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Abstract

Livestock is an integral part of the socio-economic fabric of rural India since ancient times, being a source of livelihood and a provider of draft power, manure and fuel. Sustained increases in income and urbanization have led to rapid growth in demand for animal food products, and now the livestock sector is under pressure to produce more and more. Over the last few decades, livestock production sector grew faster than crop sector as a whole and made a significant contribution to overall agricultural growth, which is considered to be a vital factor in poverty reduction in most developing countries including India. India's livestock sector is one of the leading in the world with a holding of 11.6% of the world livestock population as per the nineteenth livestock census report, and performing well with respect to production, value addition and export of milk, meat and other products. The gross value added (GVA) of livestock sector was about INR 962,682 crore at current prices during the financial year 2019–2020, which was about 28.36% of agricultural and allied sector GVA and 5.21% of total GVA. This chapter deals with the historical progression of Indian livestock development, programmes/activities initiated under three major eras, pre-independence and independence era, green revolution era and post-green revolution era, and issues that need to be resolved in the future for improved livestock production.

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Livestock rearing along with crop farming is an integral part of human life since the beginning of civilization. It has enormously contributed to the food basket and draft animal power, besides maintaining ecological balance. Due to the conducive climate and topography, livestock rearing has played a prominent socio-economic role in India. It has a significant role in generating gainful employment in the rural sector, particularly among the resource-poor farmers and women, besides supplying low-cost and quality food to millions of people. Indeed, livestock production and crop farming are inherently linked, each being dependent on the other, and both are vital for overall food security. It supports crop farming in the form of critical inputs, contributes to the health and nutrition of the household, supplements incomes, offers employment opportunities, and acts as a dependable 'bank on hooves' in times of need. Thus it acts as a supplementary and complementary activity to crop farming in India (Anonymous 2019).

To know the dynamics of the process of development inherent in a given socio-economic scenario, it is necessary to place the present situation in the appropriate historical context. A historical progression of livestock rearing in India is expected to help us understand the process of development through which the present situation has emerged. The historical progression can be divided broadly into three major eras, namely the pre-independence and independence era, the green revolution era and post-green revolution era.

12.1 Pre-Independence and Independence Era

A reasonably stable structure of livestock and crop farming in India was destroyed by the colonial exploitation during the imperial British rule during the eighteenth and nineteenth century. In the nineteenth century, the twin processes led to the destruction of important Indian hand industries, mainly textiles, and the conversion of the Indian agrarian economy into a source of raw materials for the workshops in Britain. This general phenomenon also resulted in destruction of traditional communal grazing lands and adversely affected the Indian milk economy. Indeed, Britishers changed the use of land which was traditionally meant for the cultivation of grains and fodder crops. Hundreds of acres of land were used for cash crops such as cotton and jute for the workshops in Britain. During this period, there was a proportionate increase in the acreage devoted to cash crops at the expense of food grains (Habib 1963). Division of lands with the division of households also started. Dependence on agriculture and on smaller and smaller pieces of divided land kept increasing. Intensive cropping for grains essential for living increased. Gradually by the beginning of twentieth century, the situation was such that most of the villages lacked

suitable grazing areas and even there were no forest grazing grounds for livestock. Fodder crops represented only 4% of the cropped area.

The change in the scenario of livestock farming in India was started primarily as a consequence of the demands of British military troops. Voelkar (1893) a consulting chemist to the Royal Agricultural Society of England recommended the establishment of dairy farms for the supply of milk to troops and government institutions in 1893. An imperial dairy expert was appointed in 1920, whose responsibilities included evaluating the status of the sector and outlining feasible growth plans for the dairy industry. Gradually the move of commercializing dairy industry in India caught speed and various reports from the Royal Commission on Agriculture, Colonel Olver, an animal husbandry expert of the Imperial Council of Agriculture and the Wright Report were placed in this direction.

12.1.1 Recognition of Milk as a Marketable Commodity

Finally at the beginning of twentieth century, milk recognized as marketable commodity. Otherwise, milk was traditionally produced and consumed for immediate needs. The primary impetus for this change came from two distinct demand centres, viz., the British troops stationed in India and the growing urban centres like Bombay. Reports available on the existing conditions revealed that despite the fact that 90% of the human population and 95% of the bovine population lived in rural areas, practically no milk was assembled there for sale. Milk is a perishable commodity and requires quick, regular and special transport. A lack of adequate facilities for such a means of transport that milk produced in the interior could not be economically used for meeting urban demand. Even though fluid milk fetched a higher price in the market, rural producers were forced to convert it into less perishable, but also less profitable products. In the 1930s only 31.2% of the total milk produced was used as liquid milk and 68.8% was converted into various products (Wright 1937). The first systematic attempts to link rural production with the urban market were made in the 1940s, primarily by establishing collection centres, transport facilities and distribution link between consumers in Bombay and producers in rural areas north of Bombay.

