



An overview of Indian livestock and meat sector

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ABSTRACT

Large livestock wealth coupled with strong consumer base fuels greater prospects for meat production and processing in India. Meat sector in India is growing at 6% compound annual growth rate (CAGR) and immensely contributes to national food and nutritional security, economy as well as employment generation. Effective interventions like using genetically superior animals for breeding, improved feeding and husbandry management, reducing the mortality rate, linking producers to market, creating better infrastructure for animal welfare, meat production and quality testing, minimizing the post-harvest losses, implementing food safety management system, increased value addition and further processing of meat and byproducts, establishment of traceability and creation of disease free zones and e-marketing will play key roles in the shaping the meat sector development in the country. Effective implementation of both Central and State Government schemes and programmes is expected to enhance quantitative and qualitative improvement in livestock and meat production systems in a sustainable and environment friendly manner. Further, strong public-private-producer partnership by connecting producers, input-suppliers, service providers, financial institutions, retailers and exporters will reduce the risk and ensure prosperity of the meat sector.

Keywords: Byproducts, Livestock, Meat and meat products, Nutritional security, Poultry, Safety

Livestock sector serves as an important source of milk and meat proteins besides providing raw materials for leather, considerable amount of draught power and biomass that enriches the agricultural fields of our country. It provides employment to over 300 million rural people and contributes 12% of their household income. Livestock sector has contributed 4.9% to Indian GDP and 28.4% to Agricultural GDP in the year 2017–18. Meat sector in India is growing at 6% CAGR and meat and poultry sector together contributed ₹ 2,51,384 crores, which is 24.08% of total livestock sector output (DADF 2020). In spite of huge contribution of meat and poultry sector as a source of food, nutrition, employment and income in India, the large part of meat sector remains highly unorganized and constrained by various social, ecological, cultural and environmental issues. Several policies and regulations related to the meat value chain including meat animal and poultry production, transportation, live animal marketing, slaughtering, meat inspection, processing, export, retailing were made in the past and majority of these need to be revisited and amended suitably in order to ensure sustainability of livestock and poultry sector (Kondaiah 2014). This paper address the current status of livestock and meat sector in India,

challenges, opportunities, regulatory requirements, Government schemes and action points for organized meat sector development in India.

Meat production and consumption

India has huge livestock wealth and ranks first in the world for buffaloes and second for cattle and goat population (Table 1). India also has 3rd and 5th largest number of sheep and chicken in the world, respectively. As per the livestock census data by Department of Animal Husbandry and Dairying, Government of India, between 1992 to 2019, there has been 5.90% reduction in cattle population, while buffalo, sheep and goat population increased by 30.50%, 46.23% and 29.16% respectively (Fig. 1). India has also witnessed an impressive growth in meat production, which has increased from 3.6 million tonnes in 1992–93 to 8.1 million tonnes in 2018–19 (Fig. 2). India produces around 2.20% of the world's meat production. India has the distinction of producing largest amount of buffalo meat in the world. It is also 2nd and 9th largest producer of goat meat and chicken in the world, respectively. The contribution of meat from poultry is high (50%) followed by buffalo (19%), goat (14%), sheep (8%), pig (5%) and cattle (4%) (BAHS 2019).

Meat foods play a very imperative role in human health by providing all essential nutrients needed for growth and maintenance. In addition to quality nutrients, they also provide a satisfactory eating experience. Even though,

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Table 1. Livestock population and meat production

Species of animals	Population (in millions)	World ranking	No. animals slaughtered (M)	Extraction rate (%)	Carcass yield (kg)	Meat production (MT)	World ranking
Cattle	192.50	II	3.05	1.58	103.00	0.33	
Buffalo	109.90	I	11.92	10.85	138.40	1.55	I
Goat	148.90	II	97.10	65.22	10.00	1.09	II
Sheep	74.26	III	50.86	68.48	12.00	0.68	
Chicken	851.81	V	812.00	95.41	1.41	4.06	V
Pig	9.06	–	9.00	99.00	35.00	0.40	

Source: Department of Animal Husbandry, Dairying and Fisheries, Government of India.

