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Industry**

by

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And

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TRENDS AND DEVELOPMENTS IN INDIA'S LIVESTOCK INDUSTRIES

Abstract

Since India's independence some 50 years ago, it has experienced considerable economic growth and structural change; a trend accelerated by its structural reforms which began in 1991. These changes are also reflected in trends in its livestock sector which has shown considerable growth in recent decades (especially since the late 1970s). There have also been major changes in the composition of the Indian livestock sector. The population of non-ruminants (particularly chickens) has expanded very rapidly and so their relative importance has risen substantially. Non-ruminant production (poultry and pigs) has increasingly become commercialised and industrial in nature. Trends and developments in India's livestock industries since 1961 are outlined. Consequences and prospects for consumption of livestock products in India and international trade are discussed along with the environmental impacts of developments in India's livestock industries. As observed, livestock developments in India have been significantly influenced by religious and cultural factors. Consequently, the nature of India's livestock sector is to some extent unique.

TRENDS AND DEVELOPMENTS IN INDIA'S LIVESTOCK INDUSTRIES

1. Introduction

India, which commenced structural reforms in June 1991 after forty years of planning, has recently attracted world attention. Its large economy and population, vast natural resources and highly educated and skilled human force are likely to make India important in the world economy in the coming decades.

The current and expected growth of the Indian economy has a number of important consequences for food consumption patterns in India and demand for livestock products. There is pressure on livestock industries to satisfy the growing demand for animal products, particularly traditional products such as milk and milk products, eggs, chicken, lamb and mutton. Not only has demand for traditional products been increasing greatly but demand for non-traditional livestock products, such as pork and to some extent beef and buffalo meat, has grown.

The composition of animal types utilized in India are rather different to those of other Asian countries because the particular nature of religion, caste and culture of the Indian population. Unlike most other Asian countries, or for that matter most of the developed countries, consumption patterns of livestock products in India are significantly influenced by its social and caste structures. Hindus accounted for about 80% of India's population. For Hindus the cow is a religious symbol and an idol. Within Hinduism there are different castes, the upper

caste 'Brahmins' and 'Vysas', traditionally do not eat any animal products except milk and in some eastern states, fish. Other upper caste categories do not eat beef but consume other animal products, and lower caste Hindus consume all types of major livestock products including beef from retired animals. Muslims constitutes about 16% of Indian population; eating pork is not allowed but other major meats are eaten. Most of the remaining population consists of Christians. They consume all livestock products.

Three livestock products dominate the Indian market, namely milk, eggs and chicken meat. This is because consumption of milk and chicken meat is common among all the communities in India. This partly accounts for the high growth rates in supply of these products in recent years.

This paper highlights major developments and changes in India's livestock industries over the last 45 years or so. The main driving forces behind the changes in different livestock industries and the possibilities for international trade of livestock products into and out of India are discussed in the context of recent trade liberalization. Finally, the relationships between livestock and environmental interactions and major constraints on further development of the livestock industry in India are explored.

2 Current Status Of Livestock Industries in India

2.1 Importance of Livestock in Indian Economy

The Royal Commission on Agriculture in 1927, set as an objectives for livestock development in India, increases in production per animal and a reduction in animal numbers (Jackson 1981). However, until the late 1980s there was little progress in livestock development. Only

in recent years, the livestock sector has emerged as an important segment of an expanding and diversifying agricultural sector in the Indian economy. The share of livestock products in the gross value of agricultural output increased from 6% in 1970-71 to over 25% in 1992-93 (George 1996). Livestock in India perform many functions both related to food and non-food attributes. In recent years, the demand for chicken meat, other meats, milk, and eggs has been increased tremendously. The major components of India's livestock industries are cattle and buffalo both for milk and for draught, sheep, goats, pigs, chicken and other minor animals like camels, and ducks. Some non-food functions are declining in importance. For example, mechanisation is increasingly displacing animals as source of power. Still many small and marginal farmers use livestock for draught power in cultivating their land, threshing, transport and so on. With the advent of artificial fertilisers, animal manure as fertiliser has decreased in importance. In some areas, use of animal dung for fuel is important. Livestock also provide raw materials for the animal-based industries such as those processing milk, wool, meat and leather products.

2.2 Population trends

Human and livestock populations have both grown considerably in India over the past four decades, although at different rates and percentages (see Table 1). Human population doubled between 1961 and 1997 and the changes in population of different animal types varied considerably. Between 1961 and 1997, cattle and sheep numbers increased by 195% and 41% respectively, much less than for buffaloes (80%) and goats (98%). Tremendous increase occurred in numbers of chicken which rose by 400% and pigs increased in number by 200%.

Table 1: Human and livestock population changes in India

Population (millions)	1961	1997	% change
Human	453	953	111
Cattle	175.6	209	19
Buffalo	51.2	92.2	80
Sheep	40.2	56.5	41
Goats	60.9	120.6	98
Pigs	5.2	15.5	200
Chickens	114.3	570	399

Human population growth is expected to continue for at least the next three decades in India. Relationships between human and animal population growth, livestock production methods are complex according to Templeton and Scherr (1997). Nevertheless, in India between 1961 and 1997, the annual population growth rates of human and livestock were 2.06 and 2.44 per cent respectively. Livestock numbers grew at a faster rate than human population in India in the period 1961-1997. But livestock numbers are not so important. Changes in the productivity of livestock must also be taken into account as well as the composition of the livestock population as is done below.

2.3 Major Trends in Animal Numbers

In India, as can be seen from Figure 1, populations of all major types of livestock have risen steadily in recent years except for chickens, the population of which rose dramatically in the late 1980s and early 1990s. India reported around 209 million cattle in 1997¹. That represents 47 per cent of Asia's and 16 per cent of world's cattle population. Of its 209

¹ All the data used in this paper has been obtained from FAOSTAT database from website address: <http://apps.fao.org/>. Further calculation and regressions has been done to represent the appropriate per cent contributions and growth rates by the authors.

million cattle, 34 million are dairy cattle i.e. 16 per cent of India's total cattle population. Over time the growth rates in total cattle numbers have been not changed significantly. From 1960 to 1979, their growth rate was 0.11 per annum and for period 1980-1997 their growth rate was slightly higher at 0.27 per annum. However, there is no significant change in the growth rates of dairy cattle numbers between those two periods. In fact, growth rates slightly declined from 0.74 to 0.73 per annum. The population of work animals decreased substantially. The major reason for this decline is the increase in the intensity of mechanization. Increasing use of tractors associated with Green Revolution and tractors have significantly displaced work animals in many regions of India.