The military farms gave requisition for land, bought the best young stocks and obtained abundant fodder supplies from adjacent villages. According to Pepperall Report, the prices they paid for the fodder frequently induced the villagers to sell a major proportion of their fodder crops and thereby deprived their own stock (Anonymous 1946). Thus the fodder economy started to be commercialized. The area under fodder crops increased by 51% from 1915 to 1937 (Table 12.1). However, the situation was markedly different in the case of fodder crops as the area under other crops such as sorghum and gram declined by 6% and 12%, respectively. However, this increase in the acreage under fodder, grown mainly as a commercial crop, was not able to compensate for the destruction of communal grazing lands, since an increasing fodder shortage was observed in this period. By 1944–1945, the fodder shortage became an acute problem (Table 12.2). This problem was further

Table 12.1 Area (million acres) under fodder crops^a in India (1915–1942) (Burns 1944)

Year	Area
1915–1916	7.0
1918–1919	7.0
1936–1937	10.6
Average (1915–1942)	9.1

^aFodder crops included oats, fodder sorghum, lucerne, guinea grass, etc.

Table 12.2 Demand and supply (million tons) of feedstuffs in the year 1944–1945 (Anonymous 1945)

Feedstuffs	Demand	Supply
Green fodder	226.50	78.10
Straw	127.88	87.20
Oil seed cakes and seeds	30.87	3.40
Cereal by-products	20.85	1.47

aggravated by the export of oilseeds and oilcakes. As a result, the price of milk was increased sharply. From 1939 to 1942, the average increase in the prices of milk was 50% and in 1947, the prices further increased by 230% compared to that in 1939, in the major cities (Anonymous 1949).

12.1.2 Initiation of Crossbreeding in Cows

In 1935 out of the total of 24,596,116 adult cattle, 49% were cows and out of total 5,709,614 adult buffaloes, 82% were females. The all-India average lactation yield of cows was 188 kg in 1937, whereas in the case of buffaloes it was 500 kg. However, buffaloes' contribution to the total milk produced was 54.4%. But the number of buffaloes was much smaller than that of cows. Thus buffaloes were more important than cows as milch animals during this period. Despite this predominance of buffalo as the milch animals in India, the first half of twentieth century was an era in which efforts to improve indigenous cows through crossbreeding were started. Since the Britishers were used to cow's milk and products, made from cow's milk such as cheese. Some degree of mechanization in agriculture was also started by the second quarter of the twentieth century. The use of oil engines, mechanized transport, power-driven oil mills, had slowly started replacing bullock as a source of draft power. As a result, the milch values of indigenous cows became comparatively more important than the draft power of indigenous bullocks. Moreover, it was also technologically possible to improve cows by cross-breeding because good European milch breeds of cows were available, while good buffalo breeds were not available.

The Imperial Department of Agriculture and Provincial Agricultural Department attempted cross-breeding Indian cattle with European breeds before the First World War. The experiment was found successful in raising the milk yield of indigenous cows but it was observed that the susceptibility of the crossbreds to diseases prevalent in India increased as compared to the pure Indian breed. Cross-breeding

became an accepted practice in military dairy farms. The military farms established a technological base from which further activities related to cross-breeding by artificial insemination (AI) came up. However, a systematic and thorough study of AI with reference to Indian conditions started at the Imperial Veterinary Research Institute via an Indian Council of Agricultural Research-sponsored scheme only in 1942. This detailed study on the collection, preservation and transport of semen to rural areas and the technique of AI revealed that it was possible to introduce AI in India. Consequently, after the establishment of major institutes at Calcutta, Patna, Bangalore, etc. in 1945, it was recommended that State Governments may set up AI centres in selected areas having high cattle density and adequate transport facilities.

12.1.3 Planned Livestock Development

The Government played a crucial role in the planned development of agriculture in general and livestock/dairy development in particular, since independence. On the one hand, it ensured the cheap and easy availability of essential commodities for the consumers at large; on the other hand, it also managed that the producers get their fair returns for milk and other agricultural products. Accordingly, the supportive prices were declared by the government so that no one is a loser. Indeed, in the first post-independence phase of planned livestock development, the major importance was firstly given to improving the indigenous breeds through selective breeding and secondly to organize the milch herds located in metropolitan towns on more hygienic and scientific lines. During the early 1950s, the Government adopted a policy of discouraging cross-breeding of cows and encouraging selective breeding of indigenous milch breeds. Various military and Government farms were instructed to discontinue cross-breeding of cows. Simultaneously, programmes to maintain quality bulls and castration of 'undesirable sire stocks' were launched under the Key Village Centre Schemes. This was just opposite to cross-breeding of cows in the immediate post-independence era and perhaps due to the close linkage between cross-breeding and the needs of British troops during the last phase of colonial rule.

