to 1.91 per cent per annum during 1956-61, 1.19 per cent per annum during 1961-66, 0.88 per cent per annum during 1966-72, and an increase in this growth at 2.29 per cent per annum during 1972-77 and 4.73 per cent per annum during 1977-82. The growth in sheep population again declined to 2.96 per cent per annum during 1982-87 with an increase in the same to 1.26 per cent per annum during 1992-97. The horses and ponies presented a dismal scenario in terms of their annual growth in population during the entire period between 1951 and 2003 as most of the periods viz. 1956-61, 1961-66, 1966-72, 1982-87, and 1997-2003 were marked with negative annual growth in population of horses and ponies in India. Similarly, donkeys also showed negative growth in their population during most of the periods beginning 1951. Camels showed a negative growth in their population after 1977. However, pigs registered a reasonable growth in their population between 1966 and 1992 and thereafter showed a considerable deceleration in their population growth. In fact, during the period between 1997 and 2003, majority of the species showed a negative annual growth and

consequently livestock population in India declined marginally during this period despite achieving reasonable positive growth in buffalo, sheep, goats and pig population. Unlike growth in livestock population, the population of poultry birds in India grew appreciably after 1977 so much so that they registered an annual growth in their population at 5-6 per cent during the period between 1977 and 2003.

In fact, the five decades show a significant change in the pace of growth across various species of livestock in India. The decline in cattle population between 1992 and 2003 has adversely affected the population growth of total livestock in the country because of their substantial share in total livestock population. However, as pointed out by BIRTHAL and TANEJA (2006), the decline in cattle population was chiefly confined to indigenous stock that comprised of 87 per cent of the total cattle population of the country in 2003. While there was 15 per cent drop in indigenous cattle population, the stock of crossbred increased by 62 per cent between 1997 and 2003. The decline in male indigenous cattle was sharp as against female indigenous cattle stock during 1997-2003. The major reasons for decline in indigenous cattle stocks in India are traced in increasing substitution of draught animals with mechanical power and low milk yield for these stocks of livestock (BIRTHAL and TANEJA, 2006).

#### **3.1.4 Trends in Livestock Population in Maharashtra**

The state of Maharashtra accounts for about 8 per cent share in total livestock population of India. This share has remained by and large constant during the period between 1961 and 2003 with marginal ups and down during this period. The total livestock population in Maharashtra was estimated at 26.05 million in 1961, which increased to 29.64 million in 1978 and further to 39.64 million in 1997 with a decline in the same to 36.50 million in 2003 (Table 3.3). The increase in livestock population in Maharashtra was estimated at 52.17 per cent between 1961 and 1997 and at only 40.14 per cent between 1961 and 2003. Obviously, the stocks of livestock in Maharashtra showed a sharp decline between 1997 and 2003. Among various species of livestock, cattle population in Maharashtra increased at very slow pace during the entire period between 1961 and 2003. This is evident from the fact that the cattle population in Maharashtra increased by 17.90 per cent between 1961 and 1997. The increase in population of cattle, when computed between 1961 and 2003, stood at only 4.60 per cent. This hardly shows any increase in cattle population of Maharashtra between 1961 and 2003. Within cattle, while adult male population increased from 6.49 million in 1961 to 6.89 million in 1997 with a decline in the same to 6.37 million in 2003, the increase in

female adult population was from 4.64 million in 1961 to 5.89 million in 1997 with a decline in the same to 5.01 million in 2003. The young cattle stock also followed a trend similar to changes in male and female cattle population and thus showed an increase in their stock from 4.19 million in 1961 to 5.16 million in 1997 with a decline in the same to 4.66 million in 2003. Thus, the cattle population in Maharashtra increased from 15.33 million in 1961 to 18.09 million in 1997 with a drop in the same to 16.03 million in 2003.

**Table 3.3: Trends in Livestock and Poultry Population in Maharashtra: 1961-2003**

(number in lakhs)

Category	1961	1966	1972	1978	1982	1987	1992	1997	2003
<i>Cattle</i>									
Males over 3 years	64.90	65.50	62.00	63.29	67.17	66.90	69.55	69.89	65.27
Females over 3 years	46.44	45.34	45.87	47.81	52.47	57.39	58.47	58.86	53.28
Young stock	41.94	36.49	39.12	41.08	42.28	45.55	46.39	51.60	45.03
Total Cattle	153.28	147.33	147.05	152.18	161.92	169.83	174.41	180.71	163.58
<i>Buffaloes</i>									
Males over 3 years	3.53	3.40	3.08	3.25	3.51	3.56	3.37	3.15	2.89
Females over 3 years	16.39	17.44	18.71	21.48	23.07	28.16	32.24	36.09	36.62
Young stock	10.95	9.67	11.22	14.25	13.13	15.83	18.87	21.46	21.96
Total Buffaloes	30.87	30.51	33.01	38.99	39.72	47.55	54.47	60.73	60.46
Sheep	20.93	22.04	21.28	26.36	26.71	28.73	30.74	33.68	30.75
Goats	51.81	51.21	59.11	75.63	77.05	91.95	99.41	114.34	104.56
Horses and Ponies	1.05	1.01	0.58	0.48	0.49	0.43	0.40	0.42	0.40
Other Livestock	2.54	2.51	2.58	2.78	3.61	4.06	4.49	6.50	5.20
Total Livestock	260.48	254.61	263.61	296.42	309.50	342.55	363.93	396.38	364.95
Poultry	105.77	99.02	122.17	187.51	198.44	248.39	321.87	353.92	379.68
Changes in Livestock Population of Maharashtra over the Census Periods (% variation)									
Cattle	-	-3.88	-0.16	3.49	6.40	5.08	2.70	3.61	-9.48
Buffaloes	-	-1.17	8.51	18.12	1.87	19.71	14.55	11.49	-0.44
Sheep	-	5.30	-3.49	23.87	1.33	7.56	7.00	9.56	-8.70
Goats	-	-1.16	15.43	27.95	1.88	19.34	8.11	15.02	-8.55
Horses and Ponies	-	-3.81	-42.57	-17.24	2.08	-12.24	-6.98	5.00	-4.76
Total Livestock	-	-2.25	3.58	12.45	4.41	10.79	6.24	8.92	-7.93
Poultry	-	-6.38	23.38	53.48	5.83	25.17	29.58	9.96	7.28
Share of Maharashtra in India (%)									
Cattle	8.73	8.36	8.25	8.45	8.41	8.50	8.53	9.09	8.83
Buffaloes	6.03	5.75	5.75	6.29	5.69	6.26	6.47	6.75	6.18
Sheep	5.21	5.19	5.55	6.43	5.48	6.29	6.05	5.86	5.01
Goats	8.51	7.93	8.76	10.00	8.09	8.34	8.62	9.32	8.41
Horses and Ponies	8.08	9.18	6.44	5.33	5.44	5.38	4.88	5.06	5.33
Total Livestock	7.77	7.40	7.46	8.03	7.38	7.69	7.73	8.17	7.53
Poultry	9.26	8.58	8.82	11.78	9.55	9.02	10.48	10.18	7.76

Note: Computations are based on figures compiled from Ministry of Agriculture, Government of India and Directorate of Economics and Statistics, Govt. of Maharashtra

Source: For Maharashtra: Directorate of Economics and Statistics, Govt. of Maharashtra

Unlike cattle population, the buffalo population in Maharashtra kept steadily growing over the entire period between 1961 and 2003 so much so that there was about two folds rise in buffalo population in 2003 as compared to 1961. The buffalo population in Maharashtra increased from 3.09 million in 1961 to 3.97 million in 1982 and further to 5.45 million in 1992 and 6.15 million in 2003. The major reason for such an increase in buffalo population was the substantial rise in the stocks of adult female buffalo



population as adult male buffalo population in the state either remained stagnant or declined between 1961 and 2003. This is corroborated from the fact that while the stocks of adult female buffaloes in Maharashtra increased from 1.64 million in 1961 to 3.65 million in 2003, the stocks of adult male buffaloes remained stagnant at around 0.35 million between 1961 and 1987 and thereafter declined so much so that this stock was estimated at 0.27 million in 2003. However, the young buffalo stocks followed the trend similar to adult female buffalo population and they showed an increase in their stocks from 1.10 million in 1961 to 1.31 million in 1982 and further to 1.89 million in 1992 and 2.18 million in 2003.

The goat population in Maharashtra also recorded two folds rise between 1961 and 2003 with major increase in the same being noticed after 1987. As for the stocks of sheep, the increase was relatively slower as against the increase in buffalo and goat population in Maharashtra during the period between 1961 and 2003. The population of sheep in Maharashtra remained stagnant at around 2.1 million between 1961 and 1972 but thereafter it increased substantially to 3.37 million in 1997 with a decline in the same to 3.09 million in 2003. Horses and ponies in Maharashtra showed a continuous decline in their population during the period between 1961 and 2003. The population of horses and ponies in Maharashtra declined from 1.05 lakhs in 1961 to 0.49 lakhs in 1982 and further to 0.40 lakhs in 2003. The population of other livestock in Maharashtra like pigs, mules, asses, etc. remained stagnant between 1961 and 1982 and hovered at around 3.2-3.6 lakhs during this period. However, the population of other livestock in Maharashtra increased to 4.47 lakhs in 1987 and further to 6.50 lakhs in 1997 with a substantial decline in the same to 5.08 lakhs in 2003.

The changes in stocks of various livestock species between census periods revealed that there was a decline in almost all the species of livestock between 1961 and 1966. The stocks of various species of livestock in Maharashtra started showing a rising trend only after 1978 with the only aberration of population of horses and ponies, which kept declining even after 1978. Although various species of livestock showed a significant rise in their population between census periods like 1972-78, 1982-87 and 1992-97, there was a sharp decline in population of almost all the species of livestock between 1997 and 2003. As a result, the total livestock population in Maharashtra rather declined in 2003 as compared to 1997. However, poultry population of Maharashtra kept increasing throughout the period between 1966 and 2003 with major increase in the same being noticed between 1972 and 1978 and also between 1987 and 1992.

Interestingly, the share of Maharashtra in total cattle population of India remained stable at around 8-9 per cent between 1961 and 2003. Similarly, the share of Maharashtra in total buffalo population of India remained constant at around 6 per cent during the same period. Further, Maharashtra accounted for 5-6 per cent share in total sheep population of India and this share remained by and large same between 1961 and 2003. As against, cattle, buffalo and sheep, the state of Maharashtra showed a declining share in total population of horses and ponies in India, which declined from 9 per cent in 1966 to as low as 5 per cent in 2003. However, the share of Maharashtra in total goat population of India increased from 8 per cent 1966 to 10 per cent in 1978 with a decline in the same to nearly 9 per cent 2003. The state of Maharashtra showed very significant share in total poultry birds population of India, which increased from 9 per cent in 1961 to nearly 12 per cent in 1978 with a decline in the same to 10 per cent in 1997 and 8 per cent in 2003. These estimates are concomitant of the fact that the state of Maharashtra assumes considerable importance in India in terms of livestock wealth as it accounts for significant share in India with respect to several species of livestock. The state of Maharashtra still accounts for nearly 9 per cent share in total cattle and goat population and 8 per cent share in total livestock population of the country.

### **3.1.5 Regional Variations in Livestock Population**

At the time when India gained independence in 1947, the western Maharashtra and Gujarat were joined to a single state called Bombay State<sup>1</sup>. In fact, after India got independence in 1947, many former princely states, including Gujarat state and the Deccan state, were merged with the former Bombay province, which was renamed as the State of Bombay. However, the state of Maharashtra got separated from Gujarat on 1<sup>st</sup> May 1960 and Bombay was declared as its capital. In 1966, as per Nagpur Pact, Nagpur (Vidarbha) was elevated to second capital of Maharashtra, especially for the purpose of legislative assembly meetings. Before the creation of Maharashtra in 1960, several current districts of the state had other names. For instance, Dhule was called as West Khandesh, Jalgaon as East Khandesh, Satara as North Satara and Sangli as South Satara. During this period, Ratnagiri included the district of Sindhudurg and Aurangabad included the district of Jalna. Similarly, during this period, Osmanabad included the district of Latur and Chandrapur included the district of Gadchiroli. The Raigad district was called as Kolaba

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<sup>1</sup> Although the Bombay State ceded Kannada speaking territory to Mysore in 1966, it gained Marathwada (Aurangabad Division) from Hyderabad State and Vidarbha (Amravati and Nagpur Divisions) from Madhya Pradesh and Berar. In 1960, Bombay State was split into the states of Gujarat and Maharashtra.

even during the late seventies. In fact, during the period between Livestock Census 1961 and 1977, Maharashtra had four regions, namely Konkan/Mumbai, Pune, Aurangabad and Nagpur.<sup>2</sup> The number of regions in Maharashtra increased to six between 1982 and 1997 Livestock Census, and these regions were Konkan/Mumbai, Nashik, Pune, Aurangabad, Amravati and Nagpur.<sup>3</sup> The number regions in Maharashtra further increased to seven when Livestock Census 2003 was conducted in the state.

Although the number of regions in Maharashtra has increased from four to seven between Livestock Census 1961 to 2003, the representative regions in this study have been considered as six, which not only include districts before the creation of Maharashtra but also after the establishment of the state in 1960. This means that even before the creation of Maharashtra it is assumed that there were six regions in the state, and the analysis in this study pertains to all these six regions. These six regions are: Konkan, Nashik, Pune, Aurangabad, Amravati and Nagpur. Basically, the present study includes all the districts that were in existence before the formation of Maharashtra and also the districts, which got separated in course of time and merged into different newly created regions of the state. The six regions considered in this study are representative of the scenario obtaining before and after formation of Maharashtra with inclusion of all the current districts. The specification of regions and districts within the region of Maharashtra is brought out in Table 3.4.

It is to be noted that consequent upon reorganization of states in India in 1956, the district of Chandrapur belonging to Madhya Pradesh was transferred to Bombay state and that a part of Adilabad district of Hyderabad state was transferred to Nanded district, which subsequently got transferred to Chandrapur district in 1959. The district of Chandrapur has been one of the major districts of Maharashtra ever since the creation of the state in 1960. However, a separation of Chandrapur district took place on August 26, 1982 and Gadchiroli district was bifurcated from Chandrapur district that became a part of Vidarbha region of Maharashtra.

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<sup>2</sup> The districts included in the four regions of Maharashtra between 1961 and 1977 were: Konkan Region – Brihan Mumbai, Thane, Kolaba, Ratnagiri, Nashik, Dhule and Jalgaon; Pune Region – Ahmednagar, Pune, Satara, Sangli, Solapur and Kolhapur; Aurangabad Region – Aurangabad, Parbhani, Beed, Nanded and Osmanabad; Nagpur Region – Buldhana, Akola, Amravati, Yavatmal, Wardha, Nagpur, Bhandara and Chandrapur.

<sup>3</sup> The districts included in the six regions of Maharashtra between 1961 and 1977 were: Konkan Region – Brihan Mumbai, Thane, Raigad, Ratnagiri and Sindhudurg; Nashik Region – Nashik, Dhule, Nandurbar, Jalgaon and Ahmednagar; Pune Region – Pune, Satara, Sangli, Solapur and Kolhapur; Aurangabad Region – Aurangabad, Jalna, Parbhani and Beed; Latur Region – Nanded, Osmanabad, Latur and Hingoli; Amravati Region – Buldhana, Akola, Washim, Amravati and Yavatmal; Nagpur Region – Wardha, Nagpur, Bhandara, Chandrapur, Gondia and Gadchiroli.

**Table 3.4: Specification of Regions and Districts in Maharashtra: 1951 – 2003**

Regions and Districts in Maharashtra			
1951 to 1956	1961 to 1977	1982 to 1997	2003
<b>Konkan Region</b>	<b>Konkan Region</b>	<b>Konkan Region</b>	<b>Konkan Region</b>
1. Bombay Suburb / Brihan Mumbai	1. Brihan Mumbai	1. Brihan Mumbai	1. Brihan Mumbai
2. Thane	2. Thane	2. Thane	2. Thane
3. Kolaba (now Raigad)	3. Kolaba (now Raigad)	3. Raigad	3. Raigad
4. Ratnagiri (includes Sindhudurg)	4. Ratnagiri (includes Sindhudurg)	4. Ratnagiri	4. Ratnagiri
<b>Nashik Region</b>	<b>Nashik Region</b>	5. Sindhudurg	5. Sindhudurg
5. Nashik	5. Nashik	<b>Nashik Region</b>	<b>Nashik Region</b>
6. West Khandesh (now Dhule)	6. Dhule	6. Nashik	6. Nashik
7. East Khandesh (now Jalgaon)	7. Jalgaon	7. Dhule	7. Dhule (includes Nandurbar)
8. Ahmednagar	8. Ahmednagar	8. Jalgaon	8. Jalgaon
<b>Pune Region</b>	<b>Pune Region</b>	9. Ahmednagar	9. Ahmednagar
9. Pune	9. Pune	<b>Pune Region</b>	<b>Pune Region</b>
10. North Satara (now Satara)	10. Satara	10. Pune	10. Pune
11. South Satara (now Sangli)	11. Sangli	11. Satara	11. Satara
12. Solapur	12. Solapur	12. Sangli	12. Sangli
13. Kolhapur	13. Kolhapur	13. Solapur	13. Solapur
<b>Aurangabad Region</b>	<b>Aurangabad Region</b>	14. Kolhapur	14. Kolhapur
14. Aurangabad (includes Jalna)	14. Aurangabad (includes Jalna)	<b>Aurangabad Region</b>	<b>Aurangabad Region</b>
15. Parbhani	15. Parbhani	15. Aurangabad	15. Aurangabad
16. Beed	16. Beed	16. Jalna	16. Jalna
17. Nanded	17. Nanded	17. Parbhani	17. Parbhani (includes Hingoli)
18. Osmanabad (includes Latur)	18. Osmanabad (includes Latur)	18. Beed	18. Beed
<b>Amravati Region</b>	<b>Amravati Region</b>	19. Nanded	19. Nanded
19. Buldhana	19. Buldhana	20. Osmanabad	20. Osmanabad
20. Akola	20. Akola	21. Latur	21. Latur
21. Amravati	21. Amravati	<b>Amravati Region</b>	<b>Amravati Region</b>
22. Yavatmal	22. Yavatmal	22. Buldhana	22. Buldhana
<b>Nagpur Region</b>	<b>Nagpur Region</b>	23. Akola	23. Akola (includes Washim)
23. Wardha	23. Wardha	24. Amravati	24. Amravati
24. Nagpur	24. Nagpur	25. Yavatmal	25. Yavatmal
25. Bhandara	25. Bhandara	<b>Nagpur Region</b>	<b>Nagpur Region</b>
26. Chandrapur (includes Gadchiroli)	26. Chandrapur (includes Gadchiroli)	26. Wardha	26. Wardha
		27. Nagpur	27. Nagpur
		28. Bhandara	28. Bhandara (includes Gondia)
		29. Chandrapur	29. Chandrapur
		30. Gadchiroli	30. Gadchiroli

Note: From 1961 to 1977, there were four regions in Maharashtra viz. Konkan/Mumbai, Pune, Aurangabad and Nagpur. Between 1982 and 1997, the number of regions in Maharashtra increased to six viz. Konkan/Mumbai, Nashik, Pune, Aurangabad, Amravati and Nagpur. In 2003, there were seven regions in Maharashtra viz. Konkan/Mumbai, Nashik, Pune, Aurangabad, Latur, Amravati and Nagpur. The analysis in this study is performed for six regions viz. Konkan/Mumbai, Nashik, Pune, Aurangabad, Amravati and Nagpur, which includes districts of newly carved Latur region.

With the reorganisation of the states in 1956, Amravati was transferred from Madhya Pradesh to Bombay state and in 1960 it became one of the districts of Maharashtra when the state came into being. Notably, Berar was one of the provinces of India that got divided among different states. Akola district belonging to Berar became a part of bilingual Bombay state, which was further divided into two states in 1960, and Akola district became a part of the new Maharashtra state. Further, Buldhana, which was a part of Madhya Pradesh in 1950 with Nagpur as its capital, became a part of Maharashtra in 1960 because of its Marathi speaking region of Vidarbha. It became a part of Bombay state in 1956. As for Latur, it was a part of Hyderabad state under Nizam before 1948. Until 1981, Latur was a taluka town in Osmanabad district in Marathwada region of Maharashtra. However, on 16<sup>th</sup> August 1981, a separate district of Latur was carved out of Osmanabad district. The district of Jalna was formerly a part of the Princely State of Hyderabad and after independence became a part of Aurangabad district. On May 1, 1982, a separate district of Jalna was carved out, which encompassed Bhokardan, Jafrabad and Ambad talukas of Aurangabad district and Partur taluka of Parbhani district. Further, for administrative convenience and industrial and agricultural development, Ratnagiri district was divided into Ratnagiri and Sindhudurg with effect from May 1, 1981. Although Dhule district became a part of Maharashtra ever since the state came into being, a separate district of Nandurbar was carved out of Dhule on July 1, 1998. The district of Dhule now encompasses four talukas viz. Dhule, Sakri, Shirpur and Shindkheda with headquarters at Dhule. As for the districts of Satara and Sangli, in 1947 the Satara district was bifurcated into two with South Satara having its headquarters at Sangli and North Satara at Satara. Both these districts were included in Bombay State. Since 1960, the name of North Satara district changed to Satara and South Satara to Sangli. The district of Washim came into being on July 1, 1998 and it was carved put of Akola district. However, the district of Gadchiroli was formed on August 26, 1982 by separating Gadchiroli and Sironcha talukas from Chandrapur district. The district of Gondia came into being very recently and it was carved out from Bhandara district. The Gondia district is situated on North-Eastern side of Maharashtra state having state borders of Madhya Pradesh and Chattisgarh. As for Jalgaon, it was known as East Khandesh district prior to October 21, 1960, which was earlier a part of "Khandesh".

Although various districts and regions in Maharashtra came into being before and after formation of the State, the general observation shows an up-trend in livestock

population over the last five decades across all the regions of the state. Not only this, the course of time has also witnessed significant compositional changes in bovine stock across various regions of the state. The region-wise population estimates of Maharashtra with respect to various species of livestock encompassing the period between 1951 and 2003 are brought out in Table 3.5 (a). In this sequel, the annual growth estimates for the period between 1951 and 2003 are shown in Table 3.5 (b).

**Table 3.5 (a): Regional Variations in Livestock Population in Maharashtra: 1951-2003**

(in Million)

Regions	Year	Cattle				Buffalo				Bovine	Sheep	Goats	Others	Total Livestock
		M	F	Y	T	M	F	Y	T					
Konkan	1951	0.67	0.50	0.41	1.58 (11.94)	0.11	0.20	0.09	0.40 (15.94)	1.98 (12.56)	0.01 (0.51)	0.24 (6.43)	0.02 (5.56)	2.25 (10.32)
	1966	0.73	0.47	0.37	1.58	0.13	0.24	0.10	0.46	2.04	0.01	0.27	0.02	2.33
	1982	0.81	0.52	0.42	1.75	0.13	0.26	0.12	0.51	2.26	0.02	0.42	0.03	2.73
	2003	0.72	0.43	0.43	1.58 (9.69)	0.08	0.32	0.17	0.57 (9.42)	2.15 (9.64)	0.02 (0.65)	0.47 (4.49)	0.02 (3.57)	2.67 (7.32)
Nashik	1951	1.12	0.80	0.65	2.57 (19.42)	0.03	0.22	0.11	0.36 (14.34)	2.93 (18.59)	0.46 (23.47)	1.04 (27.88)	0.09 (25.00)	4.52 (20.72)
	1966	1.35	0.85	0.62	2.82	0.03	0.25	0.12	0.40	3.22	0.53	1.28	0.08	5.11
	1982	1.32	1.03	0.78	3.13	0.04	0.37	0.20	0.61	3.75	0.70	1.69	0.11	6.25
	2003	1.37	1.29	0.99	3.65 (22.31)	0.04	0.56	0.35	0.95 (15.70)	4.60 (20.53)	1.02 (33.22)	2.85 (27.25)	0.17 (30.35)	8.64 (23.67)
Pune	1951	0.93	0.71	0.53	2.17 (16.35)	0.07	0.41	0.24	0.72 (28.69)	2.89 (18.34)	0.98 (50.00)	0.98 (26.27)	0.06 (16.67)	4.91 (22.51)
	1966	1.01	0.70	0.50	2.21	0.07	0.56	0.29	0.92	3.13	1.18	1.15	0.07	5.53
	1982	0.93	0.78	0.58	2.29	0.07	0.82	0.42	1.31	3.60	1.32	1.73	0.06	6.71
	2003	0.70	0.98	0.66	2.34 (14.28)	0.05	1.40	0.77	2.22 (36.69)	4.56 (20.35)	1.40 (45.60)	2.30 (21.99)	0.08 (14.29)	8.34 (22.85)
Aurangabad	1951	1.07	0.80	0.90	2.77 (20.91)	0.03	0.27	0.18	0.48 (19.12)	3.25 (20.62)	0.36 (18.37)	0.69 (18.50)	0.08 (22.22)	4.38 (20.08)
	1966	1.54	1.00	0.88	3.42	0.02	0.37	0.24	0.63	4.05	0.32	1.06	0.09	5.51
	1982	1.56	1.12	0.94	3.62	0.02	0.42	0.30	0.74	4.36	0.45	1.65	0.09	6.55
	2003	1.54	1.09	0.97	3.60 (21.99)	0.02	0.69	0.51	1.22 (20.17)	4.82 (21.46)	0.43 (14.01)	2.25 (21.51)	0.14 (25.00)	7.63 (20.90)
Amravati	1951	0.76	0.70	0.61	2.07 (15.58)	0.01	0.18	0.10	0.29 (11.55)	2.36 (14.98)	0.08 (4.08)	0.39 (10.46)	0.07 (19.44)	2.90 (13.30)
	1966	0.89	0.75	0.58	2.22	0.01	0.19	0.11	0.31	2.54	0.07	0.67	0.05	3.33
	1982	0.98	0.85	0.67	2.51	0.01	0.25	0.14	0.40	2.91	0.10	1.17	0.07	4.25
	2003	1.01	0.74	0.65	2.40 (14.65)	0.01	0.33	0.18	0.52 (8.60)	2.92 (13.03)	0.13 (4.24)	1.32 (12.62)	0.07 (12.50)	4.44 (12.16)
Nagpur	1951	0.81	0.69	0.59	2.09 (15.80)	0.06	0.12	0.08	0.26 (10.36)	2.35 (14.91)	0.07 (3.57)	0.39 (10.46)	0.04 (11.11)	2.85 (13.07)
	1966	1.02	0.77	0.69	2.48	0.09	0.14	0.10	0.33	2.81	0.09	0.70	0.04	3.64
	1982	1.12	0.95	0.83	2.90	0.09	0.18	0.11	0.38	3.28	0.09	1.04	0.06	4.47
	2003	1.18	0.80	0.81	2.79 (17.08)	0.09	0.26	0.22	0.57 (9.42)	3.36 (14.99)	0.07 (2.28)	1.27 (12.14)	0.08 (14.29)	4.78 (13.10)
State Total	1951	5.36	4.20	3.69	13.25	0.32	1.40	0.79	2.51	15.76	1.96	3.73	0.36	21.81
	1966	6.55	4.53	3.65	14.73	0.34	1.74	0.97	3.05	17.78	2.20	5.12	0.35	25.46
	1982	6.72	5.25	4.23	16.20	0.35	2.31	1.31	3.97	20.16	2.67	7.70	0.41	30.95
	2003	6.53	5.33	4.50	16.36	0.29	3.56	2.20	6.05	22.41	3.07	10.46	0.56	36.50
India	1951	57.83	54.40	43.07	155.30	6.78	21.00	15.62	43.40	198.70	39.10	47.20	7.80	292.80
	1966	73.32	54.68	48.20	176.20	8.19	25.40	19.41	53.00	229.20	42.40	64.60	7.90	344.10
	1982	72.84	59.21	60.40	192.45	7.96	32.50	29.32	69.78	262.23	48.76	95.25	13.25	419.59
	2003	57.55	64.50	63.13	185.18	6.68	50.97	40.27	97.92	283.10	61.47	124.36	16.07	485.00

Source: Computations are based on figures compiled from various livestock census reports of Maharashtra and India

Notes: 1) M – Male, F- Female, Y – Young stock, T - Total

2) Figures in parentheses are percentages to the total population estimate of the state for respective species of livestock.

**Table 3.5 (b): Annual Compound Growth in Livestock Population in Maharashtra: 1951-2003**

(in Million)

Regions	Year	Cattle				Buffalo				Bovine	Sheep	Goats	Others	Total Livestock
		M	F	Y	T	M	F	Y	T					
Konkan	1951	---	---	---	---	---	---	---	---	---	---	---	---	---
	1966	0.57	-0.47	-0.54	-0.03	0.72	1.32	0.43	0.96	0.18	0.54	0.64	1.42	0.24
	1982	0.66	0.58	0.72	0.65	0.19	0.52	1.68	0.69	0.66	6.07	2.89	1.10	0.98
	2003	-0.55	-0.82	0.07	-0.47	-2.05	1.07	1.35	0.52	-0.22	1.10	0.52	-0.15	-0.09
	1951-03	0.14	-0.28	0.09	0.00	-0.56	0.95	1.16	0.69	0.16	2.39	1.25	0.67	0.33
Nashik	1951	---	---	---	---	---	---	---	---	---	---	---	---	---
	1966	1.28	0.26	-0.25	0.61	-1.19	0.73	1.19	0.72	0.62	0.98	1.41	-0.67	0.82
	1982	-0.16	1.33	1.42	0.68	2.12	2.57	3.07	2.70	0.96	1.77	1.76	1.90	1.27
	2003	0.18	1.06	1.16	0.73	0.75	1.98	2.56	2.12	0.99	1.84	2.53	1.62	1.56
	1951-03	0.38	0.89	0.81	0.67	0.59	1.76	2.27	1.85	0.86	1.54	1.93	1.02	1.23
Pune	1951	---	---	---	---	---	---	---	---	---	---	---	---	---
	1966	0.62	-0.02	-0.45	0.16	-0.84	2.05	1.52	1.63	0.55	1.30	1.06	0.67	0.81
	1982	-0.57	0.67	0.90	0.19	0.04	2.46	2.43	2.30	0.88	0.69	2.63	-0.84	1.22
	2003	-1.35	1.09	0.63	0.10	-1.64	2.58	2.93	2.55	1.14	0.29	1.37	1.73	1.05
	1951-03	-0.53	0.62	0.39	0.14	-0.88	2.35	2.32	2.17	0.87	0.69	1.64	0.62	1.02
Aurangabad	1951	---	---	---	---	---	---	---	---	---	---	---	---	---
	1966	2.45	1.57	-0.25	1.41	-2.39	2.19	1.84	1.86	1.47	-0.89	2.94	0.53	1.54
	1982	0.09	0.67	0.49	0.37	0.26	0.91	1.30	1.04	0.48	2.19	2.84	-0.48	1.09
	2003	-0.08	-0.11	0.13	-0.03	-0.78	2.39	2.55	2.40	0.47	-0.19	1.50	2.29	0.74
	1951-03	0.69	0.60	0.13	0.50	-0.91	1.84	1.92	1.79	0.75	0.32	2.28	0.91	1.06
Amravati	1951	---	---	---	---	---	---	---	---	---	---	---	---	---
	1966	1.06	0.46	-0.27	0.49	0.49	0.48	0.77	0.58	0.50	-0.72	3.60	-1.27	0.95
	1982	0.59	0.81	0.96	0.76	-0.26	1.71	1.80	1.67	0.88	2.00	3.58	1.85	1.55
	2003	0.19	-0.67	-0.26	-0.21	-1.08	1.28	1.20	1.20	0.01	1.30	0.59	0.66	0.22
	1951-03	0.55	0.11	0.11	0.28	-0.37	1.16	1.24	1.54	0.41	0.91	2.32	0.45	0.82
Nagpur	1951	---	---	---	---	---	---	---	---	---	---	---	---	---
	1966	1.56	0.71	1.07	1.15	2.76	0.86	1.49	1.53	1.19	1.64	4.04	-0.51	1.64
	1982	0.59	1.32	1.13	0.98	-0.26	1.64	0.78	0.90	0.97	-0.57	2.56	3.18	1.30
	2003	0.26	-0.83	-0.09	-0.17	0.10	1.80	3.09	1.92	0.12	-1.26	0.94	1.29	0.32
	1951-03	0.72	0.27	0.61	0.55	0.74	1.45	1.88	1.46	0.67	-0.21	2.28	1.31	0.98
State Total	1951	---	---	---	---	---	---	---	---	---	---	---	---	---
	1966	1.35	0.51	-0.08	0.71	0.43	1.49	1.35	1.32	0.81	0.79	2.15	-0.09	1.04
	1982	0.16	0.92	0.93	0.60	0.21	1.78	1.95	1.68	0.79	1.22	2.61	0.98	1.24
	2003	-0.14	0.07	0.30	0.05	-0.94	2.11	2.50	2.04	0.51	0.68	1.48	1.50	0.79
	1951-03	0.38	0.45	0.38	0.40	-0.19	1.79	1.96	1.69	0.67	0.86	1.98	0.86	0.98
India	1951	---	---	---	---	---	---	---	---	---	---	---	---	---
	1966	18.03	17.41	17.53	0.87	18.17	18.10	18.55	1.36	0.98	0.86	1.90	0.19	1.10
	1982	-0.04	0.50	1.09	0.45	-0.18	1.38	1.81	1.32	0.66	0.86	2.80	2.65	1.17
	2003	-1.12	0.41	0.49	-0.10	-0.84	2.18	2.37	1.97	0.52	1.18	1.33	1.39	0.82
	1951-03	4.33	4.99	5.23	0.34	4.44	6.17	6.50	1.56	0.68	0.97	1.91	1.40	0.99

Source: Computations are based on figures compiled from various livestock census reports of Maharashtra and India

Note: M – Male, F- Female, Y – Young stock, T - Total

**Table 3.5 (c): Share of Various Species in total Livestock Population of Maharashtra: 1951-2003**  
(in per cent)

Regions	Year	Cattle	Buffalo	Bovine	Sheep	Goats	Others	Total Livestock
Konkan	1951	70.37	17.79	88.16	0.30	10.78	0.76	100
	1966	67.56	19.79	87.35	0.31	11.43	0.91	100
	1982	64.12	18.89	83.01	0.68	15.38	0.93	100
	2003	59.28	21.45	80.73	0.87	17.48	0.92	100
Nashik	1951	56.88	7.99	64.87	10.08	23.02	2.04	100
	1966	55.09	7.86	62.96	10.32	25.09	1.63	100
	1982	50.15	9.82	59.97	11.16	27.07	1.80	100
	2003	42.30	11.02	53.32	11.82	33.04	1.82	100
Pune	1951	44.23	14.68	58.90	19.88	19.96	1.25	100
	1966	40.14	16.55	56.69	21.37	20.72	1.23	100
	1982	34.09	19.58	53.67	19.64	25.81	0.88	100
	2003	28.01	26.63	54.64	16.78	27.57	1.02	100
Aurangabad	1951	63.21	10.90	74.11	8.31	15.64	1.93	100
	1966	61.96	11.42	73.37	5.78	19.18	1.67	100
	1982	55.31	11.33	66.64	6.87	25.19	1.30	100
	2003	47.15	15.93	63.08	5.66	29.47	1.79	100
Amravati	1951	71.46	9.97	81.43	2.87	13.66	2.04	100
	1966	66.73	9.44	76.18	2.24	20.12	1.46	100
	1982	58.93	9.62	68.55	2.40	27.51	1.53	100
	2003	53.84	11.78	65.62	3.00	29.70	1.68	100
Nagpur	1951	73.26	9.15	82.41	2.59	13.54	1.45	100
	1966	68.16	9.00	77.16	2.59	19.19	1.05	100
	1982	64.84	8.47	73.30	1.93	23.36	1.41	100
	2003	58.53	11.77	70.30	1.39	26.58	1.73	100
State Total	1951	60.78	11.50	72.28	8.98	17.10	1.63	100
	1966	57.87	11.98	69.85	8.66	20.11	1.38	100
	1982	52.32	12.83	65.15	8.63	24.89	1.32	100
	2003	44.82	16.57	61.39	8.42	28.65	1.53	100
India	1951	53.59	14.99	68.58	12.81	15.94	2.68	100
	1966	51.80	15.57	67.37	12.36	17.92	2.34	100
	1982	46.25	15.95	62.19	11.77	23.09	2.95	100
	2003	38.18	20.19	58.37	12.67	25.64	3.31	100

Source: Computations are based on figures compiled from various livestock census reports of Maharashtra and India



**Table 3.5 (d): Share of Male, Female and Young Stocks in total Cattle and Buffalo Population of Maharashtra: 1951-2003**

(in per cent)

Regions	Year	Cattle				Buffalo			
		M	F	Y	T	M	F	Y	T
Konkan	1951	42.49	31.89	25.62	100	28.48	49.13	22.39	100
	1966	46.41	29.85	23.74	100	27.48	51.84	20.69	100
	1982	46.49	29.50	24.01	100	25.40	50.44	24.16	100
	2003	45.74	27.43	26.84	100	14.80	56.53	28.67	100
Nashik	1951	43.49	31.34	25.17	100	8.71	61.95	29.34	100
	1966	48.08	29.77	22.15	100	6.54	62.01	31.45	100
	1982	42.10	33.00	24.90	100	5.98	60.73	33.29	100
	2003	37.52	35.28	27.20	100	4.51	59.04	36.45	100
Pune	1951	42.70	32.54	24.76	100	10.38	57.26	32.36	100
	1966	45.73	31.67	22.60	100	7.19	60.95	31.86	100
	1982	40.55	34.16	25.29	100	5.04	62.46	32.50	100
	2003	29.91	41.88	28.22	100	2.11	62.82	35.07	100
Aurangabad	1951	38.69	28.72	32.59	100	5.72	55.54	38.74	100
	1966	45.10	29.41	25.49	100	3.03	58.34	38.63	100
	1982	43.17	30.85	25.98	100	2.68	57.09	40.24	100
	2003	42.75	30.37	26.89	100	1.39	57.05	41.56	100
Amravati	1951	36.74	33.84	29.42	100	3.95	62.19	33.85	100
	1966	40.01	33.70	26.29	100	3.90	61.28	34.82	100
	1982	38.94	33.95	27.11	100	2.87	61.62	35.50	100
	2003	42.29	30.87	26.84	100	1.79	62.70	35.52	100
Nagpur	1951	38.67	33.03	28.30	100	22.75	46.38	30.86	100
	1966	41.06	30.98	27.96	100	27.25	42.03	30.72	100
	1982	38.64	32.71	28.65	100	22.68	47.19	30.13	100
	2003	42.34	28.49	29.17	100	15.60	46.12	38.28	100
State Total	1951	40.43	31.71	27.86	100	12.69	55.74	31.57	100
	1966	44.46	30.78	24.77	100	11.13	57.17	31.69	100
	1982	41.48	32.40	26.11	100	8.84	58.09	33.07	100
	2003	39.90	32.58	27.53	100	4.77	58.91	36.32	100
India	1951	39.93	32.23	27.85	100	15.66	50.47	33.87	100
	1966	41.66	31.07	27.27	100	15.48	49.41	35.11	100
	1982	38.53	31.32	30.15	100	12.21	49.86	37.93	100
	2003	31.08	34.84	34.08	100	6.82	52.06	41.12	100

Source: Computations are based on figures compiled from various livestock census reports of Maharashtra and India

Note: M – Male, F- Female, Y – Young stock, T - Total

The livestock population of Maharashtra, which stood at 21.81 million in 1951, increased to 25.46 million in 1966 and further to 30.95 million in 1982 and 36.50 million in 2003 with an annual growth rate of 1.04 per cent between 1951 and 1966, 1.24 per cent between 1966 and 1982 and 0.79 per cent between 1982 and 2003, showing thereby a deceleration in livestock population growth between 1982 and 2003 (Tables 3.5 (a) and 3.5 (b)). The overall annual growth in livestock population in Maharashtra stood at 0.98 per cent between 1951 and 2003, which was in tune with annual growth rate of 0.99 per cent for the livestock population of India during this period. Interestingly, cattle population showed a declining share in total livestock population of Maharashtra, which declined from 61 per cent in 1951 to 59 per cent in 1966 and further to 52 per cent in 1982 and 45 per cent in 2003 (Table 3.5 (c)). Contrary to this, buffalo population showed a rising share in livestock population of Maharashtra, which increased from 12 per cent in 1951 to 13 per cent in 1982 and further to 17 per cent in 2003. Although buffalo population has shown a steadily rising share in total livestock population of Maharashtra, the falling share of cattle in total livestock population during this period has outweighed the rising share of buffalo in total livestock population of the state. As a result, the share of bovines in total livestock population of the state has fallen from 73 per cent in 1951 to 65 per cent in 1982 and further to 61 per cent in 2003 (Table 3.5 (c)).

Within cattle population, the population of adult male in Maharashtra declined at an annual rate of 0.14 per cent between 1982 and 2003. During this period, the decline in adult male buffalo population was sharper and an annual decline in the same stood at 0.94 per cent. However, adult female buffaloes showed rise in their population, which increased at an annual growth rate of 2.11 per cent between 1982 and 2003. The annual growth in adult female cattle population during the period between 1982 and 2003 was very marginal and stood at only 0.07 per cent. Although a very significant rise in adult female buffalo population between 1982 and 2003 is a positive sign for the enhancement in milk production activity of the state, a near non-significant growth in adult female cattle population during this period may be considered as a matter of concern. This is owing to the fact that total milk production activity of the state still depends on female cattle population due to their significant share in total bovine population, which has been increasing at a very slow pace in more recent times. However, the reason for this could be attributed to decline in indigenous cattle population in Maharashtra, which has declined from 15.70 million in 1982 to 13.56 million in 2003 in the face of increase in exotic/crossbred cattle population from 0.49 million to 2.79 million during this period. A

substantial rise in crossbred cattle population in the state between 1982 and 2003 is obviously a welcome development as the productivity levels of indigenous cattle as against crossbred cattle is very low. Therefore, a very slow increase in female cattle population between 1982 and 2003 should not be considered as a serious threat to milk production activity of the state mainly due to the fact that high yielding crossbred cattle in the state have shown a substantial rise in the course of time.

Unlike bovines, goat population has shown a steadily increasing share in total livestock population of the state, which increased from 17 per cent in 1951 to 20 per cent in 1966 and further to 25 per cent in 1982 and 29 per cent in 2003. The major increase in goat population in Maharashtra was noticed between 1966 and 1982. However, share of sheeps in total livestock population of the state has remained constant at 8-9 per cent between 1951 and 2003. Similarly, other livestock have also shown a constant share of 1.5 per cent in total livestock population of the state during this period.

Among various regions, the regions of Nashik, Pune and Aurangabad assume considerable significance as these regions of Maharashtra not only possess highest number of cattle, buffalo, sheeps and goats but also other species of livestock. These three regions put together accounted for 63.31 per cent share in total livestock population of Maharashtra in 1951 and 66.62 per cent share in 2003. The share of Konkan region in total livestock population of Maharashtra was estimated at 10.32 per cent in 1951, which declined to 7.32 per cent in 2003. The share of Amravati and Nagpur regions in total livestock population of the state remained more or less constant and hovered at around 13 per cent between 1951 and 2003.

The buffalo population was noticed to be the highest in Pune region, which accounted for 28.68 per cent share in total buffalo population of the state in 1951 and as much as 36.69 per cent share in 2003. This is an indication of the fact that more than one thirds of the total buffalo population of the state belonged to Pune region alone in 2003 that stood at more than one fourth in this sequel in 1951, showing a remarkable importance of Pune region insofar as buffalo population in the State is concerned. Another region dominated by buffalo population was Aurangabad, which accounted for 19 per cent share in total buffalo population of the state in 1951 and 20 per cent share in this respect in 2003. The share of Nashik region in total buffalo population was estimated at about 15 per cent between 1951 and 2003. It is to be noted that though Konkan region accounted for as much as 16 per cent share in total buffalo population of the state in 1951, this share was found to decline to 9 per cent in 2003. Similarly, the share of Amravati region in

total buffalo population declined from 12 per cent in 1951 to 9 per cent in 2003. The Nagpur region showed a marginal decline in terms of its share in total buffalo population of the State, which declined from 10 per cent in 1951 to 9 per cent in 2003. As for buffalo population, Pune region recorded a steady increase, which grew at an annual rate of 1.63 per cent between 1951 and 1966, 2.30 per cent between 1966 and 1982 and 2.55 per cent between 1982 and 2003 with an overall annual growth rate of 2.17 per cent between 1951 and 2003. The adult female buffalo population in Pune region grew sharply all through the period between 1951 and 2003 with an annual growth rate of 2.35 per cent as against a decline in adult male buffalo population at an annual rate of 0.88 per cent during this period. In fact, almost all the regions of Maharashtra showed a substantial growth in their adult female buffalo population. For instance, between 1951 and 2003, the adult female buffaloes grew at an annual rate of 0.95 per cent in Konkan region, 1.76 per cent in Nashik region, 1.84 per cent in Aurangabad region, 1.16 per cent in Amravati region, 1.45 per cent in Nagpur region and as much as 2.35 per cent in Pune region. Contrary to this, in majority of the regions, the adult male buffalo population declined between 1951 and 2003 with annual decline in the same being at the rate of 0.91 per cent in Aurangabad region, 0.88 per cent in Pune region, 0.56 per cent in Konkan region and 0.37 per cent in Amravati region. It was only in the case of Nashik and Nagpur regions that adult male buffalo population rather increased between 1951 and 2003 with an annual growth in the same being at 0.59 per cent in Nashik region and 0.74 per cent in Nagpur region. Further, the share of buffalo in total livestock population increased steadily across all the regions of Maharashtra with rise in this share being from 17.79 per cent in 1951 to 21.45 per cent in 2003 in Konkan region, from 7.99 per cent to 11.02 per cent in Nashik region, from 14.68 per cent to 26.63 per cent in Pune region, from 10.91 per cent to 15.93 per cent in Aurangabad region, from 9.97 per cent to 11.78 per cent in Amravati region and from 9.15 per cent to 11.77 per cent in Nagpur region (Table 3.5 (c)). Within buffalo population, the adult female buffaloes showed almost 60 per cent share, especially in the case of Nashik, Pune, Aurangabad and Amravati regions (Table 3.5 (d)). These regions, therefore, have significant potential for augmenting milk production activity for the state as the trend is more in favour of buffaloes as against low yielding indigenous cattle.

Although cattle population in Maharashtra also increased steadily across all the regions during the period between 1951 and 2003, this increase in cattle population was at much slower pace as compared to the population increase in buffaloes during this period. Between 1951 and 2003, the increase in cattle population was noticed to be from

2.57 million to 3.65 million in Nashik region, 2.17 million to 2.34 million in Pune region, 2.72 million to 3.60 million in Aurangabad region, 2.07 million to 2.40 million in Amravati region and 2.09 million to 2.79 million in Nagpur region. The Konkan region did not show any increase in its cattle population between 1951 and 2003 and it stagnated at 1.58 million during this period. In fact, between 1951 and 2003, cattle population grew at an annual compound growth rate of 0.67 per cent in Nashik region, 0.14 per cent in Pune region, 0.50 per cent in Aurangabad region, 0.28 per cent in Amravati region and 0.55 per cent in Nagpur region with an overall annual growth rate in the same at 0.40 per cent for the State as a whole (Table 3.5 (b)). Further, between 1951 and 2003, while some regions showed a decline in their share in total cattle population of Maharashtra, the others were marked with an increase in this share. For instance, Nashik, Aurangabad and Nagpur regions showed a marginal increase in their share in total cattle population of Maharashtra between 1951 and 2003 in the face of decline in this share for Konkan, Pune and Amravati regions. The share of Nashik, Aurangabad and Nagpur regions in total cattle population of Maharashtra increased from 19.42 per cent to 22.31 per cent, 20.91 per cent to 21.99 per cent and from 15.80 per cent to 17.08 per cent, respectively, during the period between 1951 and 2003. Contrary to this, the share of Konkan, Pune and Amravati region in total cattle population of Maharashtra declined from 11.94 per cent to 9.69 per cent, 16.35 per cent to 14.28 per cent, and from 15.58 per cent to 14.65 per cent, respectively, during the period between 1951 and 2003.

The regions showing major share in total cattle population of the state also showed significant growth in their adult female cattle population, especially after 1966. For instance, the annual growth in adult female cattle population for Nashik region was estimated at 1.32 per cent from 1966 to 1982 and 1.06 per cent from 1982 to 2003. Similarly, Pune region showed an increase in its adult female cattle population with an annual growth rate of 0.67 per cent from 1966 to 1982 and 1.09 per cent from 1982 to 2003. However, though Aurangabad region showed more than 20 per cent share in total cattle population of Maharashtra, the growth in its adult female cattle population kept decelerating all through the period between 1951 and 2003, and, consequently, its adult female cattle population declined at the rate of 0.11 per cent per annum between 1982 and 2003. Even Konkan, Amravati and Nagpur regions showed a declining growth in their adult female cattle population between 1982 and 2003. The plausible reason for this could be substantial decline in adult female indigenous cattle population that accounted for significant share in total adult female cattle population in the face of substantial rise in

adult female crossbred cattle population in the state over time (Table 3.6). Since indigenous breeds of cattle suffer from low productivity with high cost of maintenance, these indigenous breeds of cattle are now showing a steep declining trend in their population in all the regions of Maharashtra.<sup>4</sup>

**Table 3.6: Change in Cattle population in Maharashtra: 1982 – 2003**

Regions	Adult Indigenous Female Cattle		Adult Crossbred Female Cattle		Total adult Female Cattle	
	1982	2003	1982	2003	1982	2003
Konkan	0.50	0.41	0.02	0.02	0.52	0.43
Nashik	0.97	0.75	0.06	0.54	1.03	1.29
Pune	0.68	0.42	0.10	0.56	0.78	0.98
Aurangabad	1.09	0.87	0.03	0.22	1.12	1.09
Amravati	0.84	0.69	0.01	0.05	0.85	0.74
Nagpur	0.94	0.71	0.01	0.09	0.95	0.80
Maharashtra State	5.02 (8.93)	3.85 (7.37)	0.23 (7.69)	1.48 (12.04)	5.25 (8.87)	5.33 (8.26)
India	56.22	52.21	2.99	12.29	59.21	64.50

Note: Figures in parentheses are percentages to India's total figure

Source: Computations are based on figures compiled from various livestock census reports of Maharashtra and India

As for growth in adult male cattle population, various regions of Maharashtra have shown mixed trends. While Pune region showed a substantial decline in its adult male cattle population between 1982 and 2003, this decline in adult male cattle population in Aurangabad region was marginal during this period. The Konkan region showed a decline in its adult male cattle population at an annual compound growth rate of 0.55 per cent between 1982 and 2003. On the other hand, the other regions like Nashik, Amravati and Nagpur showed an increase in their adult male cattle population between 1982 and 2003, which grew at an annual rate of 0.18 per cent for Nashik region, 0.19 per cent for Aurangabad and 0.26 per cent for Nagpur region. However, due to substantial decline in adult male cattle population in Pune and Konkan regions and to some extent in

<sup>4</sup> During the period between 1982 and 2003, the population of indigenous adult female cattle declined from 0.50 million to 0.41 million in Konkan region, 0.97 million to 0.75 million in Nashik region, 0.68 million to 0.42 million in Pune region, 1.09 million to 0.87 million in Aurangabad region, 0.84 million to 0.69 million in Amravati region and 0.94 million to 0.71 million in Nagpur region with a total decline in the same from 5.02 million to 3.85 million for the state as a whole. In other words, the population of adult female crossbred cattle during the period between 1982 and 2003 increased from 0.06 million to 0.54 million in Nashik region, 0.10 million to 0.56 million in Pune region, 0.03 million to 0.22 million in Aurangabad region, 0.01 million to 0.05 million in Amravati region, 0.01 million to 0.09 million in Nagpur region and 0.02 million in Konkan region with a total increase in adult female crossbred cattle population from 0.23 million to 1.48 million for the state as a whole. The adult female crossbred cattle population of India increased from 2.99 million in 1982 to 12.29 million in 2003. Between 1951 and 2003, the increase in adult female crossbred cattle population is noticed to be faster in Maharashtra as compared to India. As a result, the share of Maharashtra in total adult female crossbred cattle population of India increased from 7.69 per cent in 1982 to 12.04 per cent in 2003.

Aurangabad region, the overall annual growth in adult male cattle population for the state stood negative between 1982 and 2003 and it was estimated at 0.14 per cent during this period. Despite the fact that adult male cattle population declined in Pune and Aurangabad regions between 1982 and 2003, the overall annual growth in adult male cattle population was positive between 1951 and 2003, and during this period adult male cattle population increased at an annual growth rate of 0.14 per cent in Konkan region, 0.38 per cent in Nashik region, 0.69 per cent in Aurangabad region, 0.55 per cent in Amravati region and 0.72 per cent in Nagpur region with an overall average annual growth in the same at 0.38 per cent for the State as a whole. In fact, it was only in the case of Pune region that adult male cattle population declined at an annual rate of 0.53 per cent between 1951 and 2003. The decline in adult male cattle population between 1982 and 2003 in Pune, Konkan and Aurangabad regions and very slow growth in the same during this period in other regions of Maharashtra is mainly due to the fact that majority of the regions of the state have significantly entered into farm mechanization, which requires mechanical sources of power for various farm operations as against draught animal power from bovines.

It is to be noted that all the regions of Maharashtra showed a falling share of their cattle in total livestock population between 1951 and 2003, which declined from 70.37 per cent to 59.28 per cent in Konkan region, 56.88 per cent to 42.30 per cent in Nashik region, 44.23 per cent to 28.01 per cent in Pune region, 63.21 per cent to 47.15 per cent in Aurangabad region, 71.46 per cent to 53.84 per cent in Amravati region and 73.26 per cent to 58.53 per cent in Nagpur region with an overall decline in the same from 60.78 per cent to 44.82 per cent for the State as a whole (Table 3.5 (c)). Within cattle population, majority of the regions showed higher share of adult males as against females (Table 3.5 (d)). The plausible reason for this could be increasing dependence on draught animal power through cattle, especially in the case of small category of farmers having lower size of land holdings.

The regions like Aurangabad, Pune and Nashik showed highest stocks of bovines as their combined share in total bovine stock of Maharashtra stood at 57.55 per cent in 1951 and 62.34 per cent in 2003. The other important regions in terms of bovine stocks were Amravati and Nagpur, which showed about 15 per cent share each in total bovine stock of Maharashtra between 1951 and 2003. The share of Konkan region in total bovine stock of Maharashtra declined from 12.56 per cent in 1951 to 9.64 per cent in 2003.