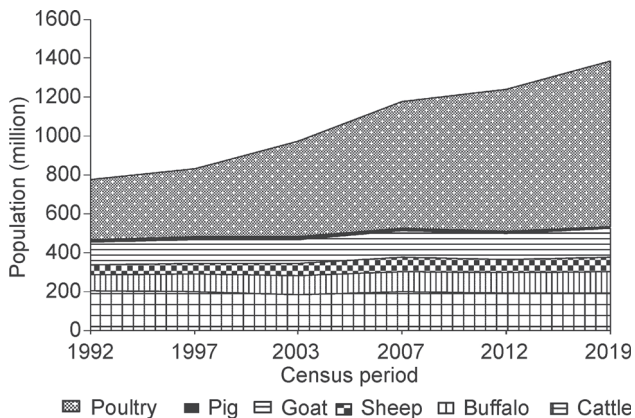


Fig. 1. Livestock population (millions) in India over different census periods.

India is the largest producer and exporter of buffalo meat in the world and stands 2nd and 9th for goat and poultry meat production, the per capita consumption in India still remains relatively low at less than 6 kg/person/annum as compared to 40 kg world average (Naveena *et al.* 2020).

Domestic meat sector

India has around 4,000 registered slaughterhouses, 25,000 unregistered premises where animals are slaughtered for domestic consumption. The slaughterhouses maintained by local bodies for production of meat for domestic consumption, do not have adequate infrastructure for hygienic harvesting of meat. The meat is marketed immediately after harvesting as hot meat without any chilling. Unless adequate number of well managed service

abattoirs are provided to meet the requirements of meat producers, it will be difficult to tackle the problem of unauthorized slaughter and to comply with regulations. Establishing abattoir with modern facilities with line system requires huge investment. On the other hand, huge modern abattoirs established in different cities based on online slaughter concept are lying unused. Hence, semi-modern abattoirs which require less monetary inputs and operational problems are more suitable for prevailing Indian situation (NABCONS 2013). Slaughterhouse by-products except hide/skin are unutilized/underutilized, hence there is a scope for value addition for increasing profit margin (Muthukumar *et al.* 2018). The treatment of waste needs proper attention for reducing environment pollution and spread of infections. Application of appropriate technology for waste utilization can turn waste in to wealth.

Poultry meat is mostly sold by slaughtering the live birds in the presence of the consumers. However, there are a few modern processing plants where poultry is slaughtered, chilled, packed and frozen chicken is sold in big cities. Compared to other meats, reasonable amount of poultry meat undergoes further processing into a range of value added meat products like sausages, patties, breaded nuggets, fried drumsticks and various traditional meat products for different markets (Naveena *et al.* 2018).

Export meat sector

Majority of buffalo meat and small proportion of sheep meat is being exported to 68 countries with excellent reputation for over 39 years and recorded as largest buffalo meat exporter in the world and 2nd largest meat exporter after Brazil. Total number of export meat plants in India is

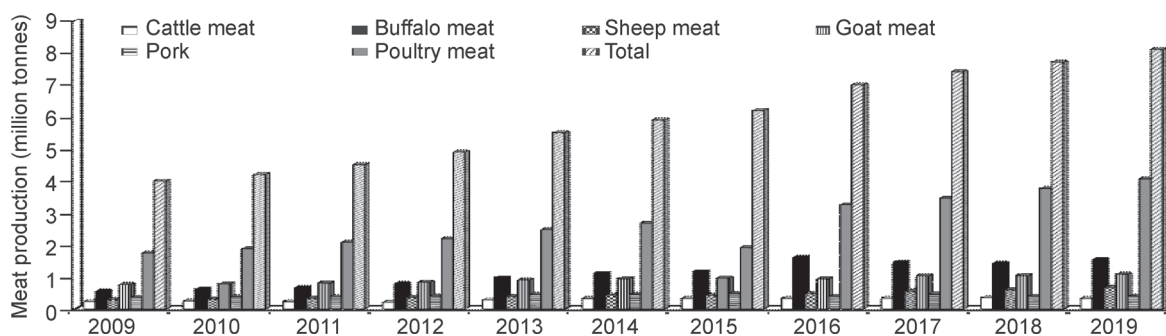


Fig. 2. Meat production (million tonnes) in India over the past 10 years.