12.2 Green Revolution Era

When the British left India in 1947, India continued to be haunted by memories of the Bengal Famine, the world's worst recorded food disaster that occurred in 1943 under British rule. It was, therefore, natural that food security was one of the main items on free India's agenda. This awareness led, on one hand, to the Green Revolution (GR) in India, and on the other, legislative measures to ensure that businessmen will never again be able to hoard food for reasons of profit. The GR, spreading over the period from 1967–1968 to 1977–1978, changed India's status from a food-deficient country to one of the world's leading agricultural nations. Until 1967 the government mainly gave attention to expanding the farming areas. But the

growth of the population was much faster than food production. This called for immediate and drastic action to increase production. The action came in the form of the GR. The GR resulted in a record grain output of 131 million tonnes in 1978–1979. Yield per unit of farmland enhanced by more than 30% between 1947 (when India gained political independence) and 1979. The crop area under high-yielding varieties of wheat and rice increased considerably. It also created plenty of jobs not only for agricultural workers but also for industrial workers through the creation of related facilities such as factories and power stations.

During the GR era, the growth and development of the livestock sector were also unique. By mid-1960s it became clear that the strategy of encouraging selective breeding of indigenous milch breeds was not yielding the desired results and per capita availability of milk was continuously declining. By this time, the Anand experiment showed that it was feasible to link rural producers to urban markets. The cross-breeding technology was then possible to be taken to the doorsteps of milk producers because of the developments, in the field of cryogenics, particularly the manufacture and transport of liquid nitrogen. Another event of crucial importance was the excess milk production in the European Economic Community (EEC) countries and consequently their anxious search for markets for milk, milk products and dairy equipments. As a result of all these factors, a new strategy was adopted in the early 1970s. This strategy had two major elements- (a) linking the rural producers with urban consumers by creating an integrated infrastructure for the collection, storage, processing, transport and distribution of milk, and (b) importing the semen of proven western dairy breeds and establishing a delivery system for carrying out artificial insemination in the villages. A major investment component for this strategy was to be financed by loans and donations from the EEC countries in form of milk powder. Besides this, the increase in livestock production was also governed by several schemes run during this period as described below.

12.2.1 Operation Flood

One of the world's largest rural development programme, operation flood was launched in 1970. It helped dairy farmers direct their own development, placing control of the resources they create in their own hands. A national milk grid linked milk producers throughout the country with consumers in over 700 towns and cities, reducing seasonal and regional price variations while ensuring that the producer gets fair prices in a transparent way on a regular basis. The main foundation of operation flood was village milk producers' cooperatives, which procured milk and provided inputs and services, making modern management and technology available to members. Operation flood's main goals were increase in milk production (a flood of milk), augmenting rural incomes and providing reasonable prices for consumers. Indeed from the outset, operation flood was conceived and implemented as much more than a dairy programme. Rather, dairying was seen as an instrument of development, generating employment and regular incomes for millions of rural people. It was implemented in three phases.

In phase I (1970–1980), it was financed by the sale of skimmed milk powder and butter oil gifted by the European Union then EEC through the World Food Programme. NDDDB planned the programme and negotiated the details of EEC assistance. During its first phase, it linked 18 of India's premier milk sheds with consumers in India's four major metropolitan cities namely Delhi, Mumbai, Kolkata and Chennai. In later phases, the number of milk sheds increased from 18 to 136 and 290 urban markets expanded the outlets for milk. Thus a self-sustaining system of 43,000 village cooperatives covering 4.25 million milk producers came up. Domestic milk powder production increased from 22,000 tonnes in the pre-project year to 140,000 tonnes. In this way EEC gifts and World Bank loans helped to promote self-reliance. Direct marketing of milk by producers' cooperatives was increased by several million litres a day. Later dairy cooperatives were again expanded and strengthened with the infrastructure required to procure and market increasing volumes of milk. Veterinary first-aid health care services, feed and artificial insemination services for cooperative members were extended, along with intensified member education. Milksheds even reached 173 with the numbers of women members and Women's Dairy Cooperative Societies increasing significantly.

12.2.2 All India Coordinated Research Project (AICRP) on Cattle

This project was initiated in 1968 with the aim to improve the production performance of cattle maintained under farm and field conditions. Under this project, Field Progeny Testing (FPT) was initiated to bring about genetic improvement in cross-bred cattle at farmers' herds in collaboration with the SAUs, State Government, and Non-Government organizations. This project contributed a lot in enhancing the productive capacity of milch cattle in the country and presented a remarkable share of the cattle population too.

12.2.3 All India Coordinated Research Project (AICRP) on Buffalo

This project started in 1970 with the objective to improve the production potential of buffaloes through the assessment of genetic merit of sires. It was initiated with the selection of bull based on progeny selection and its distribution in the field to evaluate the performance at several State and Central Government farms. The project at various institutes contributed in increasing the elite buffalo breeds and their production performance.

