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Economic losses due to livestock production constraints and agenda for research and development for Odisha

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ABSTRACT

The present study assesses research and development priorities for livestock sector in Odisha. The specific objective of this study is to identify biotic, abiotic and socio-economic constraints to livestock production at micro level; and prioritize the research and agenda based on the intensity of these constraints in the state of Odisha. On the basis of analysis of micro-information, the lack of progeny bull, mineral deficiency, shortage of green fodder, and sterility emerged as the first four persisting constraint in Odisha, which are adversely affecting the bovine in realizing potential yield. These constraints of dairy production are yet to be addressed properly. Indiscriminant/ inbreeding due to unavailability of true to breed bucks and rams and lack of fodder/feed are the common constraints for goat and sheep farming. Diseases like, dermatitis, parasitic infections and pox in Odisha are also economically important constraint for goat and sheep farming. Accordingly, there is a need to allocate research resources and target development interventions to increase the efficacy and efficiency of livestock R&D in Odisha.

Key words: Economic losses, Livestock production constraints, Research and development, Odisha

The state of Odisha shares 4.74% of India's landmass and accounts for 3.47% of the country's human population and 4.35% of livestock population. Livestock production continues to be a main source of income, employment and livelihood for millions of households, particularly in backward, tribal and rain fed areas of rural Odisha. The share of agriculture in State Gross Domestic Product (GSDP) accounts for 17.01% in 2012–13 (Government of Odisha 2014) and livestock sector contributes about 10% of the state domestic product from agriculture at current prices.

Integration of livestock production and agriculture is a common practice, which provides scope for diversification and, to some extent, has evolved as a trusted risk coping mechanism. Per capita availability of milk and meat in 2012–13 in the state is very low at 117 g milk/day and about 3.80 kg meat/year, respectively as compared to the requirement of milk and meat at 250 g/day and 11 kg/annum respectively (Government of Odisha 2014), the total milk production in Odisha during 2012–13 was about 1.78 million tonnes of which the share of cattle and buffalo milk were 1.53 million tonnes and 0.23 million tonnes, respectively. The contribution of cattle to the state milk pool was the largest (86%). The shares of buffaloes and goats were 13.7 and 0.18%, respectively (BAHS 2011–12). Sheep and goats are mainly reared by the landless and poor households for meat production. The state has 12.31 million cattle, 1.19 million buffaloes, 1.82 million sheep and 7.13 million goats, which indicates good potential for livestock sector in the state. Crossbred cattle accounts for about 13.4% but contributes to about 50.6% of the cattle milk produced in the state. There is an obvious preference for the indigenous breeds of cattle as they outclass the exotic breeds in terms of traits desirable for the draught purpose. Several factors affect the performance and productivity of milch animals. Natural shocks like; cyclones, droughts and flash floods are the regular features of Odisha, which pose enormous risk to livestock sector. Problems associated with breeding, feeding, health and management affects the whole gamut of livestock production and husbandry. Identification of important livestock constraints and quantification of losses, thereupon, is imperative to harness the potential of this sector. There is a concern about the interaction between economic competitiveness of livestock production and social factors such as poverty, unemployment, food and nutritional security, and sustainability. Evidences indicate that there are very high payoffs to investment on livestock research and development (Birthal *et al.* 1999). This suggests that there is considerable scope to invest in research and development of livestock. Unfortunately, resources allocated to research and development of livestock sector has not been in commensurate with its contribution to agricultural gross domestic product in the recent past (Birthal and Negi 2012).