Interestingly, Pune region not only showed very high share of buffaloes but also sheep population. As much as 50 per cent of the total stock of sheep of Maharashtra was noticed in Pune region alone in 1951, which declined to 46 per cent in 2003. The other important region in terms of sheep population was Nashik, which accounted for 23 per cent share in total stocks of sheep of Maharashtra during the period between 1951 and 2003. The Aurangabad region ranked 3<sup>rd</sup> in terms of sheep population, which accounted for 18 per cent share in total sheep population of Maharashtra in 1951 and 14 per cent share in 2003. The Konkan region of Maharashtra showed marginal presence in terms of sheep population. The other regions like Amravati and Nagpur showed only 3-4 per cent share in total stocks of sheep in Maharashtra.

Like the stocks of sheep, the concentration of goats was also noticed to be the highest in the regions of Nashik, Pune and Aurangabad. These three regions put together accounted for 72.65 per cent share in total goat population of Maharashtra in 1951 and 70.75 per cent share in 2003. Amravati and Nagpur regions showed 10-12 per cent share each in total goat population of Maharashtra and the share of Konkan region in this respect was 5-6 per cent between 1951 and 2003.

The population of other livestock was noticed to be the highest in Nashik region, accounting for 25 per cent share in State's other livestock in 1951 and as much as 30 per cent share in this respect in 2003. In this sequel, the other important region was Aurangabad, which showed 22 per cent share in State's other livestock population in 1951 and 25 per cent share in this respect in 2003. The Amravati region showed a declining share in other livestock population of Maharashtra, which declined from 19 per cent in 1951 to 13 per cent in 2003. Similarly, Konkan region also showed a declining share in other livestock population of Maharashtra, which declined from 6 per cent in 1951 to 4 per cent in 2003. However, the population of other livestock increased in Nagpur region over time and, as a result, this region showed an increase in its share of other livestock from 11 per cent in 1951 to 14 per cent in 2003.

Thus, an overall analysis drawn from Table 2.5 clearly underscores the fact that Nashik, Pune and Aurangabad are the most important regions of Maharashtra since these regions not only have significant stocks of bovines but also other species of livestock. The contribution of these regions towards total milk and meat production of Maharashtra is substantial owing to large stocks of livestock. Obviously, these three regions play a crucial role in augmenting milk, meat and other livestock based products of the State. There are several development programmes and schemes relating to livestock sector that



have been introduced in these regions from time to time. Although other regions like Amravati, Nagpur and Konkan have relatively lower concentration of livestock, these regions also assume considerable significance for the overall development of livestock sector of the State. In fact, efforts need to be initiated to strengthen livestock resources in Amravati, Nagpur and Konkan regions through various development programmes and policy initiatives in order to fully exploit untapped production potential of livestock sector in these regions of the state.

### **3.2 Agricultural Mechanization in Maharashtra**

For ages, man has been husbanding livestock with the aim of improving their quality and making them more useful. Cattle not only provide valuable animal protein but are also the source of power supply for the cultivation of crops. The contribution of power supply by livestock has been recognized even in some of the industrially developed countries. In most of the developing countries, the bulk of the agricultural operations is done by the use of animal power. In India, draught animals constitute roughly about 30 per cent of the total bovine population and are considered the mainstay of draught power (Nair and Dhas, 1987). Though recently mechanization of agriculture has attracted the attention of many farmers, because of the time and labour saving devices and the quicker and more efficient output of work, yet due to a number of limitations such as small size of farms, Indian agriculture will have to depend mainly upon bullock power for a long period to come. However, it has also been noticed that in certain parts of the country the level of mechanization has reached such a stage where it has gradually started displacing work animals. A section of researchers have also put forward the argument that the growth in mechanization has met the additional draught power requirement of the green revolution in agriculture by supplementing the work animal population (Mishra and Sharma, 1990; Nair and Dhas, 1990).

As a matter of fact, the issue of demand for draught animals arising out of technological and institutional changes in agriculture coupled with their supply has received very scanty attention in the past. However, the works of Sharma (1981, 1989), Binswenger (1978) and Vaidyanathan (1982) provide good insight into this important aspect of the livestock economy and its linkages with agriculture.

Technological changes in agriculture associated with the green revolution have brought about significant changes in the size and composition of animal draught power in several areas of the country. The state of Maharashtra is not an exception to this phenomenon. During the last three decades, the bovine economy of the State witnessed a

number of changes in terms of its size, composition and productivity. The size of bovine herd increased from about 17 million in the mid-fifties to 21.7 million in the late eighties. While the sex composition of bovine has shifted in favour of females, its breed composition has shifted considerably in favour of crossbreeds. Contrary to many studies which showed a decline in work animal population in some of the regions of the country, the draught animal population of Maharashtra has shown a slight increase over time. The issue of economic viability along with socio-economic acceptability of species and breeds will become more pertinent under the changed situation in the state. Therefore, an insight into the changes in size, composition and availability of draught animal power in relation to mechanical power will be helpful in understanding the extent of mechanization of agriculture in the state of Maharashtra. And, assessment of factors that have facilitated the process of diffusion and adoption of advanced technology will provide useful insights into the future prospects for the development of livestock sector in the state.

### **3.2.1 Draught Animals and Mechanical Power**

The effect of agricultural mechanization has been seen in the successive reduction of the growing requirement of bullock power and an increase in the production of livestock products (Bergmann, 1978; Myrdal, 1968; Venkatappiah, 1972). As a matter of fact, a reduction in the demand for work animals has two major consequences: a proportionate release of animal feed; and a change in the composition of livestock population in favour of milch stock and of females in all age groups. Either of the consequences or both may in turn, lead to an increase in milk and meat production. Draught animals are used mainly for land preparations, sowing, manuring, threshing and irrigation. However, these operations can also be performed by mechanical means. Draught animals can be displaced by tractors in land preparations, sowing, manuring and threshing and electrical pumpsets and oil engines can displace animals in irrigation. In consequence, the requirement of draught power may increase for other operations. Because of such differential impact of mechanization of all agricultural activity on draught animal stock, it is necessary to examine the impact of these two categories of mechanical equipment on the draught animal stock in the state of Maharashtra.

#### **3.2.1.1 Draught Animal Population in Maharashtra**

Slow growth in the stock of draught animals was observed in the state of Maharashtra. During the period between 1951 and 2003; the draught animal population in Maharashtra increased only by 0.31 per cent per annum. Even this growth came through rise in draught cattle population since the stock of draught buffaloes declined over the last

five decades in this State (Table 3.7). In fact draught animal population in the State decelerated after 1966 so much so that it declined at an annual compound growth rate of 0.20 per cent between 1982 and 2003. The estimates relating to draught animal population across all the region encompassing the entire period between 1951 and 2003 are brought out in Annexure 1.

**Table 3.7: Region-wise Draught Animal Population in Maharashtra**

Region	Year	Draught Animal Population (10 <sup>6</sup> )			CGR	NSA (10 <sup>6</sup> Ha)	DDA
		Cattle	Buffalo	Total			
Konkan	1951	0.64	0.11	0.75	--	0.86	0.87
	1966	0.72	0.12	0.85	0.80	0.87	0.97
	1982	0.80	0.13	0.93	0.60	0.81	1.14
	2003	0.69	0.07	0.77	-0.72	0.82	0.94
Nashik	1951	1.13	0.04	1.17	--	3.61	0.32
	1966	1.34	0.02	1.36	1.19	3.62	0.38
	1982	1.29	0.04	1.32	-0.25	3.57	0.37
	2003	1.33	0.03	1.36	0.17	3.57	0.38
Pune	1951	0.91	0.07	0.98	--	3.91	0.25
	1966	1.00	0.06	1.07	0.70	4.86	0.22
	1982	0.89	0.07	0.96	-0.71	3.77	0.25
	2003	0.67	0.03	0.70	-1.43	3.56	0.20
Aurangabad	1951	1.05	0.03	1.08	--	4.62	0.23
	1966	1.51	0.01	1.53	2.56	4.72	0.32
	1982	1.53	0.02	1.55	0.10	4.78	0.32
	2003	1.51	0.01	1.51	-0.10	4.57	0.33
Amravati	1951	0.73	0.01	0.74	--	2.85	0.26
	1966	0.87	0.01	0.88	1.23	2.92	0.30
	1982	0.96	0.01	0.97	0.58	3.03	0.32
	2003	0.99	0.00	0.99	0.16	3.09	0.32
Nagpur	1951	0.77	0.06	0.83	--	1.94	0.43
	1966	1.00	0.08	1.08	1.82	1.97	0.55
	1982	1.10	0.08	1.18	0.60	2.00	0.59
	2003	1.13	0.07	1.21	0.15	1.90	0.64
Maharashtra	1951	5.24	0.31	5.55	--	17.77	0.31
	1966	6.44	0.32	6.76	1.46	18.01	0.38
	1982	6.57	0.34	6.91	0.12	17.96	0.38
	2003	6.32	0.21	6.53	-0.20	17.50	0.37
India	1951	60.73	6.54	67.27	--	134.98	0.50
	1966	71.43	7.59	79.02	1.14	137.72	0.57
	1982	70.07	5.97	76.04	-0.12	142.51	0.53
	2003	54.32	5.83	60.15	-1.26	138.27	0.44

Notes: CGR – Compound Growth Rate; NSA – Net Sown Area; DDA – Density of Draught Animal  
Net sown area figures used are three year average centered around the respective years in the table.

Source: 1) All India Livestock & Farm Equipment Census, Maharashtra State (various years), Directorate of Animal Husbandry, Maharashtra State, Pune

2) Indian Livestock Census (various years) Summary Tables Volume - II Part -I, Directorate of Economics & Statistics, Department of Agriculture & Co operation, Ministry of Agriculture Government of India

The Pune region showed a declining trend in the total stock of draught animals due to fall in its draught bovine population after 1966. The draught animal population in Pune region increased between 1951 and 1966 with a steady decline in the same in the

subsequent periods. In fact, other regions of Maharashtra also showed very slow growth in draft animal population after 1966. The decline in draught animal population in Pune region and its slow growth in other regions of the State after 1966 might be due to interaction of a number of factors<sup>5</sup>, some of which are decline in the average size of cultivated holdings, shift in cropping pattern and increase in the cost of rearing of work animals. As human population pressure on land increases, the size of land holding tends to decline. Because of the indivisibility of work animals, the density of work animal population per unit of cultivated area tends to increase. However, beyond a point when the average size of cultivated holding falls below the critical minimum needed to maintain a pair of work animals, there will be a tendency to do away with work animals and to cling to milch animals (Vaidyanathan et al. 1982).

The density of work animals per hectare of net sown area across various regions of the state was observed to be almost constant over a period of five decades, with only some moderate fluctuations. This was because of the fact that while total net sown area showed falling trend in most of the regions, the stock of draught animals increased over time. Consequently, the density of work animals per hectare of net sown area remained by and large constant during this period. However, the overall trend shows an increase in draught animal population between 1951 and 2003 as against steep decline in the same for India after 1966. This is an indication of the fact that a significant section of farmers in Maharashtra are still dependent on draught animals for their various farming operations. In other words, the pace of mechanization in Maharashtra is slower as compared to other states of the country.

### **3.2.1.2 Mechanization of Irrigation in Maharashtra**

The growth of mechanization of irrigation has contributed significantly to the increase in the availability of draught power in agriculture. A rapid increase in the number of electric pumpsets and oil engines was seen in Maharashtra during the last five decades (Table 3.8). The number of electric pumpsets and oil engines in Maharashtra, which stood at only 0.2 lakhs during 1951, increased to some 5.9 lakhs in 1982 and 10.3 lakhs by 2003. The bulk of the increase was contributed by electric pumpsets. A major increase in electric pumpsets was noticed during the period 1966-1982. On the other

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<sup>5</sup> Nair (1981), Dolberg (1982) and Jabbar and Green (1983) discussed the role played by size of land holding on draught animal population. While Grewal and Kahlon (1973) and Rao (1975) argued that mechanization has led to a decline in the utilization of draught power, Sharma (1981) and Vaidyanathan (1982) argued that the increase in the mechanical power has not resulted in any reduction in the draught animal population.

hand, after registering an annual increment of nearly 16 per cent between 1951 and 1966, oil engines showed an annual decline of about one per cent between 1982 and 2003. This was mainly because of considerable fall in the number of oil engines in Nashik, Pune and Aurangabad regions of the State. Region-wise estimates for numerical strength of electric pumpsets and oil engines and their growth as well as densities with respect to all the census periods beginning 1951 are shown in Appendix 2.

**Table 3.8: Region-wise Number of Electric Pumpsets and Oil Engines in Maharashtra**

Regions	Year	Electric Pumpsets and Oil Engines (10 <sup>4</sup> )						Density of Electric Pumpsets and Oil Engines per 100 Ha of NSA
		Oil Engines		Pumpsets		Total		
		Number	CGR	Number	CGR	Number	CGR	
Konkan	1951	0.26	--	0.01	--	0.27	--	0.31
	1966	0.19	-2.01	0.13	17.53	0.32	1.29	0.37
	1982	0.12	-2.91	0.70	10.55	0.82	5.73	1.01
	2003	0.80	10.12	2.04	5.48	2.84	6.43	3.47
Nashik	1951	0.53	--	0.04	--	0.56	--	0.16
	1966	6.21	18.84	0.60	21.52	6.80	19.04	1.88
	1982	3.28	-3.75	13.96	20.84	17.25	5.74	4.83
	2003	1.32	-4.46	19.01	1.55	20.32	0.82	5.69
Pune	1951	0.75	--	0.04	--	0.79	--	0.20
	1966	4.86	13.99	1.18	27.13	6.04	15.34	1.24
	1982	6.45	1.71	10.95	14.27	17.40	6.55	4.61
	2003	4.05	-2.30	24.51	4.11	28.56	2.51	8.03
Aurangabad	1951	0.08	--	0.01	--	0.09	--	0.02
	1966	2.52	26.86	0.45	36.37	2.97	27.78	0.63
	1982	2.11	-1.05	8.77	19.44	10.88	8.09	2.28
	2003	1.40	-2.04	27.63	5.91	29.03	5.03	6.36
Amravati	1951	0.10	--	0.01	--	0.11	--	0.04
	1966	0.62	13.65	0.97	41.41	1.59	20.87	0.54
	1982	1.05	3.25	6.91	12.48	7.96	10.15	2.63
	2003	1.15	0.46	10.99	2.34	12.14	2.13	3.92
Nagpur	1951	0.04	--	0.00	--	0.04	--	0.02
	1966	0.29	14.58	0.46	39.85	0.74	21.75	0.38
	1982	0.90	7.14	3.57	13.11	4.47	11.36	2.24
	2003	2.73	5.70	6.97	3.40	9.70	3.95	5.12
Maharashtra	1951	1.76	--	0.10	--	1.86	--	0.10
	1966	14.68	16.03	3.80	28.61	18.48	17.43	1.03
	1982	13.92	-0.32	44.86	15.97	58.78	7.19	3.27
	2003	11.45	-0.97	91.14	3.61	102.59	2.82	5.86
India	1951	8.25	--	2.62	--	10.87	--	0.08
	1966	47.10	12.97	41.46	21.33	88.56	15.82	0.64
	1982	329.60	12.38	358.10	13.81	687.70	13.09	4.83
	2003	7237.40	16.70	8448.30	17.12	15685.70	16.92	113.44

Source: As in Table 3.7

Interestingly, while the number of oil engines declined drastically (a fall of about 60 per cent) in Nashik region, followed by Pune region (fall of 37 per cent and Aurangabad regions (fall of 34 per cent) during the period 1972-1987, a substantial rise, on the other hand, was also noticed in electric pumpsets in these regions of the State. The

decline in oil engines was, therefore, more than compensated by the considerable increase in electric pumpsets. Consequently, the overall growth in mechanized sources of irrigation did not get affected. Further, as the net sown area remained more or less constant over the last five decades in the State, a rapid increase in electric pumpsets and oil engines has resulted in a considerable rise in the density of these mechanized sources of irrigation per 100 hectares of net sown area.

In Maharashtra, out of the total net irrigated area, 56 per cent was well irrigated in 1972-73, which marginally rose to 58 per cent in 1982-83 and sharply to 68 per cent in 2001-02.<sup>6</sup> The rising importance of well irrigation in the state implies that the requirement of various sources of draught power for lifting water has been increasing. However, the rise in the intensity of mechanization of irrigation did not appear to have affected draught animal population in the state. This is evident from the classification of districts according to the growth of mechanized irrigation and reduction in the draught stock during 1982 to 2003. In districts like Pune, Solapur, Aurangabad, Beed and Osmanabad the increase in electric pumpsets and oil engines was more than 100 per cent, but in these districts the decline in the draught animal stock was less than 20 per cent. In majority of the districts, the draught animal stock also increased with the increase in the stock of mechanized equipment in the above period. This was observed especially in districts like Parbhani, Nanded and Yavatmal where the increase in electric pumpsets and oil engines was more than 150 per cent, but the increase in draught animal stock varied from 1 to 20 per cent. Interestingly, the increase in mechanized equipment was more than 300 per cent in Aurangabad during the period 1982 to 2003, but the total stock of draught animal remained constant during this period. In general, Nashik, Aurangabad and Nagpur regions of Maharashtra have shown increase in both mechanized equipment and draught animal population (Tables 3.7 and 3.8).

Thus, the installation of more electric pumpsets and oil engines has not had any significant influence on the changes in the draught animals stock. Given the utilization pattern of bullock, an increase in the intensity of mechanized irrigation would not have resulted in a reduction in the draught animal stock. Though it might contribute to the displacement of bullock labour from irrigation, this must have been more than

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<sup>6</sup> Out of the total net irrigated area of 1.28 million hectares in Maharashtra, the well irrigated area was 0.71 million hectares in 1972-73. By 1982-83, the total net irrigated area increased to 1.95 million hectares and well irrigated area to 1.12 million hectares. In 2001-02, the total net irrigated area was 3.14 million hectares, which encompassed area under well irrigation of the order of 2.15 million hectares. Surface irrigation was followed in the remaining area.

compensated by the increase in the cropping intensity consequent to the increase in the intensity of mechanization. It follows that if mechanization of irrigation is followed by mechanization of land preparation and other cultivation operations like harvesting and threshing, it would result in a reduction in the work animal stock. In this context, it is useful to examine the trend in availability of mechanical and draught animal power and the extent of tractorisation in the state.

### 3.2.1.3 Farm Power Availability in Maharashtra

The estimates with respect to availability of mechanical and draught animal power for various regions of Maharashtra encompassing the period between 1951 and 2003 are provided in Table 3.9 and complete series of such estimates in Appendix 3.

**Table 3.9: Availability of Mechanical and Draught Animal Power (HP) in Maharashtra**

Region	Year	Mechanical Power (MP) (10 <sup>4</sup> HP)				DAP (10 <sup>4</sup> HP)	TFP (10 <sup>4</sup> HP)	Share of MP in TFP (%)	Share of DAP in TFP (%)	Share of Pumpsets and Oil Engines in TFP (%)
		Oil Engines	Pumpsets	Tractors	Total					
Konkan	1951	1.28	0.07	0.07	1.41	30.16	31.57	4.46	95.54	4.26
	1966	0.96	0.66	0.16	1.77	33.83	35.60	4.98	95.02	4.54
	1982	0.58	3.50	0.24	4.33	37.08	41.41	10.45	89.55	9.87
	2003	4.02	10.19	2.12	16.32	30.63	46.95	34.77	65.23	30.26
Nashik	1951	2.64	0.18	0.60	3.42	46.79	50.21	6.81	93.19	5.62
	1966	31.03	2.98	2.20	36.21	54.52	90.72	39.91	60.09	37.49
	1982	16.42	69.82	23.73	109.97	52.86	162.83	67.53	32.47	52.96
	2003	6.59	95.03	85.70	187.32	54.33	241.64	77.52	22.48	42.05
Pune	1951	3.74	0.19	0.54	4.48	39.37	43.84	10.21	89.79	8.98
	1966	24.30	5.92	3.10	33.32	42.65	75.97	43.86	56.14	39.78
	1982	32.25	54.76	14.66	101.67	38.40	140.07	72.58	27.42	62.12
	2003	20.23	122.55	81.86	224.65	27.95	252.60	88.93	11.07	56.53
Aurangabad	1951	0.42	0.03	0.04	0.49	43.15	43.63	1.11	98.89	1.03
	1966	12.60	2.27	0.71	15.58	61.03	76.60	20.33	79.67	19.41
	1982	10.57	43.83	5.55	59.95	62.10	122.05	49.12	50.88	44.58
	2003	7.00	138.14	38.44	183.58	60.44	244.02	75.23	24.77	59.48
Amravati	1951	0.50	0.03	0.47	1.00	29.63	30.63	3.27	96.73	1.73
	1966	3.08	4.87	1.16	9.11	35.16	44.27	20.57	79.43	17.96
	1982	5.25	34.56	5.70	45.51	38.74	84.25	54.01	45.99	47.24
	2003	5.75	54.93	27.85	88.54	39.72	128.25	69.03	30.97	47.31
Nagpur	1951	0.20	0.02	0.07	0.30	33.01	33.31	0.89	99.11	0.67
	1966	1.43	2.29	0.74	4.46	43.22	47.68	9.36	90.64	7.80
	1982	4.51	17.85	1.81	24.18	47.35	71.53	33.80	66.20	31.27
	2003	13.67	34.84	13.38	61.89	48.26	110.15	56.19	43.81	44.04
Maharashtra	1951	8.78	0.52	1.79	11.09	222.11	233.19	4.75	95.25	3.99
	1966	73.39	18.99	8.06	100.44	270.41	370.85	27.08	72.92	24.91
	1982	69.60	224.32	51.69	345.60	276.54	622.14	55.55	44.45	47.24
	2003	57.26	455.69	249.34	762.29	261.33	1023.62	74.47	25.53	50.11
India	1951	41.24	13.09	21.59	75.91	2690.62	2766.53	2.74	97.26	1.96
	1966	235.48	207.31	135.03	577.82	3160.92	3738.74	15.45	84.55	11.84
	1982	1648.00	1790.50	1296.25	4734.75	3041.44	7776.19	60.89	39.11	44.22
	2003	36187.00	42241.50	5903.00	84331.50	2406.12	86737.62	97.23	2.77	90.42

Source: Computations are based on figures compiled from various livestock census reports of Maharashtra and India

Note: DAP Draught Animal Population; TFP – Total Farm Power; HP – Horse Power

It is assumed that one animal is equivalent to 0.4 HP, Oil engines / pump sets 5 HP and tractor to 25 HP

A steady growth in pumpsets, oil engines and tractors has resulted in a significant increase in the availability of total farm power in Maharashtra. The estimated gross availability of farm power from animal and mechanized sources in Maharashtra was about 2.3 million horse power (HP) units in 1951 and this increased to 3.7 million HP in 1966 and 6.2 million HP in 1982. By 2003, it is estimated to have increased to 10.24 million HP units in Maharashtra. Bulk of the increase in total farm power availability over time was contributed by regions like Nashik, Pune and Aurangabad. The contribution of these regions together to total farm power was 59 per cent in 1951, which sharply increased to nearly 68 per cent in 1982 and by 2003 the share of these regions was estimated to be about 72 per cent in the total farm power availability of the state.

The composition of farm power in Maharashtra has also undergone a marked change over time. While the share of power from mechanized sources in total farm power availability has shown a rising trend in the last five decades, a declining trend in this respect was noticed in the case of draught animal power, though in absolute terms, the draught animal power marginally increased from 1966 to 1982 with decline in the same thereafter. In Maharashtra, the share of animal power declined to 26 per cent by 2003, which was about 73 per cent in 1966 and as much as 95 per cent in 1951. Konkan and Nagpur regions of the State presented a slightly different scenario from the general trend obtaining in other regions in terms of draught power availability. Though draught animal power in these two regions has been declining over time, the dependence on it was found to be higher even in 2003, when about 65 per cent of the total farm power in Konkan region and nearly 44 per cent in Nagpur region was contributed by work animals. Thus, the extent of farm mechanization in these two regions was found to be very slow as compared to the other regions of the state. In contrast, the extent of mechanization in Pune region was very high, where almost 89 per cent of farm power in 2003 was derived from mechanized sources with contribution of work animals in this respect being only 11 per cent. Even Nashik and Aurangabad regions showed significant dependence on mechanized sources of power as against power from work animals since in 2003 these regions derived 75-78 per cent of total farm power from mechanized sources.

A cursory look at Table 3.9 further revealed that in Maharashtra the share of irrigation equipment in total farm power availability increased from 4 per cent to 50 per cent and that for tractors from 1 per cent to 24 per cent between 1951 and 2003. Around 67 per cent of the mechanized power in Maharashtra's agriculture was estimated to be derived from oil engines and electric pumpsets and the latter has been increasing at a



faster rate in recent years. Consequently, the consumption of electric power per hectare of cultivated land has increased rapidly.<sup>7</sup> The slower pace in the extent of mechanization in the state of Maharashtra can also be corroborated from the fact that in 2003 while the share of draught animals in total farm power was nearly 26 per cent for Maharashtra, this share for India stood at only 3 per cent. Obviously, the other states of India have followed mechanization of their farm at much faster rate as against Maharashtra. In 2003, Maharashtra accounted for only 1.18 per cent share in total farm power of India, which was 8 per cent in 1982 and as much as 10 per cent in 1966. This shows a rapid decline of Maharashtra's share in total farm power availability of India.

The extent of farm mechanization rapidly increased between 1987 and 2003 in all the states of India with the exception of Maharashtra, which showed very slow progress in this respect during this period (Appendix 3). In fact, there was more than eight folds rise in farm power through mechanized sources in India during the period between 1987 and 2003, whereas the state of Maharashtra showed hardly 25-30 per cent rise in the same during this period. The state of Maharashtra, therefore, does not stand anywhere insofar as level of farm mechanization in rest of the country is concerned.

#### **3.2.1.4 Tractorisation in Maharashtra**

One of the crucial aspects of farm mechanization is the effect of the growth of tractorisation on draught animals holding. Tractors can displace animal drawn techniques in preparatory tillage, sowing, manuring and interculture, threshing and transport. Obviously, one might expect a decline in draught animal population with an increase in the intensity of tractorisation. A study conducted in Tamil Nadu showed a decline in draught animal population over a period of 30 years due to increase in farm mechanization (Dhas, 1987). On the other hand, another study conducted by Sharma (1981) on the draught power situation in Haryana had shown that even after introduction of tractors on farms, the farmers continued to maintain their bullocks because of a variety of reasons like fear of sudden break-down of tractors, large number of fragments, etc. The focus of this study was on the supplementary role of tractor power for the draught animal power in the State.

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<sup>7</sup> According to Raj (1973) the faster diffusion of mechanization in irrigation was due to the following reasons: "The use of animal and manual labour for lifting water from wells often poses problems, even in areas where adequate supplies of groundwater are available. Moreover, when the storage capacity of tanks is small, the supplies of water may not last for more than a few months following the rainy season. That an improved technique of irrigation should more rapidly gain acceptance in areas of heavy dependence on ordinary wells and storage tanks is therefore understandable."

In the state of Maharashtra, tractorisation has taken place at a faster rate from the mid-sixties onwards. The annual growth in tractor population of Maharashtra hovered at around 12 per cent between 1951 and 1982 and declined to 8 per cent between 1982 and 2003. In 1951, there were only 714 tractors in the state, which increased to 3,224 in 1966 and further to 20,674 in 1982 (Table 3.10). By 2003, the number of tractors in the state increased to as many as 99,735, showing thereby nearly five folds rise in the same between 1982 and 2003 and 30 folds between 1966 and 2003. Bulk of the increase was observed in Nashik and Pune regions; together contributing about 67 per cent of the total tractor population of the State in 2003. Even Aurangabad region showed significant rise in its tractor population between after 1982 so much so that in 2003 the contribution of this region in total tractor population of the State stood at 15 per cent.

**Table 3.10: Number of Tractors and its Share in Total Draught Power in Maharashtra**

Regions	Year	Tractors	CGR (%)	Density of Tractor per 100 Ha of NSA	Share of Tractor Power in TFP (%)
Konkan	1951	26	--	Neg.	0.21
	1966	63	6.39	0.01	0.44
	1982	95	2.50	0.01	0.57
	2003	846	11.55	0.10	4.50
Nashik	1951	239	--	0.01	1.19
	1966	879	9.54	0.02	2.42
	1982	9491	15.35	0.27	14.57
	2003	34278	6.63	0.96	35.46
Pune	1951	216	--	0.01	1.23
	1966	1240	13.01	0.03	4.08
	1982	5864	9.77	0.16	10.47
	2003	32744	8.98	0.92	32.41
Aurangabad	1951	15	--	Neg.	0.09
	1966	283	22.83	0.01	0.92
	1982	2219	13.15	0.05	4.55
	2003	15374	10.16	0.34	15.75
Amravati	1951	189	--	0.01	1.54
	1966	462	6.46	0.02	2.61
	1982	2281	10.05	0.08	6.77
	2003	11141	8.25	0.36	21.72
Nagpur	1951	29	--	Neg.	0.22
	1966	297	17.69	0.02	1.56
	1982	724	5.49	0.04	2.53
	2003	5352	10.52	0.28	12.15
Maharashtra	1951	714	--	Neg.	0.77
	1966	3224	11.13	0.02	2.17
	1982	20674	11.79	0.12	8.31
	2003	99735	8.19	0.57	24.36
India	1951	8635	--	0.01	0.78
	1966	54012	13.69	0.04	3.61
	1982	518500	14.53	0.36	16.67
	2003	2361200	7.87	1.71	6.81

Note: CGR – Compound Growth Rate; Neg. - Negligible

There has also been a significant increase in the number of tractors per 100 hectares of net sown area. However, its availability is still very low: about six tractors per 1000 hectares in 2003. The Nashik and Pune regions show about 10 tractors per 1000 hectares of net sown area, whereas the estimate for Aurangabad, Amravati and Nagpur regions in this respect stand at 3-4 tractors. Our estimates for 2003 show that the tractors have contributed about 24 per cent of the total draught power availability in the State. In this sequel, the shares for Nashik, Pune, Aurangabad and Amravati regions are estimated at 35 per cent, 32 per cent, 16 per cent and 22 per cent, respectively.

In order to examine the displacement of draught animal population due to the growth in tractorisation, the districts of Maharashtra were classified according to the percentage increase in tractors and the percentage change in draught animal stock during the period 1982 to 2003 (Table 3.11).

**Table 3.11: Change in Draught Animal and Tractor Population between 1982 and 2003 in Maharashtra**

District	Draught Animal Stock			Tractor Population		
	1982	2003	% Change	1982	2003	% Change
Thane	272784	245654	-9.95	80	602	765.00
Raigad	230288	176062	-23.55	11	97	781.82
Ratnagiri	422717	343470	-18.74	4	57	1325.00
Nashik	392622	431273	9.84	3241	10522	224.63
Dhule	308146	383693	24.52	1185	3651	208.10
Jalgaon	280979	271852	-3.25	1970	7198	265.38
Ahmednagar	339864	271351	-20.16	3095	12907	317.03
Pune	280262	207642	-25.91	999	10999	1001.00
Satara	163451	111222	-31.95	926	6601	612.85
Sangli	132756	93390	-29.65	1097	4006	265.18
Solapur	195934	170193	-13.14	648	5231	707.25
Kolhapur	187587	116404	-37.95	2194	5907	269.23
Aurangabad	444740	426303	-4.15	1096	6683	509.76
Parbhani	265863	286137	7.62	263	1435	445.63
Beed	267502	248076	-7.26	220	1638	671.82
Nanded	231153	246194	6.51	166	1379	730.72
Osmanabad	343937	304378	-11.50	474	4179	781.65
Buldhana	237106	237632	0.22	847	3082	263.87
Akola	242125	264679	9.32	661	3816	477.31
Amravati	201744	200248	-0.74	625	2593	314.88
Yavatmal	287619	290428	0.98	148	1650	1014.86
Wardha	125598	132023	5.12	51	588	1052.94
Nagpur	213801	212334	-0.69	77	1509	1859.74
Bhandara	337617	303627	-10.07	365	1604	338.25
Chandrapur	506711	558398	10.20	230	1651	617.83

Source: Computations are based on figures compiled from various livestock census reports of Maharashtra

It was noticed that in districts where the percentage increase in tractors was higher, either there was increase in the draught animal stock or a low decline in the stock of work animals. For instance, while the increase in the tractor population was more than

250 per cent in Jalgaon, Aurangabad, Beed and Bhandara districts of Maharashtra, the decrease in draught animal population was less than 10 per cent. In districts like Pune, Solapur, Osmanabad, and Nagpur, the increase in tractor population was around 700 per cent, but decline in draught animal stock was less than 15 per cent. Interestingly, in Yavatmal district the increase in tractor population was around 1000 per cent, but the draught animal stock remained unchanged or rather marginally increased during the period 1982 to 2003. Some of the districts like Nashik, Parbhani, Nanded, Buldhana, Akola, Yavatmal, Wardha, and Chandrapur showed increase in both tractor and draught animal population between 1982 and 2003. It was only in the case of districts like Satara, Kolhapur and Sangli that draught animal population declined by more than 30 per cent between 1982 and 2003 in the face of 300-600 per cent increase in tractor population during this period. This indicates that the growth in tractors has not contributed to the reduction in the draught animal stock. Further, it is to be noted that though annual growth in tractor population in Maharashtra was higher (11.79 per cent) as compared to India (7.87 per cent) between 1982 and 2003, the share of Maharashtra in total tractor population of India stood at only 4 per cent during this period. The annual growth in tractor population of India was nearly 15 per cent between 1966 and 1982 when Maharashtra registered an annual growth in this respect at 11 per cent during this period. The major growth in tractor population was noticed from 1951 to 1956, 1961 to 1966 and 1992 to 1997 for Maharashtra and from 1951 to 1956, 1966 to 1972, and 1977 to 1982 for India with period after 1982 showing deceleration in annual growth of tractor population in India (Appendix 4).

The foregoing analysis indicates that the intensity and spread of mechanization have progressed rapidly in Maharashtra. However, even now it is operating at a low level. Therefore, its impact on displacement of work animals is likely to be low. The incidence of displacement is likely to be more in the large and medium farms where the intensity of tractorisation is higher. Further, mechanization of irrigation has taken place at much faster rate than mechanization of tillage in Maharashtra. Thus, the combined effect of mechanization on displacement of work animals is likely to be low in this state.

### **3.2.2 Trends in Compositional Changes**

The growth of different livestock species and breeds depends upon the crop economies, land utilization pattern, farmers' preference for different livestock products and technological advancement. These changes also reflect the future trend and demand situations for a particular type of livestock and its product. A study of such changes is

extremely crucial for policy planning. Therefore, an attempt has been made to evaluate the changes in the composition of bovine population over time in different regions of Maharashtra. Apart from this, the study also places onus on analysing the growth of breedable female population in relation to total stocks of animals in the state. In order to have a general idea about the six economic regions, some basic information on the human population, bovine (cattle + buffalo) population and gross cultivated area along with some relevant ratios are given in Table 3.12.

**Table 3.12: Human (2001) and Bovine (2003) Population, Gross Cultivated Area (2000-01) and their Ratios in Maharashtra**

Region	HP (10 <sup>6</sup> )	BP (10 <sup>6</sup> )	GCA (10 <sup>6</sup> Ha)	GCA/100 HP (Ha)	GCA/100 BP (Ha)	BP/100 HP
Konkan	21.49 (22.18)	2.16 (9.64)	0.89 (4.00)	4.14	41.20	10.05
Nashik	20.28 (20.93)	4.60 (20.53)	4.61 (20.71)	22.73	100.22	22.68
Pune	19.96 (20.60)	4.56 (20.35)	4.43 (19.90)	22.19	97.15	22.85
Aurangabad	15.63 (16.13)	4.81 (21.46)	6.30 (28.30)	40.31	130.98	30.77
Amravati	9.57 (9.88)	2.92 (13.03)	3.93 (17.65)	41.07	134.59	30.51
Nagpur	9.95 (10.27)	3.36 (14.99)	2.10 (9.43)	21.11	62.50	33.77
Maharashtra	96.88	22.41	22.26	22.98	99.33	23.13

Source: Computations are based on figures compiled from livestock census reports of Maharashtra, 2003 and Season and Crop Report, 2003-04, Government of Maharashtra

Note: HP = Human Population; BP = Bovine Population; GCA = Gross Cultivated Area  
Figures in parentheses indicate percentage of state population/area

It is clearly discerned from Table 3.12 that Nashik, Pune and Aurangabad regions not only have very high concentration of bovine population but also account for significant share in the State's gross cultivated area. The ratio of gross cultivated area to human and bovine population is noticed to be the highest in Amravati region, followed by Aurangabad, Nashik and Pune regions. However, the ratio of bovine to human population is seen to be the highest in Nagpur region, followed by Aurangabad, Amravati, Nashik, Pune and Konkan regions. In fact, Konkan region shows lowest ratios not only in terms of gross cultivated area to human and bovine population but also with respect to bovine to human population.

### 3.2.2.1 Bovine Population Trends in Maharashtra

The bovine population in the state has been showing rising trend over time. It increased by about 42 per cent during the five decades between 1951 and 2003. The increase in bovine population was higher during 1966-82 and 1951-1966 as compared to 1982-2003 (Table 3.13). Though cattle population in the State constituted about 80 per cent of the total bovine stock, the rise in buffalo population was much higher.

**Table 3.13: Changing Composition of Bovine Population in Maharashtra**

(in million)

Region	Year	Cattle				Buffalo				Total Bovine			
		Adult		Young Stock	Total Cattle	Adult		Young Stock	Total Buffalo	Adult		Young Stock	Total Bovine
		M	F			M	F			M	F		
Konkan	1951	0.67	0.50	0.41	1.58 (79.80)	0.11	0.20	0.09	0.40 (20.20)	0.79	0.70	0.50	1.98
	1966	0.73	0.47	0.37	1.58 (77.45)	0.13	0.24	0.10	0.46 (22.55)	0.86	0.71	0.47	2.04
	1982	0.81	0.52	0.42	1.75 (77.43)	0.13	0.26	0.12	0.51 (22.57)	0.94	0.78	0.54	2.26
	2003	0.72	0.43	0.43	1.58 (73.49)	0.08	0.32	0.17	0.57 (26.51)	0.80	0.75	0.59	2.15
Nashik	1951	1.12	0.80	0.65	2.57 (87.71)	0.03	0.22	0.11	0.36 (12.29)	1.15	1.02	0.76	2.93
	1966	1.35	0.85	0.62	2.82 (87.58)	0.03	0.25	0.12	0.40 (12.42)	1.38	1.10	0.74	3.22
	1982	1.32	1.03	0.78	3.13 (83.69)	0.04	0.37	0.20	0.61 (16.31)	1.36	1.40	0.98	3.74
	2003	1.37	1.29	0.99	3.65 (79.35)	0.04	0.56	0.35	0.95 (20.65)	1.41	1.85	1.34	4.60
Pune	1951	0.93	0.71	0.53	2.17 (75.09)	0.07	0.41	0.24	0.72 (24.91)	1.00	1.12	0.77	2.89
	1966	1.01	0.70	0.50	2.21 (70.61)	0.07	0.56	0.29	0.92 (29.39)	1.08	1.26	0.79	3.13
	1982	0.93	0.78	0.58	2.29 (63.61)	0.07	0.82	0.42	1.31 (36.39)	1.00	1.60	1.00	3.60
	2003	0.70	0.98	0.66	2.34 (51.32)	0.05	1.40	0.77	2.22 (48.68)	0.75	2.38	1.43	4.56
Aurangabad	1951	1.07	0.80	0.90	2.77 (85.23)	0.03	0.27	0.18	0.48 (14.77)	1.10	1.07	1.08	3.25
	1966	1.54	1.00	0.88	3.42 (84.44)	0.02	0.37	0.24	0.63 (15.56)	1.56	1.37	1.12	4.05
	1982	1.56	1.12	0.94	3.64 (83.11)	0.02	0.42	0.30	0.74 (16.89)	1.58	1.56	1.24	4.38
	2003	1.54	1.09	0.97	3.60 (74.69)	0.02	0.69	0.51	1.22 (25.31)	1.56	1.78	1.48	4.82
Amravati	1951	0.76	0.70	0.61	2.07 (87.71)	0.01	0.18	0.10	0.29 (12.29)	0.77	0.88	0.71	2.36
	1966	0.89	0.75	0.58	2.22 (87.40)	0.01	0.19	0.11	0.31 (12.60)	0.90	0.94	0.69	2.54
	1982	0.98	0.86	0.67	2.51 (86.25)	0.01	0.25	0.14	0.40 (13.75)	0.99	1.11	0.81	2.91
	2003	1.01	0.74	0.65	2.43 (82.37)	0.01	0.33	0.18	0.52 (17.63)	1.02	1.07	0.83	2.95
Nagpur	1951	0.81	0.69	0.59	2.09 (88.94)	0.06	0.12	0.08	0.26 (11.06)	0.87	0.81	0.67	2.35
	1966	1.02	0.77	0.69	2.48 (88.26)	0.09	0.14	0.10	0.33 (11.74)	1.11	0.91	0.80	2.81
	1982	1.12	0.95	0.83	2.90 (88.41)	0.09	0.18	0.11	0.38 (11.59)	1.21	1.13	0.94	3.28
	2003	1.18	0.80	0.81	2.79 (83.04)	0.09	0.26	0.22	0.57 (16.96)	1.27	1.06	1.03	3.36
State Total	1951	5.36	4.20	3.69	13.25 (84.07)	0.32	1.40	0.79	2.51 (15.93)	5.68	5.60	4.48	15.76
	1966	6.55	4.53	3.65	14.73 (82.85)	0.34	1.74	0.97	3.05 (17.15)	6.89	6.27	4.62	17.78
	1982	6.72	5.25	4.23	16.20 (80.32)	0.35	2.31	1.31	3.97 (19.68)	7.07	7.56	5.54	20.17
	2003	6.53	5.33	4.50	16.36 (73.00)	0.29	3.56	2.20	6.05 (27.00)	6.82	8.89	6.70	22.41
India	1951	57.83	54.40	43.07	155.30 (78.16)	6.78	21.00	15.62	43.40 (21.84)	64.61	75.40	58.69	198.70
	1966	73.32	54.68	48.20	176.20 (76.88)	8.19	25.40	19.41	53.00 (23.12)	81.51	80.08	67.61	229.20
	1982	72.84	59.21	60.40	192.45 (73.39)	7.96	32.50	29.32	69.78 (26.61)	80.80	91.71	89.72	262.23
	2003	57.55	64.50	63.13	185.18 (65.41)	6.68	50.97	40.27	97.92 (34.59)	64.23	115.47	103.40	283.10

Although cattle population in Maharashtra increased by 11 per cent between 1951 and 1966 and also by 11 per cent between 1966 and 2003, the rise in buffalo population was sharper, which increased by 22 per cent between 1951 and 1966 and 98 per cent between 1966 and 2003. The increasing trend in buffalo population was mainly due to rise in female population. Between 1951 and 2003, the stock of adult female buffaloes had more than doubled, whereas, male buffalo population remained more or less constant. In the case of cattle, though male population showed a rising trend, the female population remained constant between 1951 and 1966. An increase in stocks of female cattle was noticed between 1966 and 2003. Regions did not differ significantly and fell in line with the overall compositional changes in bovines over time in the State. However, Pune and Aurangabad regions showed a high proportion of buffalo population compared to other regions of the State. Interestingly, both India and the state of Maharashtra showed a rising share of buffalo in total bovine population in the face of falling share of cattle during the entire period between 1951 and 2003.

A notable feature of the foregoing analysis was that while the adult male bovine population remained stable over the period of five decades, the adult female bovine population has shown significant growth. Consequently, the sex ratio of adult bovine has shifted rapidly in favour of females. In case of young stock, no discernable trend was observed. Another important observation was the declining proportion of cattle population in relation to total stock of bovines. In the state of Maharashtra, it came down from 84 per cent in 1951 to 73 per cent by 2003. On the other hand, the proportion of buffalo population increased during the same period. It has also been noticed that about 96 per cent of the total adult male bovine population in Maharashtra was used for draught purposes (Tables 3.7 and 3.13). However, the growth of adult male bovine population over time has been very slow. This was perhaps due to the increasing farm mechanization in the State, though at slower pace. Further, the adult male bovine population in Maharashtra was higher than female population till 1966. But, thereafter, the female population has outnumbered the male. Similar trend was noticed in the case of India with the exception that in 1951 adult female bovine population was higher than male bovine in the country, which in fact followed between 1982 and 2003.

#### **3.2.2.2 Growth Rates in Bovines in Maharashtra**

The growth in buffalo population was much faster than cattle population in Maharashtra state. Though Aurangabad region possessed the largest bovine population, it ranked 4<sup>th</sup> in terms of overall growth (1951-2003) in buffalo population and 3<sup>rd</sup> in cattle

population (Table 3.14). The growth of cattle population<sup>8</sup> appeared to be very slow in majority of regions. In regions like Aurangabad, Amravati, Nagpur and Konkan, cattle population was found to decline between 1982 and 2003. However, its population showed considerable growth during 1966-82. In fact, the growth in both cattle and buffalo was quite appreciable between 1966 and 1982 in all the regions of the state.

**Table 3.14: Region-wise Compound Growth Rates of Cattle and Buffalo Population in Maharashtra Between Census Years**

(in per cent per annum)

Region	Period	Total Population			Breedable Female Population		
		Cattle	Buffalo	Total	Cattle	Buffalo	Total
Konkan	1951-66	-0.03	1.00	0.19	-0.43	1.43	0.14
	1966-82	0.62	0.66	0.63	0.48	0.43	0.46
	1982-03	-0.49	0.54	-0.23	-0.87	1.16	-0.10
Nashik	1951-03	0.05	1.09	-0.31	1.01	0.15	0.15
	1951-66	0.63	0.75	0.65	0.82	1.31	0.93
	1966-82	0.64	2.57	0.92	1.24	2.41	1.52
Pune	1982-03	0.76	2.21	1.03	1.11	2.09	1.39
	1951-03	0.70	0.90	2.01	1.33	2.01	1.33
	1951-66	0.17	1.70	0.58	0.02	2.23	0.91
Aurangabad	1966-82	0.18	2.19	0.83	0.61	2.33	1.43
	1982-03	0.11	2.66	1.19	1.15	2.68	1.99
	1951-03	0.15	0.92	2.49	1.53	2.49	1.53
Amravati	1951-66	1.47	1.94	1.54	1.64	2.24	1.80
	1966-82	0.35	0.99	0.46	0.68	0.96	0.75
	1982-03	-0.03	2.50	0.49	-0.11	2.50	0.74
Nagpur	1951-03	0.52	0.79	1.96	1.06	1.96	1.06
	1951-66	0.51	0.61	0.52	0.43	0.44	0.44
	1966-82	0.72	1.59	0.84	0.81	1.69	1.00
State Total	1982-03	-0.22	1.25	0.01	-0.72	2.01	0.04
	1951-03	0.30	0.43	1.49	0.47	1.49	0.47
	1951-66	1.20	1.60	1.25	0.77	0.88	0.78
India	1966-82	0.93	0.86	0.92	1.27	1.53	1.31
	1982-03	-0.18	2.00	0.12	-0.90	1.87	-0.36
	1951-03	0.58	0.71	1.51	0.52	1.51	0.52
State Total	1951-66	0.74	1.38	0.85	0.64	1.66	0.91
	1966-82	0.57	1.60	0.76	0.88	1.70	1.12
	1982-03	0.05	2.12	0.53	0.07	2.27	0.84
India	1951-03	0.42	0.71	1.95	0.97	1.95	0.97
	1951-66	0.91	1.42	1.02	0.78	1.38	0.97
	1966-82	0.43	1.26	0.63	0.75	1.44	0.99
State Total	1982-03	-0.10	2.06	0.54	0.36	2.22	1.10
	1951-03	0.36	0.72	1.76	1.05	1.76	1.05

<sup>8</sup> Annual Compound Growth Rates (CGR) were calculated using the following formula:

$$CGR = [(P_n / P_0)^{1/n} - 1] \times 100$$

Where,  $P_n$  = Population in Current Period

$P_0$  = Population in Base Period;  $n$  = Number of Years



The Nashik region had the second largest stocks of bovines in Maharashtra, which ranked 3<sup>rd</sup> in terms of overall growth in buffalo and 1<sup>st</sup> in cattle population. In terms of stocks of bovines, Pune was the third most important region of Maharashtra, though it ranked 2<sup>nd</sup> with respect to overall growth in buffalo and 5<sup>th</sup> in cattle population between 1951 and 2003. Both these regions showed positive growth in cattle and buffalo population during the entire period between 1951 and 2003.

On the whole, Konkan region showed the highest growth in buffalo population and Nashik region in cattle population during the last five decades (1951-2003). For ascertaining the reasons for these changes in the growth rate of population, planned survey is required. Several reasons viz., better demand for buffalo milk due to high fat percentage, higher average milk yield and higher price, etc. can be given for the increasing growth in the buffalo population in the State.

The data was further analysed for the growth rate of breedable cattle and buffalo for better understanding the reasons for slow growth in cattle population and increase in buffalo population. The growth rates in breedable female population showed similar trends, except some improvement in growth rates compared to total cattle and buffalo population in all the regions of the State. As in the case of total cattle population, a decline in breedable stocks of female cattle was noticed in Aurangabad, Amravati, Nagpur and Konkan regions during 1982-03. However, the growth in breedable female cattle was remarkable in Pune and Nashik regions between 1982 and 2003 (Appendix 6).

As a matter of fact, increase in buffalo population was mainly contributed by increase in stocks of breedable buffaloes. Its population increased in all the regions in all the periods thereby giving positive and substantially higher growth rate for the whole State. The highest growth in breedable female buffaloes was noticed in Pune region followed by Nashik, Aurangabad, Nagpur, Amravati and Konkan during the period 1951-03. It is pertinent to mention that the growth rates in breedable buffalo population were higher than cattle in all the regions during the period 1951-2003. This strongly suggests that the breedable cattle are being replaced by breedable buffaloes in the state.

To understand it more clearly, number of buffalo per 1000 heads of cattle was worked out (Table 3.15). It is observed that cattle population is in the process of erosion and being replaced by buffaloes in each region of the state. The highest replacement was noticed in Pune region; buffalo population has come very close to the cattle population in the region in 2003. However, the replacement of cattle by buffaloes was observed to be very slow in Amravati and Nagpur regions of the State.

### 3.2.2.3 Ratio of Milk to Milch Animals in Maharashtra

In the absence of enough improvement in the production potential of milch animals, one has to depend on the number of milch animals. The total production depends upon the proportion of animals in milk, apart from the type of milch animals. Higher proportion of animals in milk reflects high degree of breeding efficiency of the animals. Notably, there was little variation in the percentage of animals in milk over time. On an average, more than 50 per cent of buffaloes were in milk in each period (Table 3.15).

**Table 3.15: Region-wise Number of Buffaloes per Thousand Cattle and Number of Animals in Milk per Thousand Milch Animals**

Regions	Years	Buffaloes per Thousand Cattle	Animals in Milk per Thousand Milch Animals		
			Cattle	Buffalo	Total
Konkan	1951	253	559	691	598
	1966	293	404	714	513
	1982	295	463	702	544
	2003	362	551	754	640
Nashik	1951	140	532	618	552
	1966	143	335	506	374
	1982	196	432	549	463
	2003	260	579	618	591
Pune	1951	332	632	774	687
	1966	412	467	633	541
	1982	574	494	645	572
	2003	951	685	720	705
Aurangabad	1951	172	302	366	318
	1966	184	436	485	449
	1982	205	481	563	504
	2003	338	600	663	625
Amravati	1951	140	493	614	518
	1966	142	432	518	449
	1982	163	415	547	445
	2003	219	498	591	527
Nagpur	1951	125	407	638	442
	1966	132	386	466	398
	1982	131	382	520	404
	2003	201	468	580	495
Maharashtra	1951	189	479	630	518
	1966	207	409	570	454
	1982	245	443	601	491
	2003	370	573	674	613
India	1951	280	470	549	495
	1966	301	448	553	483
	1982	345	494	599	532
	2003	529	616	706	656

Source: Computations are based on figures compiled from various livestock census reports of Maharashtra and India

The breeding efficiency of buffaloes appears to be higher compared to cattle, which is reflected by the higher proportion of animals in milk. In the case of cattle, Pune region has attained an optimal proportion of 68.5 per cent in 2003. Even Aurangabad region has shown 60 per cent of its milch cattle in milk in 2003, followed by Nashik region, which shows 58 per cent of its milch animals in milk during the same time. The Konkan region shows a remarkable proportion of 75.0 per cent of buffaloes in milk in 2003, which is an achievement even for an organized sector of Animal Husbandry. The proportion of bovines in milk has grown steadily after 1972 (Appendix 7). Such high proportion of buffaloes in milk strengthens the conclusion that the breeding efficiency of buffaloes as well as the management of inputs is high in Maharashtra. Interestingly, the proportion of buffaloes in milk was marginally higher in Maharashtra compared to India in 1982 and substantially higher in 1951. This is an indication of higher breeding efficiency of buffalo in Maharashtra as compared to rest of the States in the country.

Thus, the analysis revealed that the size and composition of bovine herd in the State have undergone significant changes. During the last five decades (1951-2003), the size of the bovine population has shown steady growth. But, within the herd population, the importance of adult male has declined. At the same time, because of the increased demand for milch animals, the population of adult females has increased. It is interesting to note that the adult she-buffalo population increased at a faster rate as compared to that of cows, indicating the farmers' preference for she-buffaloes as milch stock. Higher proportion of buffaloes in milk compared to cows contradicts the usual hypothesis that cow is better than buffalo with respect to reproduction. In this context, a detailed study on the compositional changes in bovine stock in Uttar Pradesh has also shown a favourable growth rate of buffalo population and moderate growth in stocks of cattle (Singh et al, 1990). Thus, there is no doubt that the slowing down in the growth of work animals has facilitated the expansion of milch animal population in Maharashtra state, which has grown by over 59 per cent between 1951 and 2003 compared to 18 per cent of work animals thereby facilitating a shift from cows to the buffaloes and also, very likely, a rise in milk yield. The tendency for relatively faster growth of milch animals stock is nearly universal; that of substitution of buffaloes for cows, however, is not. In West Bengal, Orissa and Kerala where the cow has always been the principal source of milk, the dominance of the cow has become more pronounced. In other words, the strength of the latter tendency varies a great deal, depending partly on the trends in feed supply for the animal and partly on ecology (Vaidyanathan, 1987).

### **3.3 Farm Mechanization and Emerging Issues**

As the analysis reveals, there was an increase in the intensity of mechanization, but this did not seem to have contributed to any significant displacement of work animals per hectare of net sown area. On judging the past trend, the growth in mechanical power appeared to have served largely as a supplementary source of animal power. The impact of tractorisation in respect of displacement of work animals was also very slow in the State. Since the rate of mechanization of irrigation was faster than mechanization of tillage, the overall effect of mechanization in terms of displacement of work animals has been very slow. Although the adult male bovine population remained stable over the period of five decades, the adult female bovine population has shown perceptible growth. As a result, the sex ratio of adult bovine has shifted rapidly in favour of female during the 50 years period. Finally, the cattle population was noticed to be in the process of erosion as it was being replaced by buffaloes in the State.