12.2.4 All India Coordinated Research Project (AICRP) on Sheep and Goat

This programme was initiated in the year 1971, which led to steady growth of wool and hair by around 2% during the 1970s and 4% in the 1980s and 1990s. But in the

later phase growth rate showed a decreasing trend that remained below 1% which could be due to liberalization of the import of wool at a low rate of 15% of duty leading to an adverse impact on domestic output.

12.2.5 Special Livestock Breeding Programme

The programme was launched in 1975–1976 with an objective to enhance the production of various livestock products like milk, eggs, wool, etc. and to provide employment opportunities and supplement income to the weaker sections of the rural poor. The programme includes crossbred heifer rearing along with the setting up of other livestock production units. Simultaneously the scheme also aimed at supporting the landless agricultural labourers and marginal and small farmers in improving the quality of crossbred heifer calves. Thus the programme assisted in improving the performance of female calves from a young age to fully exploit their utility when matured.

12.2.6 Programme on Fattening of Male Buffalo Calves

Meat production showed tremendous growth during the 1960s as compared to 1950s. However, its growth remained passive during the 1970s, when total livestock output witnessed a substantial acceleration in growth. Increment in meat production growth was observed around 1980–1981 as a result of a phenomenal increase in buffalo meat which was supported through this programme and taken up under the aegis of Hind Agro Industries Limited.

12.3 Post-Green Revolution Era

The green revolution had a massive impact on the social and economic development of people whose consequence was observed during post green revolution era. The modification of agriculture practices such as intensification over the years led to overall disturbance in delicate agro-ecosystem. Although it resulted in three times more production of cereal crops with a slight increase in cultivated land (30%). Additionally, there were significant impacts on poverty reduction and lower food prices. But the combination of high production cost with low economic returns from agricultural practices are directly affecting the livelihood of farmers. The green revolution made India a country of self-sufficiency in cereal grains, thereby storing surplus unused grains as livestock feed. It has also a huge impact on the feeding behaviour of humans, as millets once cultivated as a major cereal crop to alleviate malnutrition now is replaced by rice as a staple food, making millets as a fodder crop. The Food and Agriculture Organization (FAO) has recorded that over the years 1961–2017, there are a decrease in the production of millet and an increase in the production of rice; thus, rice became the staple diet of the country. Ultimately the GR

increased the availability of fodders and grains for sustaining more livestock and enhanced their productivity.

12.3.1 Growth Trend in Livestock Population

Over the years, the need for livestock products has increased significantly being attributed to rapid urbanization, changing lifestyles, rising income levels, increased nutritional awareness among people, etc. Fortunately with the ever-increasing food needs of a growing human population, there is also an increase in almost all the livestock species across the world including India to satisfy the growing demands. As per the nineteenth Livestock Census (BAHS 2014) India's livestock sector is one of the largest in the world with a holding of 11.6% of the world livestock population which consists of buffaloes (57.83%), cattle (15.06%), sheep (7.14%), goats (17.93%), camel (2.18%), equine (1.3%) and pigs (1.2%). Indeed, India's position in the world in terms of livestock population is quite impressive, being first in the case of cattle and buffalo, second for goats and third for sheep, and tenth in the case of camel population.

There was a remarkable growth in livestock population (million heads) from 1951 (292.80) to 2019 (535.82). The twentieth livestock census released by the Department of Animal Husbandry and Dairying, Government of India showed that the livestock population increased by 4.6%, from 512.06 million in 2012 to 535.82 million in 2019 with an annual growth rate of 0.66%. This increment was led by a sharp increase in a number of small ruminants like sheep and goats, which was nearly 95% of the total livestock increase. Based on the species-wise livestock population during this period (Table 12.3), it was observed that the number of cattle gradually increased from 1951 (155.30 million) to 1992 (204.58 million), but it significantly decreased to 190.90 million in 2012. But the notable fact was that number of cattle increased in 2019 with an annual percentage growth rate of 0.12%. Among cattle, there was a marked change from indigenous cattle to crossbreds. Crossbred cows had grown at a much faster rate than indigenous stock. According to the livestock census 2019, there was a 6% decline in a total number of indigenous cattle over the previous census despite the launch of government schemes like the Gokul Mission for the improvement of indigenous breeds. However, the pace of decline of the indigenous cattle population during 2012–2019 was much lesser as compared to 2007–2012 which was about 9%. On the contrary, the population of total exotic or crossbreed cattle increased by 26.9% in 2019 as compared to the previous census of 2012. The decline in numbers was due to people's abandoning indigenous cattle. The population of buffalo increased from 43.40 million in 1951 to 109.85 million in 2019. This trend clearly showed that now-a-days people are rearing more buffaloes than cattle and other livestock due to globalization. For meat purposes, buffaloes have more commercial value than others in world trade. The annual percentage growth rate of buffalo significantly declined to 0.15 from 2012 to 2019 which was 1.45 from 1992 to 2012. A striking feature of the Indian livestock sector was that number of sheep and goats consistently increased.