Historically, the process of resource allocation in India

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has largely been based on informed opinion concerning problems and opportunities in different sectors and commodities. This involves a lot of subjectivity. Alston *et al.* (2005) suggested the need of bringing in objectivity in research priority setting and resource allocation. There are only a few studies (Saxena *et al.* 2000, Roy *et al.* 2001, Jha 2002) that attempt to identify and prioritize farm-level constraints in dairying based on quantification of volume and value of output loss. The emerging problems and challenges call for a more objective and transparent process for allocation of resources. In a seminal work, Birthal *et al.* (2002) generated quantitative estimates for allocation of livestock research resources across the states and species. This study provided useful insights for setting priorities for the livestock sector in India. Birthal and Jha (2005) also assessed the economic losses due to breeding, feeding, management, disease and management constraints in India and suggested a priority list to focus livestock R&D accordingly. The present study assesses research and development priorities for livestock sector in Odisha. The specific objective of this study is to identify biotic, abiotic and socio-economic constraints to livestock production at micro level; and prioritize the research and agenda based on the intensity of these constraints in the state of Odisha.

MATERIALS AND METHODS

An overview of livestock sector in Odisha: Odisha is amongst the most under-developed states of India. In 2013–14, per capita income was 27.60% less than the national average Nevertheless, the state has started showing signs of economic growth. In the past one decade (2000–01 to 2010–11), the per capita income grew at about 6.2% per annum in Odisha which is comparable to the national average. However, poverty remains intense and all-pervasive more so among the rural population in Odisha. Over 39% of rural population in Odisha is poor. Sustained rise in per capita income and a fast-growing urban population offer an opportunity to small-scale livestock producers to increase returns from livestock production, and enhance its income and reduce poverty.

Livestock producers have responded to the emerging opportunities. In Odisha, livestock sector grew at a rate of around 8% per annum during the period 2000–01 to 2011–12, which is more than double the rate of growth in its agricultural sector. Note that, the rate of growth in livestock sector in the state is also double the rate of growth in the sector at the national level. The share of livestock in the value of output of the agricultural sector in Odisha increased to 18.6% in 2011–12 from 12.5% in 2000–01.

In the state, agricultural sector is dominated by small landholders. About 28% rural households are landless while about 56% of the rural households possess landholdings of less than one hectare (marginal farmers). However, their share in livestock sector is much more as marginal farm households control 64% of the total cattle, 45% of the buffaloes and around 70% of the small ruminants, pigs and poultry. This distribution pattern of land and livestock implies that growth in livestock sector is likely to have a larger impact on poverty reduction than the growth in crop sector. Also, the fast-growing demand for animal food products offers an opportunity to harness the pro-poor potential of livestock.

Productivity of livestock with respect to milk and meat in Odisha is low as compared to national average. Low animal productivity is due to poor adoption of technology and also numerous biotic and abiotic constraints including dominance of poor quality breeds, poor animal health and feed and fodder scarcity. Besides, many socio-economic and institutional factors such as a lack of access to animal health and breeding services, markets and credit, and tiny holdings, shrinking common lands, etc. restrict farmers realize the potential yield of different livestock species.

Animal health as well as breeding infrastructure has remained poor in the state, as is indicated by the number of livestock units served per veterinary institution, and the proportion of breedable population of cows and buffaloes covered with artificial insemination. The number of livestock units served per livestock institution in Odisha is about 2.5 times lower than the national average. Likewise, the breedable population artificially inseminated is 35% in Odisha compared to the national average of 41% indicating poor status in the state.

Feed resources in Odisha are inadequate and poor in quality. Landholdings are too small to allow farmers to allocate any land to fodder crops. Area under grazing and pastures is also very small. Infrastructure for marketing and processing of livestock products is underdeveloped in the state. Dairy cooperatives procure only about 6% of the milk produced in the state as compared to the national average of 8.2%.

In this section, important constraints related to animal health, breeding, nutrition and management are identified based on our discussions with farmers, field veterinarians and livestock scientists and the estimates of economic losses associated with these constraints have been generated to prioritize livestock research and development agenda for the state of Odisha.

Data: Data for this exercise have been generated through focused group discussions (FGDs) with the livestock farmers of 15 selected villages in 5 of the 10 agro-climatic zones of Odisha during November and December 2012. Considering the prospects of livestock development, one district from each of five identified zone was purposely selected in consultation with the officials of Orissa State Cooperative Milk Producers Federation (OMFED) and scientists of the Odisha University of Agriculture and Technology (OUAT) at Bhubneswar, Odisha. Further, from each of the selected district, three development blocks were randomly selected and from each block, one village was again randomly selected for conducting focused group discussions with livestock farmers and field level officials of animal husbandry department.