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## CHAPTER – IV

### LIVESTOCK PRODUCTION IN MAHARASHTRA

This chapter provides an insight into the livestock production scenario of Maharashtra over the last two decades with major foci of attention on structural changes in milk, meat, wool and egg production across different districts and regions of the state, growth and instability in livestock production, productivity variations of milch animals, especially bovines, identifying factors responsible for regional imbalances in livestock production, changes in ranking of districts over time in terms of livestock production, etc. The basic idea of this chapter is to evaluate the performance of Maharashtra with respect to various livestock products with a view to formulate strategies for enhanced livestock production in the state.

#### 4.1 Structural Changes in Milk Production in Maharashtra

Maharashtra, which falls in the western region of the country, started showing quantum leaps in milk production only from 1987-88 onwards when its milk production was 2.66 million tonnes. This state occupied 11<sup>th</sup> position in the country's total milk production as early as 1986-87. The State currently occupies a much higher position in total milk production of India owing to sustained and concerted efforts towards total dairy development. During 1990-91, it had even crossed the milk production figures of Gujarat.<sup>9</sup> In fact, over the last two decades the State has progressed by leaps and bounds in its milk production. Despite these facts, there are vast regional imbalances in milk production in the State. Surprisingly, only a couple of regions in the State are contributing to more than 60 per cent of the total milk produced in the State.<sup>10</sup> Notwithstanding the regional imbalances in milk production visualized in the state of Maharashtra, the crucial questions that may merit considerations are: what prospects do the state of Maharashtra hold in milk production enterprise? With the passage of time, what structural changes have taken place in different regions of the state vis-à-vis productivity of milch animals, number of animals in milk and total production of milk? What is the extent of instability in the production growth of milk in different regions of

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<sup>9</sup> During 1990-91, while Maharashtra occupied fifth position in the country's total milk production, the position of Gujarat was sixth. The milk production figures for Maharashtra and Gujarat states during 1990-91 were 3.74 and 3.53 million tonnes, respectively.

<sup>10</sup> The contribution of Nashik and Pune regions put together to state's total milk production was 60 per cent during triennium ending 2005-06.

the State? No discussion on dairy sector development may be complete without going into these very many questions.

The present study, therefore, is an attempt to examine the above mentioned aspects with a view to evaluate comprehensively the structural changes in milk production and also to identify the factors that are responsible for imbalances in milk production across different districts and regions of this State. This exercise is attempted with a view to formulate strategies for increased milk production in the State.

#### **4.1.1 Productivity Indices of Bovines<sup>11</sup> in Maharashtra**

Many workers have reported considerable differences in respect of relative share of different district in the State's total milk production and in relation to relative share of different districts in the State's total bovine population (in-milk). In more recent times, this argument was put forward by Gupta and Jain (1994). There is, therefore, a need to go into the details of these shares and thereby examine inter-district variations in the index of productivity of bovines in the state of Maharashtra.

A close scrutiny of results presented in Table 4.1 revealed considerable variations in the productivity indices of bovines across various district of Maharashtra. The districts like Greater Bombay, Nashik, Jalgaon, Ahmednagar, Pune, Satara and Dhule showed much higher contribution to the State's total milk production compared to their contribution to the State's total bovine population (in-milk). The bovine productivity indices for these districts, therefore, stood at more than 100. There were also spectrum of districts like Thane, Raigad, Ratnagiri, Sindhudurg, Aurangabad, Jalna, Parbhani, Nanded, Latur, Buldhana, Akola, Amravati, Yavatmal, Wardha, Nagpur and Bhandara, which showed much lower contribution to the State's total milk production compared to their contribution to the State's total bovine population (in-milk). The bovine productivity indices for these districts, thus, turned out to be much below 100. In the case of districts like Chandrapur and Gadchiroli, these indices were found to be below 50. Apart from the districts like Greater Bombay, Nashik, Jalgaon, Ahmednagar, Pune, Satara and Dhule, the other districts, which showed their bovine productivity indices a little higher than 100 were Kolhapur and Aurangabad, whereas the bovine productivity indices of Sangli, Solapur, Beed and Osmanabad worked out at 99, 95, 96 and 91, respectively, indicated that the contributions of these districts to the State's total milk production had fallen little

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<sup>11</sup> It is the ratio of share of each district in the State's total milk production to the share of each district in the State's total bovine population (in-milk).

short of their contribution to the State's total bovine population (in-milk). Thus, based on bovine productivity indices, three categories of districts were identified in the State viz. districts with bovine productivity indices below 50 (category I), districts with bovine productivity indices between 50 and 100 (category II) and districts with productivity indices above 100 (category III).

**Table 4.1: Inter-district Variations in Milk Productivity Indices of Bovine (in-milk) in Maharashtra**

District	Total Bovine Population <sup>@</sup> (in -milk) (1)	Total Milk Production <sup>@@</sup> (in lakh kgs) (2)	Share of District in State's Total Bovine Population (%) (3)	Share of District in State's Total Milk Production (%) (4)	Productivity Index of Bovine [(4)/(3) x 100]	Category
Greater Bombay	58948	1789.77	1.16	2.72	235.79	III
Thane	159251	1903.07	3.12	2.90	92.81	II
Raigad	103230	925.70	2.02	1.41	69.64	II
Ratnagiri	75993	643.43	1.49	0.98	65.75	II
Sindhudurg	46288	360.41	0.91	0.55	60.47	II
Nashik	220818	3812.19	4.33	5.80	134.07	III
Dhule	168993	2554.73	3.31	3.89	117.40	III
Jalgaon	223435	3614.43	4.38	5.50	125.63	III
Ahmednagar	404137	6865.03	7.92	10.45	131.92	III
Pune	350128	6348.60	6.86	9.66	140.82	III
Satara	244282	3953.29	4.79	6.02	125.68	III
Sangli	266457	3399.26	5.22	5.17	99.07	II
Solapur	317294	3881.21	6.22	5.91	95.00	II
Kolhapur	405909	5620.27	7.95	8.55	107.53	III
Aurangabad	117385	1671.14	2.30	2.54	110.56	III
Jalna	82245	907.23	1.61	1.38	85.67	II
Parbhani	156992	1577.19	3.08	2.40	78.02	II
Beed	174229	2146.54	3.41	3.27	95.68	II
Nanded	206831	1923.10	4.05	2.93	72.21	II
Osmanabad	144457	1688.90	2.83	2.57	90.80	II
Latur	154017	1609.00	3.02	2.45	81.13	II
Buldhana	119953	1252.29	2.35	1.91	81.08	II
Akola	156434	1168.20	3.07	1.78	57.99	II
Amravati	120587	1030.54	2.36	1.57	66.37	II
Yavatmal	137749	1019.00	2.70	1.55	57.45	II
Wardha	71305	777.25	1.40	1.18	84.65	II
Nagpur	107947	1093.92	2.12	1.66	78.70	II
Bhandara	131076	1307.80	2.57	1.99	77.48	II
Chandrapur	92278	575.23	1.81	0.88	48.41	I
Gadchiroli	84498	292.38	1.66	0.44	26.87	I
Maharashtra State	5103146	65711.12	100.00	100.00	100	

Notes: @ - According to 2003 Livestock Census of Maharashtra

@@ - Total Milk Production for Triennium Ending 2005-06

Category: I - Productivity Index < 50; II - Productivity Index > 50 < 100; III - Productivity Index > 100

It could be observed that in respect of productivity indices of bovines majority of the districts in the state had fallen under category I and II. However, it is to be noted that the total contribution of districts under category III put together to State's total milk production stood at about 55 per cent. This observation clearly brings us closer to the conclusion that even though there are only 9 districts in the state whose productivity indices of bovines are above 100, by and large their contribution is very high to the State's total milk production. These are the most progressive districts of the State if milk production alone is considered as an indicator of development and growth.

In this context, an earlier study conducted by Gupta and Jain (1994) for 17 major states of the country revealed that the overall productivity index per bovine (in-milk) was 73 for Maharashtra, which turned out to be higher than the bovine productivity indices of Madhya Pradesh, Karnataka, Jammu and Kashmir, Assam and Orissa, but, at the same time, stood at much below the bovine productivity indices of other major states of the country. Thus, concerted efforts are still required to be launched in order to boost the productivity of bovines and thereby total milk production in the State.

#### **4.1.2 Milk Productivity Variations**

An examination of inter-district variations in productivity indices of bovines is one end of the problem, the other end being an evaluation into the changes that have taken place over time in terms of actual milk yield of different species of milch animals in different districts of Maharashtra. In the light of this fact, district-wise milk productivity estimates for different species of milch animals for the reference periods TE 1987-88 and TE 2005-06 are brought out in Table 4.2.

It could be discerned from Table 4.2 that during the period between TE 1987-88 and TE 2005-06 there has been significant increase in average daily milk productivity of cows and buffaloes in all the districts of Maharashtra. The districts that showed major increase in their cow milk productivity between TE 1987-88 and TE 2005-06 were Greater Bombay, Sangli, Satara, Ahmednagar, Pune, Kolhapur, Solapur, Osmanabad, Latur and Buldhana. Similarly, buffalo milk productivity also increased between TE 1987-88 and TE 2005-06 across all the districts with sharper increase in the same being noticed in the case of Greater Bombay, Thane, Ratnagiri, Sindhudurg, Nashik, Dhule, Jalgaon, Ahmednagar, Pune, Satara, Sangli and Kolhapur. Interestingly, the milk productivity of cows in Sangli district was found to be even higher than buffalo milk productivity during the period between TE 1987-88 and TE 2005-06, which could be due to higher concentration of crossbred cows in this district as compared to indigenous cows.



**Table 4.2: Inter-district Variation in Milk Productivity of Cows, Buffaloes and Goats in Maharashtra: 1985-86-2005-06**

(in Kg)

District	Cows		Buffaloes		Goats	
	TE 1987-88	TE 2005-06	TE 1987-88	TE 2005-06	TE 1987-88	TE 2005-06
Greater Bombay	4.97	5.08	6.32	6.56	0.12	0.18
Thane	1.09	1.74	2.69	3.90	0.12	0.20
Raigad	0.92	1.54	2.69	3.90	0.12	0.20
Ratnagiri	0.92	2.33	1.18	2.59	0.12	0.20
Sindhudurg	0.95	1.87	1.18	2.59	0.12	0.20
Nashik	1.53	1.98	2.55	4.47	0.20	0.21
Dhule	1.46	2.51	2.55	4.47	0.20	0.21
Jalgaon	1.47	2.46	2.55	4.47	0.20	0.21
Ahmednagar	2.09	3.52	2.35	4.14	0.17	0.20
Pune	2.43	3.81	2.35	4.14	0.17	0.20
Satara	2.45	4.26	2.56	3.48	0.22	0.28
Sangli	2.87	5.20	2.56	3.48	0.22	0.28
Solapur	1.67	2.81	2.58	3.01	0.25	0.24
Kolhapur	3.05	3.86	2.56	3.49	0.22	0.28
Aurangabad	1.36	2.28	2.60	3.11	0.18	0.22
Jalna	1.18	2.10	2.60	3.11	0.18	0.22
Parbhani	1.17	2.01	1.74	2.87	0.17	0.21
Beed	1.59	2.42	2.58	3.01	0.25	0.24
Nanded	1.15	2.02	1.74	2.87	0.17	0.21
Osmanabad	1.58	2.89	2.58	3.01	0.25	0.24
Latur	1.46	2.56	2.58	3.01	0.25	0.24
Buldhana	1.25	2.45	2.60	3.11	0.18	0.22
Akola	0.94	1.20	2.47	3.08	0.11	0.14
Amravati	0.97	1.34	2.47	3.08	0.11	0.14
Yavatmal	0.89	1.47	2.47	3.08	0.11	0.14
Wardha	0.89	1.52	2.82	3.22	0.11	0.16
Nagpur	0.88	1.88	2.82	3.22	0.11	0.16
Bhandara	0.85	1.46	2.82	3.22	0.11	0.16
Chandrapur	0.59	0.85	1.78	2.55	0.10	0.14
Gadchiroli	0.57	0.93	1.78	2.55	0.10	0.14
Maharashtra State	1.41	2.47	2.58	3.58	0.18	0.21
Coefficient of Variation (C.V.) %	60.24	46.37	33.80	24.00	31.73	20.59

Note: \* - Cows include both indigenous and crossbred cows

TE – Triennium Ending 1987-88 (Average 1985-86, 1986-87 and 1987-88)

TE – Triennium Ending 2005-06 (Average 2003-04, 2004-05 and 2005-06)

Due to rise in milk productivity of both cows and buffaloes in all the districts, the overall increase in cow milk productivity for the State was noticed to be from 1.41 kg in TE 1987-88 to 2.47 kg in TE 2005-06, and in the case of buffalo, this increase stood at from 2.58 kg to 3.58 kg during the same period. On the other hand, goat milk productivity remained by and large same in most of the districts during the period

between TE 1987-88 and TE 2005-06, though a marginal increase was noticed in goat milk productivity for the State as a whole during the same period, mainly owing to rise in goat milk productivity in Wardha, Nagpur, Bhandara, Kolhapur and Greater Bombay.

Although both cows and buffaloes have shown increases in their milk productivities over time, the increase in cow milk productivity was seen to be much faster than buffalo milk productivity. During the period between TE 1987-88 and TE 2005-06, the increase in cow milk productivity for the State as a whole was found to be 75 per cent and in the case of buffalo, this increase stood at only 39 per cent. Most of the increase in buffalo milk productivity for the State was seen to be due to the increased productivity contribution of districts like Nashik, Dhule, Jalgaon, Ahmednagar, Pune, Ratnagiri and Sindhudurg as in the case of other districts there was slower expansion in the same during the given period of time.

The higher milk productivity of cow was noticed due mainly to higher concentration of crossbred cows compared to indigenous cows in the districts belonging to Pune, Nashik and Aurangabad regions, which, without an iota of doubt, were high yielder. Generally, the milk yield of crossbred cow is seen to be 2-3 times higher than indigenous cows. This argument has been put forward by many research workers (Sardiwal and Kalla, 1975; Singh, 1980; Singh et.al. 1986; Shah and Sharma, 1994).

During TE 1987-88, the per day cow milk yield varied from 0.57 kg in Gadchiroli districts to 4.97 kg in Greater Bombay with coefficient of variation (C.V.) at 60 per cent. The inter-district fluctuation in cow milk yield in Maharashtra was seen to be less during TE 2005-06 as compared to TE 1987-88 as during TE 2005-06 it stood at 46 per cent. This held true in the case of buffalo milk yield also. It is noteworthy to mention that in due course of time Ratnagiri and Sindhudurg districts have shown substantial increase in their buffalo milk yield. While during TE 1987-88, buffalo milk yield varied from 1.18 kg in Ratnagiri and Sindhudurg districts to 6.32 kg in Greater Bombay with C.V. at 34 per cent, this variation in the same during TE 2005-06 was found to be from 2.55 kg in Chandrapur and Gadchiroli districts to 6.56 kg in Greater Bombay with C.V. at 24 per cent. In the case of goat, the inter-district variation in milk productivity was decreased from TE 1987-88 (C.V. = 31.73 per cent) to TE 2005-06 (C.V. = 20.59 per cent).

Thus, the cow milk yield was seen to be generally higher in those districts where the buffalo milk yield was also high. The factors that were responsible for higher milk yield of buffalo in a particular district could also be considered as instrumental for higher milk yield of cow in that district.

### **4.1.3 Structural Changes in Milk Production**

An attempt is now made to evaluate the changes that have taken place over time in milk production figures of various breeds of milch animals in different districts and regions of Maharashtra. The estimates of milk production for different breeds of milch animals for various districts and regions of Maharashtra in respect of the periods between TE 1987-88 and TE 2005-06 are brought out in Table 4.3.

The scenario obtaining over the past one decade reveals dramatic transformation in milk production figures for the state of Maharashtra. Although majority of the districts of this State have shown perceptible increases in their milk production levels during the period between TE 1987-88 and TE 2005-06, the period gone by has also been marked with very slow expansion in milk production in some districts, these are: Greater Bombay, Raigad, Sangli, Buldhana, Akola, Amravati, Yavatmal, and Gadchiroli. All these districts have shown only 46-93 per cent increase in their milk production levels during the period between TE 1987-88 and TE 2005-06 compared to 160 per cent overall increase in milk production for the State as a whole during the same period (Appendix 8 (f)). On the other hand, the districts that have shown perceptible rise in their milk production levels during the given period of time were Nashik, Dhule, Ahmednagar, Pune, Solapur and Aurangabad. The total increase in milk production figures for these districts was found to be above 200 per cent during the period between TE 1987-88 and TE 2005-0. It might appear from this observation that the onus of technological efforts have been more favourably inclined and concentrated in these districts of the State.

Among various districts, Ahmednagar district, in particular, has shown tremendous increase in its milk production figures during the given period of time. In fact, during TE 1987-88, the total milk production figures of Ahmednagar district stood at much lower compared to the total milk production figures of Pune, Satara, Sangli, and Kolhapur districts. However, during TE 2005-06, the scenario was seen to be completely changed as during this period Ahmednagar district had crossed the milk production figures of all the above four districts. Similarly, Pune district has also shown quantum leap in its milk production figures over the past two decades. During the period between TE 1987-88 and 2005-06, the milk production figures of Pune district rose sharply so much so that by TE 2005-06 it had crossed the milk production figures of Sangli and Kolhapur districts. The districts that have shown the least expansion in their milk production levels during the given period of time were Greater Bombay, Akola, Amravati, Yavatmal and Gadchiroli.

**Table 4.3: Changing Milk Production Pattern in Maharashtra: (1985-86 – 2005-06)**

(Milk Production in lakh kgs)

District/ Region	Indigenous Cow			Crossbred Cow			Buffalo			Goat			Total Production		
	P-I	P-II	% Chg	P-I	P-II	% Chg	P-I	P-II	% Chg	P-I	P-II	% Chg	P-I	P-II	% Chg
<b>District</b>															
Greater Bombay	34	21	-39	8	33	331	1072	1735	62	2	1	-36	1115	1790	60
Thane	188	303	61	58	67	15	580	1485	156	19	49	152	846	1903	125
Raigad	181	299	65	16	58	262	286	538	88	12	31	158	495	926	87
Ratnagiri	127	193	53	71	220	211	84	212	153	8	18	132	289	643	123
Sindhudurg	41	78	88	27	62	134	74	209	181	4	11	154	147	360	146
Nashik	491	1134	131	143	1183	726	401	1306	225	85	189	122	1121	3812	240
Dhule	312	742	138	64	593	831	370	1070	189	67	150	125	812	2555	214
Jalgaon	396	736	86	84	626	647	772	2108	173	79	144	83	1330	3614	172
Ahmednagar	472	736	56	580	4950	754	335	903	170	130	276	113	1517	6865	353
Pune	342	471	38	603	3939	553	680	1768	160	97	170	75	1723	6349	269
Satara	228	363	59	361	1575	336	903	1858	106	72	157	117	1565	3953	153
Sangli	185	257	39	420	561	34	1084	2449	126	76	132	72	1765	3399	93
Solapur	407	493	21	116	1769	1429	579	1316	127	174	303	75	1275	3881	204
Kolhapur	130	155	19	328	1082	230	1626	4308	165	53	75	43	2137	5620	163
Aurangabad	213	349	64	73	818	1018	172	386	124	58	119	104	517	1671	223
Jalna	192	294	53	23	225	866	139	309	123	39	78	99	394	907	130
Parbhani	391	565	45	35	182	413	242	729	202	56	101	81	724	1577	118
Beed	394	388	-2	79	919	1067	354	690	95	82	148	82	909	2147	136
Nanded	376	597	59	30	273	821	334	964	189	51	89	74	790	1923	143
Osmanabad	242	252	4	42	726	1617	338	612	81	40	98	145	662	1689	155
Latur	229	295	29	38	318	744	338	937	177	45	60	33	649	1609	148
Buldhana	306	356	16	70	295	320	351	508	45	60	93	55	786	1252	59
Akola	254	292	15	27	183	573	356	630	77	37	64	73	675	1168	73
Amravati	239	256	7	29	211	622	283	512	81	32	51	63	583	1031	77
Yavatmal	277	309	11	21	155	634	274	495	81	40	60	49	613	1019	66
Wardha	105	163	55	30	345	1053	120	241	101	17	28	67	272	777	186
Nagpur	191	225	18	49	463	846	213	358	68	31	47	51	484	1094	126
Bhandara	206	255	24	36	354	881	333	642	93	28	56	102	603	1308	117
Chandrapur	127	158	25	10	86	788	103	289	179	24	42	75	264	575	118
Gadchiroli	108	136	26	5	17	242	71	110	54	16	29	85	200	292	46
<b>Regions</b>															
Konkan	572	894	56	179	440	146	2096	4178	99	46	110	139	2892	5622	94
Nashik	1671	3348	100	870	7352	745	1878	5387	187	361	760	111	4781	16846	252
Pune	1293	1740	35	1828	8927	388	4872	11699	140	472	837	77	8466	23202	174
Aurangabad	2037	2741	35	320	3461	982	1916	4628	142	371	693	87	4644	11523	148
Amravati	1076	1212	13	148	844	470	1264	2145	70	169	269	59	2656	4470	68
Nagpur	736	939	28	130	1264	872	842	1641	95	115	203	77	1823	4046	122
Maharashtra State	7385	10874	47	3475	22288	541	12868	29678	131	1534	2872	87	25262	65711	160

Source: Estimates are based on figures compiled from various reports on 'Milk, Eggs, Wool and Meat Production and Livestock and Poultry Keeping Practices in Maharashtra, Directorate of Animal Husbandry, Maharashtra State, Pune

Notes: Period-I = 1985-86 – 1987-88 (Triennium Average)

Period-II = 2003-04 – 2005-06 (Triennium Average)

Chg. – Change

In the state of Maharashtra, the milk production figures of crossbred cows have grown generally much faster than the milk production figures of indigenous cows and buffaloes during the period between TE 1987-88 and TE 2005-06. The exceptions are: Thane and Sangli districts; furthermore these being the only aberration in this scenario that have shown much faster expansion in their indigenous cow milk compared to crossbred cow milk production during the same period. In fact, in the case of Greater Bombay and Beed districts, the milk production figures of indigenous cows have rather declined during the period between TE 1987-88 and TE 2005-06; the decline in milk production during this period being much sharper for Greater Bombay compared to Beed. On the other hand, in the case of Amravati and Osmanabad districts, there has been only marginal increase in indigenous cow milk production during the given period of time. As a matter of fact, majority of the districts showed their indigenous cow milk production to increase in the range of 20-60 per cent, and in the case of buffalo this increase stood at 60-160 per cent during the period between TE 1987-88 and TE 2005-06. The milk production increases in the case of goat hovered in the range of 60-150 per cent for majority of the districts during the same period. It is to be noted that the structural changes in milk production for different breeds of milch animals for various districts and regions of Maharashtra in respect of the period between TE 1987-88 and TE 2005-06 are presented in Appendix 8.

The milk production data for various districts were further analysed to get an overall insight about the imbalances prevailing in different regions of Maharashtra. These results are also brought out in Table 4.3.

An overall analysis drawn from Table 4.3 revealed that during the period between TE 1987-88 and TE 2005-06 the increases in milk production figures were much sharper for Nashik, Pune and Aurangabad regions compared to other regions of the State. However, as for the total contribution, Pune region showed the highest contribution to the State's total milk production. The contribution of Pune region to the State's total milk production stood at about 35 per cent during the period between TE 1987-88 and TE 2005-06. The other major contributors to the State's total milk production were Nashik and Aurangabad regions – contributing 26 per cent and 18 per cent to the State's total milk production during TE 2005-06. As regards milk production expansions for various breeds of milch animals, while Aurangabad region showed the maximum expansion in milk production of crossbred cows during the period between TE 1987-88 and TE 2005-06, the increase during the same period for indigenous cow, buffalo and goat milk

production was found to be the highest in the case of Nashik region. In general, the past two decades showed 160 per cent increase in total milk production for the state of Maharashtra, which has been due mainly to the production increases of crossbred cow milk as the increases in the case of indigenous cow, buffalo and goat milk production have been very slow during this period.

#### **4.1.4. Pattern of Growth and Instability in Rates of Growth**

The pattern of milk output growth along with instability in rates of growth for different districts and regions of Maharashtra in respect of various breeds of milch animals over the last two decades is presented in Tables 4.4 and 4.5.

Wide variations in rates of growth of milk production were noticed for different breeds of milch animals across different districts. During the period between 1985-86 and 2005-06, districts falling under Konkan region showed 2-4 per cent annual growth in their milk production figures with Thane district showing the maximum growth (4.3 per cent) followed by Sindhudurg (4.1 per cent), Raigad (3.9 per cent), Ratnagiri (3.5 per cent) and Greater Bombay district (2.4 per cent). However, the districts of Greater Bombay, Raigad and Sindhudurg showed a decline in their annual growth of milk production during 1985-86 – 1994-95 period as against significant growth in the same during 1995-96 – 2005-06 period. The milk production figures of the districts of Nashik region are estimated to have grown in the range of 6-8 per cent during the period between 1985-86 and 2005-06 with Ahmednagar district showing the highest growth (8.4 per cent) and Jalgaon district showing the least growth (5.7 per cent) in the same. All the districts of Nashik region showed very significant growth in their milk production during 1985-86 – 1994-95 period with considerable deceleration in the same during 1995-96 – 2005-06 period. The annual growth in milk production over the last two decades for the districts of Pune region was found to be in the range of 4 to 7 per cent with Pune district showing the highest rate of growth (7.3 per cent) followed by Solapur districts (6.3 per cent), Kolhapur (6.1 per cent), Satara ((5.6 peer cent) and Sangli district (4.1 per cent). Even in Pune region the total milk production through various breeds of milch animals decelerated considerably during the second half (1995-96 – 2005-06) compared to the first half (1985-86 – 1994-95) of the overall period (1985-86 – 2005-06). As for Aurangabad region, while districts like Jalna, Parbhani, Nanded, Osmanabad and Latur recorded 7-11 per cent annual growth in their milk production during 1985-86 – 1994-95, the annual growth in the same for these districts was found to decelerate to 2-3 per cent during 1995-96 – 2005-06. It was only in the case of Beed district that annual growth in

total milk production remained by and large constant at 5 per cent during the period between 1985-86 and 2005-06. The districts that have shown the least growth in their milk production figures during the given period of time are seen to be falling under Amravati region.

**Table 4.4: Growth in Milk Production for Different Districts and Regions of Maharashtra: (1985-86 – 2005-06)**

District/ Region	(Milk Production in lakh liters)														
	Indigenous Cow			Crossbred Cow			Buffalo			Goat			Total Production		
	P-I	P-II	P-III	P-I	P-II	P-III	P-I	P-II	P-III	P-I	P-II	P-III	P-I	P-II	P-III
<b>Districts</b>															
Greater Bombay	10.7	-15.7	-2.7 <sup>NS</sup>	3.0 <sup>NS</sup>	10.3	9.7	9.7	-2.9	2.5	5.6	-14.5	-1.2 <sup>NS</sup>	9.7	-3.0	2.4
Thane	5.00	1.0 <sup>NS</sup>	2.6	4.9	-5.8	1.5	4.0 <sup>NS</sup>	10.2	4.9	5.4	6.6	5.2	4.3 <sup>NS</sup>	7.2	4.3
Raigad	7.9	-2.2 <sup>NS</sup>	2.8	17.5	3.5	5.8	6.9	-2.2 <sup>NS</sup>	4.4	9.9	-1.0 <sup>NS</sup>	6.1	7.9	-1.9 <sup>NS</sup>	3.9
Ratnagiri	5.8 <sup>NS</sup>	2.9	0.8 <sup>NS</sup>	11.2	4.3	5.9	10.4	2.7	4.4	3.8	6.5	5.2	8.6	3.4	3.5
Sindhudurg	14.4	-2.3	2.4	9.3	3.6	3.9	15.0	-1.2 <sup>NS</sup>	5.1	15.9	1.3 <sup>NS</sup>	5.9	13.5	-0.6 <sup>NS</sup>	4.1
Nashik	6.2	1.6 <sup>NS</sup>	5.4	17.9	7.5	12.4	9.3	4.4	6.9	6.3	2.7	4.8	9.3	4.2	7.3
Dhule	6.9	4.1	4.9	22.6	7.1	12.4	6.9	5.8	6.1	5.5	4.7	4.6	8.7	5.5	6.5
Jalgaon	5.8	0.2 <sup>NS</sup>	3.9	24.6	4.5	10.5	9.5	2.3	5.8	5.8	1.1 <sup>NS</sup>	3.6	9.8	2.1	5.7
Ahmednagar	5.4	-0.4 <sup>NS</sup>	2.6	22.6	6.5	11.7	7.0	4.4	6.1	5.5	2.9	4.4	14.1	5.1	8.4
Pune	5.4	-0.5 <sup>NS</sup>	1.5	18.8	5.3	10.4	8.1	3.6	5.7	4.1	2.7	3.1	12.1	4.2	7.3
Satara	5.6	0.8 <sup>NS</sup>	2.8	13.7 <sup>NS</sup>	2.3	8.8	5.2	1.7	4.7	6.7	2.7	4.5	8.2	1.9	5.6
Sangli	2.7	1.2 <sup>NS</sup>	2.3	9.9	-3.7 <sup>NS</sup>	0.8 <sup>NS</sup>	4.4 <sup>NS</sup>	2.2	5.6	2.4	3.1	3.2	5.8	1.0 <sup>NS</sup>	4.1
Solapur	2.0	-0.3 <sup>NS</sup>	1.3	30.1	9.0	14.7	5.2	3.8	4.8	3.0	2.7	3.8	8.4	5.1	6.3
Kolhapur	2.7 <sup>NS</sup>	2.1 <sup>NS</sup>	0.7	8.5	4.3	7.2	7.1	2.3	6.3	2.0 <sup>NS</sup>	2.1	1.9	7.0	2.6	6.1
Aurangabad	6.6	-0.4 <sup>NS</sup>	2.6	26.7	4.9	13.6	8.0	-0.9 <sup>NS</sup>	5.0	5.7	1.5 <sup>NS</sup>	4.3	11.4	1.9	6.7
Jalna	6.2	0.7 <sup>NS</sup>	1.8	20.4	8.6	13.1	6.5	1.8	4.6	4.8	2.9	4.0	7.4	2.9	4.5
Parbhani	7.3	-1.2 <sup>NS</sup>	1.7	15.3	7.3	8.5	11.0	4.3	5.8	3.7	3.3	3.5	8.8	2.2	4.0
Beed	1.0 <sup>NS</sup>	-0.5 <sup>NS</sup>	-0.5 <sup>NS</sup>	21.1	11.6	13.1	5.1	3.7	3.5	4.1	3.3	3.7	5.7	5.4	4.4
Nanded	7.7	-0.2 <sup>NS</sup>	2.2	25.2	1.7 <sup>NS</sup>	13.0	12.6	1.9	5.6	3.6	2.0	3.5	10.8	1.2	4.7
Osmanabad	2.4 <sup>NS</sup>	-1.5 <sup>NS</sup>	-0.3 <sup>NS</sup>	37.4	4.8	15.9	3.5 <sup>NS</sup>	2.9	3.3	8.7	2.6	5.8	8.6	2.9	5.1
Latur	5.2	-1.4 <sup>NS</sup>	1.1 <sup>NS</sup>	28.1	4.4	10.3	8.4	4.3	5.7	2.3 <sup>NS</sup>	1.8	1.6	9.0	3.0	4.7
Buldhana	2.7	0.1 <sup>NS</sup>	0.5 <sup>NS</sup>	16.9	2.5	7.5	2.1	1.2 <sup>NS</sup>	2.3	0.9 <sup>NS</sup>	4.2	2.6	4.2	1.4	2.5
Akola	-0.7 <sup>NS</sup>	3.3	0.6 <sup>NS</sup>	16.6	8.0	10.7	1.3 <sup>NS</sup>	3.6	3.7	2.7	1.9	3.4	1.7	4.1	3.3
Amravati	-1.2 <sup>NS</sup>	3.3	0.2 <sup>NS</sup>	21.7	5.1	10.7	2.0	3.0	3.8	2.2	2.1	3.0	2.6	3.5	3.4
Yavatmal	-1.5 <sup>NS</sup>	5.9	-0.1 <sup>NS</sup>	20.1	9.6	10.0	2.4	3.5	3.6	1.7 <sup>NS</sup>	4.1	1.8	1.9 <sup>NS</sup>	5.0	2.6
Wardha	2.3 <sup>NS</sup>	4.9	2.1	26.9	5.1	13.8	4.3	2.3	4.5	3.3	1.4 <sup>NS</sup>	3.3	8.1	4.0	6.1
Nagpur	0.7 <sup>NS</sup>	5.3	0.1 <sup>NS</sup>	25.3	5.5	12.3	5.6	0.2 <sup>NS</sup>	3.0	2.3	1.9	2.5	7.4	3.3	4.3
Bhandara	1.3 <sup>NS</sup>	4.2	0.6 <sup>NS</sup>	22.7	6.4	13.0	4.0	2.9	4.0	3.8	3.9	4.2	5.2	4.0	4.4
Chandrapur	-1.3 <sup>NS</sup>	6.8	1.3 <sup>NS</sup>	13.0	16.1	12.0	13.8	1.0 <sup>NS</sup>	6.7	2.8 <sup>NS</sup>	1.2 <sup>NS</sup>	4.0	5.4	3.9	4.7
Gadchiroli	-3.4 <sup>NS</sup>	11.2	0.7 <sup>NS</sup>	-7.8 <sup>NS</sup>	19.5	8.8	2.5 <sup>NS</sup>	3.8	4.4	4.3 <sup>NS</sup>	5.0	2.9	-1.0 <sup>NS</sup>	7.6	2.3
<b>Regions</b>															
Konkan	7.2	-0.9 <sup>NS</sup>	2.0 <sup>NS</sup>	9.6	2.2 <sup>NS</sup>	4.7	8.3	0.9	3.7	7.8	3.1 <sup>NS</sup>	5.5	8.1	0.8 <sup>NS</sup>	3.5
Nashik	6.1	1.3 <sup>NS</sup>	4.2	22.1	6.5	11.7	8.5	3.4	6.2	5.8	2.8	4.4	11.0	4.3	7.2
Pune	3.8	0.3 <sup>NS</sup>	1.7	16.0	4.4	8.7	6.1	2.5	5.6	3.4	2.7	3.5	8.4	3.0	6.0
Aurangabad	5.3	-0.6 <sup>NS</sup>	1.3	26.0	6.3	13.0	8.1	2.8	4.8	4.6	2.5	3.8	8.8	2.8	4.8
Amravati	0.1 <sup>NS</sup>	2.8	0.3 <sup>NS</sup>	18.4	5.4	9.2	1.9	2.8	3.3	1.8	3.2	2.7	2.7	3.3	2.9
Nagpur	0.3 <sup>NS</sup>	5.8	0.8 <sup>NS</sup>	23.7	6.2	12.8	5.1	4.1	8.0	3.3	2.6	3.4	5.7	4.0	4.5
Maharashtra State	4.3	2.0 <sup>NS</sup>	5.3	19.0	5.5	10.2	6.8	2.5	5.0	4.2	2.8	3.8	8.3	3.2	5.4

Notes: 1) Period-I = 1985-86 – 1994-95; Period-II = 1995-96 – 2005-06; Period III = 1985-86 – 2005-06

2) All growth rates significant at 1 per cent level of probability

3) NS – Growth rates not significant at 1 per cent level of probability

**Table 4.5: Instability – Coppock Instability Index (CII) – Milk Production for Different Districts and Regions of Maharashtra: (1985-86 – 2005-06)**

(Milk Production in lakh liters)

District/ Region	Indigenous Cow			Crossbred Cow			Buffalo			Goat			Total Production		
	P-I	P-II	P-III	P-I	P-II	P-III	P-I	P-II	P-III	P-I	P-II	P-III	P-I	P-II	P-III
<b>Districts</b>															
Greater Bombay	18.8	30.5	27.8	38.7	15.4	27.4	14.7	9.6	12.8	15.4	47.7	35.9	14.6	9.7	12.8
Thane	15.1	6.5	11.4	23.7	28.2	26.0	17.9	17.4	17.7	6.6	9.2	7.9	14.3	11.0	12.6
Raigad	15.7	9.3	13.4	23.6	5.8	16.4	14.3	11.1	13.1	12.8	10.0	12.6	9.8	9.4	10.3
Ratnagiri	26.6	8.9	18.5	7.7	5.8	7.1	12.0	2.1	8.5	14.4	9.4	11.8	14.3	2.7	9.7
Sindhudurg	81.7	8.8	50.2	15.2	6.0	11.0	13.0	7.3	12.0	20.6	85.4	58.1	22.5	7.8	16.4
Nashik	14.5	6.5	11.3	16.7	7.3	13.5	6.0	3.1	5.5	10.2	4.1	7.6	10.3	3.4	8.0
Dhule	10.3	9.4	9.8	19.7	6.5	15.4	5.1	5.9	5.4	10.6	6.1	8.3	4.9	6.1	5.7
Jalgaon	11.1	6.6	9.5	26.1	5.1	19.0	4.4	3.0	5.0	9.5	4.9	7.5	5.6	2.9	5.6
Ahmednagar	3.7	6.8	6.2	19.9	5.83	15.3	10.8	3.1	8.1	4.6	3.9	4.5	8.5	3.5	7.5
Pune	8.8	6.9	8.0	13.6	4.7	11.3	8.8	2.9	7.3	4.3	4.1	4.2	5.9	2.5	5.8
Satara	6.8	6.4	6.6	15.5	7.4	88.4	6.1	2.4	4.9	7.7	4.0	6.2	23.5	3.5	15.8
Sangli	7.4	6.5	6.8	16.2	21.4	19.0	11.9	1.7	8.2	7.0	4.3	5.6	5.3	4.4	5.2
Solapur	7.1	22.4	16.4	35.2	10.1	25.5	13.3	2.4	9.2	6.5	3.7	5.1	8.8	3.4	6.6
Kolhapur	13.4	7.1	10.3	16.6	5.00	11.8	10.7	1.6	7.7	6.8	3.6	5.2	9.0	1.7	6.6
Aurangabad	7.8	5.8	7.3	27.9	4.7	21.0	15.1	8.6	12.6	8.1	4.3	6.5	12.5	2.9	9.6
Jalna	10.6	6.3	8.6	23.0	9.8	17.9	7.7	2.8	5.8	6.5	4.0	5.2	7.0	2.5	5.3
Parbhani	11.5	6.1	9.4	10.9	7.71	9.53	11.0	4.4	8.3	5.6	4.3	4.9	9.7	2.1	7.0
Beed	10.7	7.8	9.1	17.3	73.4	50.1	11.8	2.4	8.3	6.5	4.9	5.6	7.2	15.5	11.9
Nanded	12.5	5.1	9.5	27.3	8.7	22.1	12.6	1.8	9.3	6.2	3.9	5.0	9.8	2.4	7.6
Osmanabad	12.4	7.3	10.0	49.2	4.7	34.1	19.7	1.8	13.0	20.3	4.1	13.6	9.8	2.3	7.1
Latur	11.8	7.4	10.0	76.6	5.6	47.7	27.2	3.3	17.9	19.1	3.8	12.8	14.1	2.8	9.8
Buldhana	6.8	5.9	6.3	12.0	6.7	10.6	6.2	4.5	5.2	6.6	5.6	6.2	4.1	2.8	3.5
Akola	10.8	8.7	9.6	10.5	8.0	10.0	6.3	3.3	5.4	8.5	3.8	6.3	2.6	3.7	3.5
Amravati	11.1	8.6	9.8	21.5	5.5	16.1	5.6	3.3	5.0	6.3	4.3	5.2	2.4	2.9	2.8
Yavatmal	16.4	12.7	14.7	24.0	13.1	18.7	6.4	3.2	5.5	8.7	5.4	7.2	8.1	5.9	7.2
Wardha	10.3	10.9	10.4	27.8	4.8	20.9	12.1	2.3	8.4	9.1	4.7	6.9	9.5	2.4	6.9
Nagpur	19.3	11.4	15.5	24.9	4.9	18.7	9.2	5.4	7.7	8.2	4.1	6.2	7.6	2.1	5.5
Bhandara	15.4	9.8	12.6	20.8	5.6	16.2	8.7	2.5	6.2	10.6	4.9	7.9	5.9	3.2	4.6
Chandrapur	16.7	12.7	15.2	7.2	31.8	22.4	48.0	3.6	32.2	14.0	4.6	9.9	12.0	4.1	8.6
Gadchiroli	22.7	21.6	23.2	78.0	33.8	56.1	61.5	3.8	38.8	19.5	7.1	13.9	23.7	12.3	19.1
<b>Regions</b>															
Konkan	17.6	6.9	13.1	9.1	7.9	8.7	12.0	2.4	8.5	6.4	12.9	10.4	10.9	2.8	7.9
Nashik	7.9	5.4	7.6	18.9	5.8	14.7	4.7	2.2	4.4	6.4	3.9	5.4	6.8	2.6	6.0
Pune	5.6	9.6	7.9	12.6	4.8	10.2	8.0	1.7	5.9	2.5	3.9	3.3	6.0	2.2	5.0
Aurangabad	8.7	5.6	7.4	25.8	10.2	20.3	9.2	1.4	6.7	4.4	3.9	4.1	7.8	2.6	6.0
Amravati	9.8	8.3	8.9	13.9	4.8	11.0	5.0	2.7	4.3	3.9	4.3	4.1	2.9	2.8	2.9
Nagpur	14.7	12.0	13.4	21.7	5.5	16.7	8.0	2.3	5.8	7.0	3.9	5.56	5.7	3.0	4.4
Maharashtra	5.3	6.5	6.0	13.8	5.1	11.4	4.8	1.7	3.9	3.2	4.0	3.6	5.1	1.7	4.3

Source: Estimates are based on figures compiled from various reports on 'Milk, Eggs, Wool and Meat Production and Livestock and Poultry Keeping Practices in Maharashtra, Directorate of Animal Husbandry, Maharashtra State, Pune  
Notes: I) Period-I = 1985-86 – 1994-95; Period-II = 1995-96 – 2005-06; Period III = 1985-86 – 2005-06

The districts falling under Amravati region showed 2-5 per cent annual growth in their milk production figures between 1985-86 and 2005-06. However, mention may be made here that the annual growth in total milk production in Amravati region improved during the second half as against the first half of the overall period. The districts falling



under Nagpur region showed 2-6 per cent annual growth in their milk production figures during the period between same period 1985-86 and 2005-06 with Gadchiroli district being an aberration in this scenario as this district showed negative annual growth in total milk production during 1985-86 – 1994-95.

The bulk of the increase in total milk production in the state of Maharashtra is seen to be accounted for by the increase in crossbred cow milk production that has grown substantially over the past two decades. Although milk production through crossbred cows in Maharashtra increased at an annual growth rate of 10.2 per cent between 1985-86 and 2005-06, the growth in the same decelerated to 5.5 per cent between 1995-96 and 2005-06 as against 19 per cent annual growth in the same between 1985-86 and 1994-95. Except the districts of Thane and Sangli, all the districts of this State have shown significant and very high rate of growth in their crossbred cow milk production during the given period of time. However, the crossbred cow milk production of Gadchiroli district was estimated to have declined during 1985-86 – 1994-95 with a sharp increase in the same during 1995-96 – 2005-06, and consequently the overall annual growth in crossbred cow milk production for this district stood at 8.8 per cent. The rates of growth in indigenous cow, buffalo and goat milk production also decelerated during the second half as against the first half of the overall period. On an average, the annual growth in milk production between 1985-86 and 2005-06 was noticed to be 5.3 per cent for indigenous cows, 4.2 per cent for buffaloes and 3.8 per cent for goat.

In general, the milk production in the state of Maharashtra is estimated to have grown at the rate of 8.3 per cent per annum during 1985-86 – 1994-95 and 3.2 per cent per annum during 1995-96 – 2005-06 with an overall annual growth in the same at 5.4 per cent during the period between 1985-86 and 2005-06. However, this growth in milk production is achieved in the face of wide year-to-year fluctuations in the same. Very high degree of instability in milk production noticed in the case of districts like Greater Bombay, Raigad, Thane, Ratnagiri, Sindhudurg, Satara, Latur, Osmanabad, Chandrapur and Beed is seen to be associated with moderate as well as high growth rates, especially during the first half of the overall period. In the case of districts like Nashik, Dhule, Jalgaon, Ahmednagar, Pune, Kolhapur, Solapur, Aurangabad and Nagpur, high growth rates are associated with moderate instabilities. Districts showing low growth rates associated with very low degree of instability are noticed to be Buldhana, Akola and Amravati. Interestingly, the district of Gadchiroli shows very high degree of instability, which is associated with very low growth rates in the second half and negative growth in

the first half of the overall period. There is a spectrum of other districts like Sangli, Jalna, Parbhani and Bhandara, which have shown moderate growth associated with moderate instabilities. In this sequel, the district of Wardha shows high growth in milk production associated with moderate instability. In general, the districts belonging to Konkan, Nashik, Pune and Aurangabad regions have shown high to moderate rates of growth in total milk production associated with high to moderate instabilities during the period between 1985-86 and 1994-95. However, during the second half of the overall period, i.e. between 1995-96 and 2005-06, these districts are marked with low growth with low instabilities in total milk production. The districts belonging to Amravati region show very low growth associated with very low instability during the entire period between 1985-86 and 2005-06. On the other hand, the districts belonging to Nagpur region have shown moderate growth rates in milk production associated with moderate fluctuations in the rates of growth. All the regions have shown substantially lower growth in milk production during 1995-96 – 2005-06 as against the period between 1985-86 and 1994-95. Similarly, fluctuations in rates of growth of milk production have also come down for all the regions during the second half as against the first half of the overall period.

As regards instability in rates of growth of milk production for various breeds of milch animals, crossbred cows showed much higher fluctuations in their milk production growth rates compared to indigenous cow, buffalo and goat, especially during the period between 1985-86 and 1994-95. However, between 1995-96 and 2005-06, instabilities in crossbred cow milk production reduced substantially in all the districts with the exception of districts like Greater Bombay, Thane, Sangli, Beed, Chandrapur and Gadchiroli, which showed higher fluctuations in rates of growth of milk production even during this period. In fact, Greater Bombay, Chandrapur and Gadchiroli districts showed high instability even for indigenous cow milk production during the second half of the overall period. The Greater Bombay showed high degree of instability for goat milk production as well during the second half of the overall period. The high degree of instability associated with high rates of growth may not be a cause of concern. However, high degree of instability associated with low or declining rate of growth, as noticed in the case of indigenous cow milk production in Greater Bombay and Gadchiroli districts, and crossbred cow milk production in Thane district is a matter of concern. Similarly, declining rates of growth in buffalo milk production during 1995-96 – 2005-06 in Greater Bombay, Raigad, Sindhudurg and Aurangabad districts may pose a cause of concern for the future growth prospects of these districts in buffalo milk production. Therefore, in

order to correct the inter-district imbalances in milk production, more emphasis should be given by the policy makers to the districts that have shown low growth rates and high instability in milk production.

#### 4.1.5 Regional Imbalances in Growth

An overall analysis in relation to comparative position of different regions discloses that Amravati and Nagpur regions lag far behind other regions of the State in terms of growth performance of milk production (Table 4.4). The rate of growth of milk production of Amravati and Nagpur regions over the past two decades is seen to be 3-4 per cent per annum, which turns out to be much below the State's average rate of growth in the same. And, as a result of this, the share of these two regions in total milk production of Maharashtra is estimated to have declined during the period between 1985-86 and 2005-06 (Table 4.6). In fact, all the districts of Amravati and Nagpur regions have shown their milk production to have growth rates less than the State's average growth rate with the aberration of Nagpur district. Despite one-thirds contribution to the State's total milk production, Pune region has also shown its milk production to increase below the State's average rate of growth in the same during the period between 1995-96 and 2005-06 (Tables 4.4 and 4.6). However, this has not affected share of Pune region in total milk production of Maharashtra, which increased from 34 per cent during the first half to 35 per cent during the second half of the overall period. On the other hand, Konkan, Amravati and Nagpur have shown declining share in total milk production of Maharashtra in the second half as against first half of the overall period. The major increase in terms of share in total milk production is noticed in the case of Nashik region, which has shown its share in total milk production of Maharashtra to increase from 19 per cent during 1985-86 – 1994-95 to 26 per cent during 1995-96 – 2005-06.

**Table 4.6: Changing Shares of Different Regions in Total Milk Production of Maharashtra**

(in per cent)

Regions	Indigenous Cows		Crossbred Cows		Buffaloes		Goats		Total Production	
	P-I	P-II	P-I	P-II	P-I	P-II	P-I	P-II	P-I	P-II
Konkan	7.75	8.22	5.15	1.97	16.29	14.08	3.00	3.83	11.45	8.56
Nashik	22.63	30.79	25.04	32.99	14.59	18.15	23.53	26.46	18.93	25.64
Pune	17.51	16.00	52.60	40.05	37.86	39.42	30.77	29.14	33.51	35.31
Aurangabad	27.58	25.21	9.21	15.53	14.89	15.59	24.19	24.13	18.38	17.54
Amravati	14.57	11.15	4.26	3.79	9.82	7.23	11.02	9.37	10.51	6.80
Nagpur	9.97	8.64	3.74	5.67	6.54	5.53	7.50	7.07	7.22	6.16

Source: Estimates are based on figures compiled from various reports on 'Milk, Eggs, Wool and Meat Production and Livestock and Poultry Keeping Practices in Maharashtra, Directorate of Animal Husbandry, Maharashtra State, Pune

Note: Period-I = 1985-86 – 1987-88 (Triennium Average)

Period-II = 2003-04 – 2005-06 (Triennium Average)

Although Pune region showed very high share in State's total milk production through crossbred cow, buffalo and goat, in respect of production expansions of indigenous cow milk this region lagged far behind Nashik and Aurangabad regions. The higher share of Pune region in total milk production of Maharashtra was mainly due to its significant contribution to State's total milk production of crossbred cow, buffalo and goat milk production. In the case of crossbred cow, Nashik region showed significant expansion in terms of its share in total crossbred cow milk production of the State, which increased from 25 per cent during 1985-86 – 1994-95 to 33 per cent during 1995-96 – 2005-06, whereas this share for Pune region declined from 53 per cent to 40 per cent during the same period. In fact, Nashik, Pune and Aurangabad regions also showed very high share in total goat milk production of the State as there three regions accounted for almost 70 per cent of the total goat milk production of the State. The Nagpur region accounted for the lowest share in terms of all the breeds of milch animals, followed by Amravati and Konkan regions.

As for milk production growth rates, a study conducted by Patel (1993) showed much higher rate of growth in milk production for the state of Maharashtra during the decades 1970-71 – 1979-80 and 1989-90 as compared to the rate of growth in the same witnessed for the period 1985-86 and 2005-06 in this study. According to the estimates reported by Patel (1993), the total milk production of Maharashtra grew at the rate of 7.57 per cent a year during the period 1980-81 – 1989-90 as against only 4.15 per cent annual growth in the same during the period between 1970-71 and 1979-80. The present study shows a much higher rate of growth in milk production for this State for the period between 1985-86 and 1994-95 and much lower growth in this respect between 1995-96 and 2005-06 with an average annual growth rate in the same at 5.4 per cent between 1985-86 and 2005-06. Thus, it may well be inferred that there has been deceleration in rate of growth of milk production for the state of Maharashtra during the last one decade as against the decade preceding it. However, the State's current pace in the rate of growth of milk production is not very discouraging and amply demonstrates that it may even overtake States like Madhya Pradesh in the years to come (Appendix 9). In fact, it had overtaken the state of Madhya Pradesh way back in 1998-99. However, in 2005-06, Madhya Pradesh showed higher share compared to Maharashtra. There is a possibility that Maharashtra may again overtake the state of Gujarat in total milk production in the years to come, which it had already shown in 1990-91. Since the pace of growth in milk production at present is higher in Madhya Pradesh and Gujarat, these two states are

showing slightly higher share in total milk production of India. Maharashtra has to do a little catching up to again overtake the states of Madhya Pradesh and Gujarat through newly initiated livestock development programmes with the focus on augmenting total milk production of the state.

#### **4.1.6 Changing Structure in Ranking of Districts**

The ranking of districts based on their total milk production performance for three different time periods along with rank correlation coefficients between period I and II, II and III, and I and III is presented in Table 4.7.

It is to be noted that Ahmednagar district ranked first in total milk production of the State during TE 1996-97 and TE 2005-06, though its ranking was fifth during TE 1987-88, showing thereby an increase in its ranking in total milk production of the State. Similarly, Pune district showed an increase in its ranking from 3<sup>rd</sup> during TE 1987-88 to 2<sup>nd</sup> during TE 1987-88 and TE 2005-06. On the other hand, Kolhapur district showed a decline in its ranking in total milk production of the State as its ranking in this respect came down from 1<sup>st</sup> during TE 1987-88 to 3<sup>rd</sup> during TE 1987-88 and TE 2005-06. The ranking of Satara district did not change throughout the period between 1985-86 and 2005-06 as it occupied 4<sup>th</sup> position in total milk production of Maharashtra during this period. The ranking of Solapur district in total milk production of the State declined from 7<sup>th</sup> during TE 1987-88 to 8<sup>th</sup> during TE 1996-97 but increased to 5<sup>th</sup> during TE 2005-06. A steady increase in ranking in terms of total milk production of the State was noticed in the case of Nashik district as its ranking increased from 8<sup>th</sup> during TE 1987-88 to 6<sup>th</sup> during TE 2005-06. On the contrary, the ranking of Jalgaon district in total milk production of the State came down from 6<sup>th</sup> during TE 1987-88 and TE 1996-97 to 7<sup>th</sup> during TE 2005-06. In this sequel, a very sharp decline in ranking was noticed in the case of Sangli district as its ranking in total milk production of the State fell from 2<sup>nd</sup> during TE 1987-88 to as low as 8<sup>th</sup> during TE 2005-06. The district of Dhule occupied 9<sup>th</sup> position in total milk production of the State during TE 2005-06, though it ranked 12<sup>th</sup> in this respect during TE 1987-88, implying an increase in its ranking. In general, during the period between 1985-86 and 2005-06, districts like Greater Bombay, Thane, Raigad, Ratnagiri, Jalgaon, Sangli, Kolhapur, Parbhani, Buldhana, Akola, Amravati and Yavatmal showed a decrease in their ranking in total milk production of the State in the face of increase in ranking in this respect for districts like Sindhudurg, Nashik, Dhule, Ahmednagar, Pune, Solapur, Aurangabad, Nanded, Osmanabad, Latur, Wardha, Nagpur and Bhandara. Some of the districts did not show much change in their ranking in terms

of total milk production of the State and these districts were Satara, Jalna, Beed, Chandrapur and Gadchiroli. In fact, Gadchiroli, Sindhudurg, Chandrapur, Ratnagiri and districts occupied the lowest position in total milk production of the State. Interestingly, the district of Aurangabad showed sharp increase in its ranking in terms of total milk production of the State as its ranking in this respect increased from as low as 22<sup>nd</sup> during TE 1987-88 to 13<sup>th</sup> during TE 1996-97 and 15<sup>th</sup> during TE 2005-06. This was mainly due to more than 100 per cent increase in milk production in Aurangabad district between 1985-86 and 2005-06 (Appendix 8 (e)).