Table 12.3 Trends in livestock population (millions head) from 1951 to 2019 (Mondal and Mishra 2019)

Species	1951	1972	AGR (%)	1992	AGR (%)	2012	AGR (%)	2019	AGR (%)
Cattle	155.30	178.30	0.71	204.58	0.74	190.90	-0.33	192.52	0.12
Buffalo	43.40	57.40	1.54	84.21	2.34	108.70	1.45	109.85	0.15
Sheep	39.10	40.00	0.11	50.78	1.35	65.07	1.41	74.26	2.02
Goat	47.20	67.50	2.04	115.28	3.54	135.17	0.86	148.88	1.45
Horse	150	0.90	-1.90	0.82	-0.44	0.63	-1.16	0.34	-6.58
Camel	0.60	1.10	3.97	1.03	-0.32	0.40	-3.06	0.25	-5.36
Pig	4.40	6.90	2.71	12.79	4.27	10.29	-0.98	9.06	-1.71
Mule	0.06	0.08	1.59	0.19	6.88	0.20	0.26	0.08	-8.57
Donkey	1.30	1.00	-1.10	0.97	-0.15	0.32	-3.35	0.12	-8.93
Yak	-	0.04	-	0.06	2.50	0.08	1.67	0.06	-3.57
Total	292.80	353.60	0.99	470.86	1.66	512.06	0.44	535.82	0.66

AGR annual growth rate

According to the latest livestock census of 2019, sheep and goats accounted for 13.87 and 27.80% of total livestock in the country. During the last inter-census period number of sheep increased from 65.07 million in 2012 to 74.26 million in 2019 with a sharp annual percentage growth rate of 2.02%. While during the same time frame the number of goats increased from 135.17 to 148.88 million at a 1.48% annual percentage growth rate which was quite significant. On the contrary, the numbers of other livestock like donkeys, camels, pigs, horses and mules declined during this period.

12.3.2 Growth Trend in Milk and Meat Production

Presently livestock is one of the fastest-growing agricultural subsectors in developing countries including India. The global market for milk and meat is growing fast which is driven by population growth, rapid urbanization and increasing incomes in developing countries. This is an opportunity for India to improve its participation in the global market. India is the world's top milk-producing nation since 1998 and it accounts for 22% of the world's total milk production according to the UN's Food and Agriculture Organization (FAO). The country improved its milk production from 17 million tons only in 1951 to 187.7 million tons in 2019 (Table 12.4). The growth in milk production remained sluggish for more than two decades after independence (around 1% per annum) whereas the growth of the population was closer to 2% (BAHS 2014). The substantial improvement in milk production was achieved with the launch of a nationwide dairy development programme (operation flood) in the year 1970. During the last inter-census period, the production of milk increased from 127.9 million tonnes in 2012 to 187.7 million tons in 2019 at a 5.63% compound annual growth rate which was quite impressive.

Unlike milk, meat production in India mainly falls under the unorganized sector. India is the sixth largest producer of meat in the world. According to the livestock census report, the growth rate of meat production was sluggish up to 2001–2002 in India. But in 2002–2003, first time it increased significantly from 1.9 million tonnes to 2.1 million tonnes. But the highest compound annual growth appeared during 2007–2008 which was 73.91%. But it failed to maintain its growth rate afterwards.

Table 12.4 Trends in production (million tonnes) and growth of milk and meat from 1951 to 2019 (Mondal and Mishra 2019)

Year	Milk		Meat	
	Production	CAGR (%)	Production	CAGR (%)
1951	17.0	–	–	–
1972	23.2	1.49	–	–
1992	55.7	4.48	–	–
2012	127.9	4.24	5.5	–
2019	187.7	5.63	8.1	5.69

CAGR compound annual growth rate

However, it was noticeable that the production of meat increased in our country from 5.5 million tons in 2012 to 8.1 million tons in 2019 with a 5.69% compound annual growth rate. During the year 2020, it further increased to 8.60 million tons with a positive growth rate of 5.98%. Meat from Indian animals contains less fat, and while the present international trend favours low-fat meat, thus Indian meat industry has a promising future in the global market.

Besides continuation of earlier programmes on livestock development, several new measures/schemes (Anonymous 2021a) were initiated during post green revolution era by the Government to increase the productivity of livestock, which led to increase in milk production significantly to 198.40 million tons with an annual growth rate of 5.68% in 2020 and India continued to be the largest producer of milk in the world. The gross value added (GVA) of the livestock sector reached about INR 962,682 crore at current prices during the financial year 2019–2020, which was about 28.36% of agricultural and allied sector GVA and 5.21% of total GVA (Anonymous 2021b).