Key informants were identified in each village as to generate relevant information on animal husbandry and also

to facilitate group discussions with livestock farmers. While undertaking a walk through the village, meetings with the individual livestock owners including those from socially and economically weaker sections were also ascertained. Separate meeting with poor and landless livestock owners was deemed necessary as to ensure their active participation in the group discussion and to know their specific problems related to livestock production.

One focused group discussion was conducted in each of the selected villages. Livestock farmers from different social and land classes, local veterinary officers and animal scientists participated in these discussions. Each FGD team had at least one expert representing animal reproduction and breeding, pathology/parasitology, animal nutrition and social sciences. A checklist on various production constraints was prepared in advance seeking opinions of these experts.

In the focused group discussions, livestock keepers were asked to identify and discuss important factors constraining realization of production potential of different livestock species. The main discussion was related to issues of animal breeding, health, nutrition and management. Information on different constraints, their intensity and probability of occurrence, proportion of affected animals (in terms of rate of morbidity and mortality) and length of stress period (i.e. number of affected days) were generated through these discussions.

The animal scientists in the group were of much help in segregating effects and magnitude of losses by each reported constraints. As the study is based on common perceptions of scientists and farmers, it provides relatively fair estimates on the intensity of different constraints and economic losses caused by these. The data on livestock population, output and value of outputs was obtained from published sources such as Livestock Census 2007 and Basic Animal Husbandry Statistics.

Estimation procedure: Many studies have prioritized production constraints based on the concept of yield gap (Widawsky and O'Toole 1996, Ramasamy *et al.* 1997, and Roy and Datta 2000). These studies assume that technologies are already available and the gap between attainable yield (on-farm demonstrations) and actual farm yield (in farmers' fields) is due to a number of technical and socio-economic constraints. These studies further attempted to prioritize the identified constraints based on their contribution in the yield gap. Joshi *et al.*(2005) estimated damage due to prevailing constraints in maize as to prioritize maize research agenda. For livestock, Birthal and Jha (2005) quantified economic losses in milk production due to various constraints. Birthal and Jha (2005) did not use the yield gap concept as such. Instead, they identified the prevailing constraints to livestock production and estimated economic losses due to these constraints. The present study also follows the same concept and estimates the damage caused by prevailing constraints as to prioritize these in accordance with their economic significance.

Estimation of economic losses: A number of factors affect production potential and performance of animals and cause recurring losses in terms of outputs and animal lives. The extent of losses largely depends on the rates of morbidity and mortality, and these often vary with age, lactation stage and species of the animals.

To estimate the losses caused by prevailing production constraints, information on three parameters (i) yield loss caused by specific constraint that farmers could not effectively handle due to poor access to technology or lack of resources to apply available technologies; (ii) proportion/ extent of animals affected by a specific constraint; and (iii) probability of occurrence of the constraint were elicited through focused group discussions. The probability of occurrence of a constraint was based on the frequency of its occurrence during the past ten years. These three parameters have significant impact on prioritizing production constraints.

The procedure for calculating yield loss, production loss and value loss is given as under:

Yield loss: Yield loss (in dairy animals) depicts reduction in milk yield due to various constraints. It was quantified for the average herd size assuming the population of female (in milk and dry) animals having 300 days of lactation period (crossbred cows and buffaloes and 270 days for indigenous cows). Since, the constraints vary in terms of intensity (proportion of animal affected), periodicity, and frequency of occurrence, the average annual yield loss was estimated as the product of absolute yield loss, proportion of animal affected, and number of affected days in a lactation period and probability of occurrence.

$$Y = \mu * p * £$$

where, Y , average yield loss attributed to each constraint (liters or kg per animal); μ, proportion of animals affected; p, probability of occurrence of a particular constraint/event (%); £, absolute yield loss attributed to each constraint (litre/ kg per animal).