**Table 4.7: Ranking of Districts According to Total milk Production in Maharashtra**

Districts	Period – I TE 1987-88	Period – II TE 1996-97	Period – III TE 2005-06	Change	
Brihan Mumbai/ Greater Bombay	9	9	13	Decrease	Rank Correlation Coefficient:  R12 = 0.9324 R23 = 0.9706 R13 = 0.9471
Thane	11	18	12	Decrease	
Raigad	23	19	24	Decrease	
Ratnagiri	26	27	27	Decrease	
Sindhudurg	30	29	29	Increase	
Nashik	8	7	6	Increase	
Dhule	12	11	9	Increase	
Jalgaon	6	6	7	Decrease	
Ahmednagar	5	1	1	Increase	
Pune	3	2	2	Increase	
Satara	4	4	4	Constant	
Sangli	2	5	8	Decrease	
Solapur	7	8	5	Increase	
Kolhapur	1	3	3	Decrease	
Aurangabad	22	13	15	Increase	
Jalna	25	24	25	Constant	
Parbhani	15	15	17	Decrease	
Beed	10	12	10	Constant	
Nanded	13	10	11	Increase	
Osmanabad	17	14	14	Increase	
Latur	18	16	16	Increase	
Buldhana	14	17	19	Decrease	
Akola	16	22	20	Decrease	
Amravati	21	23	22	Decrease	
Yavatmal	19	25	23	Decrease	
Wardha	27	26	26	Increase	
Nagpur	24	21	21	Increase	
Bhandara	20	20	18	Increase	
Chandrapur	28	28	28	Constant	
Gadchiroli	29	30	30	Constant	

Note: Period –I = 1985/86 to 1987/88; Period –II = 1994/95 to 1996/97; Period –III = 2003/04 to 2005/06  
TE – Triennium Ending

The estimated rank correlation coefficient in respect of cross-section of districts was found to be not only positive but also very high between the period II and III (0.9706), I and III (0.9471) and I and II (0.9324). This indicated that, in general, there has

not been much of a change in the ranking of districts in respect of their contribution to State's total milk production during the period between 1985-86 and 2005-06.

#### **4.1.7 Milk Procurement in Maharashtra**

The total production of milk is the one end of the spectrum, the other end being procurement of milk by organized sector. The milk procurement estimates for different regions of Maharashtra along with total milk production estimates for these regions are brought out in Table 4.8 with a view to have an insight into the quantum of milk handled by the organized sector in the State.

In due course of time, the state of Maharashtra has shown significant expansion not only in total milk production but also procurement of this milk by the organized sector. While total milk production in Maharashtra increased from 4.99 million tonnes in 1995-96 to 6.8 million tonnes in 2005-06, the expansion in procurement of this milk by the organized sector was much sharper, which increased from 1.18 million tonnes to as much as 2.19 million tonnes during the same period, implying the share of organized sector milk procurement in total milk production to increase from 24 per cent to 32 per cent. In fact, during 2004-05, the organized sector handled as much as 38 per cent of the total milk produced in Maharashtra. Bulk of the expansion in milk procurement was contributed by Pune region, which showed milk procurement to the tune of 68 per cent of total milk production of this region in 2004-05 and 63 per cent in 2005-06. Another important region in terms of milk procurement was noticed to be Nashik, which consistently showed milk procurement in the range of 25-30 per cent of total milk production of this region between 1995-96 and 2005-06. In this sequel, milk procurement as proportion to total milk production steadily increased in the case of Aurangabad region. In fact, the share of milk procurement in total milk production for Aurangabad region increased sharply from 15 per cent in 1995-96 to 37 per cent in 2001-02 with a decline in the same to 28 per cent in 2005-06. However, Nagpur region showed mixed trend in terms of share of milk procurement in total milk production of the region as this share increased from 14 per cent in 1995-96 to 22 per cent in 1997-98 with a decline in the same to 12 per cent in 2000-01, and again a rise in this share to 27 per cent in 2004-05 with a fall in same to 14 per cent in 2005-06. In terms of share of milk procurement in total milk production, Konkan and Amravati regions showed very marginal presence.

It is to be further noted that the share of Pune region in total milk procurement of the State has steadily increased from 58 per cent in 1995-96 to as much as 70 per cent in 2005-06. On the contrary, Nashik regions shows steady decline in its share in total milk

procurement of the State, which came down from 26 per cent in 1995-96 to 19 per cent in 2005-06. Thus, decline in share of Nashik region in total milk procurement of Maharashtra has been more than compensated by the rising share of Pune region in this respect during the given period of time.

**Table 4.8: Changing Structure of Milk Procurement for Different Region of Maharashtra**

Year	Konkan	Nashik	Pune	Aurangabad	Amravati	Nagpur	Total
<b>Milk Procurement (in '000' MT)</b>							
1995-96	6.00	307.00	684.40	134.70	11.30	40.30	1183.70
1996-97	6.80	338.10	724.20	130.20	12.00	60.30	1271.60
1997-98	6.40	364.40	756.90	136.60	13.50	66.00	1343.80
1998-99	10.10	364.80	772.60	141.90	6.40	55.50	1351.30
1999-00	7.30	377.30	799.00	163.20	9.90	49.80	1406.50
2000-01	7.00	367.90	804.80	178.10	6.20	41.60	1405.60
2001-02	5.70	402.30	874.40	206.30	7.80	55.40	1551.90
2002-03	5.10	399.70	861.00	190.50	6.90	45.30	1508.50
2003-04	4.40	364.70	828.10	181.80	8.10	44.20	1431.30
2004-05	40.15	561.33	1596.56	174.48	7.50	108.81	2488.83
2005-06	4.13	416.49	1530.90	168.10	9.38	58.53	2187.53
<b>Milk Production (in lakh kg)</b>							
1995-96	5168.47	11771.69	17703.26	9019.77	3349.71	2898.36	49911.26
1996-97	5248.24	12135.45	18235.59	9237.64	3453.94	2955.33	51266.19
1997-98	5295.94	12254.16	18490.76	9402.71	3496.70	2987.99	51928.26
1998-99	5607.69	13348.73	19997.76	10076.42	3810.82	3243.82	56085.24
1999-00	5606.04	13748.66	20335.73	10178.73	3885.18	3307.08	57061.42
2000-01	5668.31	14203.95	20916.91	10341.81	3969.34	3398.95	58499.27
2001-02	5359.36	15562.22	21148.44	5613.99	4254.32	3757.08	60931.06
2002-03	5491.50	15946.73	21695.90	5764.68	4377.61	3875.18	62513.62
2003-04	5604.98	16226.65	22122.63	5856.36	4487.50	4003.19	63771.48
2004-05	5556.96	16869.40	23372.61	5883.62	4401.48	4010.95	65669.93
2005-06	5705.18	17443.12	24112.67	6036.45	4521.11	4125.99	67692.33
<b>Share of Milk Procurement in Total Production (in per cent)</b>							
1995-96	1.16	26.08	38.66	14.93	3.37	13.90	23.72
1996-97	1.30	27.86	39.71	14.09	3.47	20.40	24.80
1997-98	1.21	29.74	40.93	14.53	3.86	22.09	25.88
1998-99	1.80	27.33	38.63	14.08	1.68	17.11	24.09
1999-00	1.30	27.44	39.29	16.03	2.55	15.06	24.65
2000-01	1.23	25.90	38.48	17.22	1.56	12.24	24.03
2001-02	1.06	25.85	41.35	36.75	1.83	14.75	25.47
2002-03	0.93	25.06	39.68	33.05	1.58	11.69	24.13
2003-04	0.79	22.48	37.43	31.04	1.81	11.04	22.44
2004-05	7.23	33.28	68.31	29.66	1.70	27.13	37.90
2005-06	0.72	23.88	63.49	27.85	2.07	14.19	32.32
<b>Share in total Milk Procurement (in per cent)</b>							
1995-96	0.51	25.94	57.82	11.38	0.95	3.40	100
1996-97	0.53	26.59	56.95	10.24	0.94	4.74	100
1997-98	0.48	27.12	56.33	10.17	1.00	4.91	100
1998-99	0.75	27.00	57.17	10.50	0.47	4.11	100
1999-00	0.52	26.83	56.81	11.60	0.70	3.54	100
2000-01	0.50	26.17	57.26	12.67	0.44	2.96	100
2001-02	0.37	25.92	56.34	13.29	0.50	3.57	100
2002-03	0.34	26.50	57.08	12.63	0.46	3.00	100
2003-04	0.31	25.48	57.86	12.70	0.57	3.09	100
2004-05	1.61	22.55	64.15	7.01	0.30	4.37	100
2005-06	0.19	19.04	69.98	7.68	0.43	2.68	100

Source: Estimates are based on figures compiled from various reports on 'Milk, Eggs, Wool and Meat Production and Livestock and Poultry Keeping Practices in Maharashtra, Directorate of Animal Husbandry, Maharashtra State, Pune



As for milk procurement, it deserves mention that the state Maharashtra is marked with the highest number of dairy cooperatives in India (Appendix 10). Even the state of Uttar Pradesh that accounts of about 19 per cent of country's total milk production do not have as many dairy cooperatives as the state of Maharashtra have (Appendix 9). And, in Maharashtra, about 44 per cent of dairy cooperatives prevail in Pune region and 21 per cent in Nashik region.<sup>12</sup> Obviously, these two regions account for more than two thirds share in total dairy cooperatives prevailing in the State. Due to very high numerical strength of dairy cooperatives in Pune and Nashik regions, the organized procurement of milk is very high in these two regions. Therefore, this could be the reason for about 90 per cent of milk procurement of the State being contributed by these two regions alone. These two regions also possess the largest number of high yielding crossbred cows and buffaloes. Pune and Nashik, therefore, assume considerable importance insofar as dairy development in the State is concerned.

#### **4.2 Structural Changes in Egg Production in Maharashtra**

The egg production in Maharashtra has grown significantly over the last one decade. The egg production in Maharashtra through both improved and *deshi* breeds of poultry was estimated at 2,597 million during TE 1996-97, which increased to 3,440 million during TE 2005-06, showing thereby 32 per cent rise in the same over the last one decade (Table 4.9). Although egg production increased across all the districts and regions of the State, a couple of districts like Greater Bombay and Jalgaon showed a marginal decline in their total egg production between 1994-95 and 2005-06 (Appendix 11 (c)). On the other hand, Dhule district showed more than four folds rise in its egg production over the last one decade. The districts of Nashik, Akola and Wardha showed more than two folds rise in their egg production between 1994-95 and 2005-06. In this sequel, all other districts of the State showed an expansion in their egg production in the range of 10-70 per cent during the same period.

Among various regions, Pune region was found to account for substantial share in total egg production of Maharashtra, though its share in total egg production of the State declined from 57 per cent during TE 1996-97 to 47 per cent during TE 2005-06. The next important region in terms of egg production in Maharashtra was found to be Nashik, which accounted for 16 per cent share in total egg production of the State during TE

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<sup>12</sup> In 2003, out of 23,679 dairy cooperatives prevailing in Maharashtra, 10,469 belonged to Pune region and 4,983 to Nashik region, and, therefore, the combined share of these two regions in total dairy cooperatives stood at 65 per cent.

1996-97 and 26 per cent share during TE 2005-06. Thus, a decline in share of Pune region in total egg production of the State was compensated by an increase in share in this respect by Pune region during the same period. The share of other regions in total egg production of the State remained by and large constant over the last one decade, and hovered at around 3-4 per cent for Amravati region, 6-7 per cent for Aurangabad and Nagpur regions (Table 4.9).

**Table 4.9: District and Region-wise Total Egg Production in Maharashtra**

(in lakh numbers)

Districts/Region	TE 1996-97	TE 2005-06	CGR (%)	CII
Greater Bombay	123.79	122.34	-0.56 <sup>NS</sup>	5.70
Thane	699.71	1104.63	-10.71 <sup>NS</sup>	6.14
Raigad	689.08	752.77	0.42 <sup>NS</sup>	5.47
Ratnagiri	881.83	1057.05	1.71 <sup>***</sup>	2.85
Sindhudurg	459.77	536.28	1.32 <sup>***</sup>	3.56
<b>Konkan Region</b>	<b>2854.18 (10.99)</b>	<b>3573.07 (10.39)</b>	<b>0.96<sup>NS</sup></b>	<b>1.63</b>
Nashik	1268.60	3489.71	13.89 <sup>***</sup>	24.11
Dhule	575.06	2624.88	22.03 <sup>***</sup>	44.80
Jalgaon	403.34	396.08	-1.03 <sup>NS</sup>	8.98
Ahmednagar	1907.37	2417.14	2.50 <sup>***</sup>	1.54
<b>Nashik Region</b>	<b>4154.36 (16.00)</b>	<b>8927.81 (25.95)</b>	<b>10.13<sup>***</sup></b>	<b>15.66</b>
Pune	5263.15	5636.65	0.16 <sup>NS</sup>	7.02
Satara	2017.39	2105.50	-0.20 <sup>NS</sup>	7.25
Sangli	3465.32	4041.21	1.32 <sup>**</sup>	4.45
Solapur	2620.04	2375.88	-2.09 <sup>*</sup>	12.21
Kolhapur	1547.81	2071.93	3.25 <sup>***</sup>	1.19
<b>Pune Region</b>	<b>14913.70 (57.43)</b>	<b>16231.17 (47.18)</b>	<b>0.38<sup>NS</sup></b>	<b>6.39</b>
Aurangabad	317.31	355.62	0.79 <sup>NS</sup>	5.03
Jalna	144.33	191.99	3.18 <sup>***</sup>	1.93
Parbhani	231.37	235.69	-1.68 <sup>NS</sup>	7.89
Beed	405.41	562.48	3.74 <sup>***</sup>	2.26
Nanded	218.90	289.60	3.08 <sup>***</sup>	1.29
Osmanabad	216.01	270.72	2.29 <sup>***</sup>	1.88
Latur	121.49	176.04	4.38 <sup>***</sup>	4.45
<b>Aurangabad Region</b>	<b>1654.82 (6.37)</b>	<b>2082.14 (6.05)</b>	<b>2.19<sup>***</sup></b>	<b>1.65</b>
Buldhana	138.67	244.97	7.25 <sup>***</sup>	9.78
Akola	200.08	450.06	10.82 <sup>***</sup>	18.12
Amravati	192.48	225.96	1.42 <sup>***</sup>	3.50
Yavatmal	308.17	326.12	0.01 <sup>NS</sup>	6.09
<b>Amravati Region</b>	<b>839.40 (3.23)</b>	<b>1247.10 (3.63)</b>	<b>4.74<sup>***</sup></b>	<b>4.44</b>
Wardha	111.26	240.50	10.23 <sup>***</sup>	16.69
Nagpur	434.15	773.50	7.35 <sup>****</sup>	9.22
Bhandara	486.40	640.05	3.02 <sup>***</sup>	1.25
Chandrapur	313.93	376.01	1.73 <sup>***</sup>	2.46
Gadchiroli	208.11	308.24	4.71 <sup>***</sup>	4.54
<b>Nagpur Region</b>	<b>1553.85 (5.98)</b>	<b>2338.31 (6.80)</b>	<b>4.92<sup>***</sup></b>	<b>4.52</b>
<b>State Total</b>	<b>25970.31</b>	<b>34399.60</b>	<b>2.97<sup>***</sup></b>	<b>1.12</b>

Notes: TE -1996-97 (Average of 1994-95, 1995-96 and 1996-97)

TE - 2005-06 (Average of 2003-04, 2004-05 and 2005-06)

CGR - Annual Compound Growth Rate between 1995-96 and 2005-06

CII - Coppock Instability Index between 1995-96 and 2005-06

\*\*\*, \*\* and \* imply significance of growth rates at 1, 5 and 10 per cent level of probability.

NS- Non-significance of growth rates

Figures in parentheses are percentages to the total egg production of the State.

It is to be noted that all the districts of Maharashtra showed their total egg production to expand at an annual compound growth rate of 3-7 per cent between 1994-95 and 2005-06 with the exception of Nashik, Dhule, Akola and Wardha, which showed an annual growth in the same during this period at 10-20 per cent, and in the case of Thane, the egg production actually declined at an annual growth rate of 11 per cent over the last one decade. The high growth rates in egg production in the case of Nashik, Dhule Akola and Wardha districts were seen to be associated with very high rate of fluctuations, showing greater degree of instability in egg production in these districts. In general, egg production in Maharashtra grew at the rate of 3 per cent a year over the last one decade, which was mainly contributed by substantial growth in egg production in Nashik region of the State during this period. It deserves mention here that Maharashtra ranked 3<sup>rd</sup> in total egg production of India in 2005-06, next only to Andhra Pradesh and Tamil Nadu. The share of Maharashtra in total egg production of India was estimated at 7.83 in 1977-78, which increased to 11 per cent during eighties period but declined to 10 per cent in nineties period and further to 7.62 per cent in 2005-06 (Appendix 12). However, in absolute terms Maharashtra has shown significant expansion in its egg production, which has grown nearly 340 per cent in TE 2005-06 over TE 1996-97.

As for egg production, Pune district occupied 1<sup>st</sup> and Sangli 2<sup>nd</sup> position during the period between 1994-95 and 2005-06 (Table 4.10). The district of Nashik showed significant rise in its ranking in egg production from 7<sup>th</sup> during TE 1996-97 to 3<sup>rd</sup> during TE 2005-06. Similarly, district of Dhule also showed an increase in its ranking in egg production of Maharashtra, which increased from 11<sup>th</sup> during TE 1996-97 to as high as 4<sup>th</sup> during TE 2005-06. However, the ranking of Ahmednagar district remained same and it occupied 5<sup>th</sup> position in total egg production of Maharashtra during the last one decade. On the contrary, the ranking of Solapur, Satara, Kolhapur and Ratnagiri districts declined during this period, the decline being from 3<sup>rd</sup> to 6<sup>th</sup> for Solapur, 4<sup>th</sup> to 7<sup>th</sup> for Satara, 6<sup>th</sup> to 8<sup>th</sup> for Kolhapur and 8<sup>th</sup> to 10 for Ratnagiri district. In general, the districts like Greater Bombay, Raigad, Ratnagiri, Sindhudurg, Jalgaon, Satara, Solapur, Kolhapur, Aurangabad, Jalna, Parbhani, Nanded, Osmanabad, Amravati, Yavatmal and Bhandara showed a decrease in their ranking in total egg production of Maharashtra between 1994-95 and 2005-06, whereas the districts like Nashik, Dhule, Beed, Buldhana, Akola, Wardha, Nagpur, and Gadchiroli were marked with increase in their ranking in this respect during the same period. The ranking of some of the districts in total egg

production of Maharashtra remained same during the last one decade and these districts were Thane, Ahmednagar, Pune, Sangli, Latur and Chandrapur. Greater Bombay, Jalna, Latur and Amravati showed the lowest ranking in terms of total egg production of Maharashtra during the last one decade.

**Table 4.10: Ranking of Districts According to Total Egg Production in Maharashtra**

Districts	Period – I TE 1996-97	Period – II TE 2005-06	Change
Greater Bombay	28	30	Decrease
Thane	9	9	Constant
Raigad	10	12	Decrease
Ratnagiri	8	10	Decrease
Sindhudurg	13	15	Decrease
Nashik	7	3	Increase
Dhule	11	4	Increase
Jalgaon	16	17	Decrease
Ahmednagar	5	5	Constant
Pune	1	1	Constant
Satara	4	7	Decrease
Sangli	2	2	Constant
Solapur	3	6	Decrease
Kolhapur	6	8	Decrease
Aurangabad	17	19	Decrease
Jalna	26	28	Decrease
Parbhani	20	26	Decrease
Beed	15	14	Increase
Nanded	21	22	Decrease
Osmanabad	22	23	Decrease
Latur	29	29	Constant
Buldhana	27	24	Increase
Akola	24	16	Increase
Amravati	25	27	Decrease
Yavatmal	19	20	Decrease
Wardha	30	25	Increase
Nagpur	14	11	Increase
Bhandara	12	13	Decrease
Chandrapur	18	18	Constant
Gadchiroli	23	21	Increase

Rank Correlation  
Coefficient:  
R12 = 0.9404

Source: Estimates are based on figures compiled from various reports on 'Milk, Eggs, Wool and Meat Production and Livestock and Poultry Keeping Practices in Maharashtra, Directorate of Animal Husbandry, Maharashtra State, Pune  
Note: Period –I = 1985/86 to 1987/88; Period –II = 1994/95 to 1996/97; Period –III = 2003/04 to 2005/06  
TE – Triennium Ending

The estimated rank correlation coefficient revealed not much of a variation in ranking of districts with respect to total egg production in Maharashtra during the period between TE 1996-97 and TE 2005-06, as it turned out to be not only positive and but very high (0.9404) during this period. This also stems from the fact that majority of the districts showed only minor changes in terms of their ranking in total egg production of the State during the given period of time, and in some cases there was no change in their ranking and they continued to be leading districts in the State in terms of egg production.

### 4.3 Structural Changes in Wool Production in Maharashtra

Wool production in India is concentrated in very few states in India, particularly those having significant presence of sheep population. In terms of sheep population, Rajasthan tops the comity of States in India and, therefore, the production of wool is maximum in this State as compared to any other State of India. It was mainly because of the adaptability to such agro-climatic conditions as prevailing in Rajasthan that sheep rearing became a predominant profession of the rural folk in this State. Due to substantially high concentration of sheep population in Rajasthan, the Central Sheep and Wool Research Institute of ICAR was established in Avikanagar of Jodhpur district of Rajasthan, which has been playing a crucial role in augmenting wool production in the State through various research efforts. It is to be noted that the state of Rajasthan accounted for as much as 40 per cent share in total wool production of India until 2000-01, though its share in total wool production of India declined to 34 per cent in 2005-06 (Appendix 14). The other important States of India in terms of wool production are Jammu and Kashmir, Karnataka, Andhra Pradesh and Gujarat. However, mention may be made that insofar as wool production in India is concerned, the state of Maharashtra also accounts for considerable share. The state of Maharashtra has been contributing about 3-4 per cent to the total wool production of India for the last three decades and this share has remained by and large constant during this period with minor ups and downs. The wool production estimates of Maharashtra across various districts and regions encompassing the period between 1994-95 and 2005-06 are presented in Table 4.11. -

Although the state of Maharashtra accounts for a reasonable share in total wool production of India, there has not been much increase in wool production in the State, which has grown hardly 0.63 per cent annually during the period between 1994-95 and 2005-06. The wool production in Maharashtra was estimated at 1,550 metric tonnes during TE 1996-97 and this increased to 1,645 metric tonnes during TE 2005-06, showing hardly 6 per cent rise in the same during this period (Appendix 13). However, some of the regions of Maharashtra like Pune, Nashik and Aurangabad were noticed to account for substantially very high share in total wool production of the State. For instance, Pune region accounted for as much as 45 per cent share in total wool production of Maharashtra over the last one decade. The region of Nashik was the second in terms of total wool production of the State, which accounted for 30 per cent share in the State in wool production during TE 1996-97 and 34 per cent share in this respect during TE 2005-06. The Aurangabad region showed a share of 15-16 per cent in total wool production of

Maharashtra over the last one decade. This amply demonstrates the fact that the regions of Pune, Nashik and Aurangabad cornered more than 90 per cent share in total wool production of the State mainly because of their significantly high share of sheep population as compared to other regions of the State.

**Table 4.11 District and Region-wise Total Wool Production in Maharashtra**

(in MT)

Districts/Region	TE 1996-97	TE 2005-06	CGR (%)	CII
Greater Bombay	7.70	0.16	-40.94***	222.35
Thane	0.32	0.49	5.17***	9.57
Raigad	0.46	0.33	-4.41***	11.46
Ratnagiri	0.01	0.03	4.77***	8.07
Sindhudurg	0.01	0.13	20.74***	46.58
<b>Konkan Region</b>	<b>8.50 (0.55)</b>	<b>1.15 (0.07)</b>	<b>-24.02***</b>	<b>85.61</b>
Nashik	144.25	161.19	1.34***	2.16
Dhule	93.13	96.55	0.30**	1.41
Jalgaon	20.15	20.72	0.19 <sup>NS</sup>	1.53
Ahmednagar	205.16	277.64	4.02***	7.85
<b>Nashik Region</b>	<b>462.68 (29.86)</b>	<b>556.09 (33.81)</b>	<b>2.35***</b>	<b>4.18</b>
Pune	173.40	201.65	1.89***	3.22
Satara	183.00	179.12	-0.48*	2.64
Sangli	125.19	105.26	-2.52***	7.18
Solapur	152.02	139.38	-1.87 <sup>NS</sup>	19.61
Kolhapur	77.17	114.57	4.74**	19.96
<b>Pune Region</b>	<b>710.78 (45.87)</b>	<b>739.98 (44.99)</b>	<b>0.36**</b>	<b>1.36</b>
Aurangabad	45.72	45.73	-0.19 <sup>NS</sup>	2.11
Jalna	25.57	24.84	-0.58**	2.85
Parbhani	19.54	19.36	-0.33 <sup>NS</sup>	2.39
Beed	87.11	79.44	-1.44***	4.71
Nanded	23.53	25.05	0.68***	1.32
Osmanabad	28.66	26.32	-1.33***	4.45
Latur	22.00	26.48	2.39***	4.70
<b>Aurangabad Region</b>	<b>252.12 (16.27)</b>	<b>247.21 (15.03)</b>	<b>-0.45*</b>	<b>2.56</b>
Buldhana	48.63	45.07	-1.21***	4.16
Akola	9.17	11.02	2.32***	4.05
Amravati	10.67	11.68	1.09***	1.79
Yavatmal	4.83	5.10	0.50***	1.46
<b>Amravati Region</b>	<b>73.29 (4.73)</b>	<b>72.86 (4.43)</b>	<b>-0.27<sup>NS</sup></b>	<b>2.23</b>
Wardha	3.88	2.14	-8.01***	21.78
Nagpur	8.67	7.40	-2.29***	6.59
Bhandara	1.12	1.32	1.70***	3.52
Chandrapur	21.07	10.20	-9.59***	26.38
Gadchiroli	7.44	6.42	-2.21***	6.51
<b>Nagpur Region</b>	<b>42.17 (2.72)</b>	<b>27.47 (1.67)</b>	<b>-5.86***</b>	<b>15.72</b>
<b>State Total</b>	<b>1549.55</b>	<b>1644.77</b>	<b>0.63***</b>	<b>1.30</b>

Source: Estimates are based on figures compiled from various reports on 'Milk, Eggs, Wool and Meat Production and Livestock and Poultry Keeping Practices in Maharashtra, Directorate of Animal Husbandry, Maharashtra State, Pune

Notes: TE -1996-97 (Average of 1994-95, 1995-96 and 1996-97)

TE - 2005-06 (Average of 2003-04, 2004-05 and 2005-06)

CGR - Annual Compound Growth Rate between 1995-96 and 2005-06

CII - Coppock Instability Index between 1995-96 and 2005-06

\*\*\*, \*\* and \* imply significance of growth rates at 1, 5 and 10 per cent level of probability.

NS- Non-significance of growth rates

Figures in parentheses are percentages to the total egg production of the State.

As for the rates of growth in wool production, except Nashik and Pune regions, all the regions of the State showed a negative annual growth rate in their wool production with decline in the same being more sharp in the case of Konkan region, followed by Nagpur, Aurangabad and Amravati regions. In fact, it was mainly because of 2.35 per cent annual growth in wool production in Nashik region that overall annual growth in wool production in Maharashtra turned out to be positive during the period between 1994-95 and 2005-06. The region of Nashik, contributing about 45 per cent share in total wool production of the State, also showed about 0.36 per cent annual growth in the same during the last one decade. As a result, the state of Maharashtra registered an annual growth rate in wool production to the tune of 0.63 per cent between 1994-95 and 2005-06. Further, the extent of instability was very high in the case of districts like Solapur, Kolhapur, Sindhudurg, Greater Bombay and Wardha. Very high instability in the case of these districts with the exception of Kolhapur district is a matter of concern as the wool production in these districts have declined significantly over the last one decade, which obviously require corrective measures in these districts to enhance wool production, especially for higher contribution of the State to the country's total wool production.

The district of Ahmednagar occupied 1<sup>st</sup> position in wool production of Maharashtra during the period between 1994-95 and 2005-06 (Table 4.12). As for wool production, the ranking of Pune district was noticed to be 2<sup>nd</sup> during TE 2005-06 and 3<sup>rd</sup> during TE 1996-97. The ranking of Satara district was found to decrease from 2<sup>nd</sup> to 3<sup>rd</sup> between TE 1996-97 and TE 2005-06. On the other hand, the districts of Nashik showed an increase and Solapur a decrease in their ranking in terms of wool production of the State, the increase being from 5<sup>th</sup> to 4<sup>th</sup> for Nashik and decrease being from 4<sup>th</sup> to 5<sup>th</sup> for Solapur district during the same period. A significant rise in wool production in Kolhapur district was noticed between TE 1996-97 and TE 2005-06, and consequently its ranking in total wool production in the State increased from 9<sup>th</sup> to 6<sup>th</sup> during this period. The districts of Sangli and Dhule showed a decline in their ranking from 6<sup>th</sup> to 7<sup>th</sup> and 7<sup>th</sup> to 8<sup>th</sup>, respectively, in terms of total wool production in the State between TE 1996-97 and TE 2005-06. In general, the districts showing an increase in their ranking in total wool production of the State during the period between 1994-95 and 2005-06 were Thane, Nashik, Jalgaon, Pune, Kolhapur, Aurangabad, Parbhani, Latur, Akola, Amravati, Yavatmal, Wardha, Bhandara and Gadchiroli, whereas districts like Greater Bombay, Dhule, Satara, Sangli, Solapur, Jalna, Beed, Osmanabad, Buldhana and Chandrapur showed a decrease in their ranking in this respect during the same period. The ranking of

some of the districts in terms of total wool production of the State did not change between 1994-95 and 2005-06 and these districts were Raigad, Ratnagiri, Sindhudurg, Ahmednagar, Nanded and Nagpur. The districts belonging to Konkan region ranked very low in total wool production of the State due to lower concentration of sheep population in these districts.

**Table 4.12: Ranking of Districts According to Total Wool Production in Maharashtra**

Districts	Period – I TE 1996-97	Period – II TE 2005-06	Change
Brihan Mumbai/ Greater Bombay	22	28	Decrease
Thane	28	26	Increase
Raigad	27	27	Constant
Ratnagiri	30	30	Constant
Sindhudurg	29	29	Constant
Nashik	5	4	Increase
Dhule	7	8	Decrease
Jalgaon	17	16	Increase
Ahmednagar	1	1	Constant
Pune	3	2	Increase
Satara	2	3	Decrease
Sangli	6	7	Decrease
Solapur	4	5	Decrease
Kolhapur	9	6	Increase
Aurangabad	11	10	Increase
Jalna	13	15	Decrease
Parbhani	18	17	Increase
Beed	8	9	Decrease
Nanded	14	14	Constant
Osmanabad	12	13	Decrease
Latur	15	12	Increase
Buldhana	10	11	Decrease
Akola	20	19	Increase
Amravati	19	18	Increase
Yavatmal	24	23	Increase
Wardha	25	24	Increase
Nagpur	21	21	Constant
Bhandara	26	25	Increase
Chandrapur	16	20	Decrease
Gadchiroli	23	22	Increase

Rank Correlation  
Coefficient :

$$R_{12} = 0.9786$$

Source: Estimates are based on figures compiled from various reports on 'Milk, Eggs, Wool and Meat Production and Livestock and Poultry Keeping Practices in Maharashtra, Directorate of Animal Husbandry, Maharashtra State, Pune  
Note: Period –I = 1985/86 to 1987/88; Period –II = 1994/95 to 1996/97; Period –III = 2003/04 to 2005/06  
TE – Triennium Ending

As for wool production, the estimated rank correlation coefficient in respect of cross-section of districts was positive as well as very high between the period I and II (0.9786), implying not much of a change in the ranking of districts in respect of their contribution to State's total wool production during the period between 1994-95 and 2005-06. In fact, there were only quite a few major wool producing districts in Maharashtra and the contribution of other districts remained low and they did not show much change in their ranking in total wool production of the State.



#### 4.4 Structural Changes in Meat Production in Maharashtra

Since meat production data relating to different district of Maharashtra are not available in any of the data sources, the analysis here stands performed for the State as a whole with respect to meat production through various species of livestock. The estimates relating to meat production of Maharashtra along with rates of growth in meat production estimates and instability in growth rates in this respect for the period between 1985 and 2005-06 are brought out in Table 4.13.

**Table 4.13: Meat Production According to Various Species in Maharashtra**

Species	TE 1987-88	TE 1996-97	TE 2005-06	CGR (%)			CII		
				Period-I	Period-II	Period-III	Period-I	Period-II	Period-III
Cattle's	51.90	52.63	58.50	-0.86 <sup>NS</sup>	1.10*	0.62**	6.72	5.24	5.89
Buffaloes	30.81	65.91	88.06	6.50***	2.62***	6.79***	14.33	2.90	10.24
Sheep's	23.93	16.57	25.95	-3.60**	5.76***	1.40*	10.59	14.84	15.70
Goats	43.98	32.17	53.06	-1.92*	5.32***	1.57**	8.46	12.57	11.85
Pigs	5.65	4.87	4.95	-4.32***	-0.31 <sup>NS</sup>	-0.18 <sup>NS</sup>	6.00	4.98	5.09
Total	157.60	172.15	230.52	0.21 <sup>NS</sup>	2.98***	2.67***	6.37	3.67	5.13

Notes: Period-I = 1985-86 to 1994-95; Period-II = 1995-96 to 2005-06; Period-III = 1985-86 to 2005-06

TE -1987-88 \*Average of 1985-86, 1986-87 and 1987-88)

TE -1996-97 (Average of 1994-95, 1995-96 and 1996-97)

TE - 2005-06 (Average of 2003-04, 2004-05 and 2005-06)

CGR - Annual Compound Growth Rate

CII - Coppock Instability Index

\*\*\*, \*\* and \* imply significance of growth rates at 1, 5 and 10 per cent level of probability.

NS- Non-significance of growth rates

The total meat production in Maharashtra through various species of livestock has grown reasonably over the last two decades with the period between TE 1996-97 and TE 2005-06 showing much sharper increase in the same as against the period between TE 1987-88 and TE 1996-97 (Table 4.14). The meat production in Maharashtra was estimated at 1.58 lakh tonnes during TE 1987-88, which increased to 1.72 lakh tonnes during TE 1996-97 and by the TE 2005-06, it had grown to 2.31 lakh tonnes, showing thereby nearly 50 per cent increase over the last two decades (Tables 4.13 and 4.14). The annual growth in meat production of Maharashtra was estimated at 2.67 per cent between 1985-86 and 2005-06, which mainly came through substantial growth (2.98 per cent) in the same during the period between 1995-96 and 2005-06 as growth (0.21 per cent) in the same between 1985-86 and 1994-95 turned out to be very marginal.

It is to be noted that though cattle accounted for the major share in total meat production in Maharashtra during eighties and even nineties period, the scenario changed thereafter and at present buffaloes account for major share in total meat production of the State. In fact, there has been steady decline in share of cattle in total meat production of

Maharashtra between 1985-86 and 2005-06 in the face of continuous increase in this share for buffalo meat production. The share of cattle in total meat production of Maharashtra declined from 34 per cent during TE 1987-88 to 25 per cent during TE 2005-06 as against an increase in this share with respect to buffalo meat from 20 per cent to 38 per cent during the same time (Table 4.14). The major increase in buffalo meat production in Maharashtra was noticed between the mid-eighties and mid-nineties and thereafter it increased at a slower pace. However, the major increase in cattle meat production took place between the TE 1996-97 and TE 205-06 as against the period between TE 1987-88 and TE 1996-97. Another species of livestock contributing significantly to the total meat production of Maharashtra was goat, which accounted for 28 per cent share in total meat production of the State during TE 1987-88 and 23 per cent share during TE 2005-06 (Table 4.14). The goat meat production in Maharashtra grew at the rate of 5.32 per cent a year between 1995-96 and 2005-06, though it recorded a negative annual growth in the same at 1.92 per cent between 1985-86 and 1994-95. Similarly, meat production through sheep expanded at an annual growth rate of 5.76 per cent between 1995-96 and 2005-06 as against declining growth in the same at 3.60 per cent between 1985-86 and 1994-95. This is an indication of the fact that meat production through sheeps and goats in Maharashtra expanded tremendously only in more recent times as the period between mid-eighties and mid-nineties show negative growth in meat production of the State.

**Table 4.14: Changing Structure in Meat Production through Various Species in Maharashtra**  
(in '000' MT)

Species	TE 1987-88	TE 1996-97	TE 2005-06	Per cent Change		
				TE 1996-97 over TE 1987-88	TE 2005-06 over TE 1996-97	TE 2005-06 over TE 1987-88
Cattle's	51.90	52.63	58.50	1.39	11.17	12.71
Buffaloes	30.81	65.91	88.06	113.97	33.59	185.84
Sheep's	23.93	16.57	25.95	-30.74	56.60	8.46
Goats	43.98	32.17	53.06	-26.87	64.94	20.62
Pigs	5.65*	4.87	4.95	-13.91	1.75	-12.40
Total	157.60	172.15	230.52	11.50	33.91	49.31
Share in Maharashtra (in per cent)						
Cattle's	33.62	30.57	25.38	-9.07	-16.98	-24.51
Buffaloes	19.95	38.29	38.20	91.90	-0.24	91.44
Sheep's	15.50	9.63	11.26	-37.88	16.95	-27.36
Goats	28.49	18.68	23.02	-34.41	23.18	-19.21
Pigs	2.44	2.83	2.15	15.82	-24.01	-12.00

Note: TE -1987-88 \*Average of 1985-86, 1986-87 and 1987-88)

TE -1996-97 (Average of 1994-95, 1995-96 and 1996-97)

TE - 2005-06 (Average of 2003-04, 2004-05 and 2005-06)

As for meat production, pigs showed lowest contribution to the total meat production of the State. Not only this, meat production through pigs declined over the last two decades, the decline being at the rate of 4.32 per cent a year between 1985-86 and 1994-5 and 0.31 per cent between 1995-96 and 2005-06. Over the last two decades pig meat production in Maharashtra has been declining at an annual rate of 0.18 per cent. In fact, production of meat through pigs has come down from 5.65 thousand tonnes during TE 1987-88 to 4.95 thousand tonnes during TE 2005-06. During the same period, the production of meat through goats and sheep has expanded from 43.98 to 53.06 thousand tonnes and 23.93 to 25.95 thousand tonnes, respectively. In general, meat production in Maharashtra through various species of livestock expanded only during the last one decade as the annual growth in the same stood at 2.98 per cent between 1995-96 and 2005-06 as against only 0.21 per cent between 1985-86 and 1994-95.

The instability in meat production was noticed to be very high in the case of buffalo between 1985-86 and 1994-95 and for sheep, goats and pigs between 1995-96 and 2005-06. As a result, the overall fluctuation in meat production during the period between 1985-86 and 2005-06 turned out to be high for buffalo, sheep, goats and pigs meat production. In general, the instability in meat production in Maharashtra through various species of livestock was moderate between 1985-86 and 2005-06, which was associated with moderate rate of growth in meat production for the State during this period, though this did not hold good for the period between 1985-86 and 1994-95.

#### **4.5 Livestock Production Scenario in Maharashtra**

Two differing points of view emerged about the status of livestock rearing in the state of Maharashtra. While the State showed remarkable progress in terms of overall growth in livestock production over the last two decades with respect to milk, eggs, wool and meat, there were also wide inter-and intra-regional variations in growth rates during this period. The factors underlying regional imbalances in the growth of livestock production could be many. Imbalances might be associated with (a) differences in the distribution of breedable bovine population in different regions of the State, (b) differences in resource base with respect to feeds and fodder and animal health cover, (c) differences in terms of number of insemination in the field areas for breed improvement and thereby causing differences in genetic architecture of milch animals, and (d) differences in the productivity of animals.

The higher potentiality of livestock production in the case of some of the districts and regions of Maharashtra was assessed through significant and higher rate of growth

associated with higher index of instability of livestock production. The ready acceptability of modern technology by the livestock rearing households in rural settings, intensive efforts by the dairy co-operatives in providing balanced cattle feed, veterinary services and the availability of other infrastructure facilities could be considered as the other underlying forces that have transformed the status of livestock in most of the districts and regions of Maharashtra. In fact, dairy co-operative movement in this State has contributed in no small measure towards this substantial growth in milk production and, there cannot be two opinions about it. Not only this, the course of time has witnessed implementation of several programmes and schemes relating to livestock development in the state of Maharashtra, which truly transformed this State as one of the most important states of India insofar as livestock resources are concerned. As a result, the state of Maharashtra boasts to have significant share not only in total milk production of India but also in egg, wool and meat production.

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## CHAPTER – V

### LIVESTOCK DEVELOPMENT POLICIES AND PROGRAMMES IN MAHARASHTRA

The chapter mainly deals with providing a broader insight into various livestock development policies, programmes and schemes that were initiated in the state of Maharashtra for improving the overall livestock resource base of the state. It also brings into focus functions, aims and objectives of the Department of Animal Husbandry, Government of Maharashtra and various action points under taken by the Government with respect to genetic improvement of cattle and buffalo, disease control, livestock health care practices, availability of feeds and fodder, conservation practices of native breeds, quality control aspects, etc., besides providing a historical backdrop on policies and programmes relating to livestock sector of the State.

#### **5.1 Historical Backdrop on Livestock Policies and Programmes**

Several programmes and schemes relating to improvement of livestock health were initiated in Maharashtra even before the formation of the State in May 1961 when there existed Bombay State, which encompassed the current states of Gujarat, Maharashtra and part of Andhra Pradesh, Karnataka and Madhya Pradesh. For instance, in 1931, the Indian Council of Agricultural Research (ICAR) initiated a general scheme initially for five years that aimed at investigation into the diseases and mortality among animals belonging to Bombay province. The scheme implemented by the Bombay Government was partly subsidized by the ICAR and it continued as a partly subsidized scheme till 1948. The scheme was finally provincialised from April 1, 1948 with Government bearing the entire expenditure of the scheme keeping in view the importance of research investigation into animal diseases. The Department of Agriculture subsequently built up Disease Investigation Section to cater the needs of the farmers in the State. The success of this scheme led the ICAR to introduce another scheme relating to investigation into diseases in poultry birds, which was partly subsidized by ICAR for three years, and this scheme continued until March 1950 and subsequently got entirely financed by the State.

Another landmark in the history of Department of Agriculture was the manufacture of goat virus to control Rinderpest disease. With a view to produce various biological products, an Institute of Veterinary Biological Products came into being in

Bombay with effect from July 19, 1947, which was shifted from Bombay to Pune in 1959, and since then it has been functioning as an Institute of Veterinary Biological Products – premier vaccine manufacturing Institute of the State.

It is to be noted that a serious threat to the cattle of the country surfaced when indiscriminate slaughter of animals was taking place in Bombay State to meet the rising demand for meat, which included milch as well as young draught cattle. A statement with respect to number of animals slaughtered, including sheeps and goats, in the recognized slaughter houses in Maharashtra is provided in Table 5.1.

**Table 5.1: District-wise No. of Animals Slaughtered in Recognized Slaughter Houses (2003-04)**

Districts/Regions	Number of Slaughter Houses	Number of Animals Slaughtered				
		Bullocks	Buffaloes	Sheep	Goats	Pigs
Greater Mumbai	1	88820	104569	325396	538308	34796
Thane	3	13363	15994	10640	12079	-
Raigad	1	-	-	-	-	-
Ratnagiri	-	-	-	-	-	-
Sindhudurg	2	-	-	-	-	-
<b>Konkan Region</b>	7	102183	120683	336036	550387	34796
Nashik	10	11704	8363	268	-	-
Dhule	4	924	1427	14	-	-
Nandurbar	5	10689	4909	-	-	-
Jalgaon	19	10689	3378	-	-	-
Ahmednagar	7	5216	660	2780	2809	-
<b>Nashik Region</b>	45	39224	18737	3062	2809	-
Pune	8	23166	17556	591	646	-
Satara	12	3958	143888	12385	13318	-
Sangli	2	6940	19085	-	-	-
Solapur	4	481	519	-	-	-
Kolhapur	13	458	15449	29235	40295	-
<b>Pune Region</b>	39	35003	196497	42211	54259	-
Aurangabad	11	14987	254000	7876	802	-
Jalna	5	5009	468	-	-	-
Parbhani	6	4216	3029	-	-	-
Beed	11	2277	895	-	-	-
<b>Aurangabad Region</b>	33	26489	258392	7876	802	-
Latur	6	176	1	-	-	-
Osmanabad	4	1285	920	-	-	-
Nanded	17	7386	41481	-	-	-
Hingoli	11	1879	107	-	-	-
<b>Latur Region</b>	38	10726	42509	-	-	-
Amravati	47	8356	135	-	-	-
Akola	28	16302	1186	1707	1340	-
Washim	14	5667	468	536	517	-
Buldhana	26	16518	787	2897	5070	-
Yavatmal	30	9547	1278	5642	3959	31
<b>Amravati Region</b>	145	56390	3854	10782	10886	31
Nagpur	6	13302	10273	49951	27850	195
Wardha	14	-	-	3308	2110	-
Bhandara	1	-	-	874	616	-
Gondia	-	-	-	-	-	-
Chandrapur	7	153	29	-	-	-
Gadchiroli	3	6	-	-	-	-
<b>Nagpur Region</b>	31	13461	10302	54133	32051	195
<b>Maharashtra State</b>	338	283476	650854	454100	651194	35022

Source: Department of Animal Husbandry, Government of Maharashtra, Pune

The indiscriminate slaughter of animals led Government of India to impose certain restrictions on slaughter of useful cattle under Defence of India Rules, especially to conserve cattle wealth of the country. As a result, the Government of Bombay issued an order to ban slaughter of useful animals and also issued a separate order of fixing a weekly quota of slaughter of animals at different slaughter houses of the State. The system of licensing the dealers in the trade of animals was also introduced. The orders were issued under Bombay Essential Commodities and Cattle (control) Act, 1946. The enactment of Bombay Animal Preservation Act in 1948 saw implementation of more stringent measure to conserve cattle wealth of the State, which enabled Veterinary Officers to inspect animals rendered for slaughter at the slaughter houses, especially at those important places where number of animals slaughtered tended to be fairly high. Though the act of 1948 was applied to the same places from December 1, 1942, gradually it translated to the Municipal Council areas of Kalyan from June 1, 1954, and in rest of the State the order issued under the act of 1946 remained in force. Further, a scheme viz. "Immunization of Cattle against Diseases and Consequent Reduction in Livestock Mortality" was launched in 1943 on a moderate scale with the aim of preserving livestock wealth. Under this scheme, stockmen were appointed for immunization work who were drawn from the cadre of Compounders and Dressers in local board service in the beginning. However, a regular one-year course viz. 'Stockmen Training Course' was initiated in 1946 that enrolled ex-servicemen at Bombay in the first year, and subsequently this course got introduced in Nashik, Hingoli and Nagpur. This course was withdrawn when the demand for stockmen was adequately met.

Since Artificial Insemination (AI) was considered as the most expeditious method for the breed improvement of cattle in advanced countries during that time, the Government of Bombay decided to open a couple of AI centres in the Bombay Provinces, which was done after probing the utility of the method under Indian conditions. Establishment of Key Village Centres was another milestone in propagating AI work at the village level. In 1965, the State Government initially established Intensive Cattle Development Projects (ICDP) at Pune, Miraj, Dhule and subsequently at Chiplun (1967), Jalna (1972), Nagpur (1972) and Amraoti (1975). Every ICDP had six Regional AI centres with each having 15 sub-centres and each sub centre was catering to 1,000 breedable cattle population. Thus, each ICDP catered to about 1,00,000 breedable cattle population in the entire project. Each ICDP had also a Centralized Semen Collection

Centre (CSCC), which maintained bulls for collection of semen and subsequent supply of it to the sub-centres.

Though the state of Maharashtra came into being in 1960, the activities relating to animal husbandry were under the gamut of the Department of Agriculture. However, the Animal Husbandry and Dairying was recognized as a separate entity and on 1<sup>st</sup> May 1984 the Department of Animal Husbandry was created in the State, which changed the structure of ICDP, and subsequently only the field centres i.e. Regional AI Centres and AI Sub Centres continued.

Notably, the disease like *Rinderpest* had been responsible in the past for the 60 per cent mortality of cattle from epidemic. With the availability of freeze dried vaccine and allocation of funds by the then Planning Commission to tackle the problem, the Government of India appointed a Central *Rinderpest* Control Committee in 1954 with the objective of carrying out a pilot project to eradicate *Rinderpest* in suitable areas of South, especially to gain experience and assess the progress and also to know its economics before its implementation at all India level. The pilot project, which was initially started in southern districts of the then Bombay State, extended to Bijapur and Belgaon districts in 1955 and later extended to all the districts of the pre-organized and post-organized state of Bombay. The work under the scheme got completed in 1961 and the follow-up programme was undertaken through interstate check posts established in the State boundaries to prevent ingress of the disease through the adjoining States. Mobile Vigilance Units were also established to control the disease, which meant to create an immune belt of 20 km length on the inter-state border. Similarly, a Special *Rinderpest* Control Unit was established to control of *Rinderpest* in Greater Bombay. The unit is known as *Rinderpest* Containment Vaccination Unit.

The National Project for *Rinderpest* Eradication (N.P.R.E.) - an E.E.C. assisted Programme- was launched in April 1992 in the country. This Project has been working as a forerunner to an integrated effort aimed at strengthening the veterinary services to control livestock diseases in India. The Project aims at eradication of *Rinderpest* and contagious bovine pleuropneumonia (C.B.P.P.) through an improved management of health coverage. The state of Maharashtra has also been covered under this project and is in Zone-B since 1995-96. The State is thus partially free from *Rinderpest*, as no outbreaks of *Rinderpest* in bovines have been reported in the State since 1991-92. The vaccination against *Rinderpest* has been totally stopped in the State since 1996-97. Prior to this, the State was in Zone-C. As per the strategy for Zone C, the vaccination against *Rinderpest*



was undertaken on mass scale in all the districts bordering other States. Similarly, sheep and goats in all the districts of the State were vaccinated against Rinderpest. Achievement in the vaccination campaigns as a part of NPRES was 100 per cent. The animals vaccinated during the project period were serologically evaluated for their immune status to judge the success of vaccination. Seromonitoring was thus an essential component of the National Project on Rinderpest Eradication. E.E.C. assistance was received in the form of equipment, vehicles and technology. The expenses towards N.P.R.E. were financed by the Government of India. However, the State Government continued to bear the establishment cost of staff in the State to control Rinderpest.

It requires mention here that some of the activities relating to livestock welfare carried out by Department of Animal Husbandry were transferred to Zilla Parishads and Panchayat Samities with the enactment and passing of “ The Maharashtra Zilla Parishads & Panchayat Samities Act, 1962 (Maharashtra Act No. V of 1962)”, which mainly encompassed: (i) Veterinary Aid (excluding veterinary hospitals at Nashik, Pune, Aurangabad and Nagpur but including other veterinary hospitals), veterinary dispensaries, veterinary aid centres and veterinary chests, (ii) District Premium Bull Scheme, (iii) Scheme for extensive work in livestock improvement (Supplementary Cattle Breeding Centres), which has subsequently being discontinued by the State Government, (iv) Scheme for continuance of Premium Bull Centres in scheduled areas, (v) Scheme for opening of Premium Bull Centres in non-scheduled areas (vi) Opening up of 21 Premium Bull Centres in Deoni Tract and 4 Premium Bull Centres in Tuljapur and Osmanabad Talukas, (vii) Scheme for location of Cow Bulls in the development areas of the extension wing of the Agriculture College, Pune, (viii) Registration of Deoni Cattle and Milk Recording Scheme, (ix) Scheme regarding posting 8 Stud Bulls in Marathawada, (x) Organization of Cattle Shows and Rallies, Grant of help towards award of prizes, (xi) Scheme for development of *Goshalas* and *Panjrappoles* in the Bombay area of the State, (xii) Scheme for *Goshala* Development in Vidarbha Region, (xiii) Scheme for *Goshala* Development in Marathawada Region, (xiv) Scheme for payment of grant-in-aid to various institutions, (xv) Scheme for grant of loans to approved poultry students for starting private poultry farms, (xvi) Scheme for poultry improvement in scheduled areas (xvii) Artificial Insemination Sub Centres, (xviii) Key Village Scheme, Aurangabad, (xix) Sheep & Wool Extension Centres, and (xx) Poultry Demonstration Centres.

The Zilla Parishads are entitled to receive 100% purposive grants from the Government through the Department of Animal Husbandry for running the above activities according to the orders and instructions of the Government issued from time to time as these activities remained functional even prior to the formation of State on 1<sup>st</sup> May 1960 when Government of Bombay State stood the governing body.

There were several other programmes that came into being from time to time, e.g. the Cattle Development Programme. This programme aims at crossbreeding the local cows with exotic dairy breeds for increasing milk production of indigenous cows and improvement of indigenous local cattle breeds through selective breeding practices. The crossbreeding of cows with Jersey, Holstein Friesian, etc. has in been in operation since 1969-70. The cattle development programme is carried out through six major activities viz. (i) Cattle Breeding Farms, (ii) Intensive Cattle Development Projects, (iii) Key Village Centres, (iv) District Artificial Insemination Centres, (v) Premium Bull Scheme, Supplementary Cattle Breeding Centres and Artificial Insemination Sub-Centres under Local Sector and (vi) Fodder Development Programme. Another very important programme, i.e. Special Livestock Production Programme was launched in Maharashtra under Centrally assisted scheme during 1977-78, which envisaged distribution of subsidy for rearing crossbred heifers (milk production), poultry production, sheep production and piggery production. This programme was implemented in 14 districts of the State. The milk production programme was sanctioned for the districts of Thane, Nashik, Beed, Aurangabad, Parbhani, Nanded, Nagpur, Wardha and Bhandara and the poultry production programme for the districts of Thane, Nashik, Satara and Sangli. Under poultry production programme, each beneficiary receives aid in the form of housing of poultry birds and 50 birds at laying stage. Under the programme 301 poultry units were established in four districts. The sheep production programme was undertaken in Pune, Sangli, Ahmednagar, Solapur and Beed districts. Under the programme, a unit of 20 ewes and 1 ram is sanctioned to each beneficiary by providing financial assistance to the extent of Rs.3,000. The 'Small Farmers' receive a subsidy at 25 per cent and 'Marginal Farmers and Agricultural Labourers' at 33.3 per cent of the above amount. The piggery production programme was sanctioned to the districts of Thane and Nashik with the assistance from MAFCO during 1977-78, and this scheme envisaged supply of 10 weaners to 'Small/Marginal Farmers' and 'Agricultural Labourers'. Financial assistance for housing, purchase of piglets, etc. to the extent of Rs.2,320 is given to the beneficiaries. Out of this amount, the 'Small Farmers' receive a subsidy at 25 per cent

and 'Marginal Farmers/Agricultural Labourers' at 33.3 per cent. The weaners fattened by the beneficiaries are being sold to MAFCO. Under Special Livestock Production Programme, a total of 23,07,662 vaccinations were performed during 1979-80 against diseases in cattle, poultry, sheep and pigs.