Table 2. Volume (million tonnes) and value (US \$ million) of animal products exported from India

Name of the animal product	2017–18		2018–19		2019–20	
	Volume	Value	Volume	Value	Volume	Value
Sheep/goat meat	0.0240	134.03	0.0220	124.65	0.0140	92.62
Other meat	0.0010	2.55	0.0008	1.96	0.0010	2.35
Dairy products	0.1020	303.00	0.1810	481.52	0.1110	280.22
Processed meat	0.0002	1.54	0.0004	2.00	0.0004	2.17
Buffalo meat	1.3480	4029.88	1.2330	3587.15	1.1520	3199.60
Animal casings	0.0120	50.68	0.0150	68.27	0.0130	56.10
Poultry products	0	85.66	0	98.16	0	81.03
Total	1.4880	4607.34	1.4520	4363.71	1.2920	3714.09

Source: Agricultural and Processed Food Products Export Development Authority (APEDA).

124, out of which 76 are integrated meat export plants. They practice strict sanitary and phytosanitary measures as per International Animal Health code of OIE. These plants utilize all the slaughterhouse byproducts for production of meat cum bone meal, tallow, etc. and also produce value added meat and byproducts (Thota and Muthukumar 2020, Bajaj and Ranjhan 2020).

In the year 2012, India overtook Brazil as a top bovine meat exporter in the world with a record export of 1.10 million tones worth ₹ 17,400 crores (3,201 Million US \$) (Table 2). Buffalo meat has been in the top three export items in the agriculture commodity basket. The largest importers being Hong Kong, Vietnam, Malaysia, Egypt, Indonesia, Iraq, Saudi Arabia, Philippines and UAE. India's buffalo meat exports have been growing at an average of nearly 14% each year since 2011 (APEDA 2020). United States Department of Agriculture (USDA) has predicted that Indian buffalo meat exports could increase in the coming years because of competitive pricing and quality. Recognizing the enormous contribution of buffalo meat sector in assuring livelihood of farmers, rural economy, food security and employment to millions, the Parliamentary committee of Government of India has reviewed the meat export policy in 2018 and extended the same.

Meat and poultry for ensuring nutritional security

About 70% of Indian diet are cereal based and the country is witnessing protein inflation due to consumption of less than 17.5 g meat and poultry/day and 79 eggs/year which is far below the world average. Animal sourced foods including milk, meat and egg provide many of the nutrients (Fe, Zn, Ca, vitamin A and vitamin B₁₂) that are completely lacking (or less bioavailable) in plant-based foods and thereby ensures linear growth, cognitive and immune functions, learning and memory, thyroid function and overall goal of achieving good health and wellness (Balehgn *et al.* 2019). Compared with plant foods, animal-sourced foods provide dense and readily bioavailable sources of energy, protein, minerals, and vitamins. Animal-derived proteins provide a balanced profile of amino acids that are readily digested, whereas plant-derived proteins often lack one or more amino acids critical for growth and

other metabolic functions and are less digestible. Protein scores were between 1.40 and 1.87 times higher for the animal products than for the potentially human-edible plant protein. Herreman *et al.* (2020) established that the amino acid digestibility measured by the digestible indispensable amino acid scores (DIAAS) and protein digestibility corrected amino acid scores (PDCAS) are significantly higher for meat and poultry products relative to cereals and grains. Hence, animal sourced proteins must be targeted towards providing a healthy diet in a sustainable manner without compromising ecology and environment.