Production loss: Production loss shows the quantity of output forgone annually in a particular region due to occurrence of various constraints. The yield loss weighted with the number of affected animals provides the estimates of production loss.

$$9 = Y * N$$

where, 9 , total production loss ('000' tonnes); Y, as explained above; N, total animal of a particular species in target region (No.).

Economic loss: The value of production loss was estimated by multiplying per animal average annual production loss, population and prevailing product (milk) price. The summation of value losses due to different constraints gives the magnitude of total value loss.

$$V = 9 * Z$$

where, V, value of production loss (Rs crore); 9 , as explained above; Z, price of output (Rs/litre (milk) or kg (meat).

Losses due to mortality were quantified in value terms by multiplying the rate of mortality (both in young and adult animals), breed population, probability of occurrence and

prevailing prices of the animals. All losses excluding mortality were considered as morbidity losses while health loss estimated separately.

Yield gap: The authors have quantified yield gap, which is the difference between potential and actual yield in case of dairy animals. The yield gap can be further decomposed into yield gap I and yield gap II. Yield gap I depicts mismatch between the potential yield of a particular breed at livestock research station and the average best farms' differences in genetic potential, environmental characteristics and transferable technology are main reasons for existence of yield gap I, and therefore its elimination is difficult or even literally impossible. Yield gap II is the difference between average best farms' yield and actual yield. This gap is the resultant of constraints related to breeding, feeding, health and management and thus has economic implications.

Yield gap I = Average of potential yields obtained at experiment stations – Average attainable yields obtained at the best farms in the region

Yield gap II = Average attainable yields obtained at the best farms – Average actual farm yields obtained in the region

RESULTS AND DISCUSSION

Livestock farmers in Odisha face a number of constraints in raising livestock and increasing livestock productivity. Identification of critical constraints and quantification of losses caused by these are, therefore, essential for designing appropriate research and development programs and strategies in order to harness the untapped potential of livestock for benefit of the poor livestock producers.

Yield gap: Realized milk yields of cattle and buffaloes are substantially less than their respective potential and attainable yields (Table 1). The gap between attainable yield and realized yield under field conditions, that is yield gap II, is estimated to be about 30% in buffaloes and crossbred cows and 41% in indigenous cows. The yield gaps exist because of numerous technical, socio-economic and institutional constraints.

Table 1. Yield gaps in bovine milk production, Odisha (kg/lactation)

	Crossbred cows	Indigenous cows	Buffaloes
Potential yield	6620	2170	3160
Attainable farm yield	5500	925	2274
Actual Farm yield*	3825	546	1680
Yield gap I	1120	1245	886
Yield gap II	1675	379	723
Yield gap II as% of attainable	30.5	41.0	31.8
Actual production (000 tonnes)	726	713	229
Attainable production (000 tonnes)	1044	1209	336

*in-milk animal.

Table 2. Economic losses due to major categories of production constraint by species (million ₹)

Constraints	Crossbred	Indigenous	Buffalo	Goat	Sheep	All
Breeding	2176	13870	1648	530	115	18339
Feeding	11480	19206	691	568	28	31973
Health	2006	2287	593	460	118	5463
Management	3600	5398	3253	454	15	12720
All	19262	40761	6185	2012	276	68495

Overcoming these constraints is expected to enhance milk production in the state by 36%. The possible options to enhance milk production include replacement of indigenous cows with the high-yielding crossbreds and buffaloes. Although these species are high-yielding but require better feeding, health care, and breeding facilities to realize their potential, in which the state is acutely deficit. Another reason for dominance of indigenous cows is the use of their male off-springs for draught purpose by millions of small farmers.