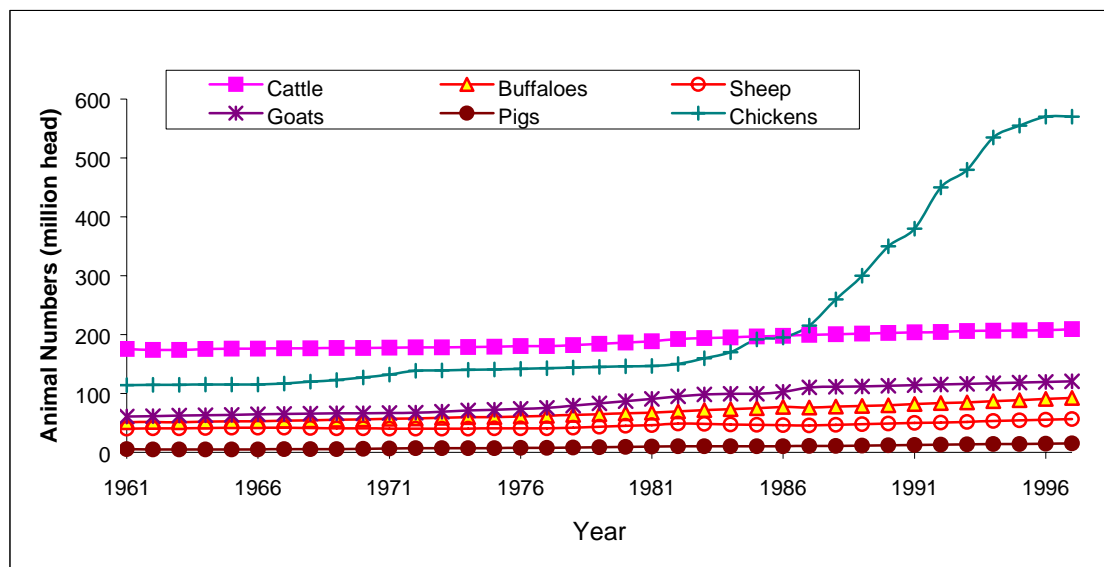


Figure 1: Livestock numbers in India

Source: Based on FAO database, see footnote 2

India reported around 92 million buffalo in 1997. That represents 62 per cent of Asia's and 60 per cent of world's buffalo population. Of these 92 million buffalo, 25 million are used for milk, i.e. 27 per cent of total buffalo. Over time, the growth rates of India's buffalo

population have increased. From 1960 to 1979, the growth rate was around 0.57 per annum, for the later period the growth rate increased to 0.82 per annum. However, there was no significant change in the growth rate of milking buffaloes between those two periods, in fact a slight decline from 0.82 to 0.81 per annum occurred. The decline in work animal population of both cattle and buffalo has contributed to a significant shift in the bovine sex-ratios in favour of females, particularly the faster increase of she-buffalo population compared to that of cows. Buffalo milk is preferred by most Indians to cow milk especially for making yoghurt. Buffalo milk is also preferred to cow's milk for producing traditional Indian sweets. Buffaloes also have the advantage of being able to utilize fodder which cannot be used by cows. The increase in number of female stock of both buffaloes and cattle has contributed to the increase of milk production in India. Globally India (along with most other countries of the Indian subcontinent) is relatively unique in its preference for buffaloes.

Traditionally in India, cattle were used more frequently for draught power than buffaloes, and buffaloes more frequently for milk production. Between 1979 and 1997, India's buffalo population increased at faster rate than its cattle population as shown in Figure 1. This is to some extent a consequence of the Green Revolution. Traditionally, a close link exists between crop and livestock activities at farm level. This link was weakened by the Green Revolution technologies. They allowed external inputs such as artificial fertilizers and tractors to be substituted for cow manure and bullock power.

Sheep and goats accounts for a substantial number of India's total livestock population. The reported sheep and goat populations in India were respectively around 57 and 121 millions in 1997; that represents 15 per cent and 27 per cent of Asia's and 5.3 per cent and 17.3 per cent of the world's sheep and goat populations. The growth rate in sheep numbers before 1980 is negligible but after 1980, numbers increased at the rate of 0.5 per annum. In addition, growth rates for numbers of goats have been significant at around 0.6 to 0.8 per annum. Over the years, the goat population has been increasing at a faster rate than sheep population. These species have played an important role in providing income and employment to poor households in the drought-prone areas of India.

By world standards, India's pig population is low. Its reported pig population during 1997 was around 15 million, that represents 2.8 per cent of Asia's and 1.6 per cent of global pig numbers. Unlike the growth rates for all other livestock, the rate of growth in numbers of pigs in India is above 1 per cent (1.4 per cent per annum).

The poultry industry is also a strongly growing livestock industry in India. The reported population for 1997 is around 570 million birds. That represents 8.7 per cent of Asia's and 0.1 per cent of world's poultry stocks. The rate of growth of chicken numbers after 1980 is unprecedented for India and reported to be around 4.3 per cent per annum. The massive increase in poultry industry is due to the substantial improvements in breeding technology. In the early 1960s, improved layers accounted for only 7 per cent of India's chicken population but by 1990 they accounted for about 60 per cent (Nair 1995).

2.3 Major Trends in Livestock Production and Products

Although the growth rates in animal numbers (except of chickens and pigs) are modest, livestock production in India has expanded at a much faster rate than livestock populations as illustrated in Figures 2 and 3, thereby, signaling significant increases in production per animal. Production of beef and veal, and buffalo meat in India has increased more than threefold since 1961. The compound annual production growth rates are significant and above one for beef and veal, pig meat, chicken meat, buffalo meat and lamb, but not for goat meat. From 1961 to 1979 the production growth rates are 1.1686 for beef and veal, 0.9325 for buffalo meat. For 1980-1997 period, the reported production growth rates of meat are approximately equal to 1.4 for both sectors of bovine industry. Goat meat is the most expensive meat of all meats in India and the demand for goat meat is high. However, various factors are responsible for its sluggish growth in its production. These include, lack of high yielding breeds and lack of availability of nutritive feed in marginal areas, poor health of the animals, particularly when they are young, and lack of processing and marketing facilities in many regions.