## **5.2 Aims and Objectives and Action Points AH Department**

The major aims as well objectives of the Department of Animal Husbandry (AH), Government of Maharashtra mainly revolve around: (a) Genetic Improvement of Livestock by Scientific Intervention to bring about increase in productivity of Livestock in the existing farming system and conservation of Native Breeds, (b) Livestock diseases prevention and control, (c) increasing awareness amongst the rural masses regarding improved Animal Husbandry practices, (d) providing gainful self-employment to the weaker sections of the society in livestock sector and (e) creating and maintaining a "Disease Free Status" with respect to major production areas so as to boost export of livestock products.

In order to achieve these aims and objectives, the department of Animal Husbandry has initiated several action points, which include: (i) achieving level of 60 per cent in Genetic Improvement of Cattle and Buffalo, (ii) effectively controlling dreadful contagious diseases like PPR (Pestis Des Petits ruminants), Foot and Mouth disease, Brucellosis, Rabies, Haemorrhagic Septicaemia, Black Quarter in livestock as well as Ranikhet Disease, Salmonellosis in poultry, (iii) providing effective and efficient health coverage to the livestock and poultry through existing network of veterinary institutions, covering both preventive and curative aspects, (iv) bringing about a balanced regional development in animal husbandry sector, amongst all the regions of the State through implementation of special area specific programs and by means of need based expansion and strengthening of the veterinary infrastructure, (v) organizing Animal Health Camps, Work-Campaigns, Beneficiary-Training Programs as tools of extension, (vi) updating human resources of the department through various trainings and keep them highly motivated, (vii) encouraging development and growth of Poultry industry in back yard poultry and self help groups through Co-operative initiative, (viii) coordinating and thus consolidating the work of Non Government Organizations in Livestock Development and conservation of Native breeds of animals, (ix) ensuring availability of fodder for fulfillment of its requirement within the state, (x) certifying slaughter of disease free 'Scheduled' animals for the sake of wholesome and hygienic meat production, (xi) ensuring E-governance and concept of paperless office and (xii) ensuring adherence to

quality standards in delivery of veterinary service as per the mandate of Indian Veterinary Council Act 1984.

### **5.3 Functions of AH Department**

The Department of Animal Husbandry, Government of Maharashtra is primarily responsible for the formulation as well as implementation of Livestock Policy throughout the State and it carries out its functions through various functionaries and institutions under the Department mostly by way of implementation of various developmental activities through plan and non-plan schemes. Some of the main items of its functions relate to: (a) Breeding Policy for livestock and poultry, (b) Animal Health Care and Disease Control, (c) Disease Diagnosis and Surveillance, (d) Manufacturing and Supply of veterinary biological and critical inputs for Genetic Improvement Programme, (e) Veterinary Education and Research through Maharashtra Animal and Fisheries Science University, (f) Promotion of Cooperative Poultry and Backyard Poultry, (g) Compilation and Analysis of Statistics, (h) Assessment of Production of animal products, (i) Feed and Fodder Development, (j) Conservation of Native Breeds, (k) Implementation of statutes and Acts relating to livestock, (l) Quality Control of Animal Products for export., etc.

### **5.4 Livestock Policies in Maharashtra**

In order to improve breeding efficiency and thus production potential of livestock, a number of policies have been initiated in the state of Maharashtra, and important among these are: (a) Breeding Policy for Non-Descript Cattle, (b) Breeding Policy for Indigenous Cattle, (c) Breeding Policy for Buffaloes, (d) Breeding Policy for Sheeps and Goats, (e) Breeding Policy for Poultry, (f) Livestock Policy for Health Care, (g) Policy for ensuring quality AI Services and Inputs, (h) Policy for Feed, Fodder, Animal Nutrition and Grazing, (i) Policy for Animal Product Development, Quality Control, Marketing and Export Promotion, (j) Policy for Veterinary Education, Human Resource Development and Extension, (k) Policy for Livestock Insurance, (l) Policy for Removal of Regional Backlog of Veterinary Institutions and (m) Policy Regarding Self Employment in Animal Husbandry Sector and Public-Private-Cooperative Participation.

#### ***(a) Breeding Policy for Non-Descript Cattle***

The breeding policy for cattle is in consonance with National Project for Cattle and Buffalo Breeding (NPCBB) and it aims at increasing productivity of cows by genetic improvement, aside from conserving the native breeds and ensuring adequate supply of good quality bullocks for animal draught power in rural areas. With a view to enhance milk production, the policy also aims to achieve a genetic improvement level of 60 per

cent by the end of 2015 and 80 per cent by 2025 from the current level of 28 per cent. These targets are expected to be achieved through consolidated and collective efforts of all the agencies engaged in cattle breeding activity viz. State Animal Husbandry Department, Co-operative Milk Unions, NGOs, Private Sector Agencies and unorganized Artificial Insemination (AI) workers in the state. Further, in order to achieve these genetic up-gradation levels, three pronged strategies are proposed to be adopted viz. (i) cross-breeding programme for genetic up-gradation of targeted non-descript cattle population in targeted herd / areas where cross-breeding program is suitable and desirable but excluding the home / breeding tracts of identified indigenous breeds of the state, (ii) natural service through 'true to type' bulls of selective native breeds, and (iii) conservation of native breeds by genetic up-gradation using semen of proven / 'true to type' bulls of the same breed and also by appropriate advanced means of bio-technology such as semen preservation, embryo preservation etc. It is envisaged that Breeder-farmers and Breeder's Associations will play an important role in breed conservation.

***(b) Breeding Policy for Indigenous Cattle***

Since the home / breed tracts of Deoni, Dangi, Khillar, Gaulao and Red Kandhari have been identified as indigenous breeds of cattle, they need to be protected and propagated through introduction of suitable technology, especially to evaluate draught power of indigenous breeds, and to achieve this three pronged strategy for genetic up-gradation/conservation of native breeds will be adopted such as (i) introduction of selected breeding bulls in herds/villages for natural service in the home tracts of these breeds, (ii) supply of frozen semen of proven / true to type indigenous breed for carrying out AI work in home tract of these breeds and also for cows of any of such breeds elsewhere and (iii) prevention of destroying of native breeds during the process of cross-breeding. The Breeder's Association will be involved in conservation of indigenous breeds and a system of herd registration, suitably designed milk competition etc. will be introduced to identify the high-milk yielding animals of indigenous breed and putting in place suitable system of buy-back of pedigreed male-calves for rearing them for getting quality breeding bulls. Further, the existing programme of castration of scrub bulls will ensure that breeding bulls of indigenous breeds do not get castrated. However, if the owner so desires, castration of such bulls will be allowed for agricultural purposes.

***(c) Breeding Policy for Buffaloes***

Like policy on cattle, the Breeding Policy for buffalo is in consonance with National Project for Cattle & Buffalo Breeding (NPCBB) and it aims at increasing the

productivity of buffaloes through genetic improvement, besides conservation of native breeds. In order to achieve self-sufficiency in milk production, it aims to achieve a genetic up-gradation level of buffaloes to the extent of 60 per cent by 2015 and 80 per cent by 2025, which is possible through the consolidated and collective efforts of all the agencies engaged in buffalo breeding activity viz. the State Animal Husbandry Department, Co-operative Milk Unions, NGOs, Private Sector Agencies and unorganized AI workers in the state. The semen of *Surati*, *Murrah*, *Mehsana*, *Zafarabadi*, *Pandharpuri* and *Nagpuri* buffaloes are proposed to be used for genetic up-gradation of non-descript buffaloes and also for performance- enhancement of descript buffalo-breeds. The strategy for buffalo breeding policy would revolve around: (i) breeding of descript bulls through semen of bulls of respective breed, (ii) breeding of non-descript buffaloes through the germ-plasm of any one of the identified breeds except *Mehsana* and *Jafarabadi*. However, subsequent selective breeding will be aimed at increasing inheritance level of the first selected breed. For this, superior germ plasm of respective breed of higher pedigreed bulls will be used, (iii) practice of conservation of *Pandharpuri* and *Nagpuri* buffaloes, especially in their home tracts and in other areas having similar geo-climatic conditions. If demanded by owners, these breeds may be used for up-gradation of non-descript buffaloes.

As for conservation of indigenous breeds of buffaloes, it deserves mention that *Pandharpuri* and *Nagpuri* have been identified as two indigenous breeds of buffalo, which need to be protected and propagated, and, therefore, a suitable technology for breed identification needs to be introduced with a team of properly trained man-power to handle this task with the help of National Bureau of Animal Genetic Resources (NBAGR), Karnal, Haryana. The breeding policy of buffaloes will not only encourage Breeder's Association to get involved in conservation of indigenous breeds but it will also allow these Breeder's Association to function on principles of management under its articles of association. Further, under the policy, it is envisaged that a system of herd registration, suitably designed milk competition etc. will be introduced to identify the high-yielding animals of indigenous breed and putting in place a suitable system of buy-back of pedigreed male-calves for developing them into breeding bulls.

#### ***(d) Breeding Policy for Sheeps and Goats***

The breeding policy of sheep primarily aims at enhanced meat production, and that for sheep, increased wool production with a view to meet local demand of meat and wool. Notably, after taking into account the results of on going experimental breeding

efforts with germ plasm found in other parts of India and also in foreign countries, Osmanabadi and Sangamneri breeds of goat and Deccani breeds of sheep are identified as germ plasm for genetic up-gradation of non-descript breeds in respective species. Kanyal breed of goat and Madgyal breed of sheep may be used for up-gradation of local non-descript goats and sheep in their breeding home tracts. Considering the low gestation period and reproductive life span in sheep and goat and also the other implications of artificial insemination technology in sheep and goat, natural service will continue to be the strategy for genetic up-gradation in sheep and goat under the policy. Mention may be made here that the *Punyashloak Ahilaya Devi Sheli va Mendhi Vikas Mahamandal*, Pune; shall be responsible to maintain farms for production of nucleus flocks of selected breeds; organize Breeder-Farmers and Breeder's Association for production of stock to be distributed under its programs and under its plan schemes by suitable strategy of buy back. It may act as supplier of nucleus flocks to such Breeder-Farmers and Breeder's Associations for multiplication. This agency along with its sister concern in Nagpur and Animal Science Division of State Agriculture Universities shall be the designated agencies responsible for conservation of native breeds of sheep and goat with element of public-sector investment.

***(e) Breeding Policy for Poultry***

The breeding policy for poultry aims at increasing production of eggs and poultry meat by increasing productivity of native birds and through introduction of new species of poultry birds, and it mainly covers chicken, Japanese quail and Duck (Table 5.2). The other species of poultry birds are proposed to be bred through private sector initiatives. The breeding policy for chicken breeds mainly covers the species suitable for back yard poultry and low investment poultry. Breeds for commercial poultry involve import of germplasm and parent line which will be determined by Government of India's Policy in this regard and will continue to be carried out primarily by private sector initiatives. Under the policy, the State will continue to supply crossbred stocks of improved breeds like RIR, Black Australorp for low investment commercial poultry and, for this purpose, these types of stocks may also be maintained in the central hatcheries and poultry farms owned by State. The State will continue to have Duck farm for supply of foundation stock of selected ducks breeds such as Khaki Campbell. Duck-fish farming shall also be tried in suitable areas. It is proposed that the State will introduce Japanese quail also in production chain at one or more of its central hatcheries for distribution of

breeding material. Suitable licensing system for farming of Japanese quail will be introduced to prevent killing of Indian Quail in violation of Wild-life Protection Act.

**Table 5.2: Work Done by Central Hatcheries and Intensive Poultry Development Blocks (2003-04)**

Sr. No.	Work Done	Central Hatcheries	Intensive Poultry Development Blocks	Total
1.	Total Egg Production	15,27,204	8,20,488	23,47,692
2.	Percentage of Egg Production	69	35.64	52
3.	No. of Eggs set for hatching	8,68,693	-	8,68,693
4.	Total No. of Chicks produced	6,04,154	-	6,04,154
5.	Average hatching percentage	70	-	70
6.	No. of Eggs sold for hatching	65,559	4,10,013	4,75,572
7.	No. of Chicks purchased	-	2,22,644	2,22,644
8.	No. of Birds sold for rearing/breeding			
	a. Chicks	3,82,894	2,10,570	5,93,464
	b. Pullets	2,670	17,132	19,802
	c. Male (small)	2,473	10,375	12,848
	d. Adult Females	197	1,664	1,861
	e. Adult Males	151	776	927
	f. Total	3,88,385	2,40,517	6,28,902
9.	Total No. of Vaccinations Done	9,79,727	4,57,122	14,36,849
10.	Poultry Training			
	a. Males			
	(i) Backward	277	558	835
	(ii) Others	502	850	1,352
	b. Females			
	(i) Backward	22	46	68
	(ii) Others	28	84	112
	Total No. of Trainees (a + b)	829	1,538	2,367

Source: Department of Animal Husbandry, Government of Maharashtra, Pune

#### **(f) Livestock Policy for Health Care**

The health care services for livestock are provided by the State through its District Polyclinics, Mini-Polyclinics and Dispensaries in local sector (Table 5.3). The health care policy aims at extending the facility of mini-polyclinics in each taluka in phased manner and provision of one veterinary dispensary for 5000 cattle unit in general areas and for 3000 cattle unit in hilly and tribal areas. However, in Municipal Corporation / council areas the local body will be primarily responsible for veterinary health care. Veterinary health-care includes disease prevention, disease diagnosis and surveillance, disease control and disease eradication and treatment of ailing animal etc. It promotes initiatives for providing door-delivery of animal health services and AI services through participation of unemployed veterinarians and non-governmental organizations largely under private investment. The State is committed to join central government's initiatives for disease prevention, disease control, disease eradication, disease diagnosis and surveillance and creation of disease free zone including zoonotic diseases under scheme like ASCAD and FMD-CP etc.



**Table 5.3: No. of Institutions in Animal Husbandry Department (as on March 31, 2004)**

Sr. No.	Name of Institute	State Sector	Local Sector	No. as on March 31, 2004
1.	Veterinary Institutions and Health			
	a. Veterinary polyclinics (Vet. Polyclinics under Agril. Universities -3)	28	3	31
	b. Veterinary Dispensaries	12	1523	1535
	c. Veterinary Aid Centers (ZP i.e. Local Sector)	-	2392	2392
	d. Mobile Veterinary Clinics	-	61	61
	e. Mobile Epizootic Control Units	6	4	10
	f. Check Posts	13	-	13
	g. Vigilance Units	6	-	6
	h. Rinderpest Control Unit, Mumbai	1	-	1
	i. Institute of Veterinary Biological Products, Pune	1	-	1
	j. Disease Investigation Section, Pune	1	-	1
	(i) Regional Disease Investigation Lab (Cattle and Mastitis)	6	1	6
	(ii) Regional Disease Investigation Lab (Sheep, Goat and others)	6	-	6
	(iii) Regional Disease Investigation Lab (Poultry Salmonella)	6	-	6
	(iv) Disease Investigation Lab (Piggery)	1	-	1
	(v) Disease Investigation Lab (Mucosal Disease)	1	-	1
2.	Cattle and Buffalo Development			
	a. Cattle breeding Farms	9	-	9
	b. Exotic Cattle breeding Farms	1	-	1
	c. Bull rearing Centers	2	-	2
	d. Key Village Centers	48	-	48
	e. Regional Artificial Insemination Centers (RAIC)	49	-	49
	Sub Centers under RAIC	670	-	670
	f. District Artificial Insemination Centers (DAIC)	29	-	29
	g. Red Khandhari breeding Center	-	1	1

Source: Department of Animal Husbandry, Government of Maharashtra, Pune

Under livestock policy for health care, the State is committed to deliver effective service through its net work of regional disease investigation laboratories with referral laboratory at Pune. It shall strive to extend the services effectively to other States in Western region through its laboratory at Pune, which has been recognized by the Government of India as Western Regional Disease Diagnostic Laboratory.

***(g) Policy for Ensuring Quality of AI Services***

The quality of AI services includes close monitoring of AI services provided by inseminators, granting of permission of AI to registered inseminators, granting permission for breeding to private agencies who have certain specified minimum facilities for storage and distribution of semen and liquid nitrogen as well as maintaining records about sources of semen used, who are also supposed to implement an AI monitoring system to review the performance of service provided by them. Under the policy, knowledge updating in respect of advance AI technology and quality

consciousness about the AI service delivery will be made mandatory, and necessary “Refresher Training Course” will be made compulsory for all AI workers (in government/ private / co-operative sector). The statement with respect to numerical strength of AI institutions and their performance is brought out in Table 5.4.

**Table 5.4: District-wise No. of Institute with AI Facilities and No. of AI Done (As on March 31, 2004)**

Districts/Regions	Jilla Parishad (Local Sector)	RAIC (HQ) & Sub-Centers	KVC (HQ)	Veterinary Polyclinics	DAIC'S	Veterinary Dispensary (State Level)	Total Institutes	No. of A.I. Done	Average AI Per Institute
Greater Mumbai	4	-	-	-	-	-	4	147	37
Thane	151	-	2	1	-	-	154	15386	100
Raigad	102	16	1	1	-	-	120	14116	118
Ratnagiri	72	80	1	1	-	-	154	19177	125
Sindhudurg	70	20	1	1	-	-	92	14129	154
<b>Konkan Region</b>	<b>399</b>	<b>116</b>	<b>5</b>	<b>4</b>	<b>-</b>	<b>-</b>	<b>524</b>	<b>50255</b>	<b>96</b>
Nashik	231	16	3	1	-	1	252	104169	413
Dhule	73	45	1	1	-	-	120	25171	210
Nandurbar	87	15	1	-	-	-	103	11880	115
Jalgaon	153	23	1	1	-	-	178	45666	257
Ahmednagar	230	-	2	1	-	-	233	180786	776
<b>Nashik Region</b>	<b>774</b>	<b>99</b>	<b>8</b>	<b>4</b>	<b>-</b>	<b>1</b>	<b>886</b>	<b>367672</b>	<b>415</b>
Pune	179	94	1	1	-	1	276	221354	802
Satara	169	16	2	1	-	-	188	184622	982
Sangli	108	45	-	1	-	-	154	157695	1024
Solapur	172	-	-	1	-	-	173	125608	726
Kolhapur	139	32	2	1	1	-	175	184130	1052
<b>Pune Region</b>	<b>767</b>	<b>187</b>	<b>5</b>	<b>5</b>	<b>1</b>	<b>1</b>	<b>966</b>	<b>873409</b>	<b>904</b>
Aurangabad	85	33	-	1	-	1	120	74140	618
Jalna	58	39	-	1	-	-	98	26177	267
Parbhani	80	-	-	-	1	-	81	19439	240
Beed	138	15	1	1	-	-	155	61339	396
<b>Aurangabad Region</b>	<b>361</b>	<b>87</b>	<b>1</b>	<b>3</b>	<b>1</b>	<b>1</b>	<b>454</b>	<b>181095</b>	<b>399</b>
Latur	127	-	2	2	-	-	131	51482	393
Osmanabad	96	-	1	1	-	-	98	44031	449
Nanded	178	-	2	1	-	-	181	38656	214
Hingoli	67	-	1	-	-	-	68	17886	263
<b>Latur Region</b>	<b>468</b>	<b>-</b>	<b>6</b>	<b>4</b>	<b>-</b>	<b>-</b>	<b>478</b>	<b>152055</b>	<b>318</b>
Amravati	105	65	-	1	-	-	171	35540	208
Akola	74	-	-	1	-	-	75	26137	348
Washim	66	-	-	-	-	-	66	15961	242
Buldhana	129	-	-	1	-	-	130	37853	291
Yavatmal	187	-	4	1	-	-	192	32581	170
<b>Amravati Region</b>	<b>561</b>	<b>65</b>	<b>4</b>	<b>4</b>	<b>-</b>	<b>-</b>	<b>634</b>	<b>148072</b>	<b>234</b>
Nagpur	103	80	-	1	-	1	185	41760	226
Wardha	91	15	2	1	1	-	110	22241	202
Bhandara	53	26	-	1	-	-	80	22960	287
Gondia	61	26	-	-	-	-	87	12630	145
Chandrapur	147	-	2	1	1	-	151	20374	135
Gadchiroli	134	-	-	1	1	-	136	11494	85
<b>Nagpur Region</b>	<b>589</b>	<b>147</b>	<b>4</b>	<b>5</b>	<b>3</b>	<b>1</b>	<b>749</b>	<b>131459</b>	<b>176</b>
<b>Maharashtra State</b>	<b>3919</b>	<b>701</b>	<b>33</b>	<b>29</b>	<b>5</b>	<b>4</b>	<b>4691</b>	<b>191617</b>	<b>409</b>

Source: Department of Animal Husbandry, Government of Maharashtra, Pune

It is to be noted that all the agencies producing frozen semen doses shall be put under obligation to have sire selection programs by technically sound progeny testing for crossbred bulls for all levels of exotic inheritance and only semen of top selected bulls

are used for inter-se mating of crossbred cows. Efforts will be made to ensure that all semen stations, whether government, co-operative or private, are registered with the government and they comply with the minimum standards of production specified by the Government of India.

As for quality standards for manufacturing of critical inputs, frozen semen laboratories and frozen semen production, Government of India has prescribed Minimum Standard Protocol (MSP) for frozen semen production, which will be adhered to under national project for cattle and buffalo breeding. The frozen semen production laboratories at Pune, Aurangabad and Nagpur will be strengthened with adoption of French-mini technology of frozen semen production. Further, the bull mother farms functioning under Maharashtra Livestock Development Board will also be strengthened by providing required quality inputs viz. F.S. doses of desired standard, elite cows and bulls through procurement from within the country or through import from other countries, modernization of cattle sheds and augmentation with respect to the coverage of the available land for fodder production. It is also proposed to introduce Livestock Act for ensuring scientific intervention in genetic improvement of livestock and production of critical inputs of high quality for genetic up-gradation of livestock, besides enforcing good management practices in commercial farming of livestock and for taking care of issues relating to health, hygiene, disease control and prevention of animal cruelty.

***(h) Policy for Feeds, Fodder, Animal Nutrition and Grazing***

The policy for feeds and fodder and animal nutrition primarily focuses on: (i) greater freedom to cattle and poultry feed manufacturing units, (ii) encouragement to farmers to allocate minimum 10 percent of the total cultivable land under fodder crop production while making their crop-plan, (iii) conversion of waste lands into community pasture lands through systematic efforts of green cover augmentation under soil and water conservation schemes with involvement of village panchayats and NGOs, (iv) democratization of management of grazing areas on forest land through effective implementation of joint-forest management and giving priority to plant and grass species which provide good quantity and quality of green fodder, etc.

In order to protect the fodder cover on grass-land or on Common Property Resources (CPR), stall-feeding will be promoted by suitable extension tool, programme-based tools and regulatory interventions. The statement relating to fodder seeds supply to farmers and fodder sapplings distribution in Maharashtra is shown in Table 5.5. It is proposed that a study groups will be set up to study the practice of “free-grazing” by

cattle on community pasture land in larger parts of Konkan, Vidarbha, Marathwada and hilly and tribal areas in order to get a suitable intervention tool designed for conserving grass land and at the same time improve the animal husbandry practices adopted by the local people in those areas; the study group will also study various aspects of sheep and goat rearing by shepherd community and intervention tools for improving their lot and also conserving pasture land resources. Promotion of fodder enrichment techniques will be researched and introduced while addressing problems relating to fodder shortage in hilly, tribal and drought prone areas. Further, it is proposed to establish fodder banks in the drought prone areas to tackle problem of fodder scarcity. The quality parameters for cattle and poultry feed, minerals and trace minerals will not only be up-graded but stipulated quality parameters will also be made mandatory for the manufacturers through enactment and enforcement of suitable legislation.

***(i) Policy for Animal Product Development and Quality Control***

The State proposes to provide adequate infrastructure and policy support in this respect where co-operative sector and private sector are playing significant role. Therefore, the State aims at disinvesting from public sector product development unit known as MAFCO. Increased private capital investment in product development, processing, packaging, market development, market intelligence and marketing is envisaged. Under this policy, the State owned Quality Control Laboratory at Goregaon, Mumbai, which is entrusted with the task of quality testing products meant for exports and imports, will be strengthened with a view to meet the stringent quality requirements of export markets and at the same time protecting the domestic consumers. It is also proposed to set up export-zones, pack houses etc through private sector initiatives and participation with respect to the products belonging to animal origin such as meat, egg, etc., especially for export promotion.

***(j) Policy for Veterinary Education and Human Resource Development***

The state of Maharashtra has already set up separate university for Animal and Fisheries Sciences at Nagpur to give a boost to human resource Development as well as research and development. In order to up-grade skills of field practitioners and subject matter experts, the existing training facilities in the country with various training Institutions will be made use of, and for this, suitable training module will be designed, which will in turn incorporate training as one of the essential components. In addition, non-plan budget will also be made available for in-service-training of subject matter specialists. Similarly, the policy strives to set up a successful model for Government-

NGO-self-employed youth-co-operative sector, farmers' self-help groups and private sector participation in extension work. Nonetheless, public funding of extension model will be limited to government institutions, co-operative sector, reputed NGOs, self-help groups of farmers and self-employed youth. Mention may be made that a detailed policy statement with respect to veterinary education, human resource development as well research and development may separately be issued.

**Table 5.5: No. of Farmers Trained, Fodder Seed Supply and Sapplings Distribution (2003-04)**

Districts/Regions	Mass Training Programme	Total Farmers Trained	Work Campaigns	Cattle Shows & Calf Rallies	Fodder Demo-Plots	Fodder Seeds Supplied (kg)	Fodder Sapplings Distributed
Greater Mumbai	-	-	-	-	-	-	-
Thane	-	-	1129	1	-	2220	-
Raigad	1	40	571	74	-	180	-
Ratnagiri	-	-	1255	-	-	9497	77000
Sindhudurg	3	120	1159	-	-	729	-
<b>Konkan Region</b>	4	160	4114	75	-	12626	77000
Nashik	6	329	1622	5	542	12008	-
Dhule	-	-	1081	1	405	35204	7665
Nandurbar	-	-	1172	-	200	9670	-
Jalgaon	5	200	954	28	225	45419	165
Ahmednagar	-	-	474	-	200	32172	-
<b>Nashik Region</b>	11	529	5303	34	1572	134473	7830
Pune	-	-	902	-	245	37367	132200
Satara	3	78	654	6	192	32945	126000
Sangli	-	-	414	13	165	102293	564650
Solapur	-	-	843	11	117	22148	-
Kolhapur	3	122	388	13	227	78235	919000
<b>Pune Region</b>	6	200	3201	43	946	272988	1741850
Aurangabad	5	200	843	1	478	116340	56200
Jalna	-	-	572	2	460	61644	109500
Parbhani	5	200	481	2	40	3510	15000
Beed	3	120	697	8	-	1158	37500
<b>Aurangabad Region</b>	13	520	2593	13	978	182652	218200
Latur	4	160	488	14	267	35116	-
Osmanabad	2	80	668	3	310	14595	-
Nanded	-	-	809	33	321	833	-
Hingoli	-	-	165	11	198	389	500
<b>Latur Region</b>	6	240	2130	61	1096	50933	500
Amravati	-	-	1541	11	384	40041	14000
Akola	-	-	307	-	331	12770	-
Washim	5	200	355	4	75	2797	68100
Buldhana	-	-	244	-	70	390	400
Yavatmal	-	-	131	-	-	23577	-
<b>Amravati Region</b>	5	200	2578	15	860	79575	82500
Nagpur	29	1170	2374	14	198	17882	19255
Wardha	2	80	1047	3	246	23531	1418
Bhandara	8	320	242	-	353	7935	17750
Gondia	5	175	166	1	180	2011	5200
Chandrapur	5	200	70	3	-	-	-
Gadchiroli	3	120	61	-	-	1058	-
<b>Nagpur Region</b>	52	2065	3960	21	977	52417	43623
<b>Maharashtra State</b>	97	3914	23879	262	6429	785664	2171503

Source: Department of Animal Husbandry, Government of Maharashtra, Pune

***(k) Policy for Livestock Insurance***

With respect to credit needs for the development of livestock sector and for livestock insurance, the state of Maharashtra will follow the policy of Central Government for the purpose. Nonetheless, the schemes of State Government and local bodies will also contain an element of credit flow to livestock farmers. This policy basically aims at promoting livestock insurance through extension of inputs and making the same mandatory in those cases where government assistance in the form of loan and subsidy is extended for the up-keep of livestock resources.

***(l) Policy for Removal of Regional Imbalances***

The Dandekar committee had identified considerable backlog with respect to veterinary institutions, graduate manned veterinary institutions and frozen semen AI centers across various regions of Maharashtra, which was covered under this policy by establishing required number of institutions and by converting the liquid semen centers into frozen semen AI centers in 1990-91. However, in 1994, region-wise and sector-wise financial and physical backlog in this respect was identified by the indicator and backlog committee constituted by the Government of Maharashtra. The backlog pertaining to the "Veterinary Services" was estimated at Rs.4.49 cores. Government of Maharashtra has sanctioned funds for A.H. sector for removal of the stipulated backlog by 2001-02, which also include grant for the establishment of new veterinary dispensaries and, therefore, under the scheme 50 new veterinary dispensaries were sanctioned by the Government of Maharashtra during 2003-04. Their recurring liability in this respect is being met out through provision of grants in the X th Five Year Plan, which includes removal of the remaining backlog in veterinary dispensaries.

***(m) Policy for Generation of Self-Employment***

The Government of Maharashtra has accorded sanctions to a scheme for imparting training to educated unemployed youth in various streams of Animal Husbandry, and this training basically aims at developing professional skills amongst the target groups for undertaking 'Animal Husbandry' as profession and thereby generation of self-employment for them. This scheme is in operation since 2002-03, and it includes several important streams of training viz. dairy cattle management, sheep and goat management, poultry management, duck rearing and management, rabbit keeping, piggery management, fodder production and proximate analysis of feed and fodder, technique of performing Artificial Insemination, etc. Under the policy, the Government

of Maharashtra has accorded sanctions for strengthening of “*Shhakari Seva Sanstha*” of the employed youth, and the package of incentives for this “Sanstha” consists of purchase of material/items (subject to minimum 25 per cent of the total quantity) from the “Sanstha” by Animal Husbandry Institutions that do not require advanced technology in the manufacturing process and availing services of unemployed persons on contract basis from the “Sanstha” to get unskilled works done of the veterinary institution.

### **5.5 Livestock Development Schemes in Maharashtra**

The livestock development schemes in Maharashtra include centrally sponsored as well as at the State and district levels. There are as many as nine livestock development schemes in Maharashtra sponsored centrally viz. National Project for Cattle and Buffalo Breeding, national Project on Rinderpest Eradication, Creation of Disease Free Zones against FMD, Livestock Census, Enrichment of Straws and Cellulosic Wastes, Establishment of Fodder Banks, Establishment of Referral Laboratory, Integrated Dairy Development Project –III- in Non-Operation Flood, Hilly Areas, and Professional Efficiency Development.

The main features of these schemes revolve around (a) streamlining genetic improvement in the cattle and buffaloes through coordinated efforts of all the agencies involved in breeding of livestock under supervision of State implanting agency - MLDB and under National Project for Cattle and Buffalo Breeding, (b) sero-monitoring and sero-surveillance amongst the animals and regular inspection for detecting disease incidence, (c) 100 per cent vaccination against FMD to the bovines in the selected districts on continued basis to eradicate the disease from specified areas, (d) carrying out actual house to house census in respect of livestock, poultry and farm equipment after every five years, (e) enrichment of low quality (nutritive value) fodder, straw by treating it with urea, (f) stocking of fodder in systematic way and making it available in scarcity conditions, (g) equipping and modernizing the ‘Disease Investigation Section’, Pune for prompt and accurate diagnosis of animal diseases and also to provide facilities of diagnosis of animal diseases to the neighboring States (western regional states), (h) implementation of Integrated Dairy Development Project with respect to Maharashtra Rajya Sahakari Dudh Mahasangh as per the directives of Government of India and (i) meeting establishment costs and also the costs on construction of office building of the Maharashtra State Veterinary Council through funds under professional efficiency development scheme.

There are seven State level schemes for the development of livestock sector and these include Establishment of Veterinary University, Establishment of State Veterinary Council, Establishment of Fodder Banks, Exhibition and Propaganda, Modernization and Strengthening of IVBP, Share Capital Contribution to MSDC and Discretionary Grants. These schemes encompass an assistance for the ongoing and necessary new construction works at university campus and at veterinary /dairy science colleges, assistance for equipping the state veterinary council and also for meeting the establishment costs, generation of fodder storage facilities with a view to provide dry fodder in scarcity conditions, mandatory participation in all-India level livestock and poultry shows as well as organization with a view to popularize important indigenous breeds, making it necessary for the induction of modern and sophisticated technologies in Vaccine and sera production and also equipping the institutes with desired amenities as compelled by FDA, making it necessary for the share capital contributory payments to the corporation in view of the commitment of state Government, and requirement of discretionary grants for carrying out the urgent minor construction and repair works at the Department.

At the district level, the State Government is running ten major schemes for the development of livestock sector, which include Establishment of Veterinary dispensaries, Up-gradation of Veterinary Aid centers, Control of Foot and Mouth disease, Construction of Buildings for Veterinary Institutions, Expansion and Modernization of Veterinary Polyclinics, Establishment of Veterinary Mini-polyclinics at Taluka levels, Rearing of Cross-bred heifers and Graded Buffalo heifers, Distribution of Units of Milch Animals and Providing Feed on subsidy, Distribution of Poultry Birds and Distribution of Goat Units. The major elements of these schemes encompass necessitating establishment of new veterinary dispensaries with a view to remove the backlog of veterinary institutions as per the recommendation of National commission on Agriculture, up-gradation of para veterinarian manned institutions by appointing veterinary graduates in light of adoption of IVC act 1984, carrying out vaccination against FMD as a preventive measure to avoid loses in Milk production and drought power, carrying out activities with respect to construction of dispensaries around owners of livestock with a view to make available veterinary services 24 hours a day to the farmers, making provisions of x-ray, sonography machines and other necessary construction works for veterinary polyclinics in order to provide expertise in service and diagnosis, establishing mini-polyclinics through re-organization of the departmental institutions and equipping them with necessary equipment / diagnostic kits and basic infrastructure, supplying growth ration (feed) on



50-67 per cent subsidy to the cross-bred heifers / graded buffalo heifers belonging to small farmers/ marginal farmers/agricultural labourers and below poverty line beneficiaries, supplying 50 per cent subsidy to the units of milch animals (3-5 crossbred cows/buffaloes) and integrating other inputs in the package like training, insurance of animals and feed for the first three months with a view to create self-employment for SC beneficiaries, supplying the tribal beneficiaries with units of 10 pullets and one cockerel on 50 per cent subsidy, which if reared carefully, can multiply and provide nutritious protein rich food in form of eggs to them and also generate income through sale of surplus stock( day old chicks / grown birds), and supplying the SC and ST beneficiaries with units of 20 females and one male and 10 females of goat, respectively, on 50 per cent subsidy, which after multiplication may generate income for the beneficiaries through sale of surplus male kids.

Thus, the Department of Animal Husbandry, Government of Maharashtra is making sincere and concerted efforts towards overall development of livestock sector of the State through various programmes, schemes and policy initiatives with focus on breed improvement, livestock health care, disease control, AI services and inputs delivery, veterinary education, human resource development and extension, animal product development, quality control, feeds and fodder supply, livestock insurance, marketing and export promotion, generation of employment opportunities, genetic improvement of livestock, etc. The initiation of various programmes and schemes is primarily aimed at enhancing the whole gamut of livestock production base of the State through animal health care practices, infrastructure development, and feeds and fodder development practices. Therefore, in order to strengthen livestock resources, several development programmes and schemes came into being from time to time ever since the inception of the State in May 1960, and in some cases the programmes relating to livestock development even were undertaken much before the establishment of the State, which are still in operation but taken different shape in course of time as per the requirement obtaining off late. All these efforts have paid rich dividends and, as a result, today Maharashtra assumes considerable importance in the production of milk, eggs and meat with growing share in country's total livestock production base.

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## CHAPTER – VI

### TRADE LIBERALIZATION AND LIVESTOCK SECTOR IN INDIA

This chapter examines the likely impact of trade liberalization under WTO regime on the domestic market in general and the livelihood of farming community of India in particular. The chapter pins attention to several aspects that need to be taken cognizance of to save livestock sector of India in the era of WTO regime in which the cattle in the rich countries are pampered at the cost of several hundred million farmers in the developing world. It is perceived that free world trade regime ushered in by the WTO not only poses many threats to India's livestock sector but also opens up many opportunities for the sector. This is certainly a point that needs to be investigated in the today's WTO regime. Therefore, this chapter initially begins with analysing trade performance of India in livestock sector and subsequently traverses through other important issues relating to provisions made in terms of trade in livestock products in WTO regime.

#### 6.1 Livestock Trade Practices of India

Although India has huge livestock population, in terms of trade it stands insignificant in the world trade of livestock products. However, since the past trend indicates a possible exportable surplus of livestock products, the emergence of India as an exporting nation of livestock products in the era of liberalization is sure to upset the traditionally exporting block of nations in these products. It is also widely believed that with the ushering in of the agricultural policy reforms in major industrial countries, the demand for livestock products from developing countries, like India, will get a real boost.

The adoption of several liberal policy measures by the Government in more recent times and the application of scientific production techniques have boosted India's livestock production. However, the point that merits consideration is how did the structure of livestock product trade of India changed over time and what future prospects India holds in the export trade of livestock products in the light of the rapidly changing world market conditions and in view of the various trade policy measures adopted by the various developed and developing nations.

Exports of various livestock products have been given due priority in various trade related policies that were initiated by the Government of India during the era of liberalization and opening up of the national economy to the international market. The

major thrust has been on genetic up-gradation of livestock to improve the productivity and production of major livestock products. To achieve this objective, emphasis is placed on development of requisite infrastructure, feed management, and better health services (Government of India, 1999). A provision of financial assistance to the tune of Rs.465.69 lakhs was made under the central sector scheme “Development of Infrastructure and Technology for Export-Oriented Livestock Product Units” during the Eighth Plan period. The assistance was provided to one unit each in Uttar Pradesh and Punjab (Ministry of Information and Broadcasting, 1999).

The concerted efforts made by the government in the past and in more recent times with increasingly greater significance accorded to livestock sector to achieve the desired level of growth in agricultural sector have certainly boosted the Country’s exports of various livestock products to newer heights. Though over the past two decades India has been net exporter of meat and meat products with negligible dependence on import trade of these products, the scenario obtaining in terms of export trade of milk and milk products during this period is not very encouraging. Despite the fact that India’s dependence on import trade of butter, ghee from cow milk, cheese and curd animal fats, etc. has come down sharply over the past two decades in the face of rise in export trade in the same, the trade balance of India in these products remains negative due to higher value associated with imports as against export (Table 6.1). Similarly in the case of animal fats and hides and skins the net exports are negative. India’s significantly greater dependence on import trade of hides and skins has led to negative trade balance in this case. India shows nearly 28 per cent annual growth in hides and skins imports as against only 7 per cent annual growth in the export trade of the same between 1981 and 2001. However, India is noticed to be net exporter of eggs as the growth as well as value of export trade of the same is significantly higher than its import trade. Another interesting feature of India is the export trade in meat and meat products. Among various meat and meat products exports from India, buffalo meat accounts for nearly 90 per cent share. The import trade of India over the past two decades in meat and meat products has been negligible. As a result, net export of India in meat and meat products is not only positive but significantly high, which has been growing at the rate of 14 per cent a year between 1981 and 2001. Interestingly, until the early nineties India’s trade balance in milk equivalent as well as in milk condensed, dry and fresh was negative since import trade of the same was much higher as compared to their export trade. However, this trend was seen to reverse in the late nineties when India’s trade balance in milk equivalent as well

as in milk condensed, dry and fresh turned positive due significantly higher value associated with export trade of the same as against their import trade. The estimates presented in Table 6.1 are concomitant of the fact that in the era of WTO regime India faces significant threat in the case of import trade of some of the dairy products like butter, ghee, cheese and curd, animal fats and some other livestock based products like hides and skins.

**Table 6.1: Export and Import Trade of India in Livestock Products**

(in '000' US \$)									
Exports/ Imports	Milk Equivalent	Milk Condensed, Dry & Fresh	Butter	Ghee from Cow Milk	Cheese & Curd	Animal Fats	Hides & Skins	Hen Egg	Meat @ Products (Buffalo)
<b>Export</b>									
TE 1983	1525	333	1186	1170	19	-	374	2526	37333
TE 1993	3910	2545	1270	1251	8	5	653	4197	72244
TE 2001	45361	20470	5127	4713	304	628	730	12477	224270
<b>CGR (%)</b>									
- 1981 -1990	0.90	7.06	-3.08	-4.57	2.38	-60.34*	-10.93	-14.02	7.89*
- 1991 - 2001	29.92*	20.09	16.85*	15.93*	56.12*	50.32*	-4.52	18.14*	18.77*
- 1981 - 2001	18.35*	20.73*	5.96*	5.65*	12.12**	-11.42	7.27	19.84*	14.17*
<b>Imports</b>									
TE 1983	132054	74009	57973	47975	72	49610	1552	11	-
TE 1993	11701	8555	2976	2976	71	295	24930	-	-
TE 2001	20265	9487	9557	9543	958	893	64299	64	-
<b>CGR (%)</b>									
- 1981 -1990	-25.02**	-21.67**	-48.23*	-48.11*	-0.94	-52.49*	56.64*	1.14	-
- 1991 - 2001	1.37	-7.53	16.32	16.29	35.14*	14.61*	12.15*	11.40	-
- 1981 - 2001	-13.63*	-18.31*	-9.96	-8.34	10.82*	-10.76	27.50*	1.51	-
<b>Net Exports/ Trade Balance</b>									
TE 1983	-130529	-73676	-56787	-46805	-53	-49610	-1178	2515	37333
TE 1993	-7791	-6010	-1706	-1725	-63	-290	-24277	4197	72244
TE 2001	25096	10983	-4430	-4830	-654	-265	-63569	12413	224270

Source: Computations are based on figures obtained from Occasional Paper, NABARD and FAO Trade Yearbook

Note: \* - significance of growth rate at 1 per cent level of probability

\*\* - significance of growth rate at 5 per cent level of probability

@ - Buffalo meat accounts for nearly 90 per cent in total meat and meat products exports of India

Despite the fact that WTO framework is based on free trade, European Union along with United States by passed and openly violated their commitments to WTO. For instance, New Zealand Dairy Board dumped a large quantity of butter oil into India at price below \$1000 per ton in 2000-01, though the prevailing international price is around \$ 1300 per ton. New Zealand's butter oil was made available at Rs.64.54 per kg that stood cheaper by Rs.15 a kg as compared to prevailing international prices of Rs.87.40 per kg. Consequently, domestic prices of butter oil crashed by 10-15 per cent as the recent import was in the range of Rs.100 to Rs.120 per kg (Sardana, 2002). Though domestic consumer gained, the Indian producers were the worst affected and faced the music of cheap imports.

## 6.2 International Trade Distortions

One of the important elements of globalization is the liberalization of international trade. Increasing flows of livestock and livestock products, including capital, exchange of information, technologies, increasing standards and changes in sectoral structure towards concentration and integration are the major components of globalization in the livestock sector (FAO, 2005). Of late the distortions in global livestock trade are taking place due to subsidized production of livestock products in EU and USA. These subsidized livestock products are exported in the world markets much below their true cost of production (Sharma et. al. 1996; Williams et. al. 1995, 2004). This coupled with trade barriers, restrictive trade policies and stringent health and sanitary standards restrict many producers in developing world to enter in higher priced international markets (Parthasarathy Rao et. al. 2005).

The USA and EU arrived at a new framework before the fifth WTO Ministerial at Cancun, which could be described as second phase of trade robbery as this framework aimed at further destroying the foundations of food self-sufficiency in some of the developing countries, which is already adversely affected under the consequent impact of the Agreement on Agriculture (AoA). Among various inequalities, the most important one is the manner in which the cattle in the rich countries are over-indulged at the cost of several hundred million farmers in the developing countries. For instance, it has been reported by Sharma (2003) that the EU provides a daily subsidy of US \$ 2.7 per cow with Japan providing three times more than US at US \$ 8, whereas half of India's 1000 million population live on less than US \$ 2 a day. Despite distinct inequalities, the domestic producers in the richest trading block, i.e. Organization for Economic Cooperation and Development (OECD) were accorded more protective ring in the new agreement. Perhaps Cancun provided this trading block a perfect platform to create further inequalities.

In the dairy sector, the subsidised exports of EU have adversely affected the dairy industry in India, Brazil and Jamaica. For instance, India imported over 1,30,000 tonnes of EU's highly subsidised skimmed milk powder in 1999-2000, which was the outcome of Euro 5 million export subsidies extended by them that works out to approximately 10,000 times the annual income of small-scale milk producer (Sharma, 2003). Further, due to butter export subsidy paid by the EU, butter oil import in India has grown at an average rate of 7.7 per cent annually. This trend has already depressed prices of ghee in

the domestic market. Incidentally, despite being the largest producer of milk in the world, India does not provide any subsidy for the dairy sector.

Sharma (2003) further argues that the colourful band of boxes – green box, blue box and amber box are actually tools used by rich countries to protect their subsidies to agriculture with the ultimate goal to dump the surpluses all over the world. It is due to these subsidies that the world markets today are flooded with excess supplies, and consequently resulting in depressed world market prices. Of late, the US has shifted most of the ‘blue box’ subsidies to ‘green box’. Ironically, EU agriculture will continue to be subsidised to the tune of Euro 43 billion for another decade. This amount will further increase with rise in members in WTO folds. As a matter of fact, the dairy sector provides livelihood to millions of farmers across India and this sector is most crucial for public health and nutritional requirements. Hence, sustained dumping of cheap imports of dairy products need to be checked by taking stringent measures to revise the tariff rates and quotas.

Notably, in India milk is produced by small farmers belonging to remote areas and processed in plants owned by cooperatives, whereas in EU countries and New Zealand there has been different concept where there stand factory style operations of milk production and squeezing their cows poses a great threat of dumping excess production at lower rates in rest of the world (Gupta, 2001). Since under WTO provisions, there has been greater emphasis on liberalizing trade and government policies to enhance world import demand for dairy products, commitments on market access, reduction of domestic support and subsidies on exports for the removal of distortions in the domestic market, the consequent effect or pressure will be on small farmers, particularly on women (Gupta, 2001). In furtherance, Gupta (2001) indicates that the cost of production of milk in India is one of the lowest in the world while prices of dairy products are among the highest, indicating who has been reaping the fruit so far.

It merits attention here that the WTO was created on January 1, 1995 as a successor to GATT and among various agreements under WTO are the Agreement on Agriculture (AoA) and Agreement on Application of sanitary and phyto-sanitary measures. The major planks of AoA were market access (tarification), domestic support, and export subsidies. According to Parthasarathy Rao et. al. (2005), all Semi-Arid Tropics (SAT) countries are members of WTO and hence are bound by WTO rules under AoA and therefore would be directly influenced by the commitments under AoA by other trading partners.

### 6.3 Producer Support for Livestock Products

Although agriculture is characterized by significant levels of government support in many developed countries subject to reduction in commitments under the AoA, these countries continue to support their domestic agriculture due to several loopholes and clauses in the AoA. The range of support is from as high as 60 per cent in many developed countries to negative or below the de minimis level, i.e. the lowest permissible level as specified by WTO. The OECD countries exercise support to their agriculture to the tune of \$ 257 billion with the average Producer Support Equivalent (PSE) to the extent of 32 per cent (Table 6.2). Among various livestock products, the highest PSE was noticed for milk (49 per cent), followed by mutton (42 per cent), beef (35 per cent), pig meat (21 per cent) and poultry meat (17 per cent). Since the chief exporters of dairy and meat products are OECD countries, their high level of protection to these commodities has a large distortionary effect on world trade (Gulati and Narayanan, 2003).

**Table 6.2: Support to agriculture and producer support equivalents for livestock products in OECD countries, 2003**

Commodity	US	EU	OECD
Support to agriculture (US \$ million)			
Total agriculture	38878	96549	257285
Livestock	10992	17943	47396
Milk	1197	20389	33598
Beef	367	4736	11032
Pig meat	677	3093	6632
Poultry meat	46	3820	5122
Mutton	166	105	1132
Eggs			
Producer support equivalent (%)			
Total agriculture	18	37	32
Livestock			
Milk	45	51	49
Beef	3	77	35
Pig meat	4	24	21
Poultry meat	4	37	17
Mutton	12	58	42
Eggs	3	2	5

Source: Parthasarathy Rao et. al. (2005)

In fact, as many as 25 developed countries indulged in export subsidies and the EU alone accounted for 88 per cent of the total subsidies, followed by EFTA (European Free Trade Association) countries and the USA (Gulati and Narayanan, 2003). Among various commodities, dairy products, butter oil, cheese and skim milk powder, beef and

veal, sugar and coarse grains are subjected to more than 50 per cent of the total export subsidies. Though several countries in South and South East Asia (SSA) and India opted for bound tariff rates (the rates negotiated with WTO prior to joining the organization, which basically represent the upper bound on the level of protection) for crop and livestock products under AoA, there was no reduction commitment as these rates stood higher than the current applied rates. Obviously, the lower rates enabled these countries to raise tariff rates under threat of cheap imports. It is to be noted that domestic support in SAT countries is below the de minimis level and they do not subsidize exports and that a majority of SAT countries in SSA joining the WTO under the least developed country (LDC) are entitled to special privileges, which protect them significantly from global market trade distortions (Parthasarathy Rao et. al. 2005).

It has been argued by Parthasarathy Rao et. al. (2005) that if AoA commitments are implemented without any bias it should lead to reducing support to agriculture in countries with high levels of support, which consequently should lead to curtailing protection in those countries and giving opportunity for exports of production where the support levels are lower or negative. Perhaps this will lead to increase world market prices for primary commodities that include livestock products (Diao et. al. 2001).

### 6.3 Export Subsidy Scenario and NPC.

As for producer support for livestock extended by developed countries, a similar story unfolds when one goes through the estimates reported by Sharma (2004). During 2001-02, the government support in OECD countries was nearly half of the value of milk production. Ironically, despite countries having lack of comparative advantage in milk production encouraged production through higher support that acted as a limiting factor for consumption as prices stood higher for consumers. The extent of support provided by OECD to their milk producers was US \$ 43,393 million during 2001-03 as against US \$ 48,107 in 1986-99 (Sharma, 2004). The EU and U.S. also followed similar suit with US \$ 18,967 million support provided to milk producers by EU and US \$ 11,714 million by US. In fact, various livestock products show significant differences in the level of support and milk is one of the most protected commodities (OECD, 2004). As for milk, while Japan, EU, Canada, Switzerland and US have very high levels of protection; this protection is relatively lower in case of Australia and New Zealand (Table 6.3). The trends shown by Sharma (2004) are concomitant of the fact that there has hardly been any significant reduction in Producer Support Estimate levels between 1986-88 and 2001-03, indicating limiting impact of WTO on trade distorting support in livestock sector.



**Table 6.3: Producer Support Estimates for Major Livestock Products in Selected OECD Countries**  
(in per cent)

Country	Milk		Beef and veal		Pig meat		Poultry meat		Eggs	
	1986-88	2001-03	1986-88	2001-03	1986-88	2001-03	1986-88	2001-03	1986-88	2001-03
Australia	29	14	6	4	3	3	3	3	37	31
Canada	61	55	10	12	5	7	18	4	22	23
EU	57	47	55	74	16	22	24	37	13	2
Japan	84	77	44	32	42	53	12	11	18	16
New Zealand	9	1	7	1	3	0	56	31	45	26
Switzerland	82	78	78	75	60	67	78	83	80	75
U.S.A.	60	48	6	4	4	4	13	4	9	4
OECD	59	48	32	33	18	21	20	17	18	21

Source: Sharma (2004) and OECD (2004)

In order to dispose off surpluses on to the world markets, export subsidization has turned as the chief policy instrument. Notably, over US \$ 27 billion was spent by WTO members for subsidizing exports and out of the 26 countries that committed to reduce export subsidies, EU turned out to be the largest user of export subsidies with 89.4 per cent subsidy expenditure, followed by Switzerland with 5.1 per cent, the US with 1.5 per cent, Norway with 1.3 per cent and other member countries with just 2.7 per cent during 1995-98 (Sharma, 2000). However, export subsidies per unit varied across commodities and countries with a downward trend in export subsidy rates in recent period (Table 6.4).

**Table 6.4: Export Subsidy Rates in Major Livestock Products in the EU and USA: 1986-90 and 1995-98**  
(in per cent)

Products/Country	1986-90	1995-98	Products/Country	1986-90	1995-98
<i>European Union</i>			USA		
Butter and butter oil	248	118	Butter and butter oil	136	58
SMP	106	39	SMP	114	44
Cheese	86	43	Cheese	98	39
Beef and veal	102	57			
Pig meat	111	173			
Poultry	44	20			
Eggs	54	15			

Source: Sharma (2004) and OECD (2004)

Regarding competitiveness of Indian dairy industry in the global markets, Sharma and Gulati (2003) clearly show India not being an efficient import substitutes of dairy products as Indian dairy prices compare poorly with the world market prices in terms of Nominal Protection Coefficient (NPC). The reason for this is traced in the nature of world prices of dairy products that have been highly distorted due to export subsidies extended by EU and US. An inter-country comparison of protection levels across major livestock producing countries in the OECD region reveals highest protection being accorded to its milk producers by Switzerland (4.54 in 2001-03), followed by Japan

(4.30), Norway (4.25) and 1.82 by OECD region as a whole (Table 6.5). New Zealand and Australia were not seen to provide any protection to milk producers since the NPC in their case turn out to be unity at the given world market prices.