Economic losses due to various constraints: Constraints related to breeding, feeding, health and management inflict substantial economic losses (Table 2) causing an annual loss worth ₹ 68,495 million, which is almost equal to the value of output of livestock of Odisha. Feed is the most important constraint accounting for 47% of the total value of output lost, and is followed by the constraints related to reproduction, management and animal health in that order. Feed constraint is more severe for cattle, indigenous as well as crossbreds. Breeding constraints are important in case of buffaloes. The severity of these constraints is almost similar in case of goats and sheep.

Some of the important constraints and the magnitude of losses caused by them in case of bovine animals, as depicted in Table 3 are discussed here.

Loss due to feed and nutrition constraints: Feed and nutrition play a critical role in dairy production. Scarcity of green fodder is identified as the most important constraint to dairy development. Scarcity of green fodder is identified as the most important constraint to dairy development. Majority of bovines also suffer from nutritional, mineral and vitamin deficiencies. Shortage of fodder, particularly green fodder, for almost 3–5 months in a year has been reported in every village where focused group discussions were carried out since land holdings in the state are small and farmers seldom cultivate green fodder. Shrinking pastures and common property resources have hardly left any scope for grazing of animals. The available fodders are of inferior quality and are often contaminated with aflatoxins and other foreign materials due to improper storage and handling.

Livestock are largely concentrated among the landless and marginal landholders where land availability is a more binding constraint to growing of fodder crops. Gathered grasses, tree leaves and barks are the main sources of green fodder for the animals. Even the large farmers who are willing to grow fodder crops do not allocate sufficient land

Table 3. Economic losses due to major constraints in bovine animals, Odisha (million Rs)

Constraint	Crossbred	Indigenous	Buffalo	All bovine
Feeding				
Lack of green fodder	8880.2	9552.6	196.3	18629.1
Scarcity of dry fodder	229.4	3779.5	85.9	4094.8
Mineral deficiency	1875.2	5874.1	408.9	8158.3
Stall feeding	495.2	0.0	0.0	495.2
Total loss due to feeding problems	11480	19206.3	691	31377.4
Breeding				
Failure of AI	112.3	477.6	0.6	590.5
Abortion	78.8	487.6	12.3	578.7
Repeat breeding	32.3	0	0	32.3
Infertility	0	6081.5	0	6081.5
Long inter-calving period	0	1705.8	0	1705.8
Lack of progeny bull	1952.4	5117.5	1635.6	8705.4
Total loss due to breeding problems	2175.9	13870.1	1648.4	17694.4
Health				
FMD	272.2	928.1	134.9	1335.2
Mastitis	710	673.1	61.3	1444.4
BQ	40.4	5.7	1.3	47.4
Enteritis	305.3	9.2	10.6	325.1
Brucellosis	41.3	44.8	3.3	89.4
Pneumonia	29.4	55	16.4	100.8
Liver flukes (Heliminths infection)	19.4	37	24.1	80.5
Theilerosis	0.8	41.9	31	73.7
Ticks	123.9	166.3	6.1	296.3
Dirrohea	198.1	139.8	9.4	347.3
Milk fever	27	0	0	27
Surrah	196.8	26.3	223.6	446.7
Anthrax	41.2	13	50.2	104.4
Milk fever	0	146.6	0	146.6
Milk fever	0	0	10.9	10.9
Timpany	0	0	9.6	9.6
Total loss due to health problems	2005.7	2286.7	592.6	4885.0
Management				
Flood, cyclone and other natural calamities	118.8	572.5	1665.0	2356.3
Scarcity of clean water	3352.6	4825.4	1587.5	9765.5
Lack of housing	128.8	0	0	128.8
Total loss due to management problems	3600.3	5397.9	3252.5	12250.6

to these crops as the available fodder crop varieties often fail to meet the expectations of farmers. Farmers need improved/ high yielding, multi-cut, short duration, low input and highly nutritive fodder crops/ varieties, which fit in their cropping pattern without affecting the income and consumption.