Challenges

Even though the economic contribution from meat production is increasing over years, the meat sector in India could be described largely unorganized. Kondaiah (2014) indicated that sustainable animal production, adequate infrastructure for hygienic harvesting of meat with efficient processing and marketing of meat and meat products, meeting the consumer requirements, minimize depletion of natural resources, cost efficient and environmentally friendly waste disposal are very essential for establishing viable and vibrant meat sector. Following section describes few important challenges faced by Indian meat sector.

Lack of concentrated efforts in animal meat production: Inadequate availability of quality feed and fodder, non-availability of superior pedigree males for breeding, high mortality and morbidity losses due to diseases, inadequate marketing infrastructure are the major concerns in meat animal production. Enhancing meat production to meet the increasing domestic and export demand when land and water available for agriculture are decreasing is a very big challenging task. Meat production is lower in India in spite of huge livestock inventory due to lower average carcass yield and lack of scientific approaches in meat animal production. Unfortunately, the salvaging and rearing of male buffalo calves scheme (SRMBC) under the XI Five Year Plan of Government of India could not yield any benefit because of the prevailing rules related to slaughter. Animal preservation act do not permit the utilization of young fattened animals for meat production, which is a very natural practice in the developed countries (Kondaiah 2010). The

poultry industry is among the fastest growing sectors, rising at a rate of 8% per year. Vertical integration of poultry production and marketing has been the major reason for increased broiler production. Most of the sheep and goat meat production are with the unorganized sector and for catching pace with the requirement of the expanding population, there is an urgent need for expanding the farming in the integrated mode. Most of the pigs are indigenous and are reared by weaker section of the society under free-range scavenging system with little input (Mohakud *et al.* 2020).

Inadequate infrastructure facilities for clean meat production, processing, marketing and quality assurance: There is a vast scope for improving the infrastructure and facilities at the service abattoirs run by local bodies to ensure supply of wholesome meat to domestic consumers. Most of these slaughterhouses lack basic facilities for hygienic slaughter and utilization of byproducts efficiently. Similarly, the majority of the retail meat shops have little or no basic facilities for hygienic handling of meat and in the aesthetic manner where the present day quality conscious consumer could buy meat willingly. In case of chicken, live birds are slaughtered in front of consumer and marketed through retail shops located in the residential areas. Lack of post harvest processing and storage facilities is resulting in wastage of valuable meat and byproducts. Due to lack of proper cold storage facilities, meat is forced to sell on the day of production, many times at a lower price at the end of the day (NABCONS 2013).

The increase in world food trade and India's potential for higher share in international food trade in line with the World Trade Organization (WTO) agreement especially on Sanitary and Phytosanitary (SPS) and technical barrier to trade (TBT) necessitates the adoption of food safety measures. Many times, importing countries require guarantees that minimum standards of hygiene have been applied in the manufacture of a food product or that products do not have excessive chemical residues. To meet these obligations, India needs to strengthen its regulatory framework. This process would include upgrading testing facilities to meet international as well as importing country requirements; upgrading human capabilities or empowering personnel in areas of testing, food handling, sanitation, and personal hygiene; risk analysis, and development and auditing of HACCP plans; developing GMP/GHP/HACCP and food safety management system (FSMS) modules for implementation at both domestic and export levels; and establishing databases on requirements of importing countries (Shukla *et al.* 2014).

Animal welfare issues: Unfortunately, lack of awareness on transportation stress and its negative effects on meat quality, many times animals are transported in overcrowded manner. Proper facilities for loading and unloading of animals, loading density, feeding /water arrangements, well ventilated and equipped transport vehicle with non-skid floors, shed for protecting animals in market are necessary from both economic and animal welfare perspectives. The

eleventh amendment to rules under the Motor Vehicles Act, 1988, deals with the transportation of livestock meant for slaughter and seeks to restrict their mistreatment.