**Table 6.5: Estimates of NPCs for Major Livestock Products in Selected OECD Countries**

Country	Milk		Beef and veal		Pig meat		Poultry		Eggs	
	1986-88	2001-03	1986-88	2001-03	1986-88	2001-03	1986-88	2001-03	1986-88	2001-03
Australia	1.38	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.18	1.00
Canada	2.61	2.24	1.04	1.02	1.04	1.02	1.19	1.02	1.28	1.28
EU	2.77	1.84	2.25	2.54	1.38	1.25	1.79	1.55	1.24	1.00
Japan	6.49	4.30	1.76	1.44	1.76	2.14	1.14	1.13	1.22	1.19
Korea	3.83	3.05	2.23	3.09	1.50	1.57	2.14	1.58	0.92	1.13
New Zealand	1.02	1.00	1.00	1.00	1.03	1.00	2.83	1.63	1.83	1.35
Norway	3.96	4.25	4.09	5.85	3.77	2.65	2.25	2.97	2.29	1.79
Switzerland	5.51	4.54	4.78	4.08	2.49	3.02	7.28	5.86	6.41	3.69
U.S.A.	2.59	1.85	1.02	1.00	1.00	1.00	1.11	1.00	1.06	1.00
OECD	2.70	1.82	1.41	1.26	1.30	1.22	1.33	1.17	1.22	1.06

Source: Sharma (2004) and OECD (2004)

The foregoing discussion and estimates clearly show that livestock stands one of the highly protected sectors in the developed nations. Though the protection levels have shown a marginally falling trend across nations between 1986-88 and 2001-03, Norway shows an increase in protection level for milk and beef and veal during this period.

#### **6.4 WTO Negotiations on Milk and Milk Products**

As a matter of fact, in 1947-48 a common agreement called as the General Agreement on Tariffs and Trade (GATT) was established by the developed countries to establish a working understanding with respect to export and import of various commodities. Since then there have been eight rounds of talks to modify the agreement. A permanent trade organisation known as WTO was established in 1995 with representation from 124 countries to facilitate fair trade practices among the member countries. And, since India was a signatory of GATT, her membership automatically got ensured in WTO. In fact, there is no harm in India becoming a member of WTO as in the absence of the WTO membership, we could have to negotiate separately with each and every country and that might have placed us at disadvantageous position (Hegde, 2001). Nonetheless, inability to put forward demands strongly during WTO negotiations worked against India. It is to be recollected that during the negotiations in 1985, India failed to bargain and agreed to allow import of milk and milk products under zero per cent bound duty, and due to our new exim policy that brought some essential milk products under Open General License further facilitated import (Hegde, 2001).

Though initially there stood no threat as world prices for milk and milk products were ruling high, in due course of time, however, many developed nations exerted pressure on their governments to provide subsidy to dairy farmers that helped them to reduce price of their dairy products and consequently influenced the world market prices. Obviously, this provided ample opportunities to the traders to import cheaper milk products with the goal of earning higher profit margins, perhaps at the cost of Indian dairy farmers. This is the plight of Indian dairy farmers in the WTO regime and as long as we continue to remain a member of WTO the threat will continue to bother us. There is hardly any time for Indian dairy farmers to face the challenges of imported milk and milk products under WTO regime and our farmers are yet to be fully geared up to face the situation or challenges arising in the era of WTO regime.

### **6.5 World Price Trends and Net Social Welfare**

A very recent study conducted by Jha (2004) has come out with several interesting observations insofar as the impact of trade liberalization on domestic producers and consumers of milk and milk products is concerned. The study specifically focuses on the fact that though trade liberalization encouraged exports during the 1990s, imports too received impetus following removal of import restrictions in the selected products during mid-1990s. Tariff reduction on milk products, in particular, may have significant implications for the livestock sector since the decision to rear cattle in India is more dependent on the profitability of milk rather than meat.

In order to evaluate the effect of trade liberalization on domestic market of milk and milk products, the study considers three alternative scenarios of world prices (fob) of milk with Rs.647 (US \$1500) per quintal as marked with lower range of world price, Rs.1140 (US \$ 2650) per quintal as higher range of world price, and Rs.884 (US \$ 2050) per quintal as intermediate range of world price.

The study observes a steep fall in the domestic prices of milk following the decision to import milk products at a low international price (Rs.640 per quintal). Since supply of milk is highly price elastic, this situation will lead to adverse affect on milk production in states like Haryana, Maharashtra, Tamil Nadu, West Bengal and Uttar Pradesh that account for more than 40 per cent share in total milk production of India. The decline in milk supply will further translate into negative producer's surplus in all the states. However, the magnitude of negative surplus is likely to vary across states. In this sequel, Uttar Pradesh will show the highest negative surplus, followed by Maharashtra, Tamil Nadu, Haryana and West Bengal (Table 6.6).

**Table 6.6: Impact of Free Import of Milk on Producer, Consumer and Net Social Welfare in Selected States of India with Different Range of World Prices in 1999**

Particulars	Low range of world price (Rs.640 per quintal)					Intermediate (Rs.850 / quintal)	
	Haryana	Maharashtra	T.N.	W.B.	U.P.	Maharashtra	Other States
Production in million quintals	46.8	57.1	45.7	34.7	141.5	57.1	
Producer price – existing	1030	1090	995	1020	960	1090	
Producer price – free trade	824	750	734	759	788	1073	
Supply elasticity with price	0.68	0.74	0.61	0.52	0.58	0.74	
Supply – existing	46.8	57.1	45.7	34.7	141.5	57.1	
Supply under free trade	40.4	43.9	38.4	29.5	126.8	56.5	No change
Change in producers surplus	-8985	-17155	-10981	-8388	-23019	-965.10	
Unit change in producers surplus	-213	-300	-240	-231	-166	-16.9	
Aggregate demand	42.1	57.1	45.7	36.3	138.7	57.1	
Wholesale price – existing	1225	1300	1200	1250	1175	1300	
Wholesale price under free trade	980	895	885	930	965	1280	
Price elasticity of demand	-0.45	-0.47	-0.44	-0.36	-0.36	-0.47	
Existing demand	42.1	57.1	45.7	36.3	138.7	57.1	
Demand under free trade	45.8	65.4	50.9	39.6	147.6	57.4	No change
Change in consumer's surplus	10779	24819	15227	12151	30064	1146	
Unit change in consumer's surplus	256	435	333	335	217	20.1	
Change in total surplus/welfare	1793	7663	4246	3763	7045	181	
Employment (change in million man-days)	-35.7	-76.2	-42.1	-26.5	-84.8	-3.5	
Forex (change in million US \$)	-56.8	-125.4	-79.2	-50.2	-133.9	-8.3	

Source: Jha (2004).

The study further finds that at the intermediate range of world price (Rs.850 per quintal), the derived duty paid (DDP) price at one of the Indian port will be Rs.1204 per quintal. On the other hand, price differences in the wholesale market suggest that import would take place only in Mumbai, which would have limited effect on the producers and consumers of milk. The producers and consumers in other states would by and large remain unaffected. At the high range of world price (Rs.1140 per quintal fob at US port), since the ex-port price is significantly higher than the domestic prices, chances of imports at such a high price are less, and, as a result, milk production and consumption will, therefore, be largely unaffected in the country.

The analysis incorporated in this study in general presents a trade-off between the producer's and consumer's interest and establishes that the imports will generally benefit the consumers. However, the losses to the producers also need to be understood adequately. Though the analysis shows that consequent to imports the total economic welfare would increase since a decrease in producer's surplus is over-compensated by the increase in consumer's surplus, the decrease in producers' surplus stands under-estimated in the sense that it ignores loss in employment because of decline in milk production.

The study shows concern for the protection of livestock sector in India in view of loss of employment and the wide ramifications this has for the rural economy. It emphasizes upon the fact that a high import at the low range of the world price would cause enormous loss of employment in the country and, therefore, on this account the sector requires protection from low world price of milk. Since as of now protection in the form of moderate tariff (35-40 per cent) and tariff rate quota appears to be sufficient, any argument for further reduction of tariff must be resisted. The Harbinson's draft in the on-going negotiations on agriculture also recognizes the need for protecting a strategic sector/ sub-sector in a developing country.

### **6.6 Domestic Price Trends**

In the new trade regime, pricing issue is of primary importance because on it depends the availability of basic raw material, that is milk. Co-operatives are known for differential seasonal pricing. Thus, while a lean season produce commands a higher procurement price, in flush season the producers are paid relatively less for their produce. This is helpful to both farmers and co-operatives in terms of averaging out of the realization as well as the costs. This type of differential pricing helps in warding off unscrupulous competitors who generally seek to offer a higher procurement price for milk during summers. Though the proportion of milk production during flush and lean seasons varies from 100 and 40, the overall demand remains more or less constant throughout the year. To handle competition, higher price is usually paid for milk during the lean season to attract more supply. This is in tune with the fact that feeds and fodder are in short supply during lean season and, thus, costlier to use, making milk production that much dearer. The producer farmers are, therefore, justified in seeking higher price for milk during lean season to offset increasing cost of production and, in maintaining uniformity in income from milk sales throughout the year even when there may be slump in demand for milk during flush season owing to restricted handling capacity of dairy processing plants and, hence, a lower procurement price on offer for them (Shah, 1996). Further, in due course of time, the planners have favoured a two axis pricing policy for milk that reckons both fat and solids-not fat (SNF) content of milk for its pricing in order to stimulate and give fresh fillip to cow milk production. Though a simple and economically viable technique for SNF testing at village level has been evolved, such a cost effective simple method is not readily available or adopted in or by a significant number of villages of India as of now.

Notably, in the aftermath of liberalisation, conversion of surplus milk to powders helped development of milk production activity in India. Purchase of surplus milk during flush season and conversion to milk powder for recombination during lean season not only formed a major milestone of our development strategy but also helped in expanding market and maintaining a pull on production. In the face of fast changing domestic and international market conditions, taste, preferences and availability of products in processed form, etc., emphasis of late is on meeting the growing market demand for milk powders, butter, ghee, cheese, and other dairy products. Consequent upon rise in demand for products in processed form, the wholesale prices of dairy products have grown faster than wholesale prices of milk and all-commodities (Table 6.7).

**Table 6.7: Wholesale Price Indices of Dairy Products, Food Articles and All-Commodities of India**  
(base 1981-82 = 100)

Product	1990-91	1992-93	1995-96	1997-98	1999-2000	ACGR (%)		
						1991-95	1996-2000	1991-2000
Milk	209.2	264.8	313.8	348.6	403.2	9.86	6.90	6.86
Tinned MP	203.6	305.2	322.2	365.9	442.7	12.00	8.31	7.83
Skimmed MP	178.6	289.9	344.1	372.0	385.6	8.96 <sup>NS</sup>	2.12 <sup>NS</sup>	8.02
Baby food	179.5	211.4	262.0	380.2	423.1	4.89	12.85	10.96
Butter	216.7	262.6	371.1	400.6	452.1	8.66	5.40	8.89
Ghee	188.7	239.1	325.2	342.7	400.4	10.88	5.91	8.35
Cattle feed	155.0	195.8	247.5	289.2	335.5	9.40	7.39	8.72
Fodder	224.4	245.4	326.3	417.3	428.1	4.67 <sup>NS</sup>	7.24	8.30
Food Articles	200.6	271.0	335.7	388.0	457.7	11.10	8.13	9.08
All-commodities	182.7	228.7	295.8	329.8	383.1	10.43	5.37	7.87

Source: Computations are based on 'Basic Animal Husbandry Statistics, 2002', Department of Animal Husbandry and Dairying, Ministry of Agriculture, Government of India, New Delhi

Note: @ - all growth rates are significant at 1 per cent level of probability

NS - growth rates not significant at one per cent level of probability

With 1981-82 as the base year, majority of milk and milk products listed in Table 14 showed higher wholesale price index (WPI) as compared to WPI of all-commodities during the entire period between 1990-91 and 1999-2000. Interestingly, while fluid milk, tinned as well as skimmed milk powder, butter and ghee produced in India showed higher growth in their WPI during the first half of the 1990s, this growth in WPI was faster for baby food during the second half of the 1990s period.

In general, not only growth in WPI with respect to baby food was higher than growth in WPI of all commodities but also all food articles put together produced in India during the period between 1990-91 and 1999-2000. The trends in WPI with respect to inputs such as cattle feed and fodder were in tune with rise in WPI of milk and milk products. The rise in milk production came about through productivity enhancements,

which in turn was due to greater expenditure made on feeds and fodder owing to rise in their costs. The growing trends towards crossbreeding and greater significance accorded to high yielding animals could be the reasons for such relative trends with respect to WPI of milk and milk products and feeds and fodder.

### 6.7 Demands-Supply Perspective

Several research workers have provided various estimates of India's demand for milk (Kumar and Mathur, 1996; Patel, 1993; Dastagiri, 2003). Among various studies, the study conducted by Dastagiri (2003) relates to estimation of production, consumption and surplus of milk in India for the years 2000 and 2020. While estimating demand, this study assumed 1.63 per cent, 1.54 per cent, 1.40 per cent and 1.51 per cent per annum growth in population during 1993-2000, 2000-10, 2010-20 and 1993-2020, respectively, 1.46 per cent, 3.62 per cent and 3.49 per cent per annum growth in per capita income for rural, urban and pooled, respectively, and pace of urbanization consistent with the recent historical trend. The estimates provided by Dastagiri (2003) with respect to production (supply) and consumption (demand) of milk and various other livestock products are brought out in Table 6.8.

**Table 6.8: Projections of Livestock Products Production and Domestic Consumption**

Year/Livestock Product		2000	2020	Growth rate
Milk (in million tonnes)	Production	78.56	232.09	5.56
	Consumption	60.77	147.21	4.77
	Surplus	17.79	84.88	
Mutton and goat meat (in million tonnes)	Production	0.67	9.85	14.40
	Consumption -	1.36	12.72	13.62
	Surplus	-1.31	-3.13	
Beef and buffalo meat (in million tonnes)	Production	3.29	9.11	5.22
	Consumption	0.61	1.15	3.39
	Surplus	2.68	7.96	
Chicken (in million tonnes)	Production	0.65	2.70	7.38
	Consumption	0.33	0.81	4.72
	Surplus	0.32	1.89	
Egg (in billion nos.)	Production	32.75	102.91	5.89
	Consumption	13.88	44.06	6.12
	Surplus	8.87	68.85	
Fish (in million tonnes)	Production	5.66	13	4.40
	Consumption	4.45	8.52	3.30
	Surplus	1.21	4.48	
Pork (in million tonnes)	Production -	0.55	8.22	14.44
	Consumption	N.E.	N.E.	N.E.
	Surplus			
Mutton (in million tonnes)	Production	0.55	8.21	14.44
	Consumption	N.E.	N.E.	N.E.
	Surplus			
Beef (in million tonnes)	Production	1.48	5.61	6.87
	Consumption	N.E.	N.E.	N.E.
	Surplus			

Source: Dastagiri (2003)

Among various livestock products, the major surplus in 2020 is reported to emerge in the case of milk and eggs as production growth will be significantly higher than consumption growth for these two specific commodities produced in India. In 2020, the major surplus to the tune of 85 million litres will emerge for milk alone, followed by 69 billion eggs. Fish, chicken and beef and buffalo meat produced in India are also likely to generate surplus in 2020. The estimates provided in Table 6.7 not only indicate self sufficiency of India in various livestock products in 2020 but also generation of adequate surplus for exports as well as conversion of them into value added products. Technological advances encompassing genetic and feed improvements, reproductive technologies, etc. are cited as the engine of livestock production growth in the years to come. The consequent likely beneficial impact is seen on farmers whose welfare will not only strengthen but the productivity of animals will also improve. However, notably, the past trend also reveals negligible share of India in world exports of milk (0.01-0.02 per cent) in the face of significant share in imports of milk (0.01-1.59 per cent) during the period between 1974-76 and 1996-98 (Kumar, et. al., 2001).

Although there seems to be an indication of likelihood of generation of significant surpluses of livestock products in the near future, the past trend in terms of employment in livestock sector is not very encouraging (Appendix 3). The past trend between 1983 and 2000 not only shows steady fall in numerical strength of workers engaged in various livestock activities but also in terms of falling share of workers engaged in livestock activities in total workers of the country, both at all-India level and in rural India. This is certainly a discouraging trend that needs to be rectified to strengthen and safeguard this important sector of Indian economy.

Though in general employment in livestock sector in India is seen to have declined during 1980s and 1990s periods, this decline may be in certain livestock activities other than milk production as most of the activities in milk business are handled or governed largely by family labour. The dairy sector will therefore remain a focal point for the overall sectoral development of agriculture in India. The efforts made in this sector are paying proposition or paid rich dividends so far. And, India, of late, is witnessing an all pervasive white revolution that can go a long way in ameliorating the lot of those farmers who have positive leaning towards emerging innovative technologies and scientific farm management techniques and also in creating conditions for elimination of regional socio-economic disparities and imbalances. The advantage in the



emerging new technology is that, when optimally utilized, they can truly transform the dairy sector by stepping up milk production to desired levels. The government should, therefore, endeavour to evolve, initiate and implement a more egalitarian policy, especially policies related to procurement pricing and input delivery system that is capable of boosting our livestock production base with all the expediency it deserves.

Since India is likely to generate significant surpluses of milk after meeting the domestic requirement, the residual will therefore be available for conversion into value added products for exports provided international prices remain favourable. Under such a veritable situation, cooperatives will have to play a crucial role in diverting farmers' produce in the world market. In fact, cooperatives have an edge over other competing sectors due to their organizational structure. The federal structure despite many weaknesses provides a very wide network to link many producers to the tertiary level of the economy. The organizational structure build up through federal structure over the years would continue to be a point of great strength to cooperatives. Their relevance will now be felt not only in expanding production but also in export trade of milk and milk products. However, how best India can meet the challenges arising in the WTO regime would depend on India's export capabilities and available surplus for exports, aside from favourable international market conditions. In the present milieu, the subsidies extended by European Union countries have created havoc and cheated farmers belonging to developing countries due to depressed international market prices. As long as subsidized production in modern bloc countries continue, the farmers in the developing bloc nations will remain the deprived sections to reap the fruits emanating in the free trade regime due to trade distortions.

### **6.8 Stakeholders' Perception**

The entire dairy business can be categorized into three distinct activities, viz., milk production and its transportation to plants, processing for conversion of milk into pasteurized form and various dairy products, and transportation of products to domestic and export markets. The entire process of movement of milk output from the point of production to the point of consumption in raw/fluid and processed form involves several stakeholders with their varied roles in the process. Although major stakeholders in the dairy policy include milk producers, middlemen, formal and informal sector processors (cooperatives, private, government, etc.), wholesalers, retailers, consumers, etc., in this study only the views expressed by selected milk producers and the secretaries of the

selected DCS have been recorded and evaluated in terms of impact of trade related practices indulged in WTO regime on Indian dairy farmers.

In order to extract perceptions of milk producers regarding impact of trade related trends obtaining in WTO regime on their milk business, a quick study/survey was conducted in January 2009 in Kolhapur district of Maharashtra of India. Kolhapur is considered as one of the most developed districts of Maharashtra not only in terms of resource endowments, viz., irrigation network, market infrastructure, etc. but also with respect to awareness of farmers regarding various development activities encompassing input and output prices, policies, market intelligence service for the diversion of products, etc. The study is based on views expressed by secretaries of two selected societies and 30 sampled milk producers drawn from Kolhapur district of Maharashtra.

Multistage stratified random sampling technique was used for the selection of *talukas*, villages and milk producing households from Kolhapur district of Maharashtra of India. The *talukas* in the district were classified into two groups as those falling in the eastern and in the western part of the district. Two *talukas*, one of eastern and western parts, were selected purposely from the district. Similarly, based on higher status of DCS in terms of their audit class, literacy level of farmers, numerical strength of bovines, quantity of milk production, etc., one village from each *taluka* was selected purposely. The village of *Shedshal* belonging to eastern part and *Ghotawade* belonging to western part of Kolhapur district were finally selected for a quick survey. The households in each of the two selected villages, with DCS operating in their village, were categorized as small (1-2 milch bovines), medium (3-4 milch bovines) and large (5 and above milch bovines) based on herd strength using cumulative frequency square root technique (Dalenius and Hodges, 1950) and 15 milk producing households were selected from each village subject to probability proportion to size technique. The selected households were also members of the village milk co-operative society. Out of 30 selected households from two villages, 23 belonged to small category, 4 to medium and the remaining 3 to large category.

Interestingly, though majority of sampled milk producers were quite aware of the market forces, none among them could air their view in terms of positive or negative impact of globalization and liberalization of policies in the WTO regime. Even the secretaries of the selected societies could not visualize any threat to milk business due to import of milk products at low ruling international market prices. However, when the milk producers as well as the secretaries of the societies were explained the consequences

of cheap imports flowing in the Indian markets due to subsidized production in modern bloc countries that depress their true cost of production and enable them to enter in the world market at much lower prices owing to hidden actual cost, the immediate reaction of these stakeholders drawn from Kolhapur district was in favour of receiving similar kind of subsidies for their milk business.

The stakeholders were quite worried on account of the fact that flow of such cheap imports of milk products, particularly milk powder, might adversely affect their milk production as well as marketed quantities of milk as they could clearly visualize lower prices on offer for their much rich milk output. Under such a veritable situation, these stakeholders were unable to see any incentive to market their produce at unremunerative prices owing to flow of cheap imports of milk powder in the country. As pointed out by Jha (2004), this kind of situation may protect consumer's interest but certainly at the cost of producer's interest leading to adverse affect on domestic production of milk owing to lower ruling prices of milk and milk products in the international market. The selected stakeholders were, therefore, either in favour of receiving similar kind of subsidies as practiced in the European countries or complete abolition of such subsidies practiced in these modern bloc countries. It has already been reported by Sharma et al. (2003) that the competition from subsidized imports will pose a great challenge to the cooperative sector, as they will depress the domestic market prices as well as producers' prices. The increased competition in domestic market from cooperatives coupled with subsidized imports will pose a major challenge to even private sector, and their survival in the fast changing market conditions will become another issue to be addressed. Further, highly subsidized production of dairy products have already led to cost push effect in modern trading bloc in the face of cost pull effect in developing world with little scope for exporting dairy products left with developing nations due to highly distorted and very thin world dairy market, particularly those in EU, USA, Japan and Canada.

## **6.9 Livestock Trade and Emerging Issues**

Despite constraints like rearing of livestock under sub optimal conditions due to low economic status of livestock owners, India has now become the largest producer of milk in the world. The development of Indian dairy sector is an unprecedented success story as it is based on millions of small producers. Government of India is making concerted efforts to raise the per capita availability of milk through increase in productivity of milch animals. In order to achieve this ambitious goal, assistance is being

provided to the State Governments for controlling animal diseases, scientific management and up-gradation of genetic resources, increasing availability of nutritious feeds and fodder, improving microbiological quality of milk, etc. The microbiological quality of milk is poor owing to inadequate knowledge of clean milk production and lack of post milking chilling facilities at the village level. In the present milieu, when production of dairy products to match international standards has become necessary to compete in international market of milk and milk products, steps need to be initiated to improve quality of Indian milk products with a view to boost export trade of these products in free trade regime and earn valuable foreign exchange as well as provide clean and quality milk to domestic population for their better health. Though India does not want to leave any stone unturned insofar as her presence in international trade of milk and milk products is concerned, the liberalisation of markets within the WTO framework, especially due to the export subsidies indulged in by OECD countries, now seen to be threatening the Indian dairy sector.

In the WTO regime, surging imports have not only affected farm incomes but also employment in many developing countries. Consequent upon cheap imports and absence of adequate protection measures, safeguarding income and livelihood of poor farmers have emerged issues that need to be addressed by policy makers. As rightly pointed out by Sharma (2003), *“the developing world have suddenly become the children of a lesser god and they are the neo-poor”*. Further, though producer milk prices in India stand significantly lower than US and Western Europe, dairy product prices are relatively higher than international market prices owing to domestic processing inefficiencies in India (World Bank, 1999). An earlier study conducted by Sharma et al. (1996) assessed the impact of GATT on dairy products and projected the world dairy product prices to rise by about 2.3 per cent in real terms by the year 2002. The study categorically emphasized on the fact that domestic product prices would remain higher than world market prices despite expected surge in world market prices. This necessitates improvement in production and processing efficiency of livestock sector in India to make it competitive with imports.

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## CHAPTER – VII

### SUMMARY AND CONCLUSIONS

#### 7.1 Backdrop

The livestock of India is a natural endowment, a renewable resource, which in terms of its germ plasm spectrum and genetic variability, is incomparable with any other country in the world. Historically, the role of livestock has been complementary to crop production. This sector has been well knit with the socio-economic fabric of our rural economy and played an important role in the employment and income generation. Besides having vast employment potential, this sector not only provides milk and milk products, meat, egg, wool, hides and skins and draught power but also stabilizes the farm incomes. Needless to mention that India's livestock sector needs to be encouraged, but not at the cost of cereal production but of course by truly utilizing and exploiting the complementary, supplementary, synergistic and even symbiotic relationship of raising animals with crop production. Encompassing a wide geographical area and reflecting different political system, differing levels of economic development, social systems and changes in tastes, preferences and traditions, the approach to livestock development has varied widely from region to region in India, especially with respect to consumption of milk and milk products. Viewing our livestock spectrum in the light of these variabilities, it is pertinent to ask whether the future of our livestock will remain as bright as in the past. It is perceived that free world trade regime ushered in by the WTO not only poses many threats to India's livestock industry but also opens up many opportunities for the industry. This is certainly a point that needs to be investigated in the today's WTO regime, which has been marked with sustained dumping of cheap imports of dairy products on to the developing countries and which needs to be checked by taking stringent measures to revive tariff rates and quotas.

#### 7.2 Need for Study

In view of the strategic importance of livestock sector in the agricultural development of our economy, its systematic and well conceived development becomes the pre-condition for successful agricultural policy. Technological changes in agriculture associated with the green revolution have brought about significant changes not only in the structure of milk production but also in the size and composition of animal draught

power in several areas of the country. The state of Maharashtra is not an exception to this phenomenon. The issues of increase in milk production and demand for and supply of inputs have acquired new dimension in the state of Maharashtra. Undoubtedly, therefore, for designing appropriate policies of livestock development and thereby giving a further boost to their contribution, it is extremely essential to focus on the nature and significance of changes taking place in the animal husbandry sector across various regions of the state. This study, thus, comprehensively evaluates various issues relating to livestock sector of the state, especially in respect of changing structure in livestock production, changes in size and composition of availability of draught animal power, impact of mechanization on draught power availability and changes in policies governing development of livestock sector in Maharashtra in terms population and production dynamics and infrastructure development, aside from assessing prospects of developing livestock sector in WTO regime.

### **7.3 Objectives of the Study**

The study has been conducted in the light of the following specific objectives:

1. To assess the changes in size, composition and availability of draught animal power in relation to mechanical power with a view to assess to extent of mechanization in the state of Maharashtra.
2. To examine the changes in the composition of bovine population over time and also to analyse growth of breedable female population vis-à-vis total stocks of bovines in the State.
3. To evaluate the structural changes in milk production and also to identify factors responsible for imbalances in milk production across different regions of the State.
4. To examine opportunities as well as threats to livestock sector in WTO regime.

### **7.4 Methodology**

The reference period of study for the changing dynamics of livestock population for Maharashtra and India is from 1951 to 2003. However, the pattern of livestock production with respect to Maharashtra state is evaluated encompassing the period between 1985-86 and 2005-06, as before 1985-86 the estimates for various livestock products, including milk, are not available consistently for various districts of the state. Efforts have been made to collect information on other important aspects of livestock development encompassing last 4-5 decades.

Data used for this study were chiefly collected from various secondary sources. Data on livestock population for different districts of Maharashtra and India were collected from various livestock census report of Maharashtra and India viz. 'Livestock and Farm Equipment Census, Maharashtra State, Directorate of Animal Husbandry and Dairying, Maharashtra State, Pune' and 'India Livestock Census, Summary Tables, Volume –II, Part –I, Directorate of Economics and Statistics, Department of Agriculture and Co-operation, Ministry of Agriculture, Government, of India'. The major sources for data on livestock production were 'Report on Milk, Eggs, Wool and Meat Production and Livestock and Poultry Keeping Practices in Maharashtra, Directorate of Animal Husbandry, Maharashtra State, Pune', 'Statistical Diary, Statistical Cell, Directorate of Animal Husbandry, Government of Maharashtra, Pune', 'Statistical Handbook, Statistical Cell, Directorate of Animal Husbandry, Government of Maharashtra, Pune', 'Statistical Epitome, Statistical Cell, Directorate of Animal Husbandry, Government of Maharashtra, Pune', etc. The data on other related aspects on livestock development are collected from 'Statistical Abstract of India, Ministry of Statistics and Programme Implementation, Government of India', 'Districtwise Agricultural Statistical Information of Maharashtra, Part-II, Office of the Commissioner Agriculture, Pune' and also from 'Bulletin on Food Statistics, Directorate of Economics and Statistics, Ministry of Agriculture, Government of India, New Delhi', 'Cooperative Movement at a Glance in Maharashtra, office of the Commissioner for Cooperation and Registrar of Cooperative Societies, Maharashtra State, Pune', 'National Accounts Statistics, Central Statistical Organisation, Ministry of Planning and Programme Implementation, Government of India', 'Basic Animal Husbandry Statistics, 1999, 2002, 2006, Department of Animal Husbandry and Dairying, Ministry of Agriculture, Government of India, New Delhi', 'Annual Report, Department of Animal Husbandry and Dairying, Ministry of Agriculture, New Delhi', 'Season and Crop Report, Government of Maharashtra' and various other secondary sources and official records of the state, government of Maharashtra.

The analytical techniques in this study include estimation of growth rates, instability in growth, estimation of coefficient of variations and rank correlation coefficients between two periods. Rank correlation coefficients were calculated to examine the changes in ranking of districts over time in terms of production of various products of livestock origin.

In this study, exponential trend equations have been fitted to the time series data obtained for various parameters from various sources in order to compute compound

rates of growth that were also tested for their significance by the student 't' statistics. With a view to understand growth performance of various parameters better and in order to capture year to year fluctuation in the same over the given period of time, an index of instability was also incorporated in the analysis, which appeared to have taken care of the trend component in the time series data. The instability was also estimated with the help of computation of Coefficient of Variation.

## **7.5 Major Findings**

The major findings mainly revolve around various estimates relating to changes in livestock population over time in Maharashtra vis-à-vis India, variations in livestock population across regions of Maharashtra, changes in size and composition of livestock, growth in breedable population vis-à-vis total stocks of bovines, availability of draught animal and mechanical power over time in the state, the extent of tractorisation and mechanization of irrigation, the impact of farm mechanization on draught power availability and assessment of factors responsible for the adoption of advanced technology. Besides providing estimates relating to livestock population dynamics, the findings include estimates with respect to the livestock production scenario of Maharashtra over the last two decades with major foci of attention on structural changes in milk, meat, wool and egg production across different districts and regions of the State, growth and instability in livestock production, productivity variations of milch animals, especially bovines, identifying factors responsible for regional imbalances in livestock production, changes in ranking of districts over time in terms of livestock production, etc. The findings also encompass a broader insight into various livestock development policies, programmes and schemes that were initiated in the state of Maharashtra for improving the overall livestock resource base of the State, besides examining the likely impact of trade liberalization under WTO regime on the domestic market in general and the livelihood of farming community of India in particular.

### **7.5.1 Dynamics of Changes in Livestock Population**

The government has adopted several initiatives and policies as well strategies to improve the quality of livestock resources, which not only encompass up-gradation of genetic stocks, improved feed, fodder and nutrition management but also provision of improved health services, building of market infrastructure for livestock products to ensure better and remunerative prices to the primary producers and reasonable prices to the ultimate consumers. Further, the policies adopted by the State Animal Husbandry Department such as extension of free breeding, vaccination and veterinary services and



permission of free grazing on community lands has led to significant expansion of herd size of the farmers and, consequently, India has become one of the largest countries in terms of livestock population of the world.

#### **7.5.1.1 India's Ranking in World Livestock Wealth**

Due to significant programme and policy initiatives undertaken by the government to develop livestock sector, India boasts to have become the richest country in the world in livestock wealth, both in terms of numerical strength and germplasm. It is heartening to note that India holds top position in some of the species of livestock resources of the world. In 2005, India ranked 1<sup>st</sup> in world buffalo population, 2<sup>nd</sup> in cattle and goat, 3<sup>rd</sup> in sheep, 4<sup>th</sup> in ducks, 5<sup>th</sup> in chickens and 6<sup>th</sup> in camel population of the world. India accounts for as much as 56 per cent of the world buffalo population. India boasts to have a large genetic diversity of livestock containing 26 breeds of cattle, 8 breeds of buffaloes, 40 breeds of sheep, 20 breeds of goats and 7 breeds of camels.

#### **7.5.1.2 Livestock Population Trends in India**

Livestock population in India has grown steadily over the past five decades. This is evident from the fact that India had 292.80 million livestock 1951, which increased to 344.10 million in 1966, and further to 369.00 million in 1977, 470.86 million in 1992 and 485.00 million in 2003, showing thereby 66 per cent rise in livestock population of India between 1951 and 2003. The major increase in livestock population of India took place between 1977 and 1982 and also between 1956 and 1961. After 1982, there has been continuous deceleration in livestock population increase and consequently livestock population of India has rather declined by 0.08 per cent between 1997 and 2003. In fact, the decline in cattle population between 1992 and 2003 has adversely affected the population growth of total livestock in the country because of their substantial share in total livestock population.

#### **7.5.1.3 Livestock Population Trends in Maharashtra**

The state of Maharashtra accounts for about 8 per cent share in total livestock population of India. The total livestock population in Maharashtra was estimated at 26.05 million in 1961, which increased to 29.64 million in 1978 and further to 39.64 million in 1997 with a decline in the same to 36.50 million in 2003. The increase in livestock population in Maharashtra was estimated at 52.17 per cent between 1961 and 1997 and at only 40.14 per cent between 1961 and 2003. Obviously, the stocks of livestock in Maharashtra showed a sharp decline between 1997 and 2003. Among various species of livestock, cattle population in Maharashtra increased at very slow pace during the period

between 1961 and 2003. However, the buffalo population in Maharashtra kept steadily growing over the entire period between 1961 and 2003 so much so that there was about two folds rise in buffalo population in 2003 as compared to 1961. The major reason for such an increase in buffalo population was the substantial rise in the stocks of adult female buffalo population as adult male buffalo population in the State either remained stagnant or declined between 1961 and 2003. The goat population in Maharashtra also recorded two folds rise between 1961 and 2003 with major increase in the same being noticed after 1987. As for the stocks of sheep, the increase was relatively slower as against the increase in buffalo and goat population in Maharashtra during the period between 1961 and 2003. Interestingly, the share of Maharashtra in total population of India between 1961 and 2003 remained stable at 8-9 per cent for cattle, 6 per cent for buffalo and 5-6 per cent for sheep.

#### **7.5.1.4 Regional Variations in Livestock Population**

Among various regions, the regions of Nashik, Pune and Aurangabad assume considerable significance as these regions of Maharashtra not only possess highest number of cattle, buffalo, sheeps and goats but also other species of livestock. These three regions put together accounted for 63.31 per cent share in total livestock population of Maharashtra in 1951 and 66.62 per cent share in 2003. The share of Konkan region in total livestock population of Maharashtra was estimated at 10.32 per cent in 1951, which declined to 7.32 per cent in 2003. The share of Amravati and Nagpur regions in total livestock population of the state remained more or less constant and hovered at around 13 per cent between 1951 and 2003. The buffalo population was noticed to be the highest in Pune region, which accounted for 28.68 per cent share in total buffalo population of the State in 1951 and as much as 36.69 per cent share in 2003. Another region dominated by buffalo population was the Aurangabad, which accounted for 19 per cent share in total buffalo population of the State in 1951 and 20 per cent share in this respect in 2003. The share of Nashik region in total buffalo population was estimated at about 15 per cent between 1951 and 2003. As for cattle, between 1951 and 2003, Nashik, Aurangabad and Nagpur regions showed a marginal increase in their share in total cattle population of Maharashtra in the face of decline in this share for Konkan, Pune and Amravati regions. The regions showing major share in total cattle population of the State also showed significant growth in their adult female cattle population, especially after 1966. All the regions of Maharashtra showed a falling share of their cattle in total livestock population between 1951 and 2003, which declined from 70.37 per cent to 59.28 per cent in Konkan

region, 56.88 per cent to 42.30 per cent in Nashik region, 44.23 per cent to 28.01 per cent in Pune region, 63.21 per cent to 47.15 per cent in Aurangabad region, 71.46 per cent to 53.84 per cent in Amravati region and 73.26 per cent to 58.53 per cent in Nagpur region with an overall decline in the same from 60.78 per cent to 44.82 per cent for the state as a whole. The regions like Aurangabad, Pune and Nashik showed highest stocks of bovines as their combined share in total bovine stock of Maharashtra stood at 57.55 per cent in 1951 and 62.34 per cent in 2003. In general, Nashik, Pune and Aurangabad are noticed to be the most important regions of Maharashtra since these regions not only have significant stocks of bovines but also other species of livestock.

### **7.5.2 Agricultural Mechanization in Maharashtra**

The bovine economy of Maharashtra witnessed a number of changes in terms of its size, composition and productivity. The size of bovine herd increased from about 17 million in the mid-fifties to 21.7 million in the late eighties. While the sex composition of bovine has shifted in favour of females, its breed composition has shifted considerably in favour crossbreeds. The draught animal population of Maharashtra has shown a slight increase over time. The issue of economic viability along with socio-economic acceptability of species and breeds will become more pertinent under the changed situation in the State. Therefore, an insight into the changes in size, composition and availability of draught animal power in relation to mechanical power will be helpful in understanding the extent of mechanization of agriculture in the state of Maharashtra. And, assessment of factors that have facilitated the process of diffusion and adoption of advanced technology will provide useful insights into the future prospects for the development of livestock sector in the State.

#### **7.5.2.1 Draught Animal Population in Maharashtra**

Slow growth in the stock of draught animals was observed in the state of Maharashtra. During the period between 1951 and 2003, the draught animal population in Maharashtra increased only by 0.31 per cent per annum. The Pune region showed a declining trend in the total stock of draught animals due to fall in its draught bovine population after 1966. The other regions of Maharashtra also showed very slow growth in draft animal population after 1966. The decline in draught animal population in Pune region and its slow growth in other regions of the state after 1966 might be due to interaction of a number of factors, some of which are decline in the average size of cultivated holdings, shift in cropping pattern and increase in the cost of rearing work animals. As human population pressure on land increases, the size of land holding tends

to decline. Because of the indivisibility of work animals, the density of work animal population per unit of cultivated area tends to increase. However, beyond a point when the average size of cultivated holding falls below the critical minimum needed to maintain a pair of work animals, there will be a tendency to do away with work animals and to cling to milch animals.

#### **7.5.2.2 Mechanization of Irrigation in Maharashtra**

The growth of mechanization of irrigation has contributed significantly to the increase in the availability of draught power in agriculture. A rapid increase in the number of electric pumpsets and oil engines was seen in Maharashtra during the last five decades. The number of electric pumpsets and oil engines in Maharashtra, which stood at only 0.2 lakhs during 1951, increased to some 5.9 lakhs in 1982 and 10.3 lakhs by 2003. The bulk of the increase was contributed by electric pumpsets. In Maharashtra, out of the total net irrigated area, 56 per cent was well irrigated in 1972-73, which marginally rose to 58 per cent in 1982-83 and sharply to 68 per cent in 2001-02. The rising importance of well irrigation in the state implies that the requirement of various sources of draught power for lifting water has been increasing. Notably, the installation of more electric pumpsets and oil engines has not had any significant influence on the changes in the draught animals stock. Given the utilization pattern of bullock, an increase in the intensity of mechanized irrigation would not have resulted in a reduction in the draught animal stock. Though it might contribute to the displacement of bullock labour from irrigation, this must have been more than compensated by the increase in the cropping intensity consequent to the increase in the intensity of mechanization. It follows that if mechanization of irrigation is followed by mechanization of land preparation and other cultivation operations like harvesting and threshing, it would result in a reduction in the work animal stock.

#### **7.5.2.3 Farm Power Availability in Maharashtra**

A steady growth in pumpsets, oil engines and tractors has resulted in a significant increase in the availability of total farm power in Maharashtra. The estimated gross availability of farm power from animal and mechanized sources in Maharashtra was about 2.3 million horse power (HP) units in 1951 and this increased to 3.7 million HP in 1966 and 6.2 million HP in 1982. By 2003, it is estimated to have increased to 10.24 million HP units in Maharashtra. Bulk of the increase in total farm power availability over time was contributed by regions like Nashik, Pune and Aurangabad. The composition of farm power in Maharashtra has also undergone a marked change over

time. While the share of power from mechanized sources in total farm power availability has shown a rising trend in the last five decades, a declining trend in this respect was noticed in the case of draught animal power, though in absolute terms, the draught animal power marginally increased from 1966 to 1982 with decline in the same thereafter. In Maharashtra, the share of animal power declined to 26 per cent by 2003, which was about 73 per cent in 1966 and as much as 95 per cent in 1951. The study also revealed that in Maharashtra the share of irrigation equipment in total farm power availability increased from 4 per cent to 50 per cent and that for tractors from 1 per cent to 24 per cent between 1951 and 2003. Around 67 per cent of the mechanized power in Maharashtra's agriculture was estimated to be derived from oil engines and electric pumpsets and the latter has been increasing at a faster rate in recent years. Consequently, the consumption of electric power per hectare of cultivated land has increased rapidly.

#### **7.5.2.4 Tractorisation in Maharashtra**

In the state of Maharashtra, tractorisation has taken place at a faster rate from the mid-sixties onwards. The annual growth in tractor population of Maharashtra hovered at around 12 per cent between 1951 and 1982 and declined to 8 per cent between 1982 and 2003. In 1951, there were only 714 tractors in the state, which increased to 3,224 in 1966 and further to 20,674 in 1982. By 2003, the number of tractors in the state increased to as many as 99,735, showing thereby nearly five folds rise in the same between 1982 and 2003 and 30 folds between 1966 and 2003. Bulk of the increase was observed in Nashik and Pune regions; together contributing about 67 per cent of the total tractor population of the state in 2003. As for mechanization, one of the major observations of this study is that though the intensity and spread of mechanization has progressed rapidly in Maharashtra, even now it is operating at a low level. Therefore, its impact on displacement of work animals is likely to be low. The incidence of displacement is likely to be more in the large and medium farms where the intensity of tractorisation is higher. Further, mechanization of irrigation has taken place at much faster rate than mechanization of tillage in Maharashtra. Thus, the combined effect of mechanization on displacement of work animals is likely to be low in this State.

#### **7.5.3 Trends in Compositional Changes**

The growth of different livestock species and breeds depends upon the crop economies, land utilization pattern, farmers' preference for different livestock products and technological advancement. These changes also reflect the future trend and demand situations for a particular type of livestock and its product. A study of such changes is

extremely crucial for policy planning. Therefore, an attempt has been made in this study to evaluate the changes in the composition of bovine population over time in different regions of Maharashtra.

#### **7.5.3.1 Bovine Population Trends in Maharashtra**

The bovine population in the State has been showing rising trend over time. It increased by about 42 per cent during the five decades between 1951 and 2003. A notable feature was that while the adult male bovine population remained stable over the period of five decades, the adult female bovine population has shown significant growth. Consequently, the sex ratio of adult bovine has shifted rapidly in favour of females. Another important observation was the declining proportion of cattle population in relation to total stock of bovines. It has also been noticed that about 96 per cent of the total adult male bovine population in Maharashtra was used for draught purposes. However, the growth of adult male bovine population over time has been very slow. This was perhaps due to the increasing farm mechanization in the State.

#### **7.5.3.2 Growth Rates in Bovines in Maharashtra**

The growth in buffalo population was much faster than cattle population in Maharashtra state. Though Aurangabad region possessed the largest bovine population, it ranked 4<sup>th</sup> in terms of overall growth (1951-2003) in buffalo population and 3<sup>rd</sup> in cattle population. The Nashik region had the second largest stocks of bovines in Maharashtra, which ranked 3<sup>rd</sup> in terms of overall growth in buffalo and 1<sup>st</sup> in cattle population. In terms of stocks of bovines, Pune was the third most important region of Maharashtra, though it ranked 2<sup>nd</sup> with respect to overall growth in buffalo and 5<sup>th</sup> in cattle population between 1951 and 2003. Both these regions showed positive growth in cattle and buffalo population during the entire period between 1951 and 2003. In fact, increase in buffalo population was mainly contributed by increase in stocks of breedable buffaloes. Its population increased in all the regions in all the periods thereby giving positive and substantially higher growth rate for the whole State.

#### **7.5.3.3 Ratio of Milk to Milch Animals in Maharashtra**

The breeding efficiency of buffaloes appears to be higher compared to cattle, which is reflected by the higher proportion of animals in milk. In the case of cattle, Pune region has attained an optimal proportion of 68.5 per cent in 2003. Even Aurangabad region has shown 60 per cent of its milch cattle in milk in 2003, followed by Nashik region, which shows 58 per cent of its milch animals in milk during the same time. The Konkan region shows a remarkable proportion of 75.0 per cent of buffaloes in milk in

2003, which is an achievement even for an organized sector of Animal Husbandry. The proportion of bovines in milk has grown steadily after 1972. Such high proportion of buffaloes in milk strengthens the conclusion that the breeding efficiency of buffaloes as well as the management of inputs is high in Maharashtra.

#### **7.5.4 Structural Changes in Milk Production in Maharashtra**

Maharashtra, which falls in the western region of the country, started showing quantum leaps in milk production only from 1987-88 onwards when its milk production was 2.66 million tonnes. This state occupied 11<sup>th</sup> position in the country's total milk production as early as 1986-87. The State currently occupies a much higher position in total milk production owing to sustained and concerted efforts towards total dairy development. During 1990-91, it had even crossed the milk production figures of Gujarat. Despite showing significant expansion in milk production over time, there are vast regional imbalances in milk production in the State. In fact, only a couple of regions in the State are contributing to more than 60 per cent of the total milk produced in the State. Notwithstanding the regional imbalances in milk production visualized in the state of Maharashtra, the crucial questions that may merit considerations are: what prospects do the state of Maharashtra hold in milk production enterprise? With the passage of time, what structural changes have taken place in different regions of the state vis-à-vis productivity of milch animals, number of animals in milk and total production of milk? What is the extent of instability in the production growth of milk in different regions of the State? No discussion on dairy sector development may be complete without going into these very many questions.

##### **7.5.4.1 Productivity Indices of Bovines in Maharashtra**

There were considerable variations in the productivity indices of bovines across various district of Maharashtra. The districts like Greater Bombay, Nashik, Jalgaon, Ahmednagar, Pune, Satara and Dhule showed much higher contribution to the State's total milk production compared to their contribution to the State's total bovine population. The bovine productivity indices for these districts, therefore, stood at more than 100. There were also spectrum of districts like Thane, Raigad, Ratnagiri, Sindhudurg, Aurangabad, Jalna, Parbhani, Nanded, Latur, Buldhana, Akola, Amravati, Yavatmal, Wardha, Nagpur and Bhandara, which showed much lower contribution to the State's total milk production compared to their contribution to the State's total bovine population. The bovine productivity indices for these districts, thus, turned out to be much below 100. In the case of districts like Chandrapur and Gadchiroli, these indices

were found to be below 50. In fact, there stand only 9 districts in the state whose productivity indices of bovines are above 100 and by and large their contribution is very high to the State's total milk production.

#### **7.5.4.2 Milk Productivity Variations**

There has been significant increase in average daily milk productivity of cows and buffaloes in all the districts of Maharashtra over the last two decades. The districts that showed major increase in their cow milk productivity were Greater Bombay, Sangli, Satara, Ahmednagar, Pune, Kolhapur, Solapur, Osmanabad, Latur and Buldhana. Similarly, buffalo milk productivity also increased across all the districts with sharper increase in the same being noticed in the case of Greater Bombay, Thane, Ratnagiri, Sindhudurg, Nashik, Dhule, Jalgaon, Ahmednagar, Pune, Satara, Sangli and Kolhapur. Although both cows and buffaloes have shown increases in their milk productivities over time, the increase in cow milk productivity was seen to be much faster than buffalo milk productivity. The higher milk productivity of cow was noticed due mainly to higher concentration of crossbred cows compared to indigenous cows in the districts belonging to Pune, Nashik and Aurangabad regions.

#### **7.5.4.3 Structural Changes in Milk Production**

An overall analysis revealed that during the period between TE 1987-88 and TE 2005-06 the increases in milk production figures were much sharper for Nashik, Pune and Aurangabad regions compared to other regions of the State. However, as for the total contribution, Pune region showed the highest contribution to the State's total milk production. The contribution of Pune region to the State's total milk production stood at about 35 per cent during the period between TE 1987-88 and TE 2005-06. The other major contributors to the State's total milk production were Nashik and Aurangabad regions – contributing 26 per cent and 18 per cent to the State's total milk production during TE 2005-06. As regards milk production expansions, while Aurangabad region showed the maximum expansion in milk production of crossbred cows during the period between TE 1987-88 and TE 2005-06, the increase during the same period for indigenous cow, buffalo and goat milk production was found to be the highest in the case of Nashik region. In general, the past two decades showed 160 per cent increase in total milk production for the state of Maharashtra, which has been due mainly to the production increases of crossbred cow milk as the increases in the case of indigenous cow, buffalo and goat milk production have been very slow during this period.



#### **7.5.4.4 Pattern of Growth and Instability in Rates of Growth**

Wide variations in rates of growth of milk production were noticed for different breeds of milch animals across different districts. During the period between 1985-86 and 2005-06, districts falling under Konkan region showed 2-4 per cent annual growth in their milk production figures with Thane district showing the maximum growth (4.3 per cent), followed by Sindhudurg (4.1 per cent), Raigad (3.9 per cent), Ratnagiri (3.5 per cent) and Greater Bombay district (2.4 per cent). The milk production figures of the districts of Nashik region are estimated to have grown in the range of 6-8 per cent during the period between 1985-86 and 2005-06 with Ahmednagar district showing the highest growth (8.4 per cent) and Jalgaon district showing the least growth (5.7 per cent) in the same. The districts that have shown the least growth in their milk production figures during the given period of time are seen to be falling under Amravati region. In general, the milk production in the state of Maharashtra is estimated to have grown at the rate of 8.3 per cent per annum during 1985-86 – 1994-95 and 3.2 per cent per annum during 1995-96 – 2005-06 with an overall annual growth in the same at 5.4 per cent during the period between 1985-86 and 2005-06. As regards instability in rates of growth of milk production for various breeds of milch animals, crossbred cows showed much higher fluctuations in their milk production growth rates compared to indigenous cow, buffalo and goat, especially during the period between 1985-86 and 1994-95.

#### **7.5.4.5 Regional Imbalances in Growth**

Although Pune region showed very high share in State's total milk production through crossbred cow, buffalo and goat, in respect of production expansions of indigenous cow milk this region lagged far behind Nashik and Aurangabad regions. The higher share of Pune region in total milk production of Maharashtra was mainly due to its significant contribution to State's total milk production of crossbred cow, buffalo and goat milk production. In the case of crossbred cow, Nashik region showed significant expansion in terms of its share in total crossbred cow milk production of the State, which increased from 25 per cent during 1985-86 – 1994-95 to 33 per cent during 1995-96 – 2005-06, whereas this share for Pune region declined from 53 per cent to 40 per cent during the same period. In fact, Nashik, Pune and Aurangabad regions also showed very high share in total goat milk production of the State as these three regions accounted for almost 70 per cent of the total goat milk production of the State. The Nagpur region accounted for the lowest share in terms of all the breeds of milch animals, followed by Amravati and Konkan regions.

#### **7.5.4.6 Changing Structure in Ranking of Districts**

It is to be noted that Ahmednagar district ranked first in total milk production of the State during TE 1996-97 and TE 2005-06, though its ranking was fifth during TE 1987-88, showing thereby an increase in its ranking in total milk production of the State. Similarly, Pune district showed an increase in its ranking from 3<sup>rd</sup> during TE 1987-88 to 2<sup>nd</sup> during TE 1987-88 and TE 2005-06. On the other hand, Kolhapur district showed a decline in its ranking in total milk production of the State as its ranking in this respect came down from 1<sup>st</sup> during TE 1987-88 to 3<sup>rd</sup> during TE 1987-88 and TE 2005-06. The ranking of Satara district did not change throughout the period between 1985-86 and 2005-06 as occupied 4<sup>th</sup> position in total milk production of Maharashtra during this period. The ranking of Solapur district in total milk production of the State declined from 7<sup>th</sup> during TE 1987-88 to 8<sup>th</sup> during TE 1996-97 but increased to 5<sup>th</sup> during TE 2005-06. Although there were some differences in ranking of districts in total milk production of the State, the estimated rank correlation coefficient in respect of cross-section of districts was found to be not only positive but also very high between the periods under consideration. This indicated that, in general, there has not been much of a change in the ranking of districts in respect of their contribution to State's total milk production during the period between 1985-86 and 2005-06.

#### **7.5.4.7 Milk Procurement in Maharashtra**

The state of Maharashtra has shown significant expansion not only in total milk production but also procurement of this milk by the organized sector. While total milk production in Maharashtra increased from 4.99 million tonnes in 1995-96 to 6.8 million tonnes in 2005-06, the expansion in procurement of this milk by the organized sector was much sharper, which increased from 1.18 million tonnes to as much as 2.19 million tonnes during the same period, implying the share of organized sector milk procurement in total milk production to increase from 24 per cent to 32 per cent. In fact, 2004-05, the organized sector handled as much as 38 per cent of the total milk produced in Maharashtra. Bulk of the expansion in milk procurement was contributed by Pune region, which showed milk procurement to the tune of 68 per cent of total milk production of this region in 2004-05 and 63 per cent in 2005-06. Another important region in terms of milk procurement was noticed to be Nashik, which consistently showed milk procurement in the range of 25-30 per cent of total milk production of this region between 1995-96 and 2005-06. In this sequel, milk procurement as proportion to total milk production steadily increased in the case of Aurangabad region. In fact, the share of milk procurement in total

milk production for Aurangabad region increased sharply from 15 per cent in 1995-96 to 37 per cent in 2001-02 with a decline in the same to 28 per cent in 2005-06. It is to be noted that about 44 per cent of dairy cooperatives prevail in Pune region and 21 per cent in Nashik region. These two regions account for more than two thirds share in total dairy cooperatives prevailing in the State. Due to very high numerical strength of dairy cooperatives in Pune and Nashik regions, the organized procurement of milk is very high in these two regions.