There is an important shift towards monogastric animals, mainly chickens and pigs, in India (see Table 1). While ruminant meat accounted for 86% of red meat supply in 1961, that had fallen to 76% in 1997 in India. The expected increasing market share for chicken and pork is anticipated to further reduce ruminant meat consumption in relation to red meat consumption. Given these trends, livestock production in India is likely to become more intensified.

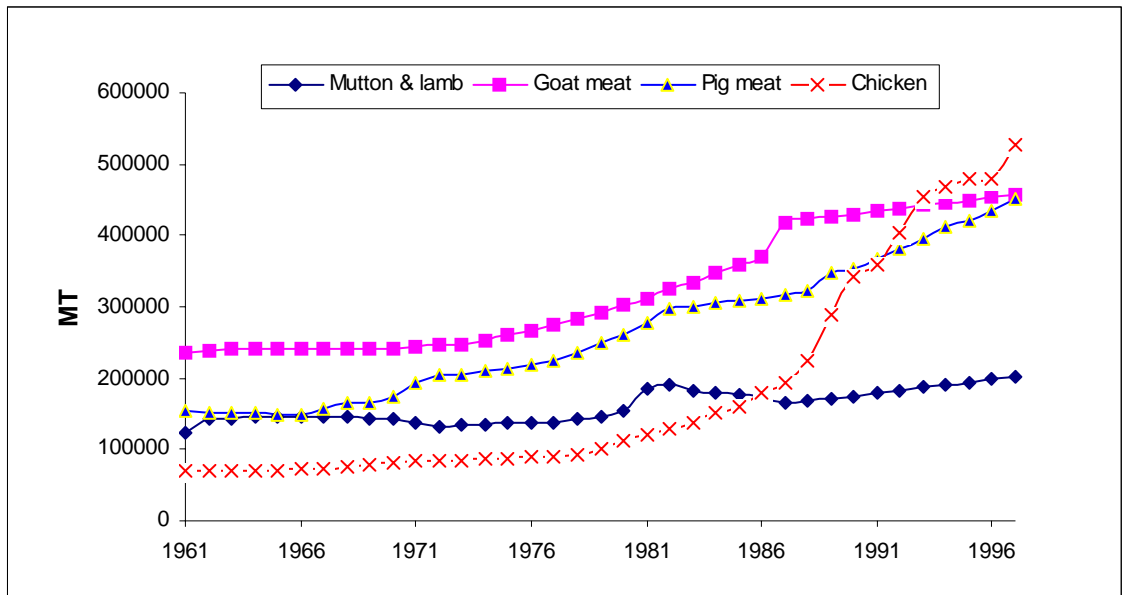


Figure 2: Livestock meat production in India, 1961-1997

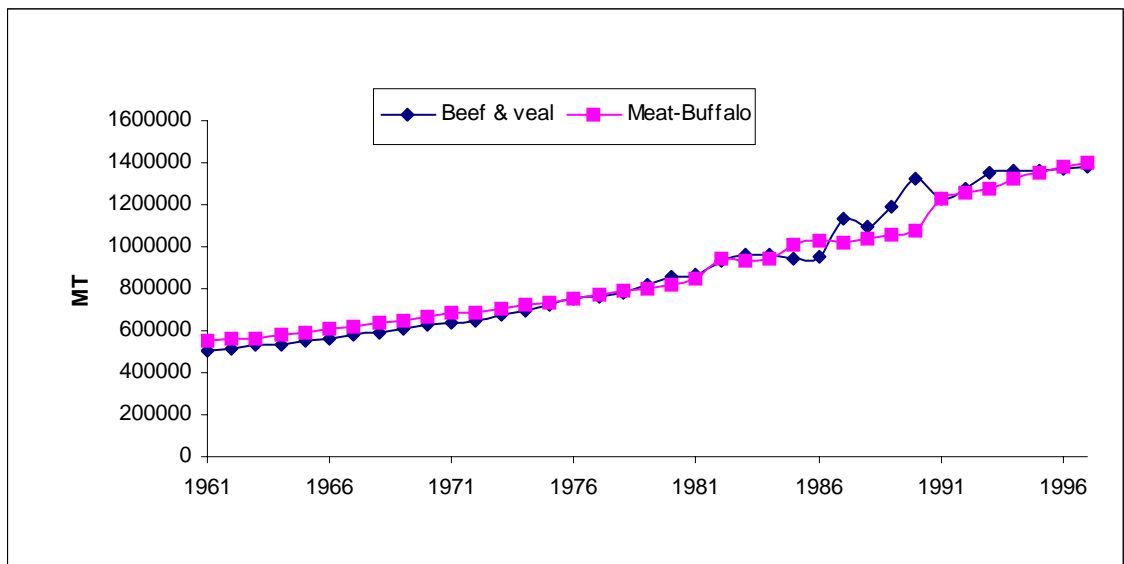


Figure 3: Beef and veal, and buffalo meat production in India, 1961-1997

Milk production in India exceeded 71 MT in the 1997, representing 13 per cent of world milk production. Thus India is the world's major milk-producing country. Buffalo and cow milk contributed equally to India's production as shown in Figure 4. Two predominant factors contributed to the positive and steady rate of growth of milk production in India: a moderate increase in its milking animal population and technological improvements in productivity per

animal. The lactating efficiency and milk yield of cows and buffaloes have improved, with buffalo milk yields increasing faster than that of cows as shown in Figure 5. There was a gradual shift in favour of buffaloes as milch animals because their superiority in terms of milk yield, lactating efficiency, quality of milk and their milk producing capacity when utilising ordinary feeds.