Nascent status of value addition and further processing: Further processing and value addition of meat in India is around 21% mainly due to processing of buffalo meat (~95%) in export meat plants and processing of chicken (~11%). These figures clearly show significantly lower value addition of meat in India as compared to world's average of more than 70%. Because of non-availability of cheaper, indigenous meat processing equipment, the existing meat processors are mainly using imported machineries. Huge cost, lack of trained service personnel and delays in import of these machineries are some of the important stumbling blocks for several micro and small entrepreneurs willing to venture into meat processing. All these factors coupled with other costs like creation of large scale infrastructure, manpower, advertisement and other logistics result in cost escalation forcing meat processors to market the ready-to-eat value added meat products at higher rates. This again restricts the market to only affluent populace and deprives the common man and the rural poor, who constitute more than 70% of India's population from consuming these value added meat products (Kondaiah 2004).

Under utilization of byproducts and improper waste disposal: When an animal is slaughtered, only one-third of it is harvested as meat and the rest comprise byproducts and waste. The byproducts of cattle, pigs and sheep represent 66, 52 and 68% of the live weight, respectively (Muthukumar *et al.* 2014). These non carcass materials are usually separated into categories of decreasing value such as edible byproducts, pet food, animal feed or fertilizer depending upon the potential market. However, inadequate quantity of materials, lack of markets, cost of processing etc. do not always permit byproducts recovery. Generation of huge quantities of wastes during slaughter operation, starting from lairage to meat production stages in centralized slaughter necessitates greater attention to manage the waste. Despite the fact that pollutants of the meat industry are of bio-degradable nature, their management is essential to prevent public health risks, meet the regulations and provide positive image to the sector. In the slaughterhouses regulated by local bodies, though byproducts are being collected by some agencies for processing into products, but waste such as blood and ruminal contents are getting accumulated in the premises and result in odor and pollution problems affecting the image of the meat sector. Recovery of solid wastes and their disposal through composting and land application as fertilizer would considerably improve the present image of the slaughterhouses (Franke-Whittle and Insam 2013). Organized facilities for small scale processing of some of the byproducts such as fat rendering, casings processing, etc. should be provided.

Prevalence of economically important diseases: The incidence of mad cow disease has not been reported and India has been free from Rinderpest since 1995. The biggest

concern is the prevalence of foot and mouth disease (FMD). The FMD control programme is being implemented since last 20 years and systematic immunisation is being carried out for susceptible buffalo meat export zones in different states as per OIE mandate of disease free zones (DFZ). Control programmes are also being implemented to eradicate diseases like contagious bovine pleuropneumonia, brucellosis peste des petits ruminants and avian influenza (DADF 2020). But for most other animal-borne pathogens like *E. coli*, *Salmonella* spp., *Campylobacter* spp., etc. eradication of the organisms in most animal populations is currently not possible, even if good animal husbandry is strictly applied. Barbuddhe *et al.* (2020) suggested that by applying the principles of good agriculture and animal husbandry practices and by improving the environmental conditions under which animals are grown, the hygienic quality of meat can be improved.

Traceability: The regulatory system requires documentation tracing a food product back through the supply chain to its source or forward through the chain to the consumer. Department of Animal Husbandry and Dairying, Government of India has implemented Information Network for Animal Productivity and Health (INAPH) application which captures real time reliable data on breeding, nutrition and health of cattle and buffaloes in different states in collaboration with National Dairy Development Board (NDDB). APEDA, through its Meat Net offers health certificate to the registered companies for each export consignments online. The new blockchain based technologies are being developed to address the issue (Prashar *et al.* 2020). However, the additional cost involved in these logistics is delaying its implementation.

Opportunities

Dairy and poultry industry in the last three decades have shown how organized production and marketing practices can help in augmenting production and to increase the profitability to producers. The meat sector has to take cues from the success of dairy and poultry industry to evolve into an organized sector. The following are some of the important opportunities need to be explored to organize the meat sector.