12.3.3 National Livestock Mission (NLM)

This scheme was started in the financial year 2014–2015 and revised from time to time. It aims towards employment generation, entrepreneurship development, increase in per-animal productivity and thus targeting increased production of meat, milk, and wool under the umbrella scheme development programme. The surplus production will assist in the export earnings after meeting the domestic demands. National livestock mission plans to develop entrepreneurs to create forward and backward linkage for the produce available at the unorganized sector and to link with the organized sector. It has three sub-missions. Sub-mission on breed development of livestock aims at entrepreneurship development and breed improvement in sheep, goat and piggery by providing the incentivization to the individual, FPOs, FCOs JLGs, SHGs, etc. for entrepreneurship development and also to the state government for breed improvement infrastructure. While sub-mission on feed and fodder development aims towards strengthening of fodder seed chain to improve the availability of certified fodder seed required for fodder production and encouraging entrepreneurs to establish units of fodder block/hay bailing/silage making through incentivization. The last sub-mission on innovation and extension aims to incentivize the institutes, universities and organizations carrying out research and development related to sheep, goat, pig and feed and fodder sector, extension activities, livestock insurance and innovation.

12.3.4 Rashtriya Gokul Mission (RGM)

It was implemented for the development and conservation of indigenous bovine breeds in December 2014. This mission is very important for the betterment of resource-poor as more than 80% low producing indigenous animals are with small

and marginal farmers and landless labourers. It is important for enhancing milk production and productivity of bovines to meet the growing demand for milk and making dairying more remunerative to the rural farmers of the country. It is leading to the multiplication of elite animals of indigenous breeds and increased availability of indigenous stock. It is proposed to be continued under the umbrella scheme Rashtriya Pashudhan Vikas Yojna. The RGM is expected to enhance productivity and benefit the programme, percolating to all cattle and buffaloes of India, especially with small and marginal farmers. It will also benefit women in particular since over 70% of the work involved in livestock farming is performed by women.

12.3.5 Promoting Sex-Sorted Semen

With the mechanization of crop farming, the utility of male cattle and buffaloes has been reduced. Livestock farmers are not willing to maintain bullocks/male buffaloes for agriculture or any other draft work. Hence, male calves born at farmer's houses have become a liability. Farmers often let the male calves loose which are resulting into increase in the stray animal population. Only female calves can be produced (with more than 90% accuracy) by use of technology like sex-sorted semen in an artificial insemination programme. Extensive use of this technology is also expected to increase the number of female animals, thereby improving the income of farmers through the sale of female animals or by the sale of milk.

12.3.6 Implementing National Digital Livestock Mission (Livestock)

Livestock-related activities and transactions including health and breeding services, sale and purchase, etc. should take place in entirely digital mode based on unique animal ID Pashu Aadhaar which is currently being assigned through ear tagging to all large and small animals throughout the country. A complete open-source tech stack is expected to enable inputs of all reporting including disease and outbreak reporting by veterinarians and field-level workers and service providers through a user-end digital interface. Farmers can access their own data, make service requests, and access the latest technical and business information through an updated version of the farmer-facing app e-GOPALA or through a connected national level four-digit call centre number. Since all farmers will be linked, direct benefit transfers from all central or state-level schemes, and e-vouchers giving the power to choose a service provider, will also be possible through this mechanism. Even dairy processors, other private companies, app developers, and researchers can access the database through established data-sharing standards, and product traceability regulations can be designed and enforced on the basis of this database. Indeed, not only the ease of working and accountability of service providers is increased manifold, and farmers are fully empowered, but also the entire economy around livestock is multiplied through this database.

12.3.7 National Animal Disease Control Programme (NCDP)

India's livestock wealth is quite impressive, but the prevalence of animal diseases is a serious impediment to the growth of the livestock sector. Losses are humongous and often beyond estimation due to diseases like foot and mouth disease (FMD), brucellosis, etc. It is because of FMD that there is not only a reduction in milk production and trade in livestock products but also there is infertility and a reduction in the quality of hides and skins of the animals, including their draught power. Thus FMD has a direct negative impact on the trade of milk and other livestock products. Similarly, brucellosis is another important disease of livestock resulting in huge financial losses and has an adverse impact on human health, as it has zoonotic potential. Farm workers and livestock owners are always at risk of contracting as well as spreading this disease. Hence, control of Brucellosis will have a double impact, both in human and livestock health, besides rich economic gains to the animal owners/farmers. Hence, it is crucial to control FMD by vaccination of all cattle, buffaloes, goats, sheep and pigs and brucellosis by vaccination of all female bovine calves (4–8 months old) in the country. This will not only make animals healthy but will also result in better productivity and acceptability of our animal products the world over. Besides, efforts in this direction will lead to contribute towards improving farmers' income.