Small ruminants (sheep and goats) largely depend on pastures and grazing lands for their feed requirement. The grazing land, however is deteriorating in area as well quality, and this appears as the single most important constraint on small ruminant husbandry in the state. Establishment of fodder banks, and feed and fodder kiosks can be an alternative to address feed problems. There is a need to develop and disseminate low-cost fodder technologies for enriching quality, and enhancing nutritive value and digestibility of fodders. Even available technologies like, use of urea and molasses to enrich straws (dry fodder) have not been common among livestock keepers because of lack of awareness and their benefits.

Losses due to breeding related constraints: Losses associated with breeding/reproduction makeup 27% of the total economic losses in Odisha. It emanates from Table 3 that scarcity of progeny bulls for breeding was the main constraint followed by infertility in bovine production. Abortion, failure of AI, and long inter-calving period were reported as other problems in bovine breeding. Although 'Artificial Insemination Program' is one of the most hyped programs, collection and storage of quality semen is critical to harness benefits of the AI technology. But, most AI centers are constrained by lack of facilities and trained professionals. Crude practices, negligence and obsolete equipments often fail to produce desired results and reduce chances of conception. The failure of AI dissuades its adoption by the livestock owners. Repeat breeding and long inter-calving period are also common in indigenous cattle and buffaloes. The inter-calving interval varied between 14–17 months in indigenous cattle. The average inter-calving interval for the buffaloes was about 15 months. Late calving was also a major breeding problem. Usually, the females of cattle and buffaloes took 40–48 months or even more for first calving.

In case of small ruminants also, lack of males for breeding has emerged as the most important constraint (Table 4) followed by inbreeding. It is therefore, imperative that sufficient number of breeding bucks should be provided from outside flock to facilitate breeding effectively and to check inbreeding.

Multiplicity of breeding constraints may be addressed through research and development programs. The state is dominated by low-yielding indigenous breeds (mostly non-descript type), which are often prone to late calving, infertility, abortion, etc. Therefore, adequate R&D effort is required to improve the genetic stock as well as yield potentials of indigenous cattle. The centrally sponsored scheme entitled 'National Project for Cattle and Buffalo Breeding (NPCBB)' launched in October 2000 is a major step in this direction. The state has established "Odisha

Livestock Resources Development Society (OLRDS)" to implement this program. However, there is a need to review the performance of NPCBB in the state and intensify breed improvement efforts.

Losses due to health related constraints: Diseases reduce production potential of livestock, directly or indirectly. The direct loss to the farmers is the loss that occurs due to outbreak and prevalence of diseases and pests. Since the direct losses are more apparent, these losses are of a great concern for the farmers. Health related constraints account for 7% of the total losses. Annually, output worth ₹ 4,885 million is lost due to various diseases (Table 3) among which about 90% of these are associated with bovines.

Table 4. Economic losses due to major constraints in sheep and goats (million Rs)

Constraints	Goat	Sheep
Breeding		
Lack of male for breeding	529.9	64.6
Inbreeding/indiscriminate breeding	-	50.1
Total breeding problem	529.9	114.7
Health		
GI infections	29.4	17.6
PPRV	4.3	5.4
Johne's disease	3.7	3.2
Amphootomiasis	3.2	0.6
Blue tongue	0	2.3
Dermatitis	85.2	12.5
Brucellosis	2.1	12
FMD/ Foot rot	14.9	0
Mange disease	0.8	0.2
Lices	14.2	18.8
Tticks	18.9	0.8
Parasitic infection	15.2	18
ET	7.7	1.3
Pox	0.3	0.4
Birth of blind lambs	260	14.9
Mycoplasma	0	1.1
Abortion	0	0.4
Total health problem	459.9	109.5

Inadequate veterinary services and infrastructure together with poor income status of majority of rural population are deterrent to adoption of vaccinations and other health measures. The practice of de-worming of animals is almost absent. Although both preventive and curative measures are available for most of the diseases, lack of awareness about their availability and also high costs of medicines/ vaccines and veterinary services are barriers to their adoption at farm level. Moreover, lack of effective monitoring encourages flow of spurious/ expired drugs and vaccines. Administration of such drugs and vaccines does not yield desirable results and thus farmers lose faith in available scientific remedies and preventive drugs. Since most vaccines are sensitive to light and temperature and often lose their potency, a proper storage mechanism needs to be set-up. It is, therefore, imperative to develop cool chains and develop vaccines which could be stored at normal room condition. Further, it is also essential to make farmers aware and train about animal health and management.