Meat production potential: India can easily increase its meat production through buffalo veal production. It is estimated that about 10–12 million male buffalo calves are removed from the production system due to non-remunerative cost of raising them. Salvaging these calves from early death and growing them to the larger weights of 250 kg live weight would result in production of one million metric tonnes of boneless buffalo meat of high quality. Meat from such animals is tender, lean and juicy (Kondaiah 2010). Export-oriented slaughterhouses should establish backward integration with farmers for raising these animals by providing health, feeding and extension management services at farmer's doorsteps and buy back them at remunerative prices. The Government of India under the National Livestock Mission (NLM) has rightly chosen to

promote the Salvage of Male Buffalo Calves (SMBC), under the Entrepreneurship Development and Employment Generation (EDEG) scheme (DADF 2020).

Huge gap between demand and supply: Expert committee of ICMR has recommended 60 g of protein/day with net protein utilization (NPU) of 65. Without substituting vegetable protein with adequate amount of animal protein, it would not be possible to achieve protein quality of NPU 65 in the national diets. A minimum requirement for animal protein would be targeted at 20 g per capita per day compared to the present availability of 10 g or world average of 29 g. Besides, FAO has projected that poultry meat consumption would double from the present level consumption of 10 to 18 kg/capita/year in 2030 (FAO 2006). Hence, the production level of meat has to be increased to meet the national nutritional security through meat.

Change in food habits: Even though, cultural patterns rather than income dominate meat consumption in India, the ready-to-eat meat sector is growing with consumer affluence. Increasing urbanization, family dynamics, rising income, increasing exposure to various mass media and changing food habits greatly enhance the demand for fresh or frozen and nutritionally superior value added products especially in metros, cities and smaller towns. With over 1 billion population and 350 million strong urban middle class and changing food habits, the processed food market is promising a huge potential to be tapped. Several national and multinational meat processing companies like Venky's Xprs, Fresco Pollo, Suguna Daily Fresh, Al-Kabeer Exports, Kentucky Fried Chicken (KFC), McDonald, Mary-Brown, Subway, Godrej-Tyson, Sumeru, Meat Products of India Ltd., etc. have opened many quick service restaurants (QSR) and selling various value added poultry meat products.

Demand for traditional meat products: India being a wide country with large number of ethnic groups and varied food habits, varieties of meat products of indigenous taste profile are being prepared and consumed. Highly perishable nature of these products restricts their marketability. Product optimization, automation, improved packaging, branding and upscaling of traditional processes will enable to market these products beyond the geographical borders without marked change in their quality attributes. The Hyderabad Haleem is one such traditional meat product being airlifted and sold in various parts of the globe (Muthukumar *et al.* 2005).

Changing face of Indian meat marketing: The evolution of modern retail outlets in several Tier-I and Tier-II cities with better state of the art facilities for packaging, labelling, chilling and cold chain will hopefully address the drawbacks of the existing situation. The packaging and branding makes the fresh meat, marinated meat and ready-to-eat meat products available to the consumers in the most attractive form. Marketing techniques and technologies have shifted consequently, more and more virtual e-commerce stores that sell products and services were emerged. The meat sector which has a distinctive marked space all-time in the retail

arena has also witnessed this change dramatically. Robust growth of online meat marketing start-ups in India shoot-up in the Tier-I and Tier-II cities with differentiated product offering to satisfying their customers demand and convenience. Online retail channels are working hard to transform the inefficient supply chain and retail market predominantly occupied by local butcher shops into an efficient platform by quick delivery and response factor. Most dominant players in the raw meat supplying are Licious, Farmage, Meatigo, Starchick, Fresho, Fresh To Home, TenderCuts, Neatmeat, Zappfresh, etc.

Meat food safety regulatory agencies

It is of paramount importance for national agencies for implementation and monitoring of food safety regulations and practices for production of quality and safe food, and also protection of consumers and personnel involved in food production from food borne diseases. Few Government agencies involved in ensuring the safety of meat food value chain are explained below.

Food Safety and Standards Authority of India (FSSAI): The FSSAI was formed under the Food Safety and Standards Act, 2006 by consolidating various acts and orders that have hitherto handled food related issues in various Ministries and Departments. The autonomous statutory authority has been mandated for laying down science based standards for food, regulate their production, storage, distribution, marketing and import and also to ensure availability of safe and quality food for human consumption (FSSAI 2021).