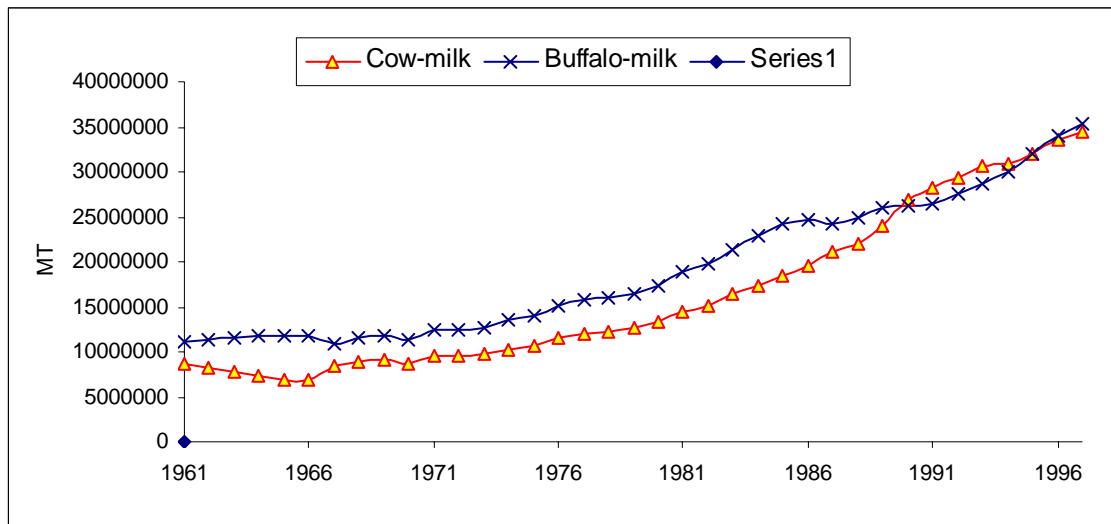


Figure 4: Milk production in India, 1961-1997

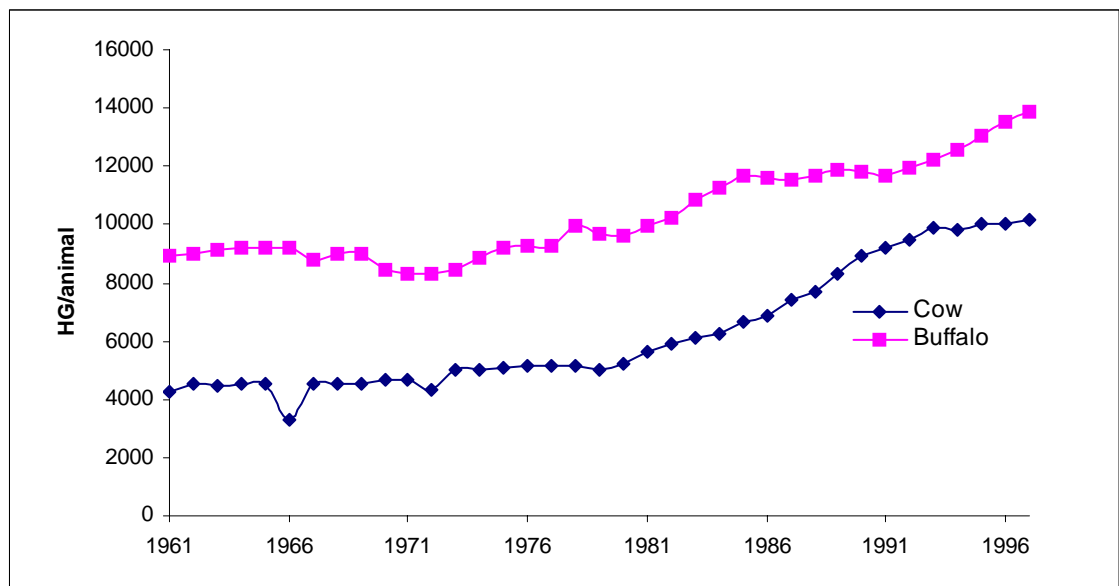


Figure 5: Milk yield in India, 1961-1997

India has increased its milk production threefold since the 1960s and also been able to distribute milk to millions of consumers in rapidly growing cities throughout the country under the “Operation Flood” programs and under overall guidance of the national Dairy Development Board at Anand. This Board founded the well-known “Anand Pattern” of cooperative dairying. This is the world’s largest and most successful dairy development project. It has succeeded in linking poor, often landless rural milk producers, with rapidly growing urban markets through cooperative institutions that own and operate facilities ranging from village collection centres to large modern dairies. Dairying has been adopted to generate steady income and employment all round the year and as a diversification strategy for many poor rural farmers in India. Milk production in India takes place in millions of small and dispersed households each having one to three animals. Geographically, milk production is not uniform in India. Milk production is mainly concentrated in Western states of Gujarat and Maharashtra and distributed from there across to the Eastern states of Bihar and West Bengal. The main reasons for the regional concentration of milk in production to western and central India is the superior adaptability of bovine breeds to those areas, the ready availability of coarse grains in those regions and the establishment of the National Dairy Development Board at Anand in Gujarat, which promoted milk production in Western India rather than in other regions.

3 Demand, consumption and international trade

The driving force behind the increasing demand for livestock products in India is a combination of population growth, rising per capita incomes and urbanization. The population of India was estimated to be 945 millions in 1996 and grew at the rate of 2.11%

per annum in the period 1981 - 1996. It is estimated that India's population will grow at a rate of 1.8% during the next decade (Bhalla 1995). The estimated rural and urban population growth rates in India are about 1.47 and 2.61 respectively for the next decade.

Gandhi and Mani (1995) examined the variations in behaviour of livestock product demand during the period 1970-71 to 1989-90. Their analysis showed a substantial increase in consumer demand for livestock products both in rural and urban areas. The rate of increase in demand for such products outpaced the demand for pulses, edible oil and vegetables. They found that the demand for livestock products increased rapidly with increases in income, when compared to other food items. Among livestock products, milk showed the greatest expansion in demand, followed by eggs, fish, and meat. The income elasticities of demand for these products are all above unity. Indian consumers show a very high elasticity of demand for milk with respect to growth in their per capita income. This, along with steady urbanization, has stimulated the demand for milk and milk products and other livestock products.

As shown in Figure 6, per capita availability of red meat, has increased in India in the past 40 years, particularly in the last 15 years. In 1961, it was 3.6 kg/annum and during the 1990s it rose to 4.6 kg/annum. Between 1960 and 1980, there was little growth in per capita meat availability but after 1980, there was dramatic increase mainly due to greater poultry supplies. However, the availability curve has flattened since 1993, and it could decline in future given the resource constraints on livestock production and marketing in India and the production growth of India's population. Nevertheless, per capita consumption of red meat in India is

about 4.6kg/annum. This is very low compared with global per capita red meat consumption of 38.5kg/annum in 1997 (FAO 1997).