#### **7.5.5 Structural Changes in Egg Production in Maharashtra**

The egg production in Maharashtra through both improved and *deshi* breeds of poultry was estimated at 2,597 million during TE 1996-97, which increased to 3,440 million during TE 2005-06, showing thereby 32 per cent rise in the same over the last one decade. Among various regions, Pune region was found to account for substantial share in total egg production of Maharashtra, though its share in total egg production of the State declined from 57 per cent during TE 1996-97 to 47 per cent during TE 2005-06. The next important region in terms of egg production in Maharashtra was found to be Nashik, which accounted for 16 per cent share in total egg production of the State during TE 1996-97 and 26 per cent during TE 2005-06. Thus, a decline in share of Pune region in total egg production of the State was compensated by an increase in share in this respect by Pune region during the same period. The share of other regions in total egg production of the State remained by and large constant over the last one decade, and hovered at around 3-4 per cent for Amravati region, 6-7 per cent for Aurangabad and Nagpur regions.

#### **7.5.6 Structural Changes in Wool Production in Maharashtra**

Although the state of Maharashtra accounts for a reasonable share in total wool production of India, there has not been much increase in wool production in the State, which has grown hardly 0.63 per cent annually during the period between 1994-95 and 2005-06. The wool production in Maharashtra was estimated at 1,550 metric tonnes during TE 1996-97 and this increased to 1,645 metric tonnes during TE 2005-06, showing hardly 6 per cent rise in the same during this period. However, some of the regions of Maharashtra like Pune, Nashik and Aurangabad were noticed to account for substantially very high share in total wool production of the State. Pune region accounted for as much as 45 per cent share in total wool production of Maharashtra over the last one decade. The region of Nashik was the second in terms of total wool production of the State, which accounted for 30 per cent share in the State in wool production during TE

1996-97 and 34 per cent share in this respect during TE 2005-06. The Aurangabad region showed a share of 15-16 per cent in total wool production of Maharashtra over the last one decade. This amply demonstrates the fact that the regions of Pune, Nashik and Aurangabad cornered more than 90 per cent share in total wool production of the State mainly because of their significantly high share of sheep population as compared to other regions of the State. As for wool production, the estimated rank correlation coefficient in respect of cross-section of districts was positive as well as very high, implying not much of a change in the ranking of districts in respect of their contribution to State's total wool production during the period between 1994-95 and 2005-06.

#### **7.5.7 Structural Changes in Meat Production in Maharashtra**

The meat production in Maharashtra was estimated at 1.58 lakh tonnes during TE 1987-88, which increased to 1.72 lakh tonnes during TE 1996-97 and by the TE 2005-06, it had grown to 2.31 lakh tonnes, showing thereby nearly 50 per cent increase over the last two decades. It is to be noted that though cattle accounted for the major share in total meat production in Maharashtra during eighties and even nineties period, the scenario changed thereafter and at present buffaloes account for major share in total meat production of the State. Another species of livestock contributing significantly to the total meat production of Maharashtra was goat, which accounted for 28 per cent share in total meat production of the State during TE 1987-88 and 23 per cent during TE 2005-06. The goat meat production in Maharashtra grew at the rate of 5.32 per cent a year between 1995-96 and 2005-06, though it recorded a negative annual growth in the same at 1.92 per cent between 1985-86 and 1994-95. Similarly, sheep meat production in the State grew at rate of 5.76 a year between 1995-96 and 2005-06. This is an indication of the fact that meat production through sheeps and goats in Maharashtra expanded tremendously only in more recent times.

#### **7.5.8 Livestock Production Scenario in Maharashtra**

Two differing points of view emerged about the status of livestock rearing in the state of Maharashtra. While the State showed remarkable progress in terms of overall growth in livestock production over the last two decades with respect to milk, eggs, wool and meat, there were also wide inter-and intra-regional variations in growth rates during this period. The factors underlying regional imbalances in the growth of livestock production could be many. Imbalances might be associated with (a) differences in the distribution of breedable bovine population in different regions of the State, (b) differences in resource base with respect to feeds and fodder and animal health cover, (c)

differences in terms of number of insemination in the field areas for breed improvement and thereby causing differences in genetic architecture of milch animals, and (d) differences in the productivity of animals. Further, the ready acceptability of modern technology by the livestock rearing households in rural settings, intensive efforts by the dairy co-operatives in providing balanced cattle feed, veterinary services and the availability of other infrastructure facilities could be considered as the other underlying forces that have transformed the status of livestock in most of the districts of the State.

#### **7.5.9 Livestock Development Policies and Programmes**

Several programmes and schemes relating to improvement of livestock health were initiated in Maharashtra even before the formation of the State in May 1961 when there existed Bombay State, which encompassed the current states of Gujarat, Maharashtra, part of Andhra Pradesh, Karnataka and Madhya Pradesh. For instance, since Artificial Insemination (AI) was considered as the most expeditious method for the breed improvement of cattle, the Government of Bombay decided to open a couple of AI centres in the Bombay Provinces prior to the establishment of the state of Maharashtra, which was done after probing the utility of the method under Indian conditions. Establishment of Key Village Centres was another milestone in propagating AI work at the village level. In 1965, the State Government initially established Intensive Cattle Development Projects (ICDP) at Pune, Miraj, Dhule and subsequently at Chiplun (1967), Jalna (1972), Nagpur (1972) and Amraoti (1975). Every ICDP had six Regional AI centres with each having 15 sub-centres and each sub centre was catering to 1,000 breedable cattle population. Thus, each ICDP catered to about 1,00,000 breedable cattle population in the entire project. Each ICDP had also a Centralized Semen Collection Centre (CSCC), which maintained bulls for collection of semen and subsequent supply of it to the sub-centres.

The National Project for Rinderpest Eradication (N.P.R.E.) - an E.E.C. assisted Programme- was launched in April 1992 in the country. The state of Maharashtra has also been covered under this project and is in Zone-B since 1995-96. The State is thus partially free from Rinderpest, as no outbreaks of Rinderpest in bovines have been reported in the State since 1991-92. The vaccination against Rinderpest has been totally stopped in the State since 1996-97. Prior to this, the State was in Zone-C. As per the strategy for Zone C, the vaccination against Rinderpest was undertaken on mass scale in all the districts bordering other States. Similarly, sheep and goats in all the districts of the State were vaccinated against Rinderpest.

There were several other programmes that came into being from time to time, e.g. the Cattle Development Programme. This programme aims at crossbreeding the local cows with exotic dairy breeds for increasing milk production of indigenous cows and improvement of indigenous local cattle breeds through selective breeding practices. The cattle development programme is carried out through six major activities viz. (i) Cattle Breeding Farms, (ii) Intensive Cattle Development Projects, (iii) Key Village Centres (iv) District Artificial Insemination Centres, (v) Premium Bull Scheme, Supplementary Cattle Breeding Centres and Artificial Insemination Sub-Centres under Local Sector and (vi) Fodder Development Programme. Another very important programme, i.e. Special Livestock Production Programme was launched in Maharashtra under Centrally assisted scheme during 1977-78, which envisaged distribution of subsidy for rearing crossbred heifers (milk production), poultry production, sheep production and piggery production.

In order to improve breeding efficiency and thus production potential of livestock, a number of policies have been initiated in the state of Maharashtra, and important among these are: (a) Breeding Policy for Non-Descript Cattle, (b) Breeding Policy for Indigenous Cattle, (c) Breeding Policy for Buffaloes, (d) Breeding Policy for Sheeps and Goats, (e) Breeding Policy for Poultry, (f) Livestock Policy for Health Care, (g) Policy for ensuring quality AI Services and Inputs, (h) Policy for Feed, Fodder, Animal Nutrition and Grazing, (i) Policy for Animal Product Development, Quality Control, Marketing and Export Promotion, (j) Policy for Veterinary Education, Human Resource Development and Extension, (k) Policy for Livestock Insurance, (l) Policy for Removal of Regional Backlog of Veterinary Institutions and (m) Policy Regarding Self Employment in Animal Husbandry Sector and Public-Private-Cooperative Participation.

Thus, the Government of Maharashtra is making sincere and concerted efforts towards overall development of livestock sector of the State through various programmes, schemes and policy initiatives with focus on breed improvement, livestock health care, disease control, AI services and inputs delivery, veterinary education, human resource development and extension, animal product development, quality control, feeds and fodder supply, livestock insurance, marketing and export promotion, generation of employment opportunities, genetic improvement of livestock, etc. The initiation of various programmes and schemes is primarily aimed at enhancing the whole gamut of livestock production base of the State through animal health care practices, infrastructure development, and feeds and fodder development practices. All these efforts have paid rich dividends and, as a result, today Maharashtra assumes considerable importance in the

production of milk, eggs and meat with growing share in country's total livestock production base.

#### **7.5.10 Trade Liberalization and Livestock Sector**

Though over the past two decades India has been net exporter of meat and meat products with negligible dependence on import trade of these products, the scenario obtaining in terms of export trade of milk and milk products during this period is not very encouraging. Despite the fact that India's dependence on import trade of butter, ghee from cow milk, cheese and curd animal fats, etc. has come down sharply over the past two decades in the face of rise in export trade in the same, the trade balance of India in these products remains negative due to higher value associated with imports as against export. In the era of WTO regime India faces significant threat in the case of import trade of some of the dairy products like butter, ghee, cheese and curd, animal fats and some other livestock based products like hides and skins.

Of late the distortions in global livestock trade are taking place due to subsidized production of livestock products in EU and USA. These subsidized livestock products are exported in the world markets much below their true cost of production. This coupled with trade barriers, restrictive trade policies and stringent health and sanitary standards restrict many producers in developing world to enter in higher priced international markets. In the dairy sector, the subsidised exports of EU have adversely affected the dairy industry in India, Brazil and Jamaica.

A very recent study comes out with several interesting observations insofar as the impact of trade liberalization on domestic producers and consumers of milk and milk products is concerned. In order to evaluate the effect of trade liberalization on domestic market of milk and milk products, the study considers three alternative scenarios of world prices (fob) of milk with Rs.647 (US \$1500) per quintal as marked with lower range of world price, Rs.1140 (US \$ 2650) per quintal as higher range of world price, and Rs.884 (US \$ 2050) per quintal as intermediate range of world price. The study observes a steep fall in the domestic prices of milk following the decision to import milk products at a low international price (Rs.640 per quintal). Since supply of milk is highly price elastic, this situation will lead to adverse affect on milk production in states like Haryana, Maharashtra, Tamil Nadu, West Bengal and Uttar Pradesh that account for more than 40 per cent share in total milk production of India. The decline in milk supply will further translate into negative producer's surplus in all the states of India. However, the magnitude of negative surplus is likely to vary across states. In this sequel, Uttar Pradesh

will show the highest negative surplus, followed by Maharashtra, Tamil Nadu, Haryana and West Bengal.

In the WTO regime, surging imports have not only affected farm incomes but also employment in many developing countries. Consequent upon cheap imports and absence of adequate protection measures, safeguarding income and livelihood of poor farmers have emerged issues that need to be addressed by policy makers.

### **7.6 Policy Implications and Conclusions**

An analysis into farm mechanization in Maharashtra reveals that technological changes in agriculture associated with the green revolution has brought about significant changes in the size and composition of animal draught power as there is relatively increasing dependence on mechanized sources of farm power as against animal draught power. The reduction in the demand for work animals has two major consequences: a proportionate release of animal feed; and a change in the composition of livestock population in favour of milch stock. Although the rising importance of well irrigation in the state implies that the requirement of various sources of draught power for lifting water has been increasing, the rise in the intensity of mechanization did not appear to have affected the draught animal population in the state. Further, given the utilization pattern of bullock, an increase in the intensity of mechanized irrigation would not have resulted in a reduction in the draught animal stock. Though it might contribute to the displacement of bullock labour from irrigation, this must have been more than compensated by the increase in the cropping intensity consequent to the increase in the intensity of mechanization. In fact, the intensity and spread of mechanization is operating at low level in Maharashtra, its impact on displacement of work animals is likely to be low. Interestingly, while the adult male bovine population remained stable over the last five decades in Maharashtra, the adult female bovine population increased significantly, implying a rapid shift in the sex ratio of bovines in favour of females.

The findings of this study with respect to mechanization of farm have four major policy implications. Firstly, while draught animals are not displaced by other sources of farm power, there is a sharp increase in the stock of female bovine population. This trend is desirable in the light of the growing economic opportunity for increasing milk production and for undertaking dairying as a commercial proposition. Secondly, as buffalo population is increasing in proportion, the income generating capacity of milch animals will be higher because of higher productivity of buffaloes in terms of milk. As a matter of fact, at present, India is the largest milk producer in the world.



Now, India has emerged as an exporter of milk products in contrast to its import in the earlier years. With the increasing number of milch animals and milk production in rural settings, it may be possible for India to emerge in future as the largest producer and exporter of milk products in the world. Thirdly, since the use of animals for draught purposes is showing no significant growth, farmers should resort to modern techniques of tilling as substitute to animal power in the face of growing farming activities. This may in turn bring opportunities for improvement in land productivity and a still higher income generation from the farmers' scarce land and other resources. Finally, the increasing use of mechanical equipment for cultivation in lieu of additional power will progressively increase the rural demand for energy i.e., for electricity, diesel, etc. Therefore, there must be adequate investment in power sector in the future to accommodate this increasing rural demand for power.

It is to be further noted that the course of time has witnessed implementation of several programmes and schemes relating to livestock development in the state of Maharashtra, which truly transformed this State into one of the most important states of India insofar as livestock resources are concerned. Consequently, the state of Maharashtra boasts to have significant share not only in total milk production of India but also in eggs, wool, meat and a host of other livestock based products. However, what kind of future strategy would be appropriate for the state of Maharashtra in order to sustain the growth of milk production, at least at the current level, is the crucial question that could strike one. In this context, it deserves mention that a medium term strategy that can realize the unutilized/underutilized production potential of animals will be more conducive than a strategy based on capital intensive and high production technology. This in turn will lead to formulation of a long-term strategy for increasing the resources base of the farmers. There still exists vast scope for increasing milch animal productivity by following improved animal husbandry practices. However, this warrants effective machinery for imparting extension services to the farmers through co-operatives. Many of the prevailing notions among the farmers need to be changed in view of higher milch animal productivity. Even with all this, the prospects for increased milk production in the State in the years to come will also depend on the extent to which farmers undertake fodder cultivation as an integral part of milk production. These measures will surely provide rich dividends for increased milk production in the State as well as other livestock based products.

As for the prospects of livestock sector in the era of WTO regime, one of the recent studies observes a steep fall in the domestic prices of milk following the decision to import milk products at a low international price (Rs.640 per quintal). Since supply of milk is highly price elastic, this situation will lead to adverse affect on milk production in states like Haryana, Maharashtra, Tamil Nadu, West Bengal and Uttar Pradesh that account for more than 40 per cent share in total milk production of India. The study further finds that at the intermediate range of world price (Rs.850 per quintal), the derived duty paid (DDP) price at one of the Indian port will be Rs.1204 per quintal. On the other hand, price differences in the wholesale market suggest that import would take place only in Mumbai, which would have limited effect on the producers and consumers of milk. The producers and consumers in other states would by and large remain unaffected. However, the study shows concern for the protection of livestock sector in India in view of loss of employment and the wide ramifications this has for the rural economy. It emphasizes upon the fact that a high import at the low range of the world price would cause enormous loss of employment in the country and, therefore, on this account the sector requires protection from low world price of milk. Since as of now protection in the form of moderate tariff (35-40 per cent) and tariff rate quota appears to be sufficient, any argument for further reduction of tariff must be resisted.

As for scope for the expansion of Indian dairy industry in new liberalized trade regime is concerned, it has been observed that, in general, the Indian dairy sector would be competitive only if the export subsidies on dairy products are abolished. In more relaxed market environment, the real challenge before Indian livestock sector would be in terms of Sanitary and Phytosanitary Measures (SPS), Agreement on Technical Barriers to Trade (TBT) and animal welfare related issues. With a view to meet these requirements - both domestically and in the world markets - modernization of supply chain encompassing producer as well as consumer is the need of the hour.

Undoubtedly, India is already price competitive in the world market and when subsidies from competitive producers like USA and EU countries are removed, the situation will make India more price competitive. In case India is not able to capture the world market in the event of removal of subsidies from the modern bloc countries, the other competitors like Australia and New Zealand would capture this market and enter in a big way to flood markets with their dairy products, making us loosing our competitiveness and a great opportunity in the new trade regime.

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## APPENDIX

**Annexure 1: Region-wise Draught Animal Population in Maharashtra: 1951-2003**

Region	Year	Draught Animal Population			CGR	NSA (10 <sup>2</sup> Ha)	DDA
		Cattle	Buffalo	Total			
Konkan	1951	644662	109296	753958	--	8647	0.87
	1956	677775	112812	790587	0.95	8647	0.91
	1961	738008	125367	863375	1.78	8647	1.00
	1966	721980	123739	845719	-0.41	8693	0.97
	1972	735408	114004	849412	0.09	7946	1.07
	1977	751646	112091	863737	0.34	8218	1.05
	1982	798021	129004	927025	1.42	8103	1.14
	1987	813069	136423	949492	0.48	8888	1.07
	1992	791742	123021	914763	-0.74	9350	0.98
	1997	781646	101799	883445	-0.69	9475	0.93
2003	691094	74633	765727	-2.82	8181	0.94	
Nashik	1951	1130882	38889	1169771	--	36075	0.32
	1956	1104005	22526	1126531	-0.75	36075	0.31
	1961	1258387	29186	1287573	2.71	36075	0.36
	1966	1339702	23252	1362954	1.14	36153	0.38
	1972	1201100	19194	1220294	-2.19	34006	0.36
	1977	1199432	24082	1223514	0.05	36391	0.34
	1982	1285297	36314	1321611	1.55	35695	0.37
	1987	1265654	26948	1292602	-0.44	35871	0.36
	1992	1389597	29900	1419497	1.89	35167	0.40
	1997	1432165	34630	1466795	0.66	35276	0.42
2003	1328555	29614	1358169	-1.53	35690	0.38	
Pune	1951	909428	74789	984217	--	39145	0.25
	1956	902465	60725	963190	-0.43	39145	0.25
	1961	1028217	77117	1105334	2.79	39145	0.28
	1966	1004221	62144	1066365	-0.72	48551	0.22
	1972	919333	56958	976291	-1.75	34110	0.29
	1977	909370	64862	974232	-0.04	37309	0.26
	1982	891875	68115	959990	-0.29	37735	0.25
	1987	841675	50344	892019	-1.46	37267	0.24
	1992	833078	41901	874979	-0.39	36796	0.24
	1997	761006	33680	794686	-1.91	35995	0.22
2003	668814	30037	698851	-2.54	35557	0.20	
Aurangabad	1951	1052303	26423	1078726	--	46235	0.23
	1956	1294059	18176	1312235	4.00	46235	0.28
	1961	1492976	33396	1526372	3.07	46235	0.33
	1966	1510776	14927	1525703	-0.01	47155	0.32
	1972	1347910	10440	1358350	-2.30	44696	0.30
	1977	1399795	14387	1414182	0.81	49038	0.29
	1982	1534937	17584	1552521	1.88	47795	0.32
	1987	1464438	9411	1473849	-1.03	48648	0.30
	1992	1545069	8492	1553561	1.06	48308	0.32
	1997	1622198	6912	1629110	0.95	48594	0.34
2003	1505771	5317	1511088	-1.49	45676	0.33	
Amravati	1951	731895	8782	740677	--	28473	0.26
	1956	830775	8336	839111	2.53	28473	0.29
	1961	875760	11149	886909	1.11	28473	0.31
	1966	871424	7568	878992	-0.18	29227	0.30
	1972	852986	5801	858787	-0.46	30356	0.28
	1977	929890	6432	936322	1.74	30768	0.30
	1982	960306	8288	968594	0.68	30305	0.32
	1987	942171	4248	946419	-0.46	31444	0.30
	1992	1005371	3079	1008450	1.28	31264	0.32
	1997	1021741	2463	1024204	0.31	30427	0.34
2003	991291	1696	992987	-0.62	30941	0.32	



**Annexure 1(Cont...): Region-wise Draught Animal Population in Maharashtra: 1951-2003**

Region	Year	Draught Animal Population			CGR	NSA (10 <sup>2</sup> Ha)	DDA
		Cattle	Buffalo	Total			
Nagpur	1951	769637	55693	825330	--	19412	0.43
	1956	883201	61485	944686	2.74	19412	0.49
	1961	1013481	86140	1099621	3.08	19412	0.57
	1966	995823	84582	1080405	-0.35	19676	0.55
	1972	1045448	78983	1124431	0.80	20287	0.55
	1977	1047917	77432	1125349	0.02	20540	0.55
	1982	1100938	82789	1183727	1.02	19967	0.59
	1987	1129996	75384	1205380	0.36	19087	0.63
	1992	1182059	77990	1260049	0.89	19458	0.65
	1997	1174893	78203	1253096	-0.11	18268	0.69
2003	1133904	72478	1206382	-0.76	18960	0.63	
Maharashtra	1951	5238807	313872	5552679	--	177720	0.31
	1956	5692280	284060	5976340	1.48	177720	0.34
	1961	6406829	362355	6769184	2.52	177720	0.38
	1966	6443926	316212	6760138	-0.03	180108	0.38
	1972	6102185	285380	6387565	-1.13	171401	0.37
	1977	6238050	299286	6537336	0.46	182265	0.36
	1982	6571374	342094	6913468	1.13	179600	0.38
	1987	6457003	302758	6759761	-0.45	181205	0.37
	1992	6746916	284383	7031299	0.79	180345	0.39
	1997	6793649	257687	7051336	0.06	178034	0.40
2003	6319429	213775	6533204	-1.51	175006	0.37	
India	1951	60726641	6538796	67265437	--	1349797	0.50
	1956	64312482	6374188	70686670	1.00	1349797	0.52
	1961	72818000	7625000	80443000	2.62	1349797	0.60
	1966	71431000	7592000	79023000	-0.36	1377213	0.57
	1972	72562000	7612000	80174000	0.29	1402930	0.57
	1977	73227000	7934000	81161000	0.25	1416903	0.57
	1982	70066000	5970000	76036000	-1.30	1425143	0.53
	1987	58588000	6633000	65221000	-3.02	1386313	0.47
	1992	63231000	7357000	70588000	1.59	1421847	0.50
	1997	55761000	6802000	62563000	-2.38	1425480	0.44
2003	54319000	5834000	60153000	-0.78	1382673	0.44	

**Appendix 2: Region-wise Number of Electric Pumpsets and Oil Engines in Maharashtra**

Regions	Year	Electric Pumpsets and Oil Engines						Density of Electric Pumpsets and Oil Engines per 100 Ha of NSA
		Oil Engines		Pumpsets		Total		
		Number	CGR	Number	CGR	Number	CGR	
Konkan	1951	2558	--	131	--	2689	--	0.31
	1956	968	-17.66	57	-15.33	1025	-17.54	0.12
	1961	1455	8.49	111	14.26	1566	8.85	0.18
	1966	1914	5.64	1316	63.98	3230	15.58	0.37
	1972	1958	0.46	3798	23.61	5756	12.25	0.72
	1977	1327	-7.49	7235	13.76	8562	8.27	1.04
	1982	1169	-2.50	7007	-0.64	8176	-0.92	1.01
	1987	1813	9.17	5037	-6.39	6850	-3.48	0.77
	1992	2638	7.79	8662	11.45	11300	10.53	1.20
	1997	4142	9.44	9340	1.52	13482	3.59	1.42
	2003	8036	14.17	20380	16.89	28416	16.08	3.47
Nashik	1951	5271	--	368	--	5639	--	0.16
	1956	9134	11.62	198	-11.66	9332	10.60	0.26
	1961	26403	23.65	601	24.87	27004	23.68	0.75
	1966	62063	18.64	5955	58.20	68018	20.29	1.88
	1972	60363	-0.55	60441	58.96	120804	12.17	3.55
	1977	44168	-6.06	119402	14.59	163570	6.25	4.49
	1982	32848	-5.75	139631	3.18	172479	1.07	4.83
	1987	35563	1.60	171211	4.16	206774	3.69	5.76
	1992	15441	-15.37	221876	5.32	237317	2.79	6.75
	1997	20212	5.53	230430	0.76	250642	1.10	7.11
	2003	13176	-8.20	190065	-3.78	203241	-4.11	5.69
Pune	1951	7488	--	384	--	7872	--	0.20
	1956	11111	8.21	219	-10.62	11330	7.55	0.29
	1961	22690	15.35	444	15.18	23134	15.35	0.59
	1966	48590	16.45	11847	92.86	60437	21.17	1.24
	1972	60360	4.43	39487	27.22	99847	10.56	2.93
	1977	73856	4.12	98973	20.17	172829	11.60	4.63
	1982	64506	-2.67	109510	2.04	174016	0.14	4.61
	1987	58361	-1.98	129781	3.45	188142	1.57	5.04
	1992	45461	-4.87	139653	1.48	185114	-0.32	5.03
	1997	41109	-1.99	194700	6.87	235809	4.96	6.55
	2003	40467	-0.31	245109	4.71	285576	3.90	8.03
Aurangabad	1951	842	--	54	--	896	--	0.02
	1956	2703	26.27	73	6.21	2776	25.38	0.06
	1961	8329	25.24	305	33.11	8634	25.48	0.19
	1966	25197	24.78	4541	71.62	29738	28.06	0.63
	1972	38072	8.61	28978	44.87	67050	17.66	1.50
	1977	26978	-6.66	65730	17.80	92708	6.69	1.89
	1982	21146	-4.75	87667	5.93	108813	3.26	2.28
	1987	19980	-1.13	156455	12.28	176435	10.15	0.04
	1992	13782	-7.16	191591	4.14	205373	3.08	0.04
	1997	14484	1.00	245006	5.04	259490	4.79	5.34
	2003	13998	-0.68	276285	2.43	290283	2.27	6.36
Amravati	1951	991	--	69	--	1060	--	0.04
	1956	1719	11.65	533	50.51	2252	16.27	0.08
	1961	3008	11.84	2645	37.77	5653	20.21	0.20
	1966	6163	15.43	9740	29.79	15903	22.98	0.54
	1972	7898	5.09	23186	18.94	31084	14.34	1.02
	1977	12536	9.68	56644	19.56	69180	17.35	2.25
	1982	10498	-3.49	69110	4.06	79608	2.85	2.63
	1987	16419	9.36	88436	5.06	104855	5.66	3.33
	1992	7858	-13.70	100536	2.60	108394	0.67	3.47
	1997	10376	5.72	108029	1.45	118405	1.78	3.89
	2003	11504	2.09	109861	0.34	121365	0.50	3.92

**Appendix 2 (Cont...): Region-wise Number of Electric Pumpsets and Oil Engines in Maharashtra**

Regions	Year	Electric Pumpsets and Oil Engines						Density of Electric Pumpsets and Oil Engines per 100 Ha of NSA
		Oil Engines		Pumpsets		Total		
		Number	CGR	Number	CGR	Number	CGR	
Nagpur	1951	409	--	38	--	447	--	0.02
	1956	982	19.15	953	90.49	1935	34.05	0.10
	1961	1862	13.65	2424	20.53	4286	17.24	0.22
	1966	2859	8.95	4580	13.57	7439	11.66	0.38
	1972	5027	11.95	13888	24.84	18915	20.52	0.93
	1977	8937	12.20	30075	16.71	39012	15.58	1.90
	1982	9029	0.21	35706	3.49	44735	2.78	2.24
	1987	10871	3.78	48729	6.42	59600	5.91	3.12
	1992	14310	5.65	69538	7.37	83848	7.07	4.31
	1997	21936	8.92	64319	-1.55	86255	0.57	4.72
	2003	27344	4.51	69682	1.61	97026	2.38	5.12
Maharashtra	1951	17559	--	1044	--	18603	--	0.10
	1956	26617	8.68	2033	14.26	28650	9.02	0.16
	1961	63747	19.09	6530	26.29	70277	19.66	0.40
	1966	146786	18.15	37979	42.21	184765	21.33	1.03
	1972	173678	3.42	169778	34.92	343456	13.20	2.00
	1977	167802	-0.69	378009	17.36	545811	9.71	2.99
	1982	139196	-3.67	448631	3.49	587827	1.49	3.27
	1987	143007	0.54	599649	5.97	742656	4.79	4.10
	1992	99490	-7.00	731856	4.07	831346	2.28	4.61
	1997	112259	2.44	851824	3.08	964083	3.01	5.42
	2003	114525	0.40	911382	1.36	1025907	1.25	5.86
India	1951	82477	--	26174	--	108651	--	0.08
	1956	122511	8.24	47034	12.44	169545	9.31	0.13
	1961	229972	13.42	160168	27.77	390140	18.14	0.29
	1966	470968	15.42	414610	20.95	885578	17.82	0.64
	1972	1557000	27.02	1618000	31.30	3175000	29.09	2.26
	1977	2358700	8.66	2439700	8.56	4798400	8.61	3.39
	1982	3296000	6.92	3581000	7.98	6877000	7.46	4.83
	1987	11665600	28.76	4517800	4.76	16183400	18.67	11.67
	1992	45774000	31.44	64035000	69.94	109809000	46.66	77.22
	1997	70938000	9.16	72987000	2.65	143925000	5.56	100.96
	2003	72374000	0.40	84483000	2.97	156857000	1.74	113.44

**Appendix 3: Availability of Mechanical and Draught Animal Power (HP) in Maharashtra**

Region	Year	Mechanical Power (MP) (10 <sup>4</sup> HP)				DAP (10 <sup>4</sup> HP)	TFP (10 <sup>4</sup> HP)	Share of MP in TFP (%)	Share of DAP in TFP (%)	Share of Pumpsets and Oil Engines in TFP (%)
		Oil Engines	Pumpsets	Tractors	Total					
Konkan	1951	1.28	0.07	0.07	1.41	30.16	31.57	4.46	95.54	4.26
	1956	0.48	0.03	0.07	0.58	31.62	32.20	1.81	98.19	1.59
	1961	0.73	0.06	0.09	0.88	34.53	35.41	2.48	97.52	2.21
	1966	0.96	0.66	0.16	1.77	33.83	35.60	4.98	95.02	4.54
	1972	0.98	1.90	0.24	3.12	33.98	37.09	8.41	91.59	7.76
	1977	0.66	3.62	0.32	4.60	34.55	39.15	11.76	88.24	10.93
	1982	0.59	3.50	0.24	4.33	37.08	41.41	10.45	89.55	9.87
	1987	0.91	2.52	0.31	3.74	37.98	41.71	8.95	91.05	6.07
	1992	1.32	4.33	0.81	6.46	36.59	43.05	15.01	84.99	13.12
	1997	2.07	4.67	1.22	7.96	35.34	43.30	18.39	81.61	15.57
2003	4.02	10.19	2.12	16.32	30.63	46.95	34.77	65.23	30.26	
Nashik	1951	2.64	0.18	0.60	3.42	46.79	50.21	6.81	93.19	5.62
	1956	4.57	0.09	0.75	5.41	45.06	50.47	10.72	89.28	9.24
	1961	13.20	0.30	0.87	14.37	51.50	65.87	21.81	78.19	20.50
	1966	31.03	2.98	2.20	36.21	54.52	90.72	39.91	60.09	37.49
	1972	30.18	3.02	4.69	65.09	48.81	113.90	57.14	42.86	53.03
	1977	22.09	59.70	13.11	94.90	48.95	143.84	65.98	34.02	56.86
	1982	16.42	69.82	23.73	109.97	52.86	162.83	67.53	32.47	52.96
	1987	17.78	85.61	32.59	135.98	51.70	187.68	72.45	27.55	46.31
	1992	7.72	110.94	46.11	164.77	56.78	221.55	74.37	25.63	53.56
	1997	10.11	115.21	75.66	200.98	58.67	259.65	77.40	22.60	48.27
2003	6.59	95.03	85.70	187.32	54.33	241.64	77.52	22.48	42.05	
Pune	1951	33.75	0.19	0.54	4.48	39.37	43.84	10.21	89.79	8.98
	1956	5.56	0.11	0.58	6.25	38.53	44.78	13.96	86.04	12.65
	1961	11.35	0.22	0.68	12.25	44.21	56.46	21.69	78.31	20.49
	1966	24.30	5.92	3.10	33.32	42.65	75.97	43.86	56.14	39.78
	1972	30.18	19.74	5.76	55.68	39.05	94.73	58.78	41.22	52.70
	1977	36.93	49.48	9.58	95.99	38.97	134.96	71.13	28.87	64.03
	1982	32.25	54.76	14.66	101.67	38.40	140.07	72.58	27.42	62.12
	1987	29.18	64.89	27.07	121.14	35.68	156.82	77.25	22.75	42.07
	1992	22.73	69.83	36.31	128.86	35.00	163.86	78.64	21.36	56.48
	1997	20.55	97.35	64.83	182.73	31.79	214.52	85.18	14.82	54.96
2003	20.23	122.55	81.86	224.65	27.95	252.60	88.93	11.07	56.53	
Aurangabad	1951	0.42	0.03	0.04	0.49	43.15	43.63	1.11	98.89	1.03
	1956	1.35	0.04	2.60	3.99	52.49	56.47	7.06	92.94	2.46
	1961	4.16	0.15	0.39	4.71	61.05	65.76	7.16	92.84	6.56
	1966	12.60	2.27	0.71	15.58	61.03	76.60	20.33	79.67	19.41
	1972	19.04	14.49	1.19	34.71	54.33	89.04	38.98	61.02	37.65
	1977	13.49	32.87	3.10	49.45	56.57	106.02	46.64	53.36	43.72
	1982	10.57	43.83	5.55	59.95	62.10	122.05	49.12	50.88	44.58
	1987	9.99	78.23	9.99	98.20	58.95	157.16	62.49	37.51	50.03
	1992	6.89	95.80	14.71	117.40	62.14	179.54	65.39	34.61	57.19
	1997	7.24	122.50	28.02	157.76	65.16	222.92	70.77	29.23	58.20
2003	7.00	138.14	38.44	183.58	60.44	244.02	75.23	24.77	59.48	
Amravati	1951	0.50	0.03	0.47	1.00	29.63	30.63	3.27	96.73	1.73
	1956	0.86	0.27	1.10	2.23	33.56	35.79	6.22	93.78	3.15
	1961	1.50	1.32	1.07	3.89	35.48	39.37	9.89	90.11	7.18
	1966	3.08	4.87	1.16	9.11	35.16	44.27	20.57	79.43	17.96
	1972	3.95	11.59	1.45	16.99	34.35	51.34	33.09	66.91	30.27
	1977	6.27	28.32	3.50	38.09	37.45	75.54	50.42	49.58	45.79
	1982	5.25	34.56	5.70	45.51	38.74	84.25	54.01	45.99	47.24
	1987	8.21	44.22	6.87	59.29	37.86	97.15	61.03	38.97	45.80
	1992	3.93	50.27	9.91	64.11	40.34	104.45	61.38	38.62	51.89
	1997	5.19	54.01	19.58	78.78	40.97	119.75	65.79	34.21	49.44
2003	5.75	54.93	27.85	88.54	39.72	128.25	69.03	30.97	47.31	

**Appendix 3 (Cont...): Availability of Mechanical and Draught Animal Power (HP) in Maharashtra**

Region	Year	Mechanical Power (MP) (10 <sup>4</sup> HP)				DAP (10 <sup>4</sup> HP)	TFP (10 <sup>4</sup> HP)	Share of MP in TFP (%)	Share of DAP in TFP (%)	Share of Pumpsets and Oil Engines in TFP (%)
		Oil Engines	Pumpsets	Tractors	Total					
Nagpur	1951	0.20	0.02	0.07	0.30	33.01	33.31	0.89	99.11	0.67
	1956	0.49	0.48	0.65	1.62	37.79	39.40	4.10	95.90	2.46
	1961	0.93	1.21	0.47	2.61	43.98	46.59	5.60	94.40	4.60
	1966	1.43	2.29	0.74	4.46	43.22	47.68	9.36	90.64	7.80
	1972	2.51	6.94	0.71	10.16	44.98	55.14	18.43	81.57	17.15
	1977	4.47	15.04	1.26	20.77	45.01	65.78	31.57	68.43	29.65
	1982	4.51	17.85	1.81	24.18	47.35	71.53	33.80	66.20	31.27
	1987	5.44	24.36	4.34	34.14	48.22	82.35	41.45	58.55	29.80
	1992	7.16	34.77	7.93	49.85	50.40	100.26	49.73	50.27	41.82
	1997	10.97	32.16	14.08	57.21	50.12	107.33	53.30	46.70	40.18
	2003	13.67	34.84	13.38	61.89	48.26	110.15	56.19	43.81	44.04
Maharashtra	1951	8.78	0.52	1.79	11.09	222.11	233.19	4.75	95.25	3.99
	1956	13.31	1.02	5.75	20.07	239.05	259.13	7.75	92.25	5.53
	1961	3.19	3.27	3.57	38.71	270.77	309.47	12.51	87.49	11.35
	1966	73.39	18.99	8.06	100.44	270.41	370.85	27.08	72.92	24.91
	1972	86.84	84.89	14.01	185.74	255.50	441.25	42.10	57.90	38.92
	1977	83.90	189.00	30.87	303.77	261.49	565.27	53.74	46.26	48.28
	1982	69.60	224.32	51.69	345.60	276.54	622.14	55.55	44.45	47.24
	1987	71.50	299.82	81.16	452.49	270.39	722.78	62.60	37.40	41.93
	1992	49.75	365.93	115.78	531.46	281.25	812.71	65.39	34.61	51.15
	1997	56.13	425.91	203.38	685.42	282.05	967.48	70.85	29.15	49.82
	2003	57.26	455.69	249.34	762.29	261.33	1023.62	74.47	25.53	50.11
India	1951	41.24	13.09	21.59	75.91	2690.62	2766.53	2.74	97.26	1.96
	1956	61.26	23.52	52.51	137.29	2827.47	2964.75	4.63	95.37	2.86
	1961	114.99	80.08	77.54	272.61	3217.72	3490.33	7.81	92.19	5.59
	1966	235.48	207.31	135.03	577.82	3160.92	3738.74	15.45	84.55	11.84
	1972	778.50	809.00	370.50	1958.00	3206.96	5164.96	37.91	62.09	30.74
	1977	1179.35	1219.85	689.75	3088.95	3246.44	6335.39	48.76	51.24	37.87
	1982	1648.00	1790.50	1296.25	4734.75	3041.44	7776.19	60.89	39.11	44.22
	1987	5832.80	2258.90	1846.00	9937.70	2608.84	12546.54	79.21	20.79	18.59
	1992	22887.00	32017.50	3054.50	57959.00	2823.52	60782.52	95.35	4.65	90.33
	1997	35469.00	36493.50	4653.25	76615.75	2502.52	79118.27	96.84	3.16	90.96
	2003	36187.00	42241.50	5903.00	84331.50	2406.12	86737.62	97.23	2.77	90.42

Note: DAP Draught Animal Population; TFP – Total Farm Power; HP – Horse Power

It is assumed that one animal is equivalent to 0.4 HP, Oil engines / pump sets 5 HP and tractor to 25 HP

**Appendix 4: Number of Tractors and its Share in Total Draught Power in Maharashtra**

Regions	Year	Tractors	CGR (%)	Density of Tractor per 100 Ha of NSA	Share of Tractor Power in TFP (%)
Konkan	1951	26	--	Neg.	0.21
	1956	28	1.49	Neg.	0.22
	1961	38	6.30	Neg.	0.27
	1966	63	10.64	0.01	0.44
	1972	96	8.79	0.01	0.65
	1977	129	6.09	0.02	0.82
	1982	95	-5.94	0.01	0.57
	1987	124	5.47	0.01	0.74
	1992	324	21.18	0.03	1.88
	1997	489	8.58	0.05	2.82
	2003	846	11.59	0.10	4.50
Nashik	1951	239	--	0.01	1.19
	1956	298	4.51	0.01	1.48
	1961	346	3.03	0.01	1.31
	1966	879	20.50	0.02	2.42
	1972	1874	16.35	0.06	4.11
	1977	5245	22.86	0.14	9.12
	1982	9491	12.59	0.27	14.57
	1987	13036	6.55	0.36	17.36
	1992	18445	7.19	0.52	20.81
	1997	30262	10.41	0.86	29.14
	2003	34278	2.52	0.96	35.46
Pune	1951	216	--	0.01	1.23
	1956	234	1.61	0.01	1.31
	1961	273	3.13	0.01	1.21
	1966	1240	35.35	0.03	4.08
	1972	2302	13.17	0.07	6.08
	1977	3831	10.72	0.10	7.10
	1982	5864	8.89	0.16	10.47
	1987	10829	13.05	0.29	17.26
	1992	14523	6.05	0.39	22.16
	1997	25932	12.29	0.72	30.22
	2003	32744	4.78	0.92	32.41
Aurangabad	1951	15	--	Neg.	0.09
	1956	104	13.34	Neg.	0.46
	1961	156	-31.56	Neg.	0.59
	1966	283	12.65	0.01	0.92
	1972	474	10.87	0.01	1.33
	1977	1239	21.19	0.03	2.92
	1982	2219	12.36	0.05	4.55
	1987	3994	12.47	0.08	6.35
	1992	5884	8.06	0.12	8.19
	1997	11206	13.75	0.23	12.57
	2003	15374	6.53	0.34	15.75
Amravati	1951	189	--	0.01	1.54
	1956	440	18.41	0.02	3.07
	1961	427	-0.60	0.02	2.71
	1966	462	1.59	0.02	2.61
	1972	578	4.58	0.02	2.81
	1977	1399	19.34	0.05	4.63
	1982	2281	10.27	0.08	6.77
	1987	2746	3.78	0.09	7.07
	1992	3965	7.62	0.13	9.49
	1997	7832	14.58	0.26	16.35
	2003	11141	7.30	0.36	21.72

**Appendix 4 (cont...): Number of Tractors and its Share in Total Draught Power in Maharashtra**

Regions	Year	Tractors	CGR (%)	Density of Tractor per 100 Ha of NSA	Share of Tractor Power in TFP (%)
Nagpur	1951	29	--	Neg.	0.22
	1956	260	55.07	1.34	1.65
	1961	187	-6.38	0.01	1.00
	1966	297	9.69	0.02	1.56
	1972	282	-1.03	0.01	1.28
	1977	505	12.36	0.02	1.92
	1982	724	7.47	0.04	2.53
	1987	1735	19.10	0.09	5.27
	1992	3172	12.83	0.16	7.91
	1997	5632	12.17	0.31	13.12
	2003	5352	-1.01	0.28	12.15
Maharashtra	1951	714	--	Neg.	0.77
	1956	2299	26.35	0.01	2.22
	1961	1427	-9.10	0.01	1.15
	1966	3224	17.70	0.02	2.17
	1972	5606	11.70	0.03	3.18
	1977	12348	17.11	0.08	5.46
	1982	20674	10.86	0.12	8.31
	1987	32464	9.44	0.18	11.23
	1992	46313	7.36	0.26	14.25
	1997	81353	11.93	0.46	21.02
	2003	99735	4.16	0.57	24.36
India	1951	8635	--	0.01	0.78
	1956	21005	19.46	0.02	1.77
	1961	31016	8.11	0.02	2.22
	1966	54012	11.73	0.04	3.61
	1972	148200	22.37	10.56	7.17
	1977	275900	13.24	0.19	10.89
	1982	518500	13.45	0.36	16.67
	1987	738400	7.33	0.53	14.71
	1992	1221800	10.60	0.86	5.03
	1997	1861300	8.78	1.31	5.88
	2003	2361200	4.87	1.71	6.81

Note: CGR – Compound Growth Rate; Neg. - Negligible

Appendix 5: Changing Composition of Bovine Population in Maharashtra

(in million)

Region	Year	Cattle				Buffalo				Total Bovine			
		Adult		Young Stock	Total Cattle	Adult		Young Stock	Total Buffalo	Adult		Young Stock	Total Bovine
		M	F			M	F			M	F		
Konkan	1951	0.67	0.50	0.41	1.58	0.11	0.20	0.09	0.40	0.79	0.70	0.50	1.98
	1956	0.70	0.48	0.40	1.58	0.12	0.22	0.10	0.43	0.82	0.69	0.50	2.01
	1961	0.75	0.49	0.40	1.64	0.13	0.23	0.10	0.45	0.87	0.72	0.50	2.09
	1966	0.73	0.47	0.37	1.58	0.13	0.24	0.10	0.46	0.86	0.71	0.47	2.04
	1972	0.75	0.49	0.41	1.65	0.12	0.25	0.10	0.47	0.87	0.74	0.51	2.12
	1977	0.76	0.34	0.38	1.49	0.12	0.24	0.11	0.47	0.88	0.58	0.49	1.96
	1982	0.81	0.52	0.42	1.75	0.13	0.26	0.12	0.51	0.94	0.78	0.54	2.26
	1987	0.85	0.58	0.47	1.90	0.15	0.37	0.18	0.70	1.00	0.95	0.65	2.60
	1992	0.83	0.58	0.45	1.86	0.13	0.33	0.18	0.65	0.96	0.92	0.63	2.51
	1997	0.80	0.54	0.48	1.83	0.11	0.37	0.17	0.65	0.91	0.90	0.66	2.48
2003	0.72	0.43	0.43	1.58	0.08	0.32	0.17	0.57	0.80	0.75	0.59	2.15	
Nashik	1951	1.12	0.80	0.65	2.57	0.03	0.22	0.11	0.36	1.15	1.02	0.76	2.93
	1956	1.12	0.75	0.69	2.56	0.02	0.20	0.13	0.36	1.14	0.95	0.82	2.92
	1961	1.27	0.86	0.71	2.84	0.03	0.22	0.14	0.39	1.30	1.08	0.85	3.23
	1966	1.35	0.85	0.62	2.82	0.03	0.25	0.12	0.40	1.38	1.10	0.74	3.22
	1972	1.22	0.85	0.69	2.76	0.02	0.26	0.16	0.44	1.24	1.12	0.84	3.20
	1977	1.22	0.91	0.76	2.90	0.03	0.35	0.23	0.60	1.25	1.26	0.99	3.50
	1982	1.32	1.03	0.78	3.13	0.04	0.37	0.20	0.61	1.36	1.40	0.98	3.74
	1987	1.31	1.23	0.86	3.40	0.03	0.45	0.26	0.74	1.34	1.68	1.12	4.14
	1992	1.43	1.42	1.02	3.86	0.04	0.52	0.33	0.89	1.47	1.94	1.35	4.75
	1997	1.48	1.36	1.18	4.02	0.05	0.59	0.36	1.00	1.53	1.96	1.54	5.02
2003	1.37	1.29	0.99	3.65	0.04	0.56	0.35	0.95	1.41	1.85	1.34	4.60	
Pune	1951	0.93	0.71	0.53	2.17	0.07	0.41	0.24	0.72	1.00	1.12	0.77	2.89
	1956	0.91	0.66	0.57	2.15	0.06	0.43	0.28	0.78	0.97	1.10	0.86	2.92
	1961	1.04	0.75	0.61	2.40	0.07	0.52	0.33	0.93	1.11	1.27	0.94	3.33
	1966	1.01	0.70	0.50	2.21	0.07	0.56	0.29	0.92	1.08	1.26	0.79	3.13
	1972	0.93	0.65	0.49	2.07	0.06	0.64	0.36	1.06	0.99	1.29	0.85	3.13
	1977	0.92	0.67	0.56	2.15	0.07	0.77	0.51	1.35	0.99	1.44	1.07	3.50
	1982	0.93	0.78	0.58	2.29	0.07	0.82	0.42	1.31	1.00	1.60	1.00	3.60
	1987	0.87	0.95	0.60	2.42	0.06	0.96	0.47	1.50	0.92	1.92	1.07	3.92
	1992	0.86	1.07	0.64	2.57	0.05	1.16	0.57	1.78	0.91	2.23	1.21	4.35
	1997	0.79	0.98	0.78	2.55	0.04	1.31	0.74	2.10	0.83	2.29	1.52	4.64
2003	0.70	0.98	0.66	2.34	0.05	1.40	0.77	2.22	0.75	2.38	1.43	4.56	
Aurangabad	1951	1.07	0.80	0.90	2.77	0.03	0.27	0.18	0.48	1.10	1.07	1.08	3.25
	1956	1.32	0.97	1.00	3.30	0.02	0.33	0.23	0.57	1.34	1.30	1.23	3.87
	1961	1.51	1.06	1.07	3.65	0.02	0.35	0.29	0.67	1.54	1.41	1.37	4.32
	1966	1.54	1.00	0.88	3.42	0.02	0.37	0.24	0.63	1.56	1.37	1.12	4.05
	1972	1.37	1.00	0.89	3.25	0.01	0.37	0.27	0.65	1.38	1.37	1.16	3.91
	1977	1.41	1.01	0.91	3.33	0.02	0.39	0.31	0.72	1.43	1.40	1.22	4.05
	1982	1.56	1.12	0.94	3.64	0.02	0.42	0.30	0.74	1.58	1.56	1.24	4.38
	1987	1.52	1.28	1.03	3.82	0.02	0.54	0.35	0.91	1.54	1.82	1.38	4.73
	1992	1.59	1.31	0.99	3.89	0.02	0.63	0.44	1.09	1.60	1.94	1.43	4.98
	1997	1.65	1.24	1.09	3.98	0.01	0.72	0.49	1.22	1.67	1.95	1.58	5.20
2003	1.54	1.09	0.97	3.60	0.02	0.69	0.51	1.22	1.56	1.78	1.48	4.82	
Amravati	1951	0.76	0.70	0.61	2.07	0.01	0.18	0.10	0.29	0.77	0.88	0.71	2.36
	1956	0.87	0.76	0.68	2.31	0.01	0.18	0.12	0.31	0.88	0.94	0.80	2.62
	1961	0.89	0.74	0.67	2.30	0.01	0.19	0.13	0.33	0.90	0.93	0.80	2.63
	1966	0.89	0.75	0.58	2.22	0.01	0.19	0.11	0.31	0.90	0.94	0.69	2.54
	1972	0.87	0.74	0.65	2.27	0.01	0.20	0.12	0.33	0.88	0.94	0.77	2.60
	1977	0.95	0.82	0.69	2.46	0.01	0.23	0.14	0.39	0.96	1.05	0.84	2.85
	1982	0.98	0.86	0.67	2.51	0.01	0.25	0.14	0.40	0.99	1.11	0.81	2.91
	1987	0.97	0.93	0.69	2.59	0.01	0.29	0.16	0.46	0.99	1.21	0.85	3.04
	1992	1.03	0.93	0.69	2.65	0.01	0.32	0.19	0.52	1.04	1.25	0.88	3.17
	1997	1.04	0.86	0.72	2.62	0.01	0.35	0.19	0.54	1.05	1.21	0.90	3.16
2003	1.01	0.74	0.65	2.43	0.01	0.33	0.18	0.52	1.02	1.07	0.83	2.95	



**Appendix 5 (Cont...): Changing Composition of Bovine Population in Maharashtra**

(in million)

Region	Year	Cattle				Buffalo				Total Bovine			
		Adult		Young Stock	Total Cattle	Adult		Young Stock	Total Buffalo	Adult		Young Stock	Total Bovine
		M	F			M	F			M	F		
Nagpur	1951	0.81	0.69	0.59	2.09	0.06	0.12	0.08	0.26	0.87	0.81	0.67	2.35
	1956	0.93	0.72	0.63	2.27	0.07	0.10	0.08	0.25	1.00	0.82	0.70	2.52
	1961	1.04	0.74	0.72	2.49	0.09	0.13	0.11	0.32	1.13	0.87	0.82	2.82
	1966	1.02	0.77	0.69	2.48	0.09	0.14	0.10	0.33	1.11	0.91	0.80	2.81
	1972	1.07	0.85	0.79	2.70	0.08	0.15	0.11	0.35	1.15	1.00	0.90	3.05
	1977	1.07	0.88	0.80	2.75	0.08	0.17	0.13	0.38	1.15	1.05	0.93	3.13
	1982	1.12	0.95	0.83	2.90	0.09	0.18	0.11	0.38	1.21	1.13	0.94	3.28
	1987	1.17	1.07	0.91	3.16	0.08	0.23	0.16	0.47	1.26	1.30	1.07	3.63
	1992	1.22	1.01	0.85	3.09	0.09	0.25	0.18	0.52	1.31	1.27	1.03	3.61
	1997	1.22	0.91	0.95	3.08	0.09	0.27	0.20	0.57	1.31	1.18	1.15	3.65
	2003	1.18	0.80	0.81	2.79	0.09	0.26	0.22	0.57	1.27	1.06	1.03	3.36
State Total	1951	5.36	4.20	3.69	13.25	0.32	1.40	0.79	2.51	5.68	5.60	4.48	15.76
	1956	5.85	4.34	3.97	14.16	0.30	1.46	0.94	2.70	6.15	5.80	4.91	16.86
	1961	6.49	4.64	4.19	15.33	0.35	1.64	1.09	3.09	6.84	6.28	5.29	18.41
	1966	6.55	4.53	3.65	14.73	0.34	1.74	0.97	3.05	6.89	6.27	4.62	17.78
	1972	6.21	4.59	3.91	14.71	0.31	1.87	1.12	3.30	6.51	6.46	5.03	18.01
	1977	6.33	4.64	4.11	15.08	0.33	2.15	1.42	3.90	6.65	6.79	5.53	18.97
	1982	6.72	5.25	4.23	16.20	0.35	2.31	1.31	3.97	7.07	7.56	5.54	20.17
	1987	6.69	6.05	4.55	17.29	0.36	2.82	1.58	4.76	7.05	8.87	6.14	22.06
	1992	6.96	6.32	4.64	17.92	0.34	3.22	1.89	5.45	7.29	9.55	6.53	23.36
	1997	6.99	5.89	5.20	18.07	0.31	3.61	2.15	6.07	7.30	9.49	7.35	24.14
	2003	6.53	5.33	4.50	16.36	0.29	3.56	2.20	6.05	6.82	8.89	6.70	22.41
India	1951	57.83	54.40	43.07	155.30	6.78	21.00	15.62	43.40	64.61	75.40	58.69	198.70
	1956	64.87	49.89	43.80	158.56	6.51	22.34	16.07	44.91	71.37	72.23	59.88	203.48
	1961	72.53	54.20	46.59	173.32	7.68	25.02	18.35	51.05	80.21	79.23	64.94	224.38
	1966	73.32	54.68	48.20	176.20	8.19	25.40	19.41	53.00	81.51	80.08	67.61	229.20
	1972	74.46	56.40	46.77	177.63	8.07	29.24	19.90	57.21	82.53	85.64	66.67	234.84
	1977	74.91	57.60	47.62	180.13	8.38	31.87	21.74	61.99	83.29	89.46	69.36	242.11
	1982	72.84	59.21	60.40	192.45	7.96	32.50	29.32	69.78	80.80	91.71	89.72	262.23
	1987	74.66	64.92	62.96	202.54	7.47	39.13	29.37	75.97	82.13	104.06	92.32	278.51
	1992	74.49	68.43	65.73	208.65	8.09	43.81	32.31	84.21	82.58	112.23	98.05	292.85
	1997	68.72	69.83	65.74	204.29	7.95	46.77	35.20	89.92	76.67	116.60	100.94	294.21
	2003	57.55	64.50	63.13	185.18	6.68	50.97	40.27	97.92	64.23	115.47	103.40	283.10