Bureau of Indian Standards (BIS): The National Standards Body of India has objectives of harmonious development of standardization, marking and quality certification; provide new thrust to standardization and quality control and to evolve a national strategy for according recognition to standards and integrating them with growth and development of production and exports.

Department of Animal Husbandry and Dairying (DADF): The major responsibilities include matters pertaining to livestock production, diseases prevention and productivity improvement and dairy development. In addition to playing greater role in epidemiological surveillance of animal diseases, veterinary services also ensure the safety and suitability of foods of animal origin especially meat through conducting ante and post-mortem inspection.

Export Inspection Council (EIC): The EIC ensures products notified under the Export (Quality Control and Inspection) Act 1963 are meeting the requirements of the importing countries in respect of their quality and safety through inspection, testing and certification of food items. Meat and meat products, poultry meat and meat products, egg products, fish and fishery products, dairy products are some of food items for which EIC provides mandatory export certification.

Agricultural and Processed Food Products Export Development Authority (APEDA): An apex body responsible for the export promotion of agricultural

products. Registration with APEDA is mandatory for all export oriented meat processing plants.

Government of India's Initiatives for sustainable livestock production

The Government of India, since independence, has been implementing several schemes and programme aimed at enhancing the quantitative and qualitative improvement in livestock production systems in a sustainable and environment friendly manner, containment of economically important and zoonotic diseases, capacity building of all stakeholders and enhancing livelihood opportunities and standard of living of livestock keepers and farmers, and all round development of livestock sector. Following are some of the new initiatives and schemes from Government of India.

National Livestock Mission: Aims for higher productivity and production in a sustainable and environment friendly manner and enhanced livelihood opportunities. This scheme promotes salvaging of male buffalo calves, under the 'entrepreneurship development and employment generation scheme'.

Pashudhan Sanjivni: An animal wellness programme includes animal health cards, unique identification number and national database, advanced breeding technology and national genomic centre.

Livestock Health and Disease Control Scheme: Provides financial assistance to States for control and containment of animal diseases. The Government has also announced ₹ 13,353 crore 5 years package for FMD and brucellosis vaccination around the country.

Animal Husbandry Infrastructure Development Fund: An amount of ₹ 15,000 crore has been allocated in October 2020 for incentivizing investments by individual entrepreneurs, private companies, and farmer producer organizations to establish infrastructure for dairy and meat processing and animal feed plant.

Mega Food Park: A scheme under Ministry of Food Processing aims at providing a mechanism to link agricultural production to the market to ensure maximizing value addition, minimizing wastage, increasing farmers income and creating employment opportunities particularly in rural sector.

National Bank for Agriculture and Rural Development (NABARD): Promotes sustainable and equitable agriculture and rural development through participative financial and non-financial interventions, innovations, technology and institutional development for securing prosperity

State Governments initiatives for white and pink revolution

Several state governments implementing subsidized livestock and poultry distribution scheme on a large scale aiming to facilitate not only the economic development of rural farming community, but also facilitate production of sufficient milk, meat and egg to enhance the nutritional security in the state. For example in Telangana, the traditional shepherd families are supported with the supply

of (20+1) sheep on 75% subsidy with a total project outlay of ₹ 5,000 crores.

Robust veterinary and animal husbandry institutional network

The animal husbandry and allied sectors have a vast infrastructural support from the government of India. There are more than 11,100 veterinary hospitals and polyclinics, 22,000 veterinary dispensaries and 27,000 veterinary aid centres. These institutions mostly provide clinical veterinary and breeding services. India has one of the largest breeding infrastructures in the world (48 frozen semen stations, 3,297 bulls and 98,283 artificial insemination centres) with total production of about 81 million frozen straws per year and 62 million artificial inseminations. Veterinary education too is gaining a lot of emphasis. The country has 13 state veterinary universities, 2 deemed universities constituting about 18.84% of National Agriculture Research System. There are currently 55 veterinary colleges catering to the growing requirement of human resource and their development in the country. The Indian Council of Agriculture Research (ICAR) is the apex body for co-ordinating, guiding and managing research and education in agriculture including 19 animal science institutes in the entire country.