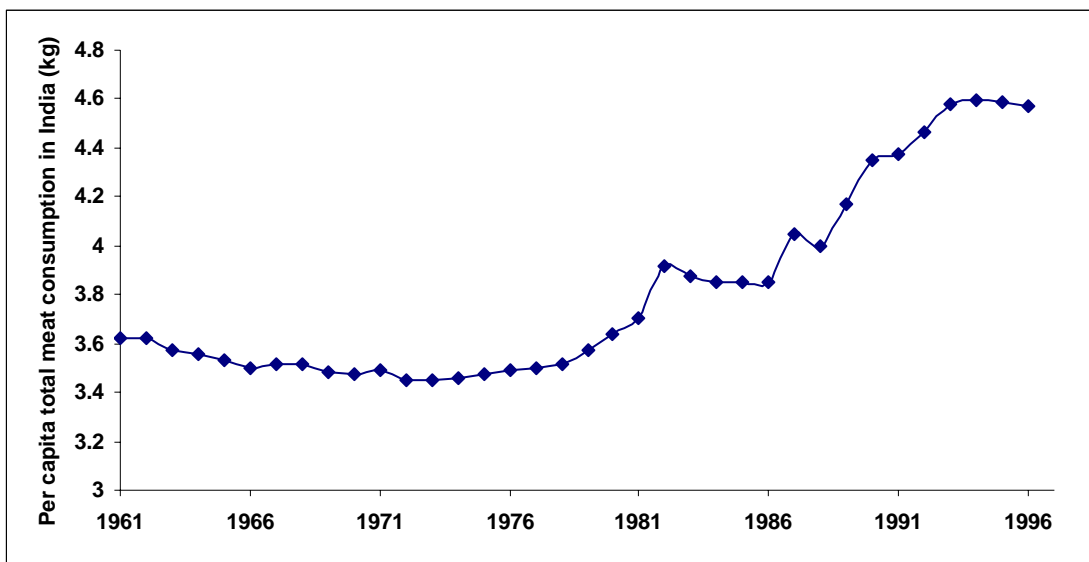


Figure 6: Estimated per capita consumption of red meat in India per annum (kg)², 1961-1997

Per capita consumption of milk and milk products has increased in India substantially (see Figure 7). Consumption per head of milk and milk products increased from 44 kg/annum in 1961 to 73 kg/annum in 1997. The upward trend in consumption was more pronounced after 1980. Unlike meat consumption, milk consumption per capita is still rising, indicating that the dairy industry is continuing to increase its per capita supply to India’s growing population of 952 million.

Because, the demand for and the production of livestock products in India have been increasing rapidly in recent years, it is interesting to examine India’s international trade experience in livestock and livestock products. Milk and milk products, beef and veal

² Estimates were calculated by dividing total meat availability (after subtracting exports from total meat production and imports) by total population.

dominate India's international trade in livestock products. Exports of beef and veal have outpaced imports (see Table 2). Exports of beef and veal have increased dramatically during the past 10 years, particularly to the Middle East and some South Asian countries. In 1961, 335 MT of beef and veal meat were exported by India and this increased to 28117 MT in 1996.

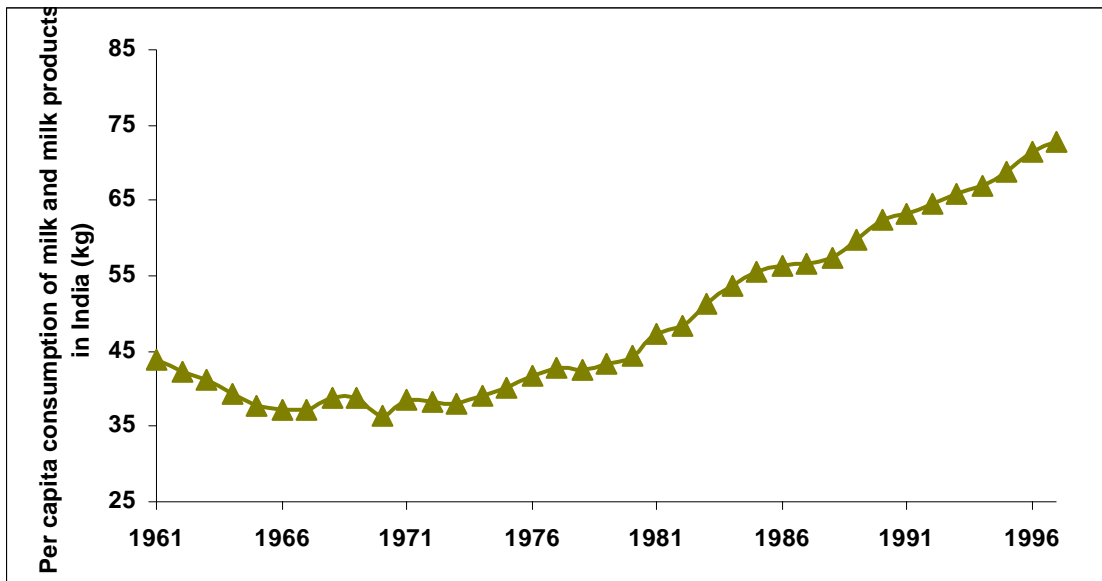


Figure 7: Estimated consumption per capita milk and milk products in India per annum (kg), 1961-1977

Conversely, total imports of milk and milk products have exceeded exports during the past 40 years or so (see Table 1). The share of imported skim milk powder in total milk and milk products imported was 98% during 1961, but fell to 13% in 1996. In nominal value terms, imports of milk and milk products valued at \$14 million in 1961 slightly increased to \$19 million in 1996. On the other hand, exports of milk and milk products which were negligible during 1961 increased to \$8 million during 1996. Although, India has virtually achieved self-sufficiency in meeting its demand for milk and milk products, it is not in a position to be a