12.3.8 Livestock Health and Disease Control Scheme

This scheme aims to improve the animal health sector by way of the implementation of prophylactic vaccination programmes against various diseases of livestock, capacity building, disease surveillance and strengthening of veterinary infrastructure. It is visualized that implementation of the scheme will ultimately lead to prevention and control, subsequently eradicating diseases, increased access to veterinary services, higher productivity from animals, boosting up of trade in livestock, in livestock products and improving the socio-economic status of livestock farmers.

12.4 Future Projections and Needs

Earlier smallholder livestock production was widespread in the country, but recently it has witnessed a gradual transformation to a semi-commercial or commercial mode. However, the requirements for age-old traditional production system and the current as well as future production systems are not similar and the country needs to be equipped with effective technological backstopping and efficient input delivery systems besides facilitating favourable market and marketing networks. Indeed, there are number of critical gaps, which needs to be bridged for improved livestock production, like resource-driven livestock production than demand-driven, mindset of people to manage animals under a low/negligible input system, the presence of huge non-descript livestock population, low genetic improvement in organized and

unorganized rural herds, poor productivity of native animals, inadequate availability of superior germplasm, inadequate feed and fodder supply, indiscriminate breeding of animals in field conditions, inadequate availability of vaccines, cold-chain and other health measures, unorganized marketing of animal products and problems associated with the diffusion of new technologies. So we need to put our concerted efforts on following issues (Srivastava 2018).

12.4.1 Recording Performances of Animals

At present we do not have an effective mechanism to identify the animals and performance recording, although small-scale level progeny testing programs are in use at a few places. The elite germplasm of all breeds needs to be identified and subjected to performance recording under systematic breeding programmes so that more numbers of elite germplasm become available and male offspring from these elite females can be exploited for future artificial breeding purposes.

12.4.2 Working on Indigenous/Native Animals

In our country, we have a huge number of indigenous animals who are capable of sustaining productivity under even very low inputs and also known for their drought tolerance and disease resistance. But there has been a change in the utilization pattern of these genetic resources, now they are facing stiffer competition for their survival, which warrants urgent measures to be taken for their conservation. Indigenous breeds like Gir, Sahiwal, Tharparkar, Red Sindhi, etc. are potential milk yielders, producing 1200–3000 L or even more milk per lactation. These breeds need to be promoted and used for the grading-up of non-descript cattle in different regions of the country for improving their milk productivity. Besides the regular programs for conservation and improvement such as indigenous cattle, we have several *gaushalas* which need to be considered for the development and conservation of indigenous breeds in their respective regions. Similarly, we have other species of indigenous animals like buffalo, sheep, goat, pig, etc. which are highly suitable and adapted to Indian conditions also need to be considered for conservation and genetic improvement.

12.4.3 Augmenting Availability of Quality Feed Resources

We need to have an effective plan for augmenting the availability of quality feed resources in the country, as there is a shortage of feeds and fodders for livestock, leading to an inadequate supply of nutrients especially protein, energy and minerals. The regional and seasonal deficits of fodders and feeds are more important than the national deficit as it is not economical to transport them over long distances. In order to meet the nutritional requirements of animals, there is a need to increase the

bioavailability of nutrients from feeds and fodders using chemical, biological and biotechnological techniques. Indeed, it is required to improve the productivity of the land and also to meet the feed and fodder requirements from the limited area available for this purpose. We also need to look at newer feed resources and evaluate them for livestock feeding and find out how much these can be exploited in bridging the gap between supply and demand of the nutrients.

12.4.4 Prevention and Control of Animal Diseases

It is an important issue that needs cooperation from many stakeholders in the livestock production chain. Particularly at the farm level, better prevention and control of diseases lead to much higher output. We need to develop a strong and reliable epidemiological status of economically and zoonotically important diseases in different regions of the country to identify high, moderate and low prevalence areas and to formulate control or eradication strategies. It is true that vaccination is the most capable way to control many diseases, but it is not 100% effective in preventing the diseases like brucellosis. Thus, vaccination coupled with good husbandry practices is essentially needed to control the disease. Exact diagnosis of diseases is not possible under field conditions due to the inadequate availability of veterinary laboratories/health centres. Thus the diagnosis is very often made based on the symptoms only. We need to keep pace with the contemporary developments in the technical improvements of the conventional vaccines to make them more useful and also continue with research and development efforts for newer generation vaccines in the long term.

12.4.5 Creation of Special Animal Product Zones (SAPZ)

Zone-specific planning is the need of the hour for any livestock development program. Intensive livestock development programs requiring germplasm improvement through selection and upgrading need to be put in place along with region-specific production packages. In order to promote the export of livestock products, we need to set-up Special Animal Product Zones (SAPZs). SAPZs should be identified keeping in view the basic infrastructure and other requirements including the availability of land and irrigation facilities for the production of fodders, healthcare and marketing facilities in the region. These SAPZs need to be linked with an export-based processing plants, the compound feed industry, regulated animal market, veterinary polyclinics, semen bank, etc. in the cooperative or private sector. The farmers in SAPZs need to be offered incentives to set-up medium scale (20–100 animals) or large-scale (more than 100 animals) commercial livestock farms depending upon the purpose (milk, meat, etc). The farmers also need to be assured of the minimum price for animal products and an added premium for quality.