Role of ICAR-National Research Centre on Meat

In its efforts to contribute towards organised meat sector development in the country, ICAR-NRC on Meat, Hyderabad has been working to address the important issues right from meat animal production, meat quality, safety to consumption. The Centre is playing a pivotal role for conducting basic and applied research in various aspects of meat production, processing, quality control and marketing; developing appropriate and relevant processing technologies for several value added meat products for improved palatability and enhancing product shelf life; providing need based training for scientific, managerial and technical personnel in meat and allied sectors; establishing liaison with industry, trade, regulatory and developmental organizations operating in meat sector; providing consultancy services to entrepreneurs. The institute has developed the protocols for organic fodder and sheep production and obtained the organic certification. The centre has developed the technologies for authentication of meat species to address all meat adulteration issues across the country and has established the National Accreditation Board for Testing and Calibration (NABL) laboratory and obtained ISO/IEC 17025:2017 NABL accreditation certificate. The centre has implemented Food Safety Management System (FSMS) in its meat and poultry processing facilities and obtained FSSC/ISO 22000 certification besides accreditation from FSSAI-Food Safety Training and Certification (FOSTaC). The institute is also accredited by Agricultural Skill Council of India (ASCI) and is identified as National Referral Laboratory by FSSAI, Government of India for various meat quality and safety analysis.

NRCM-Agribusiness Incubator (ABI), a pioneering initiative in the domain of meat processing, is serving as a single window for providing incubation support services to the entrepreneurs in meat processing and developing their businesses. The ABI is functioning with the major objectives of generating employment opportunities and promoting viable enterprises in meat / poultry processing. The centre has established well-equipped agribusiness incubator with modern Food Safety Management System (FSMS) certified facilities for wholesome meat production such as primary poultry processing unit (150 birds per hour), experimental abattoir and value added meat processing plant, mobile unit for awareness creation and marketing, rendering cum pet food plant and office to facilitate entrepreneurship in meat sector. So far the institute has trained around 2,000 entrepreneurs from across India and commercialised various meat processing technologies through more than 50 MoU's.

In addition to commercialization of technologies, the centre is protecting those intellectual property rights through patent, industrial design, trade mark and copy rights. This includes packaging process for improving the shelf-life of meat, meat based high protein and low fat meal maker, process for making uniform, smooth and succulent seekh kebabs, burger patty mould, meat treat - healthy and yummy and database for meat traceability. The institute is also extending helping hand to different stakeholders, line departments and regulatory bodies through consultancy, brainstorming workshops and policy papers, etc. Overall the centre's efforts are oriented towards achieving sustainable development goals (SDG's), while ensuring Atmanirbhar Bharat (NRCM 2021).

Conclusion

In addition to assuring livelihood and employment to millions of farmers and livestock holders, livestock sector immensely contributes to national food and nutritional security, economy as well as employment generation. However, shortage in availability of quality feed and fodder, non-availability of superior pedigree breeding stocks, prevailing economically important diseases, inadequate marketing infrastructure are some the major bottlenecks in livestock rearing and enhancing meat production to meet the increasing domestic and export demand. Successful milk cooperative models and vertical integration of poultry production and marketing must be tried in sheep and goat sector with complete value chain approach. The way forward for livestock and meat sector development includes building sustainable production chain, industry driven collaboration to advance food safety and traceability, agencies/government departments to link key-stakeholders in a value chain, ensuring animal health, welfare, environment protection and efficient usage of natural resources, evolving a comprehensive national policy for slaughter of animals and meat production system in India. Animal sourced proteins must be targeted towards providing a healthy diet in a sustainable manner without compromising ecology and environment. This involves commitment from

Government, Industries and stakeholders including consumers. Positive public policy support and investment in meat sector can make them more competitive vis-à-vis other sector and sustainable in the long term.

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