**Appendix 6: Region-wise Compound Growth Rates of Cattle and Buffalo Population in Maharashtra  
Between Census Years**

(in per cent per annum)

Region	Period	Total Population			Breedable Female Population		
		Cattle	Buffalo	Total	Cattle	Buffalo	Total
Konkan	1951	--	--	--	--	--	--
	1956	6.04	-1.44	-4.92	-0.89	2.07	-0.03
	1961	-5.00	-0.96	4.05	0.43	0.74	0.52
	1966	-0.81	-0.44	0.54	-0.76	1.28	-0.10
	1972	0.92	-0.24	-0.76	0.58	0.40	0.52
	1977	-0.22	0.10	0.20	-0.05	-0.52	-0.21
	1982	1.37	-2.02	-1.50	1.07	1.57	1.24
	1987	1.59	-5.84	-2.64	2.19	7.33	4.03
	1992	-0.52	1.33	0.73	-0.01	-1.79	-0.69
	1997	-0.15	0.12	0.14	-1.13	1.90	0.04
2003	-2.81	2.45	2.77	-4.40	-2.53	-3.62	
Nashik	1951	--	--	--	--	--	--
	1956	-0.13	0.16	0.13	0.11	-0.72	-0.07
	1961	2.11	-1.80	-2.03	2.64	2.19	2.54
	1966	-0.15	-0.49	0.07	-0.37	2.32	0.20
	1972	-0.40	1.89	0.10	0.24	1.01	0.42
	1977	0.96	-5.95	-1.74	1.55	5.85	2.63
	1982	1.60	-0.42	-1.38	2.34	1.27	2.05
	1987	1.07	-3.65	-1.52	1.91	3.72	2.40
	1992	2.31	-3.62	-2.52	2.12	3.35	2.47
	1997	1.62	-2.42	-1.76	1.56	2.51	1.84
2003	-1.90	1.12	1.77	-1.11	-1.17	-1.13	
Pune	1951	--	--	--	--	--	--
	1956	-0.20	-1.56	-0.26	-1.18	1.24	-0.26
	1961	2.30	-3.41	-2.57	2.77	3.67	3.13
	1966	-1.60	0.23	1.22	-1.48	1.48	-0.23
	1972	-1.37	-2.90	0.02	-1.43	2.69	0.48
	1977	0.77	-4.72	-2.21	0.62	3.90	2.29
	1982	1.22	0.55	-0.55	2.91	1.19	2.01
	1987	0.14	-2.59	-1.08	1.43	3.37	2.45
	1992	0.81	-3.42	-1.89	1.50	3.71	2.71
	1997	1.21	-3.19	-2.08	1.58	2.52	2.11
2003	-1.70	-1.15	0.37	0.11	1.14	0.71	
Aurangabad	1951	--	--	--	--	--	--
	1956	3.53	-3.47	-3.41	4.25	2.43	3.80
	1961	2.04	-3.12	-2.17	1.47	2.54	1.72
	1966	-1.31	1.20	1.30	-0.96	1.43	-0.36
	1972	-0.99	-0.78	0.71	-0.02	0.49	0.11
	1977	0.47	-1.85	-0.71	0.30	1.06	0.51
	1982	1.70	-0.65	-1.50	2.00	1.66	1.90
	1987	0.86	-3.95	-1.42	2.01	4.86	2.83
	1992	0.17	-3.59	-0.89	-0.08	3.47	1.05
	1997	0.86	-2.18	-1.16	0.14	2.45	0.95
2003	-2.00	0.02	1.55	-2.47	-0.71	-1.81	
Amravati	1951	--	--	--	--	--	--
	1956	2.22	-1.45	-2.08	1.62	-0.11	1.28
	1961	-0.04	-0.97	-0.08	-0.42	0.52	-0.23
	1966	-0.70	0.71	0.71	0.04	0.86	0.20
	1972	0.42	-0.85	-0.47	-0.19	0.51	-0.04
	1977	1.64	-3.23	-1.83	1.99	3.29	2.27
	1982	0.36	-1.13	-0.47	0.91	1.87	1.13
	1987	0.51	-2.14	-0.74	1.24	2.53	1.54
	1992	0.46	-2.46	-0.78	0.03	2.38	0.61
	1997	-0.05	-0.96	-0.12	-1.07	1.61	-0.34
2003	-1.78	0.65	1.61	-3.02	1.54	-1.62	

**Appendix 6 (Cont...): Region-wise Compound Growth Rates of Cattle and Buffalo Population in Maharashtra between Census Years**

(in per cent per annum)

Region	Period	Total Population			Breedable Female Population		
		Cattle	Buffalo	Total	Cattle	Buffalo	Total
Nagpur	1951	--	--	--	--	--	--
	1956	1.66	0.92	-1.36	0.77	-3.10	0.23
	1961	1.86	-4.99	-2.17	0.58	4.07	1.05
	1966	-0.08	-0.32	0.03	0.84	1.66	0.96
	1972	1.71	-1.20	-1.63	1.98	2.01	1.98
	1977	0.34	-1.59	-0.48	0.75	1.64	0.89
	1982	1.06	-0.04	-0.93	1.53	1.47	1.52
	1987	1.59	-4.13	-1.88	1.94	4.92	2.44
	1992	-0.52	-2.08	0.16	-1.50	2.38	-0.76
	1997	0.16	-1.74	-0.40	-1.27	1.58	-0.65
	2003	-1.92	0.16	1.67	-2.73	-1.29	-2.39
Maharashtra	1951	--	--	--	--	--	--
	1956	2.09	-1.44	-1.95	1.00	0.78	0.95
	1961	0.84	-2.66	-1.13	1.31	2.45	1.59
	1966	-0.79	0.23	0.70	-0.46	1.50	0.06
	1972	-0.04	-1.56	-0.25	0.20	1.40	0.54
	1977	0.69	-3.28	-1.19	0.91	2.86	1.49
	1982	1.25	-0.37	-1.06	1.83	1.43	1.71
	1987	0.96	-3.57	-1.50	1.79	4.21	2.55
	1992	0.53	-2.65	-1.02	0.38	2.72	1.18
	1997	0.71	-2.15	-1.06	0.15	2.28	0.93
	2003	-1.97	0.09	1.51	-1.99	-0.09	-1.25
India	1951	--	--	--	--	--	--
	1956	0.50	-0.74	-0.55	0.39	0.64	0.47
	1961	1.80	-2.53	-1.94	1.54	2.27	1.77
	1966	0.31	-0.72	-0.40	0.30	1.03	0.54
	1972	0.18	-1.55	-0.51	0.62	2.32	1.20
	1977	0.28	-1.59	-0.61	0.45	1.79	0.92
	1982	0.97	-1.00	-0.97	1.45	0.71	1.18
	1987	1.10	-3.02	-1.61	0.75	3.61	1.81
	1992	0.49	-2.04	-0.93	0.57	2.23	1.23
	1997	-0.56	-1.30	0.00	0.23	1.30	0.67
	2003	-1.42	-1.69	0.40	-0.12	1.77	0.69

**Appendix 7: Region-wise Number of Buffaloes per Thousand Cattle and Number of Animals in Milk per Thousand Milch Animals**

Regions	Years	Buffaloes per Thousand Cattle	Animals in Milk per Thousand Milch Animals		
			Cattle	Buffalo	Total
Konkan	1951	253	559	691	598
	1956	203	487	706	557
	1961	275	382	688	482
	1966	293	404	714	513
	1972	283	361	702	481
	1977	285	399	718	510
	1982	295	463	702	544
	1987	368	482	717	576
	1992	354	441	676	530
	1997	354	490	722	586
	2003	362	551	754	640
Nashik	1951	140	532	618	552
	1956	140	448	554	470
	1961	138	357	499	387
	1966	143	335	506	374
	1972	160	377	514	409
	1977	208	417	595	467
	1982	196	432	549	463
	1987	224	486	564	508
	1992	240	507	547	519
	1997	250	557	580	564
	2003	260	579	618	591
Pune	1951	332	632	774	687
	1956	363	550	710	614
	1961	385	447	625	520
	1966	412	467	633	541
	1972	512	443	618	530
	1977	627	536	728	640
	1982	574	494	645	572
	1987	651	608	683	648
	1992	743	628	684	660
	1997	823	657	713	689
	2003	951	685	720	705
Aurangabad	1951	172	302	366	318
	1956	173	472	602	501
	1961	183	454	551	478
	1966	184	436	485	449
	1972	201	480	558	501
	1977	216	555	673	588
	1982	205	481	563	504
	1987	240	521	602	546
	1992	286	539	588	555
	1997	306	584	626	599
	2003	338	600	663	625
Amravati	1951	140	493	614	518
	1956	135	491	650	522
	1961	142	422	582	454
	1966	142	432	518	449
	1972	145	405	539	433
	1977	157	409	583	448
	1982	163	415	547	445
	1987	177	411	520	437
	1992	196	387	502	417
	1997	207	470	558	496
	2003	219	498	591	527

**Appendix 7 (Cont...): Region-wise Number of Buffaloes per Thousand Cattle and Number of Animals in Milk per Thousand Milch Animals**

Regions	Years	Buffaloes per Thousand Cattle	Animals in Milk per Thousand Milch Animals		
			Cattle	Buffalo	Total
Nagpur	1951	125	407	638	442
	1956	110	333	639	371
	1961	129	374	549	399
	1966	132	386	466	398
	1972	129	411	496	424
	1977	137	359	592	396
	1982	131	382	520	404
	1987	149	396	514	418
	1992	170	364	101	332
	1997	184	456	557	479
	2003	201	468	580	495
Maharashtra	1951	189	479	630	518
	1956	183	462	654	510
	1961	201	410	591	457
	1966	207	409	570	454
	1972	224	418	584	467
	1977	256	449	669	518
	1982	245	443	601	491
	1987	280	483	623	529
	1992	312	483	612	529
	1997	336	545	648	584
	2003	370	573	674	613
India	1951	280	470	549	495
	1956	283	483	608	523
	1961	295	452	568	490
	1966	301	448	553	483
	1972	322	456	571	496
	1977	344	466	587	510
	1982	345	494	599	532
	1987	380	532	645	576
	1992	412	546	643	586
	1997	452	572	665	611
	2003	529	616	706	656

**Appendix 8 (a): Structural Changes in Milk Production of Indigenous Cows in Maharashtra**

(in lakh kgs)

Districts	Triennium Average			Per cent Change		
	Period - I	Period - II	Period - III	2 Over 1	3 Over 2	3 Over 1
Greater Bombay	34.30	70.88	20.95	106.66	-70.45	-38.93
Thane	188.35	264.63	302.65	40.49	14.37	60.68
Raigad	180.96	327.78	298.79	81.13	-8.84	65.12
Ratnagiri	126.66	149.32	193.36	17.89	29.50	52.66
Sindhudurg	41.45	87.82	78.06	111.86	-11.12	88.30
Nashik	491.46	987.51	1133.78	100.93	14.81	130.70
Dhule	311.66	541.65	741.78	73.80	36.95	138.01
Jalgaon	395.56	712.10	736.30	80.02	3.40	86.14
Ahmednagar	472.48	737.00	736.24	55.98	-0.10	55.82
Pune	342.14	472.68	470.70	38.15	-0.42	37.57
Satara	228.28	334.25	363.43	46.42	8.73	59.20
Sangli	184.80	229.95	257.01	24.44	11.77	39.08
Solapur	407.19	484.06	493.48	18.88	1.95	21.19
Kolhapur	130.44	130.78	155.13	0.26	18.62	18.92
Aurangabad	213.18	356.70	349.09	67.32	-2.13	63.75
Jalna	191.87	277.24	294.12	44.49	6.09	53.29
Parbhani	390.83	605.72	565.15	54.98	-6.70	44.60
Beed	394.47	388.37	388.44	-1.55	0.02	-1.53
Nanded	375.50	589.42	597.01	56.97	1.29	58.99
Osmanabad	241.77	273.88	252.26	13.28	-7.90	4.34
Latur	229.04	310.89	294.97	35.73	-5.12	28.78
Buldhana	305.56	351.97	355.85	15.19	1.10	16.46
Akola	254.25	223.32	291.58	-12.17	30.57	14.68
Amravati	238.84	197.36	256.44	-17.37	29.94	7.37
Yavatmal	277.36	198.15	308.50	-28.56	55.69	11.23
Wardha	105.27	110.67	163.37	5.13	47.62	55.19
Nagpur	190.50	149.51	225.33	-21.52	50.72	18.29
Bhandara	205.51	182.02	255.29	-11.43	40.25	24.22
Chandrapur	126.92	95.59	158.15	-24.68	65.45	24.61
Gadchiroli	108.12	61.13	136.47	-43.46	123.25	26.22
State Total	7384.73	9902.32	10873.66	34.09	9.81	-47.25

Note: Period - I = 1985 / 86 to 1987 / 88; Period - II = 1994 / 95 to 1997 / 98; Period - III = 2003 / 04 to 2005 / 06

**Appendix 8 (b): Structural Changes in Milk Production of Crossbred Cows in Maharashtra**

(in lakh kgs)

Districts	Triennium Average			Per cent Change		
	Period - I	Period - II	Period - III	2 Over 1	3 Over 2	3 Over 1
Greater Bombay	7.66	14.64	33.03	91.23	125.59	331.40
Thane	58.04	97.68	66.84	68.29	-31.58	15.15
Raigad	16.02	42.48	57.99	165.11	36.49	261.86
Ratnagiri	70.75	153.36	219.97	116.75	43.44	210.90
Sindhudurg	26.59	43.92	62.28	65.19	41.79	134.23
Nashik	143.17	651.85	1183.30	355.30	81.53	726.50
Dhule	63.63	337.92	592.57	431.05	75.36	831.24
Jalgaon	83.73	425.77	625.88	408.48	47.00	647.47
Ahmednagar	579.57	2918.92	4949.78	403.64	69.58	754.05
Pune	603.12	2536.12	3939.41	320.50	55.33	553.17
Satara	361.30	1247.06	1574.87	245.16	26.29	335.89
Sangli	420.01	693.37	561.44	65.08	-19.03	33.67
Solapur	115.68	878.90	1768.73	659.75	101.24	1428.95
Kolhapur	327.63	749.05	1082.14	128.63	44.47	230.29
Aurangabad	73.15	538.57	817.97	636.29	51.88	1018.27
Jalna	23.33	114.73	225.45	391.79	96.51	866.43
Parbhani	35.40	100.56	181.76	184.07	80.74	413.43
Beed	78.78	384.25	919.23	387.76	139.23	1066.86
Nanded	29.62	226.56	272.76	664.77	20.39	820.73
Osmanabad	42.31	481.45	726.34	1037.98	50.87	1616.83
Latur	37.64	221.75	317.56	489.08	43.20	743.58
Buldhana	70.21	228.48	294.97	225.44	29.10	320.13
Akola	27.15	98.16	182.70	261.57	86.12	572.97
Amravati	29.22	139.20	210.91	376.36	51.52	621.77
Yavatmal	21.17	72.72	155.42	243.52	113.71	634.16
Wardha	29.91	225.60	344.72	654.36	52.80	1052.68
Nagpur	48.99	295.44	463.28	503.02	56.81	845.59
Bhandara	36.08	211.44	353.87	486.09	67.36	880.88
Chandrapur	9.74	26.00	86.45	166.98	232.56	787.85
Gadchiroli	4.91	4.25	16.79	-13.41	294.98	242.01
State Total	3474.51	14160.20	22288.41	307.54	57.40	541.48

Note: Period - I =1985 / 86 to 1987 / 88; Period - II = 1994 / 95 to1997 / 98; Period - III = 2003 / 04 to 2005 / 06

**Appendix 8 (c): Structural Changes in Milk Production of Total (Indigenous + Crossbred) Cows in Maharashtra**  
(in lakh kgs)

Districts	Triennium Average			Per cent Change		
	Period - I	Period - II	Period - III	2 Over 1	3 Over 2	3 Over 1
Greater Bombay	41.96	85.52	53.97	103.84	-36.89	28.64
Thane	246.39	362.31	369.48	47.04	1.98	49.96
Raigad	196.98	370.26	356.78	87.97	-3.64	81.12
Ratnagiri	197.41	302.67	413.33	53.32	36.56	109.37
Sindhudurg	68.04	131.75	140.34	93.63	6.52	106.25
Nashik	634.63	1639.36	2317.08	158.32	41.34	265.11
Dhule	375.29	879.58	1334.35	134.37	51.70	255.55
Jalgaon	479.30	1137.87	1362.18	137.40	19.71	184.20
Ahmednagar	1052.05	3655.92	5686.02	247.50	55.53	440.47
Pune	945.27	3008.79	4410.10	218.30	46.57	366.55
Satara	589.57	1581.31	1938.30	168.21	22.58	228.76
Sangli	604.81	923.32	818.46	52.66	-11.36	35.33
Solapur	522.88	1362.95	2262.21	160.66	65.98	332.65
Kolhapur	458.08	879.83	1237.27	92.07	40.63	170.10
Aurangabad	286.33	895.27	1167.06	212.67	30.36	307.60
Jalna	215.20	391.96	519.57	82.14	32.56	141.44
Parbhani	426.23	706.28	746.91	65.71	5.75	75.24
Beed	473.25	772.62	1307.67	63.26	69.25	176.32
Nanded	405.12	815.98	869.78	101.41	6.59	114.69
Osmanabad	284.08	755.33	978.60	165.89	29.56	244.48
Latur	266.69	532.64	612.53	99.73	15.00	129.68
Buldhana	375.77	580.45	650.82	54.47	12.12	73.20
Akola	281.40	321.48	474.28	14.24	47.53	68.54
Amravati	268.06	336.56	467.35	25.55	38.86	74.35
Yavatmal	298.53	270.87	463.92	-9.26	71.27	55.40
Wardha	135.18	336.27	508.09	148.76	51.10	275.86
Nagpur	239.49	444.95	688.61	85.79	54.76	187.53
Bhandara	241.59	393.46	609.15	62.86	54.82	152.14
Chandrapur	136.66	121.59	244.60	-11.03	101.18	78.99
Gadchiroli	113.03	65.38	153.26	-42.16	134.41	35.59
State Total	10859.25	24062.52	33162.07	121.59	37.82	205.38

Note: Period - I =1985 / 86 to 1987 / 88; Period - II = 1994 / 95 to 1997 / 98; Period - III = 2003 / 04 to 2005 / 06



**Appendix 8 (d): Structural Changes in Milk Production of Buffaloes in Maharashtra**

(in lakh kgs)

Districts	Triennium Average			Per cent Change		
	Period - I	Period - II	Period - III	2 Over 1	3 Over 2	3 Over 1
Greater Bombay	1071.60	2069.23	1734.61	93.10	-16.17	61.87
Thane	580.41	679.28	1484.79	17.03	118.58	155.82
Raigad	285.87	595.49	538.08	108.31	-9.64	88.23
Ratnagiri	83.80	167.05	211.64	99.34	26.69	152.54
Sindhudurg	74.31	219.69	208.94	195.63	-4.89	181.17
Nashik	401.32	908.06	1305.81	126.27	43.80	225.38
Dhule	370.45	664.84	1070.39	79.47	61.00	188.95
Jalgaon	771.77	1697.96	2108.05	120.01	24.15	173.15
Ahmednagar	334.94	625.37	902.74	86.71	44.35	169.52
Pune	680.03	1310.15	1768.10	92.66	34.95	160.00
Satara	903.34	1542.42	1858.26	70.75	20.48	105.71
Sangli	1084.01	1962.08	2449.26	81.00	24.83	125.94
Solapur	579.01	976.76	1315.81	68.70	34.71	127.25
Kolhapur	1626.01	3450.06	4307.53	112.18	24.85	164.91
Aurangabad	172.06	388.17	385.54	125.60	-0.68	124.07
Jalna	138.98	253.34	309.25	82.29	22.07	122.52
Parbhani	241.72	511.79	729.30	111.73	42.50	201.72
Beed	353.85	518.57	690.44	46.55	33.14	95.12
Nanded	333.79	798.90	963.99	139.34	20.67	188.80
Osmanabad	337.77	479.89	612.23	42.08	27.58	81.26
Latur	337.77	666.56	936.82	97.34	40.54	177.35
Buldhana	350.75	442.06	508.36	26.03	15.00	44.93
Akola	356.05	443.43	629.50	24.54	41.96	76.80
Amravati	283.02	374.38	511.76	32.28	36.70	80.82
Yavatmal	273.88	352.13	495.33	28.57	40.67	80.85
Wardha	120.03	199.21	241.36	65.96	21.16	101.08
Nagpur	213.39	345.08	358.38	61.71	3.86	67.94
Bhandara	333.43	507.13	642.47	52.10	26.69	92.69
Chandrapur	103.41	249.54	288.92	141.31	15.78	179.40
Gadchiroli	71.34	77.96	109.81	9.29	40.84	53.93
State Total	12868.12	23476.57	29677.47	82.44	26.41	130.63

Note: Period - I =1985 / 86 to 1987 / 88; Period - II = 1994 / 95 to 1997 / 98; Period - III = 2003 / 04 to 2005 / 06

**Appendix 8 (e): Structural Changes in Milk Production of Goats in Maharashtra**

(in lakh kgs)

Districts	Triennium Average			Per cent Change		
	Period – I	Period - II	Period - III	2 Over 1	3 Over 2	3 Over 1
Greater Bombay	1.86	3.58	1.19	92.13	-66.73	-36.08
Thane	19.33	28.30	48.80	46.36	72.45	152.39
Raigad	11.95	30.74	30.83	157.27	0.29	158.02
Ratnagiri	7.96	11.16	18.46	40.23	65.33	131.85
Sindhudurg	4.39	11.62	11.13	164.47	-4.19	153.39
Nashik	85.39	146.85	189.30	71.97	28.91	121.68
Dhule	66.73	101.38	149.99	51.93	47.94	124.77
Jalgaon	78.62	125.33	144.20	59.41	15.06	83.42
Ahmednagar	129.98	211.83	276.27	62.97	30.42	112.55
Pune	97.36	131.94	170.40	35.52	29.15	75.03
Satara	72.24	121.41	156.73	68.07	29.09	116.96
Sangli	76.35	99.19	131.55	29.92	32.62	72.30
Solapur	173.58	235.30	303.19	35.55	28.85	74.66
Kolhapur	52.88	60.96	75.48	15.28	23.81	42.73
Aurangabad	58.20	100.62	118.54	72.88	17.81	103.67
Jalna	39.46	60.15	78.41	52.44	30.36	98.72
Parbhani	55.77	75.41	100.97	35.20	33.91	81.04
Beed	81.68	110.33	148.43	35.08	34.53	81.73
Nanded	51.41	73.12	89.34	42.24	22.17	73.78
Osmanabad	40.01	76.66	98.07	91.62	27.93	145.14
Latur	44.86	49.23	59.65	9.73	21.18	32.97
Buldhana	59.95	64.93	93.11	8.30	43.40	55.30
Akola	37.23	53.18	64.43	42.82	21.16	73.03
Amravati	31.59	41.66	51.43	31.89	23.44	62.81
Yavatmal	40.23	42.15	59.75	4.77	41.77	48.53
Wardha	16.68	23.69	27.80	41.99	17.36	66.65
Nagpur	31.11	38.55	46.93	23.93	21.74	50.87
Bhandara	27.82	40.21	56.17	44.53	39.67	101.87
Chandrapur	23.88	36.00	41.71	50.71	15.87	74.63
Gadchiroli	15.82	19.35	29.32	22.34	51.51	85.35
State Total	1534.34	2224.82	2871.58	45.00	29.07	87.15

Note: Period - I =1985 / 86 to 1987 / 88; Period - II = 1994 / 95 to 1997 / 98; Period - III = 2003 / 04 to 2005 / 06

**Appendix 8 (f): Structural Changes in Total Milk Production of Maharashtra**

(in lakh kgs)

Districts	Triennium Average			Per cent Change		
	Period - I	Period - II	Period - III	2 Over 1	3 Over 2	3 Over 1
Greater Bombay	1115.42	2158.33	1789.77	93.50	-17.08	60.46
Thane	846.14	1069.89	1903.07	26.44	77.88	124.91
Raigad	494.80	996.50	925.70	101.39	-7.10	87.08
Ratnagiri	289.18	480.89	643.43	66.30	33.80	122.50
Sindhudurg	146.75	363.05	360.41	147.40	-0.73	145.60
Nashik	1121.35	2694.26	3812.19	140.27	41.49	239.97
Dhule	812.47	1645.80	2554.73	102.57	55.23	214.44
Jalgaon	1329.68	2961.15	3614.43	122.70	22.06	171.83
Ahmednagar	1516.98	4493.12	6865.03	196.19	52.79	352.55
Pune	1722.66	4450.88	6348.60	158.37	42.64	268.54
Satara	1565.15	3245.13	3953.29	107.34	21.82	152.58
Sangli	1765.16	2984.59	3399.26	69.08	13.89	92.57
Solapur	1275.47	2575.01	3881.21	101.89	50.73	204.30
Kolhapur	2136.97	4390.85	5620.27	105.47	28.00	163.00
Aurangabad	516.59	1384.06	1671.14	167.92	20.74	223.49
Jalna	393.63	705.45	907.23	79.22	28.60	130.48
Parbhani	723.72	1293.47	1577.19	78.73	21.93	117.93
Beed	908.78	1401.52	2146.54	54.22	53.16	136.20
Nanded	790.32	1688.00	1923.10	113.58	13.93	143.33
Osmanabad	661.86	1311.88	1688.90	98.21	28.74	155.18
Latur	649.32	1248.43	1609.00	92.27	28.88	147.80
Buldhana	786.47	1087.44	1252.29	38.27	15.16	59.23
Akola	674.68	818.09	1168.20	21.26	42.80	73.15
Amravati	582.67	752.60	1030.54	29.16	36.93	76.87
Yavatmal	612.64	665.14	1019.00	8.57	53.20	66.33
Wardha	271.90	559.17	777.25	105.66	39.00	185.86
Nagpur	483.99	828.58	1093.92	71.20	32.02	126.02
Bhandara	602.84	940.80	1307.80	56.06	39.01	116.94
Chandrapur	263.95	407.12	575.23	54.24	41.29	117.93
Gadchiroli	200.18	162.69	292.38	-18.73	79.71	46.06
State Total	25261.71	49763.92	65711.12	96.99	32.05	160.12

Note: Period - I =1985 / 86 to 1987 / 88; Period - II = 1994 / 95 to 1997 / 98; Period - III = 2003 / 04 to 2005 / 06

**Appendix 9: Changing Shares of States in Total Milk Production of India**

(in per cent)

States	1977 -78	1980 -81	1985 -86	1990 -91	1995 -96	1996 -97	1997 -98	1998 -99	1999 -00	2000 -01	2001 -02	2002 -03	2003 -04	2004 -05	2005 -06
A.P.	7.55	6.36	6.32	5.58	6.44	6.47	6.22	6.44	6.54	6.85	6.89	7.64	7.90	7.85	7.85
Assam	1.52	1.47	1.20	1.14	1.29	1.07	1.00	0.96	0.85	0.85	0.81	0.82	0.83	0.80	0.77
Bihar	6.73	6.14	6.14	5.77	5.01	4.92	4.75	4.58	4.41	4.22	4.27	4.43	4.69	6.57	6.59
Gujarat	7.32	6.81	7.44	6.53	6.97	6.99	6.83	6.73	6.73	6.59	6.95	7.07	7.29	7.29	7.17
Haryana	5.86	6.92	5.81	6.33	6.20	6.09	6.08	6.02	5.98	6.02	5.90	5.95	5.93	5.65	5.46
H.P.	1.01	1.00	0.98	1.06	1.02	1.01	0.99	0.96	0.95	0.94	0.90	0.90	0.89	0.94	0.90
J & K	0.76	0.79	0.86	1.03	1.30	1.30	1.36	1.32	1.64	1.64	1.61	1.61	1.61	1.54	1.44
Karnataka	3.91	4.51	4.58	4.43	4.81	5.01	5.52	5.63	5.71	5.71	5.68	5.27	4.38	4.24	4.14
Kerala	1.95	2.87	2.92	3.13	3.40	3.27	3.26	3.22	3.23	3.23	3.22	2.81	2.40	2.19	2.13
M.P.	7.23	7.22	6.57	8.71	7.75	7.56	7.47	7.24	7.05	6.87	7.20	7.13	7.04	6.85	7.34
Maharashtra	5.06	5.55	5.61	6.92	7.54	7.42	7.22	7.46	7.29	7.26	7.22	7.24	7.24	7.10	6.97
Manipur	0.19	0.19	0.16	0.15	0.09	0.09	0.09	0.09	0.09	0.09	0.08	0.08	0.08	0.08	0.08
Meghalaya	0.18	0.18	0.10	0.09	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
Nagaland	0.01	0.01	0.01	0.08	0.07	0.07	0.06	0.06	0.06	0.06	0.07	0.07	0.07	0.07	0.08
Orissa	0.77	0.98	0.90	0.87	0.94	0.99	0.93	0.97	1.09	1.09	1.10	1.09	1.13	1.39	1.38
Punjab	9.87	10.19	9.31	9.72	9.71	9.78	9.96	9.83	9.84	9.65	9.40	9.49	9.53	9.25	9.18
Rajasthan	11.21	10.28	9.43	8.04	7.86	8.50	9.02	9.21	9.30	9.25	9.19	9.04	9.14	8.99	8.98
Sikkim	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.04	0.04	0.04	0.05	0.05	0.05	0.05
T.N.	4.52	5.50	7.09	6.25	5.73	5.76	5.65	5.68	5.86	6.09	5.91	5.36	5.39	5.17	5.64
Tripura	0.05	0.05	0.05	0.05	0.06	0.06	0.08	0.10	0.10	0.10	0.11	0.09	0.10	0.09	0.09
U.P.	19.26	18.12	18.23	17.96	17.96	17.94	17.98	18.11	18.08	18.46	18.62	19.00	19.45	19.15	19.12
W.B.	4.08	4.06	5.46	5.40	5.05	4.89	4.75	4.58	4.43	4.31	4.16	4.18	4.18	4.10	4.01
UTs	0.89	0.76	0.80	0.71	0.66	0.67	0.66	0.68	0.65	0.63	0.60	0.60	0.60	0.58	0.56
India	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

**Appendix 10: Dairy Development in Different States under Cooperative Sector**

States	As on 31-3-1998				As on 31-3-2005				
	DCS Organized (nos)	Farmer Members ('000')	Rural Milk Procurement ('000' kg/day)	Liquid Milk Sale ('000' LD)	DCS Organized	Farmer Members ('000')	Rural Milk Procurement ('000' kg/day)	Liquid Milk Sale ('000' LD)	Processing Capacity ('000' LD)
A.P.	5108	710	748	2397	4561	762	1055	1028	2150
Assam	123	2	3	60	66	3	4	7	60
Bihar	2737	143	211	586	5023	254	482	293	666
Chattisgarh	-	-	-	-	445	20	18	30	-
Delhi	-	-	-	1150	-	-	-	2103	1350
Goa	155	17	25	75	174	19	51	90	75
Gujarat	12132	2039	3989	6960	11615	2428	5857	2226	6720
Haryana	2630	166	199	530	5172	239	367	214	530
H.P.	254	15	16	30	387	20	28	16	40
Jharkhand	-	-	-	-	80	2	6	173	-
Karnataka	7871	1499	1474	2030	9619	1809	2700	1597	2530
Kerala	1509	419	317	410	3238	733	669	801	905
M.P.	4601	237	196	1030	4815	239	392	304	1000
Maharashtra	16387	1174	2210	3970	19192	1621	2698	2595	4650
Nagaland	35	1	1	-	76	3	3	4	10
Orissa	1268	92	77	125	1896	130	164	151	185
Pondichery	85	24	31	50	100	32	51	59	50
Punjab	6175	362	739	1460	6893	409	780	501	1545
Rajasthan	5413	390	661	1050	10852	565	1470	874	1295
Sikkim	162	5	7	15	194	7	7	7	15
T.N.	7775	1888	1156	2421	8031	1998	1981	1329	2601
Tripura	84	4	1	10	84	4	3	9	10
U.P.	11568	597	673	1140	18272	845	958	425	1670
W.B.	1459	91	160	1570	2367	184	326	792	1600
<b>Total</b>	<b>77531</b>	<b>9875</b>	<b>12894</b>	<b>27084</b>	<b>113152</b>	<b>12326</b>	<b>20070</b>	<b>15628</b>	<b>29657</b>

Note: DCS – Dairy Cooperative Societies; LD Liters per Day

Source: 'Basic Animal Husbandry Statistics, 1999 and 2006, Department of Animal Husbandry and Dairying, Ministry of Agriculture, Government of India', Government of India, New Delhi

**Appendix 11 (a): District and Region-wise Deshi Egg Production in Maharashtra**

(in lakh numbers)

Districts/Region	TE 1996-97	TE 2005-06	CGR (%)	CII
Greater Bombay	70.10	60.50	-2.12***	6.04
Thane	616.57	828.51	3.28***	1.99
Raigad	533.53	652.60	1.97***	2.09
Ratnagiri	579.66	805.76	3.78***	2.89
Sindhudurg	352.46	397.78	0.87*	4.12
<b>Konkan Region</b>	<b>2152.33</b>	<b>2745.14</b>	<b>2.58***</b>	<b>1.41</b>
Nashik	456.62	614.39	3.32***	2.03
Dhule	339.45	445.96	3.01***	2.11
Jalgaon	273.63	313.77	1.09**	3.74
Ahmednagar	1082.75	1559.39	4.31***	4.07
<b>Nashik Region</b>	<b>2152.44</b>	<b>2933.51</b>	<b>3.52***</b>	<b>2.48</b>
Pune	1345.56	1550.15	1.18***	3.44
Satara	1128.15	1492.71	3.09***	1.69
Sangli	812.62	960.76	1.53***	2.83
Solapur	849.63	1055.38	2.19***	1.71
Kolhapur	532.79	743.59	3.87***	3.32
<b>Pune Region</b>	<b>4668.75</b>	<b>5802.59</b>	<b>2.22***</b>	<b>1.69</b>
Aurangabad	177.36	205.80	1.26***	3.30
Jalna	131.71	180.67	3.62***	2.81
Parbhani	145.29	176.03	1.86***	2.33
Beed	276.90	410.48	4.68***	4.74
Nanded	151.10	205.11	3.44***	2.22
Osmanabad	161.13	194.07	1.75***	2.60
Latur	106.02	129.87	2.05***	3.15
<b>Aurangabad Region</b>	<b>1149.50</b>	<b>1502.02</b>	<b>2.91***</b>	<b>1.62</b>
Buldhana	114.56	157.00	3.59***	2.53
Akola	173.39	335.08	8.56***	13.33
Amravati	140.30	143.65	-0.46 <sup>NS</sup>	7.16
Yavatmal	284.14	289.97	-0.49 <sup>NS</sup>	7.08
<b>Amravati Region</b>	<b>712.39</b>	<b>925.69</b>	<b>2.84***</b>	<b>1.51</b>
Wardha	97.06	132.49	3.56***	2.74
Nagpur	165.95	228.23	3.65***	2.84
Bhandara	287.55	336.93	1.43***	2.78
Chandrapur	279.96	333.33	1.63***	2.57
Gadchiroli	187.02	265.13	4.10***	3.73
<b>Nagpur Region</b>	<b>1017.53</b>	<b>1296.10</b>	<b>2.58***</b>	<b>1.47</b>
<b>State Total</b>	<b>11852.95</b>	<b>15205.05</b>	<b>2.66***</b>	<b>1.44</b>

Notes: TE -1996-97 (Average of 1994-95, 1995-96 and 1996-97)

TE - 2005-06 (Average of 2003-04, 2004-05 and 2005-06)

CGR - Annual Compound Growth Rate between 1995-96 and 2005-06

CII - Coppock Instability Index between 1995-96 and 2005-06

\*\*\*, \*\* and \* imply significance of growth rates at 1, 5 and 10 per cent level of probability.

NS- Non-significance of growth rates

**Appendix 11 (b): District and Region-wise Improved Egg Production in Maharashtra**

(in lakh numbers)

Districts/Region	TE 1996-97	TE 2005-06	CGR (%)	CII
Greater Bombay	53.69	61.85	1.12*	5.51
Thane	83.14	276.12	16.84***	30.66
Raigad	155.55	100.17	-6.56***	25.30
Ratnagiri	302.16	251.29	-3.24**	15.98
Sindhudurg	107.31	138.50	2.72***	2.03
<b>Konkan Region</b>	<b>701.85</b>	<b>827.93</b>	<b>1.48***</b>	<b>4.57</b>
Nashik	811.98	2875.32	17.89***	33.24
Dhule	235.61	2178.92	34.36***	77.63
Jalgaon	129.71	82.31	-6.75***	25.74
Ahmednagar	824.62	857.75	-0.25 <sup>NS</sup>	8.49
<b>Nashik Region</b>	<b>2001.92</b>	<b>5994.30</b>	<b>15.22***</b>	<b>26.70</b>
Pune	3917.59	4086.51	-0.21 <sup>NS</sup>	8.42
Satara	889.24	612.78	-5.70**	22.75
Sangli	2652.69	3080.45	1.26**	5.04
Solapur	1770.41	1320.50	-4.67**	19.84
Kolhapur	1015.02	1328.35	2.92***	1.68
<b>Pune Region</b>	<b>10244.95</b>	<b>10428.58</b>	<b>-0.54<sup>NS</sup></b>	<b>9.21</b>
Aurangabad	139.94	149.82	0.16 <sup>NS</sup>	7.57
Jalna	12.62	11.32	-2.25*	13.39
Parbhani	86.08	59.66	-5.64**	22.62
Beed	128.51	152.00	1.50***	4.53
Nanded	67.80	84.49	2.24***	2.94
Osmanabad	54.89	76.65	3.80***	1.44
Latur	15.47	46.17	15.09***	26.34
<b>Aurangabad Region</b>	<b>505.32</b>	<b>580.12</b>	<b>1.09*</b>	<b>5.42</b>
Buldhana	24.10	87.97	18.46***	34.77
Akola	26.69	114.98	21.01***	41.16
Amravati	52.18	82.31	5.58***	4.76
Yavatmal	24.04	36.15	4.96***	3.89
<b>Amravati Region</b>	<b>127.01</b>	<b>321.41</b>	<b>12.62***</b>	<b>20.59</b>
Wardha	14.20	108.01	30.91***	67.61
Nagpur	268.21	545.28	9.29***	12.82
Bhandara	198.85	303.12	5.07***	3.63
Chandrapur	33.97	42.69	2.46***	2.00
Gadchiroli	21.10	43.11	9.31***	12.39
<b>Nagpur Region</b>	<b>536.32</b>	<b>1042.20</b>	<b>8.62***</b>	<b>11.31</b>
<b>State Total</b>	<b>14117.36</b>	<b>19194.55</b>	<b>3.46***</b>	<b>1.16</b>

Notes: TE -1996-97 (Average of 1994-95, 1995-96 and 1996-97)

TE - 2005-06 (Average of 2003-04, 2004-05 and 2005-06)

CGR - Annual Compound Growth Rate between 1995-96 and 2005-06

CII - Coppock Instability Index between 1995-96 and 2005-06

\*\*\*, \*\* and \* imply significance of growth rates at 1, 5 and 10 per cent level of probability.

NS- Non-significance of growth rates

**Appendix 11 (c): Structural Changes in District and Region-wise Total Egg Production in Maharashtra**

(in lakh numbers)

Districts/Region	TE 1996-97	TE 2005-06	% Change
Greater Bombay	123.79	122.34	-1.17
Thane	699.71	1104.63	57.87
Raigad	689.08	752.77	9.24
Ratnagiri	881.83	1057.05	19.87
Sindhudurg	459.77	536.28	16.64
Nashik	1268.60	3489.71	175.08
Dhule	575.06	2624.88	356.45
Jalgaon	403.34	396.08	-1.80
Ahmednagar	1907.37	2417.14	26.73
Pune	5263.15	5636.65	7.10
Satara	2017.39	2105.50	4.37
Sangli	3465.32	4041.21	16.62
Solapur	2620.04	2375.88	-9.32
Kolhapur	1547.81	2071.93	33.86
Aurangabad	317.31	355.62	12.07
Jalna	144.33	191.99	33.02
Parbhani	231.37	235.69	1.87
Beed	405.41	562.48	38.74
Nanded	218.90	289.60	32.30
Osmanabad	216.01	270.72	25.33
Latur	121.49	176.04	44.90
Buldhana	138.67	244.97	76.66
Akola	200.08	450.06	124.94
Amravati	192.48	225.96	17.39
Yavatmal	308.17	326.12	5.82
Wardha	111.26	240.50	116.16
Nagpur	434.15	773.50	78.16
Bhandara	486.40	640.05	31.59
Chandrapur	313.93	376.01	19.78
Gadchiroli	208.11	308.24	48.11
<b>State Total</b>	<b>25970.31</b>	<b>34399.60</b>	<b>32.46</b>

Notes: TE -1996-97 (Average of 1994-95, 1995-96 and 1996-97)

TE - 2005-06 (Average of 2003-04, 2004-05 and 2005-06)



## Appendix 12: Changing Shares of States in Total Egg Production of India

(in per cent)

States	1977 -78	1980 -81	1985 -86	1990 -91	1995 -96	1996 -97	1997 -98	1998 -99	1999 -00	2000 -01	2001 -02	2002 -03	2003 -04	2004 -05	2005 -06
A.P.	9.29	18.76	19.44	18.13	22.16	20.58	20.05	20.10	20.84	32.21	34.38	37.32	37.11	34.96	35.59
Assam	3.03	3.11	2.15	1.93	1.73	1.77	1.68	1.65	1.61	1.38	1.31	1.28	1.27	1.15	1.16
Bihar	7.00	7.38	6.82	6.32	5.15	5.13	4.95	4.85	4.73	3.46	3.50	3.51	3.43	3.29	3.67
Gujarat	1.93	1.88	1.56	1.95	1.82	1.82	1.70	1.58	1.57	0.94	0.96	0.97	1.10	1.11	1.25
Haryana	2.14	1.79	2.12	2.32	2.32	2.34	2.31	2.32	2.48	2.96	2.80	3.14	3.17	3.28	3.27
H.P.	0.17	0.23	0.24	0.25	0.27	0.26	0.26	0.26	0.26	0.22	0.21	0.21	0.21	0.18	0.16
J & K	1.79	2.06	1.41	1.34	1.40	1.44	1.81	1.76	1.84	1.55	1.57	1.56	1.58	1.35	1.37
Karnataka	28.00	7.94	6.65	6.08	5.73	5.93	6.32	6.57	6.54	5.44	5.23	5.00	4.28	3.92	3.97
Kerala	10.21	9.43	8.43	7.34	7.31	7.36	7.09	6.93	6.75	5.55	5.17	3.38	3.16	2.65	2.59
M.P.	3.40	4.91	4.59	4.81	4.39	4.55	4.70	4.75	4.12	3.92	3.57	3.93	4.22	3.94	3.96
Maharashtra	7.83	11.33	9.36	9.93	9.57	9.77	9.64	9.97	10.06	8.46	8.25	8.27	8.35	7.60	7.62
Manipur	0.23	0.27	0.26	0.31	0.22	0.22	0.21	0.22	0.22	0.19	0.19	0.18	0.20	0.18	0.18
Meghalaya	0.25	0.31	0.36	0.32	0.28	0.29	0.28	0.28	0.28	0.24	0.23	0.24	0.23	0.21	0.21
Nagaland	0.12	0.14	0.12	0.19	0.17	0.17	0.16	0.16	0.17	0.15	0.14	0.17	0.17	0.17	0.19
Orissa	2.99	3.28	2.01	2.01	2.15	2.18	2.54	2.59	2.12	1.99	2.16	2.28	2.30	2.69	2.77
Punjab	4.08	5.08	6.11	8.62	9.23	9.94	10.14	8.92	9.14	8.09	7.65	7.86	7.59	8.14	7.61
Rajasthan	1.12	1.28	1.22	1.33	1.60	1.75	1.75	1.81	1.82	1.56	1.55	1.60	1.66	1.53	1.52
Sikkim	0.02	0.03	0.03	0.06	0.06	0.06	0.06	0.05	0.03	0.03	0.03	0.03	0.03	0.03	0.03
T.N.	5.64	8.15	12.82	12.10	11.21	11.06	11.21	12.17	12.63	10.73	10.91	9.10	9.36	14.15	13.46
Tripura	0.18	0.22	0.17	0.16	0.16	0.19	0.34	0.37	0.34	0.29	0.16	0.25	0.25	0.24	0.24
U.P.	2.23	2.97	2.33	2.46	2.47	2.54	2.52	2.60	2.63	2.46	2.31	2.11	2.62	2.41	2.40
W.B.	7.18	8.07	10.27	10.79	9.44	9.47	9.18	9.00	8.77	7.35	7.00	6.90	6.98	6.39	6.41
UTs	1.18	1.39	1.55	1.27	1.16	1.16	1.09	1.06	1.04	0.83	0.74	0.71	0.72	0.42	0.39
India	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

**Appendix 13: Structural Changes in District and Region-wise Total Wool Production in Maharashtra**

(in MT)

Districts/Region	TE 1996-97	TE 2005-06	% Change
Greater Bombay	7.70	0.16	-97.87
Thane	0.32	0.49	51.95
Raigad	0.46	0.33	-28.11
Ratnagiri	0.01	0.03	321.74
Sindhudurg	0.01	0.13	942.11
Nashik	144.25	161.19	11.74
Dhule	93.13	96.55	3.67
Jalgaon	20.15	20.72	2.85
Ahmednagar	205.16	277.64	35.33
Pune	173.40	201.65	16.29
Satara	183.00	179.12	-2.12
Sangli	125.19	105.26	-15.91
Solapur	152.02	139.38	-8.31
Kolhapur	77.17	114.57	48.47
Aurangabad	45.72	45.73	0.02
Jalna	25.57	24.84	-2.87
Parbhani	19.54	19.36	-0.93
Beed	87.11	79.44	-8.80
Nanded	23.53	25.05	6.47
Osmanabad	28.66	26.32	-8.16
Latur	22.00	26.48	20.38
Buldhana	48.63	45.07	-7.33
Akola	9.17	11.02	20.20
Amravati	10.67	11.68	9.50
Yavatmal	4.83	5.10	5.64
Wardha	3.88	2.14	-44.92
Nagpur	8.67	7.40	-14.58
Bhandara	1.12	1.32	18.02
Chandrapur	21.07	10.20	-51.60
Gadchiroli	7.44	6.42	-13.82
<b>State Total</b>	<b>1549.55</b>	<b>1644.77</b>	<b>6.14</b>

Notes: TE -1996-97 (Average of 1994-95, 1995-96 and 1996-97)

TE - 2005-06 (Average of 2003-04, 2004-05 and 2005-06)

**Appendix 14: Changing Shares of States in Total Wool Production of India**

(in per cent)

States	1977 -78	1980 -81	1985 -86	1990 -91	1995 -96	1996 -97	1997 -98	1998 -99	1999 -00	2000 -01	2001 -02	2002 -03	2003 -04	2004 -05	2005 -06
A.P.	8.11	4.31	3.92	4.02	6.61	6.66	6.52	6.57	6.55	6.80	6.97	6.83	7.49	8.25	8.86
Bihar	2.55	2.88	2.62	2.65	2.83	2.77	2.77	2.71	2.66	0.64	0.87	0.63	0.75	0.85	0.49
Chhatisgarch	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.39	0.49	0.49	0.52	0.57	0.54
Gujarat	5.73	5.84	6.45	4.26	5.61	5.45	5.72	5.56	5.53	5.66	5.67	5.74	5.73	6.62	6.96
Haryana	2.30	2.81	3.46	3.31	4.33	4.20	4.17	4.12	4.60	4.81	4.97	5.04	5.19	2.93	2.53
H.P.	3.53	3.71	3.31	3.38	3.65	3.51	3.43	3.35	3.29	3.27	3.20	3.16	3.29	3.59	3.57
J & K	5.39	5.79	7.45	9.46	9.79	11.41	10.13	11.62	11.37	11.54	11.74	11.94	12.77	15.97	16.49
Jharkhand	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.60	0.60	0.71	0.65	0.33	0.33
Karnataka	10.39	8.24	8.72	10.40	9.67	9.53	10.30	11.10	11.37	11.79	11.63	12.70	11.03	12.30	12.47
M.P.	2.14	2.47	2.26	1.45	1.84	1.77	1.76	1.74	1.67	1.30	1.32	1.28	1.36	1.53	0.96
Maharashtra	2.91	3.81	3.42	3.41	3.65	3.54	3.47	3.40	3.36	3.37	3.32	3.25	3.45	3.63	3.65
Punjab	3.26	3.78	3.33	3.59	2.83	2.70	2.64	1.94	2.07	2.17	2.14	1.94	1.14	1.27	1.59
Rajasthan	38.43	41.28	40.88	39.02	41.12	40.57	41.28	40.26	40.13	40.13	39.74	38.92	38.93	33.76	34.32
Sikkim	0.06	0.07	0.06	0.07	0.08	0.08	0.08	0.07	0.02	0.02	0.02	0.02	0.01	0.01	0.00
T.N.	9.13	9.38	8.23	8.87	1.67	1.61	1.56	1.41	1.35	1.31	1.29	1.20	1.54	1.68	1.67
U.P.	4.32	4.10	4.45	4.49	4.71	4.65	4.67	4.66	4.57	3.71	3.74	3.72	3.97	4.41	3.25
Uttaranchal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.02	0.86	1.03	0.70	0.78	0.79
W.B.	1.37	1.38	1.29	1.48	1.47	1.41	1.38	1.35	1.33	1.32	1.29	1.28	1.34	1.48	1.48
Arunachal Pradesh	0.38	0.15	0.14	0.14	0.14	0.13	0.13	0.13	0.12	0.12	0.12	0.12	0.12	0.04	0.03
India	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

**ANNEXURE I: COMMENTS ON DRAFT REPORT BY DESIGNATED AERC  
UNIT, VALLABH VIDYANAGAR, GUJARAT**

**TITLE OF THE STUDY REPORT: EVALUATION OF FIVE DECADES OF LIVESTOCK  
DEVELOPMENT IN MAHARASHTRA AND THREATS  
AND OPPORTUNITIES IN WTO REGIME**

**AUTHOR: DEEPAK SHAH**

**ORGANISATION: AGRO-ECONOMIC RESEARCH CENTRE, GOKHALE INSTITUTE OF  
POLITICS AND ECONOMICS, PUNE**

**DATE OF RECEIPT OF THE STUDY REPORT FOR COMMENTS: 28-10-2009**

**DATE OF DISPATCH OF COMMENTS BY THE DESIGNATED CENTRE: 09-11-2009**

**1. COMMENTS ON THE METHODOLOGY:**

The methodology adopted is satisfactory.

**2. COMMENTS ON THE ADEQUACY AND QUALITY OF THE COVERAGE IN THE  
STUDY:**

The report provides good coverage and insight towards the objectives of the study. However, indicating below few minor deficiencies that can be addressed to improve the report.

1. Preface-page (iii), 6<sup>th</sup> line: Gujarat state is also a leading producer of milk and milk products. Therefore, please include Gujarat in the list of states mentioned in line 6.
2. Page 6, Table 1.3, and Sl. No. 1: Please give note about figures shown in the parentheses.
3. Page 9, Line 3: It should be 2003-04 not 200-04.
4. Page 38, Line 5: Actually it should be 2003 and not 203.
5. Page 43, Line 2: Percent is wrongly spelled as peercent.
6. Page 107 Table 5.1: No discussion of this table on page 106 & 107. This table is discussed on page 98 hence it must appear on page 98.
7. Page 120 paragraph below table 6.1 line 4: Please mention the year when this happened.
8. Page 125 Table no. 6.3 & 6.4: Please specify unit of the number shown in the table.
9. Page 131 Table no. 6.8: If possible show the unit of different livestock products in bracket in either column 1 or 2.
10. Chapter -6: Likely impact of trade liberalization under WTO regime has been not discussed for wool.
11. The sources of data are not shown in many of the tables e.g. Table no. 3.11, 3.12; 3.15, 4.3, 4.5, 4.8, 4.10, 4.11, and 4.12.

**3. COMMENTS ON PRESENTATION AND GET UP ETC. OF THE REPORT:**

We appreciate the quality of the report and the sincere efforts put in by the project leader.

**4. OVERALL VIEW ON ACCEPTABILITY OF REPORT:**

After necessary corrections, you may proceed for final submission of the report.

## **ANNEXURE II: ACTION TAKEN BY THE AUTHOR ON THE COMMENTS OF THE DESIGNATED CENTRE FOR THE STUDY ENTITLED**

### **“EVALUATION OF FIVE DECADES OF LIVESTOCK DEVELOPMENT IN MAHARASHTRA AND THREATS AND OPPORTUNITIES IN WTO REGIME”**

The author is thankful to the reviewers for the keen interest taken and the suggestions made by them on the report. The comments have been taken care of at length and replies to these comments are given as follows:

1. COMMENTS ON METHODOLOGY: No Revision Required

2. COMMENTS ON THE ADEQUACY AND QUALITY OF THE COVERAGE OF OBJECTIVES IN THE STUDY:

As per comments, the report provides good coverage and insight towards the objectives of the study. The following minor deficiencies have been removed in the report in view of suggestions:

1. Preface-page (iii), 6<sup>th</sup> line: Correction has been incorporated
2. Page 6, Table 1.3, and Sl. No. 1: Correction has been incorporated
3. Page 9, Line 3: Correction has been incorporated
4. Page 38, Line 5: Correction has been incorporated
5. Page 43, Line 2: Correction has been incorporated
6. Page 107 Table 5.1: The Table 5.1 is brought on page 98 of the report
7. Page 120 paragraph below table 6.1 line 4: Year and reference have been incorporated
8. Page 125 Table no. 6.3 & 6.4: Units of the numbers have been specified
9. Page 131 Table no. 6.8: Units of different livestock products are shown within brackets in column no. 1.
10. Chapter -6: The literature relating to likely impact of trade liberalization under WTO regime for wool is not available and, therefore, not discussed.
11. The sources of data for all the tables have now been shown in the report.

3. COMMENTS ON PRESENTATION OF GET UP ETC.:

The quality of the report is appreciated by the reviewer.

4. OVERALL VIEW ON THE ACCEPTABILITY OF THE REPORT:

The report has been recommended for acceptance and submission after necessary corrections. The necessary corrections have been made in the report.

November 27, 2009

Deepak Shah