12.4.6 Policy Issues

We have a huge population of non-descript livestock that need to be characterized and the homogenous populations deserve the status of breeds to be recognized as a new breed. Once they are recognized properly, suitable policies need to be evolved to improve their productivity while restricting the growth of low producing population. Exclusively by facilitating the large-scale commercial livestock production, it may not be possible to obtain inclusive growth, however, boosting the smallholder farmers as a whole and commercial livestock production in identified areas will put livestock as an instrument of inclusive economic development. To achieve this, we need to have a stringent mechanism/legislation in place that protects the interests of the large smallholder population, while facilitating scaling up commercial livestock production. Livestock producers also need to be brought under an organized umbrella by establishing livestock cooperatives/groups/breed societies etc. to encourage the concept of 'quality assured production' and incentivizing in the form of better prices for the quality producers. Although it requires establishing quality test centres at various levels. Indeed, a check system needs to be established for tracing 'from table to farm' for the prevention of the sale of substandard livestock products as it is expected affects adversely the consumer health.

12.5 Conclusions

Livestock has been an important source of livelihood for resource-poor farmers over the years. The gross value added (GVA) of the livestock sector was about 28.36% of agricultural and allied sector GVA and 5.21% of total GVA during the financial year 2019–2020. Among the different livestock components, a major share of value comes from milk followed by meat. It has been observed that in India the total number of livestock is increasing day by day at a steady rate. However, this increment is largely driven by a sharp increase in the number of sheep and goats, which is nearly 95% of the total livestock increase. Among the livestock, there has been a marked shift from indigenous cattle to crossbreds. Based on the livestock census in 2019, there was a 6% decline in the total number of indigenous cattle and a 26.9% rise in total exotic or crossbred cattle over the previous census. Similarly, there was also a decline in number of other livestock like donkeys, camels, pigs, horses and mules. India possesses huge livestock wealth, but the productivity of livestock is pretty low due to many constraints like the dominance of animal population with local low-yielding breeds, shortage of feed and fodder, inappropriate management and disease control measures, etc. Proper attention need to be given to the above-mentioned constraints along with policy/input support from the government and other stakeholders. The poor productivity of Indian livestock can be improved by adopting suitable breeding strategies like cross-breeding, upgrading and selection based on the agro-climatic conditions, farmers' resource availability and preferences. Similarly, the necessary supporting infrastructure with effective

input delivery systems and viable processing enterprises need to be encouraged for the better contribution of livestock in the Indian economy in years to come.

References

- Anonymous (1945) Report of the milk sub-committee appointed by the policy committee on agriculture, poultry and fishery. Ministry of Agriculture, Government of India, New Delhi
- Anonymous (1946) The dairy industry of India: report on an investigation with recommendations, also known as the Pepperall report. Manager of Publications, Delhi, pp 1–17
- Anonymous (1949) Marketing of milk in the Indian union. Directorate of Marketing and Inspection, Ministry of Agriculture, Government of India, New Delhi, pp 13–14
- Anonymous (2019) Annual Report (2018–19). Department of Animal Husbandry, Dairying and Fisheries, Ministry of Agriculture & Farmers Welfare, Government of India
- Anonymous (2021a) Schemes/programmes. Department Animal Husbandry and Dairying. Ministry of Fisheries, Animal Husbandry and Dairying, Government of India, New Delhi. <https://dahd.nic.in/schemes-programmes>. Accessed 16 Dec 2021
- Anonymous (2021b) Annual report (2020–21). Department Animal Husbandry and Dairying. Ministry of Fisheries, Animal Husbandry and Dairying, Government of India, New Delhi. <https://dahd.nic.in/schemes-programmes>. Accessed 18 Dec 2021
- BAHS (2014) Basic animal husbandry statistics. Department of Animal Husbandry, Dairying and Fisheries, Krishi Bhawan, New Delhi, pp 1–156
- Burns W (1944) Technological possibilities of agricultural development in India. Government Printing Press, Punjab, pp 1–20
- Habib I (1963) The agrarian system of Mughal India (1556–1707). Asia Publishing, New Delhi, pp 1–53
- Mondal S, Mishra AP (2019) Dynamics and performance of livestock and poultry sector in India: a spatio-temporal analysis. *Natl Geogr J India* 65(4):389–402
- Srivastava AK (2018) Strategy paper: livestock development in India. Trust for Advancement in Agricultural Sciences, New Delhi, pp 1–20
- Voelkar JA (1893) Report on the improvement on Indian agriculture. Printed by Eyre and Spottiswoode, London, pp 1–216
- Wright NC (1937) Report on the development of cattle and dairy industries in India. Manager of Publications, Delhi