Table 2: Imports and exports of major livestock products in India, 1961-1996

Year	BEEF AND VEAL				MILK AND MILK PRODUCTS			
	Imports		Exports		Imports		Exports	
	Volume (MT)	Value (\$000)	Volume (MT)	Value (\$000)	Volume (MT)	Value (\$000)	Volume (MT)	Value (\$000)
1961	56	41	335	459	42081	13818	7	12
1962	4	7	220	323	56174	18466	3	5
1963	10	12	202	316	47539	17476	14	22
1964	9	10	139	563	50880	20260	11	21
1965	19	13	17	43	38506	14767	14	22
1966	5	6	14	49	50806	21258	20	19
1967	5	3	19	61	40995	19907	178	114
1968	20	21	20	83	39191	15147	56	55
1969	15	20	11	24	44211	20596	72	57
1970	19	34			30092	11008	82	66
1971	3	4			42255	18484	212	258
1972	1	2	3	9	47682	28071	484	558
1973	2	6	2	8	33927	20030	65	101
1974	2	3			41564	33769	45	67
1975	1	1			49597	29394	48	76
1976	63	80	2	11	23271	27198	256	371
1977	4	7	77	69	49090	56909	1528	853
1978			653	693	47618	72248	412	745
1979	41	289	3672	4185	40443	66169	296	966
1980	2	7	5594	8525	43302	123873	271	832
1981	108	710	4761	6258	68054	149120	301	1080
1982	0	2	5571	8300	82044	183336	436	1863
1983	0	5	2446	3294	16175	27722	438	1585
1984	13	39	2420	3582	71631	105631	601	2271
1985	30	100	2470	3078	44760	59480	554	1981
1986	40	120	3198	3795	17454	30476	1057	2710
1987	18	36	8007	8127	50980	78963	891	2671
1988			11185	11146	36991	66122	656	1486
1989			10686	9935	18865	30808	427	1083
1990			11168	10593	596	1377	560	1275
1991	1	1	12559	11464	4023	8772	2596	4510
1992	1	2	5304	4954	7871	17590	1071	3138
1993	3	6	19565	16278	2670	5592	1889	3604
1994			22705	17319	5018	9223	8606	11954
1995			28117	29610	9123	19395	4054	7977
1996			28117	29610	9136	19436	4054	7977

net exporter of milk and milk products. Imports after declining now appear to be showing a slight upward trend. Imports of other animal products such as chicken, lamb and goat meat,

and pork are insignificant. However, during past five years exports of these products have increased.

Integration of the Indian economy into the world economy through trade, investment and technology transfer is bound to have major influences on its livestock industries. Mishra (1995) argued that the trade liberalisation implications for Indian livestock industries fall into two broad groups: issues that arise out of the opening up of the market to imports; and those that arise out of deregulation of domestic market. Considerations arising from first group are issues such as the comparative advantage or disadvantage of Indian livestock industries, export potential and strategies and tariff and non-tariff barriers to international trade in livestock and livestock products. The main issue arising out of deregulation of the domestic market is the ability of the corporate sector to enter into agriculture and allied activities in the name of modernisation, and scale economies thereby capturing raw material supplies for agro-processing and exports. In such cases, there is a possibility of the private economic benefits conflicting with social benefits. The recent entry of private firms into milk collection and processing in India has created a conflict of interest with dairy cooperatives. So it is important to identify which institutional-structures maximise social welfare from livestock production and processing in India.

Trade liberalisation can have important positive economic consequences for social welfare. On the one hand, about 200 million affluent middle-and upper-class consumers (who are willing to eat and pay for diversified livestock products) can benefit substantially from the trade liberalisation. On the other hand, the resource-poor growers with limited technical

knowledge or for that matter little market intelligence may not be able to compete effectively in the global market and may suffer a deterioration in their incomes.

4 Livestock and Environment

Historically, the development of animal production has responded to agro-ecological opportunities and demand for livestock products and in some areas environmentally sustainable systems have evolved. In recent decades, however, many of these systems have been pushed beyond their sustainable equilibrium (FAO 1996). There is a whole range of livestock-environment interactions both direct and indirect, which are mainly based on the livestock production systems. Some of the interactions are positive and resource-enhancing, while others are negative and resource-depleting. Some effects are reversible with the use of human knowledge but others are not.

Traditionally, livestock production in India has been part of mixed farming systems, which had a high degree of environmental sustainability. But, in recent years, small, medium and large-scale capital intensive production systems are emerging for pig, poultry, and dairy production. The environmental sustainability of these modern systems are uncertain. The positive links between livestock and environment under mixed farming systems are well known. The high level of integration between crops and livestock provides incentives for internalizing many livestock environmental impacts. Manure is used as organic fertilizers, resulting in a better balance of soil nutrients, animal traction allows for savings on fossil energy, crop residues are used as feed and the incorporation of nitrogen fixing leguminous crops in the crop rotation is well developed in India. In addition, the diversified nature of

mixed farming systems in India helps to conserve a wide variety of plant and animal biodiversity and serves as a buffer against environmental degradation (FAO 1996). However, population pressure and increasing demand for livestock products in India are altering the balance of mixed farming systems affecting the ratio of grazing land (mainly communal land) to arable land. The rapidly increasing demand for livestock products may be eroding the traditional resource-base for livestock production in India.

The negative environmental consequences of livestock population and production systems have received increased attention in recent years. Intensified animal production systems can impact adversely on the economic and social fabric of farming community as well the its surrounding environment. The pressure of increased demand for livestock products may be transferring the Indian livestock sector from one which is primarily driven by resource-availability based on available waste and crop residues, to one which actively seeks out other resources in competition with other industries. Pressure from livestock production in some cases is causing degradation by over grazing, deforestation, biodiversity loss, land and water pollution, and increases in unwelcome gaseous emissions.

Severe scarcity of feeds and feed resources, and excessive stocking rates on common grazing lands are said to be posing major threats for the environment in India. Pandey *et al* (1995) estimated the gap between availability and reasonable requirements for feed and fodder resources for the entire Indian livestock population will be about 507 million tonnes by the end of 2001. This deficit has been raised by excessive stocking rates on common property resources (CPRs), thereby creating detrimental effects on the environment. In India, the common property resources consist of village forest, village common pastures, wasteland,

community threshing grounds, ponds, lakes etc. These CPRs help in sustaining a number of animals for draught and livestock production beyond those which would be permitted by the individual's own land. This is especially for small farmers. In the absence of CPRs, it is not possible for the rural households in general and the poor in particular, to undertake livestock rearing activities in India. In many of the regions in India, overstocking in CPRs takes place because it has little private cost (Nair 1995). The growth of small ruminant population also damages the environment, but the more serious problem is the extension of cultivation to marginal and sub-marginal lands. One way to reduce the pressure of livestock on environment is to encourage systematic culling of non-productive animals and strengthen communal controls over common land (Tisdell and Roy 1997).

In India, commercial poultry production is located around the urban centres for mainly two reasons: lack of infrastructure in rural areas and high transport costs. This results in foul smells and poultry wastes are often improperly disposed of. Hence, enormous pollution problems and associated human health risks result. In areas of high animal concentrations, excess nitrogen and phosphorus leaches or runs off into groundwater and often damages aquatic and wetland ecosystem, eg., by promoting eutrophication. Processing facilities for livestock products are primitive in India. Slaughterhouses release large amounts of waste into the environment, polluting land and surface waters as well as posing a serious human health risk. Because of weak infrastructure, slaughterhouses often operate in urban settings, where the discharge of the blood, offal and other waste products is usually uncontrolled. This waste provides breeding grounds for mosquitoes and flies, which act as vectors for many of diseases such as malaria and cholera.

Livestock not only interact with and affect most environments within their domain but also affect the global environment. Livestock and livestock-waste emit huge quantities of greenhouse gases such as methane contributing to the phenomenon of global warming and nitrous oxide, which can contribute to acid rains. Livestock and in particular ruminants are one of the important sources of methane emission on the globe. There are two sources of methane emission from livestock: (1) from digestive process of ruminants; and (2) from animal waste. 'The estimated value of methane emission from digestive process of ruminants in India accounts for 6.47 Tg yr⁻¹, and animal wastes accounts for 1.60 Tg yr⁻¹' (Bandyopadhyay et al., 1996). There are various ways the emission of methane can be reduced such as by modifying the composition of the diet, improving fibre digestion efficiency and eliminating the protozoa in rumen. However, none of the measures have been adopted in India.

Developments in animal biotechnology could occupy an important role in livestock development in India. India is one of the oldest civilized and geographically diversified countries in the world and domestication of animals started long ago in various, tropical to temperate regions of India and contributed to diversification of its livestock. Most importantly, the Indian subcontinent is the treasure house of *Bos indicus* cattle breeds that are the most suited for livestock production in the tropics, be it for their draught power, milk or meat (Nath 1993). Given the wide spectrum of germplasm and genetic variability within each species of its livestock, India has a great potential for the development of livestock biotechnology breeding (both 'intragenic' as well as 'transgenic') so as to improve various quantitative and qualitative traits. Not only traits in major animals are important, but also the possible future value of conserving minor animals like, camel, yak, mithun, water buffaloes

are considerable. A recent note by Pal (1993) in *World Animal Review* was about halting decline of the yak population in India. Yaks are tough animals, which can tolerate very low temperatures and are the only large mammals able to graze at 6000 m above sea level even at -40° C.

5 Major constraints on the growth and development of India's livestock industries

➤ Scarcity of animal food and resources for supplying animal food

The development and sustainability of livestock sector is disadvantaged by the scarcity of animal food and resources for food production in India. 'As much as 10 to 15% of the existing milk production can appreciably be increased through adequate feeding of present bovine population' (Chatterjee and Acharya 1992). The area and fertility levels of common grazing lands have declined due to over stocking and soil erosion. The production of coarse grains has been on the decline in India (Nair 1995). There is inadequate scope to divert land from food crops to fodder unless a significant shift occurs in the relative profitability of livestock production compared to other food and commercial crops. Since the growth in demand for livestock products is expected to increase at an accelerating rate, the indirect consumption of grain in the form of concentrate feeds may increase. The excessive number of animals in relation to available feed supply has been identified as one of the major causes of the low productivity of cattle in India (George 1996). Better fed animals can be healthier and more productive.

➤ Anti-cow slaughter legislation

The holiness of the cow among Hindus conflicts with its economic utilization. Due to the stagnation and expected decline in demand for draught animal stock, there is an increase in number of male calves not required for replacement of that stock. The rational approach to the disposal of increased number of male calves in the future is to rear them for meat for export purposes. The question then arises of whether religious restrictions on cow slaughter is the principle reason for low productivity of cattle or their poor animal nutrition. Government restrictions on slaughter and in some states, legislation on banning slaughter of all bovines may lead to the lost economic opportunities for many of rural people. Therefore, Indian policy-makers need to review the legislation against slaughter of cows since it contributes to inadequate utilisation of bovine stock and husbandry of such stock.

➤ **Research and development issues**

The agricultural budget for education and research tends to neglect livestock in India. ‘Only under 8th Five Year Plan (1990-95), about 7% of budget for agriculture has been allocated for animal husbandry’ (Rao 1997). Consequently, research in the livestock have been mainly confined to the academic and research community. Little attention has been given to extension to the grower level or to dissemination through the appropriate channels. Low diffusion and spread of cross-breeding technology is one of the reasons for low levels of livestock productivity in India.

There is lack of participatory and systems approaches to livestock development and research. In most cases, livestock development is considered in isolation, with little integration into rural systems.

➤ **Institutional structure**

Marketing and processing: Inadequate market infrastructure, unorganized markets for livestock and its products inhibit the systematic development of livestock industries in India. Pricing of livestock products is an important aspect. There is no central market that can iron out the price irregularities in the market. In some states, governments subsidises milk production and prices are regulated which inhibits marketing efficiency.

➤ **Animal health and welfare issues**

The knowledge and methods of diagnosis and treatment of animal disease at farm level is not well developed in India. Outbreaks of diseases are common in commercial and private farms. Some of the major disease problems in poultry are ‘Colibacillosis’, ‘mycotoxicosis’ and ‘leech disease’. Parasites such as helminth are a major problem in cattle, buffalo, goats and sheep. Animal diseases can cause major economic losses through mortality, reduced productivity and fertility, effects on human health and by restrict export opportunities. Although livestock health is becoming an important economic matter, development programs of the Government of India do not usually involve any economic evaluation of livestock health aspects. Improved animal health can promote economic development through more efficient use of resources for livestock, additional export earnings, and improved livelihood of livestock producers.

6 Concluding comments

As observed in this article, significant growth in livestock numbers and livestock production has occurred in India in recent decades, particularly since the late 1970s. The bulk of the

increase in livestock supplies has come from increased productivity of animals. However, supply appears to be basically following a sigmoidal or logistic pattern. The logistic growth pattern of livestock numbers is quite clear from Figure 8. Annual growth rates of India's total livestock production have declined since the late 1980s after accelerating from the mid-1970s onwards. Growth in livestock biomass is likely to have shown even greater deceleration after the late 1980s as the percentage of non-ruminants, especially poultry, in the livestock population rose. There has also been some deceleration in the growth rate of production from livestock as is apparent from Figure 9. Peak growth rates in production occurred in the late 1970s and early 1980s but declining rates became evident in the early 1990s. Their deceleration is however not as marked as that for livestock numbers, because of increasing productivity per animal. Nevertheless, these results indicate that limits to expansion in the supply of livestock products in India are becoming more binding; a factor which may result in greater net imports of livestock products to India to mainly satisfy the demands of middle-class consumers. It may be possible for India to reduce the limitations now being placed on the expansion of its livestock industries but probably not at sufficient speed to offset the predicted increase in its net imports of livestock products.

Environmental constraints, as discussed, could pose constraints to the future growth of India's livestock sector. The commercial sector of livestock production is of growing importance in India and intensification of this production is increasing with associated environmental problems growing. In some cases e.g. in dairying areas, market-oriented developments threaten stable socio-economic patterns as well as the use of mixed farming practices. Therefore, adverse consequences for social and environmental sustainability appear to be emerging.

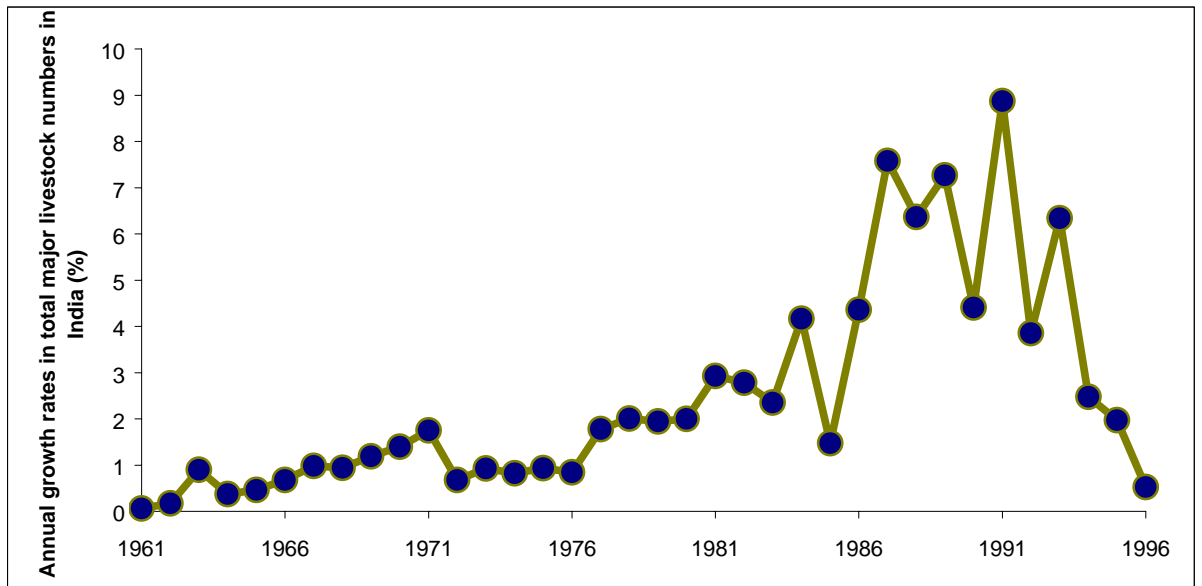


Figure 8: Annual growth rates in total livestock numbers in India, 1961-1996

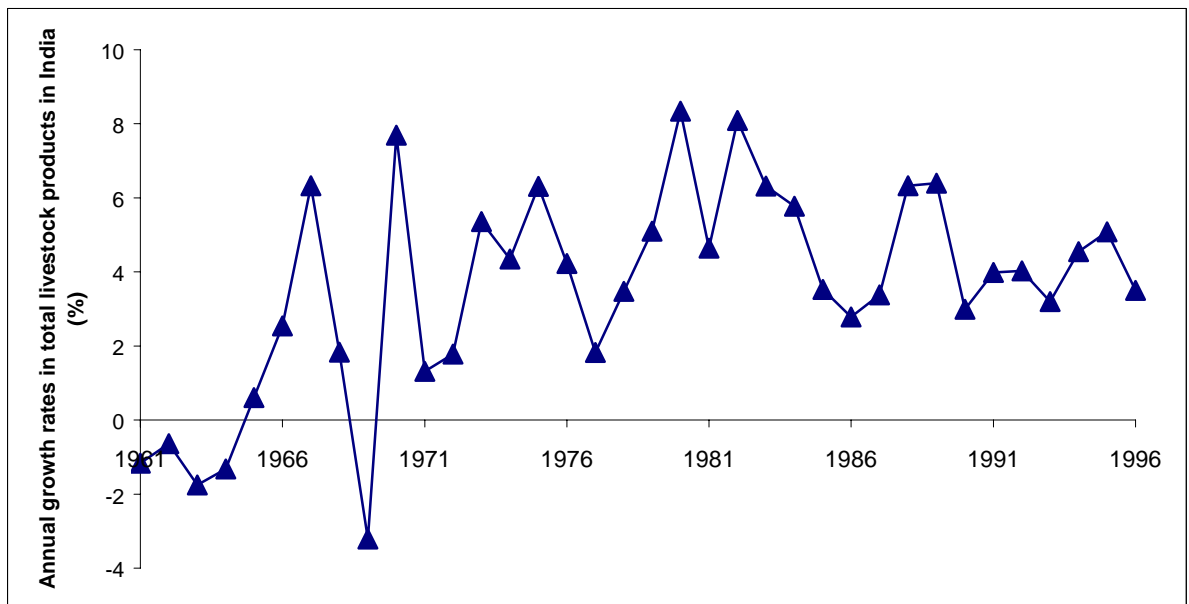


Figure 9: Annual growth rates in total livestock products in kgs in India, 1961-1996.

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