The estimated losses due to health problems are ₹ 460 million in goats and ₹ 110 million in sheep. Birth of blind lambs, brucellosis, GI infections, dermatitis, etc. were found critical in case of sheep and goats. It is, therefore, imperative that these problems should be accorded high R&D priorities to promote goat and sheep production in the state of Odisha.

A centrally sponsored scheme 'Assistance to States for Control of Livestock Diseases (ASCAD)', with a funding pattern of 75:25 (centre:state) was implemented in the State with focus on mass vaccination and diagnosis of diseases. The animal health in Odisha is taken care through a network of 540 veterinary hospitals and dispensaries with 827 veterinary doctors and 2,939 Livestock Aid Centres (LAC) with 2,550 livestock inspectors (Economic Survey 2011–12, Govt of Odisha). However, strengthening and revival of animal health centers and other veterinary services are imperative. Establishing more numbers of mobile veterinary facility is essential to extend the outreach and efficacy of

Table 5. Micro priorities* for livestock R&D in Odisha

Species	Constraints (First is the most important and last is the least one)
Crossbred cattle	1, 28, 10, 3, 12, 4, 14, 11, 2, 20, 22, 29, 19, 27, 5, 6, 15, 23, 13, 7, 16, 21, 17, 18
Indigenous cattle	1, 8, 3, 10, 28, 2, 9, 11, 12, 27, 6, 5, 19, 24, 20, 16, 15, 18, 17, 22, 23, 14, 13
Buffaloes	27, 10, 28, 3, 22, 1, 11, 2, 12, 23, 18, 17, 16, 6, 25, 14, 26, 20, 19, 15, 13, 5
Goats	30, 10, 31, 32, 33, 19, 34, 11, 35, 36, 37, 38, 39, 15, 40, 41
Sheep	6, 30, 35, 34, 33, 44, 32, 15, 37, 38, 42, 36, 43, 19, 39
All species	1, 28, 10, 3, 8, 2, 27, 9, 12, 11, 31, 5, 6, 4, 22, 20, 14, 19, 32, 24, 29, 23, 15, 16, 33, 17, 18, 30, 13, 34, 35, 36, 7, 21, 25, 38, 26, 37, 39, 40, 43, 44, 41, 42

Where, 1, unavailability of green fodder; 2, scarcity of dry fodder; 3, mineral deficiency; 4,stall feeding; 5,failue of AI; 6, abortion; 7, repeat breeding; 8, infertility; 9, intercalving period; 10, lack of progeny bull; 11, fmd; 12, mastitis; 13, bq; 14, enteritis; 15, brucellosis; 16, pneumonea; 17, liverflukes (heliminths infection); 18, theilerosis; 19, ticks; 20, dirrohea; 21, milk fever; 22, surrah; 23, anthrax; 24, milk fever;25, ????; 26, timpany; 27, flood and cyclone; 28, scarcity of clean water; 29, housing; 30, inbreeding/ indiscriminate breeding 31, lack of breeding ram/ buck; 32, birth of blind lambs; 33, dermatitis; 34, gi infections; 35, parasitic infection; 36, lices; 37, ET; 38, PPRV; 39, Johnes's disease;40, ???; 41, mange disease; 42, pox; 43, blue tongue; 44, mycoplasma.

veterinary services in the state. It is also required to track the movement of migratory animals, as they become carriers and get involved in inter spatial transmission of several pathogens and vectors.

Losses due to management related constraints: Management of animal herds is very important. Table 3 also shows some of the important problems related to the management of dairy animals. Scarcity of clean and safe water for animals, inappropriate housing, and management and maintenance of animals in the wake of natural calamities like; flood, cyclone and drought is difficult and daunting task. The occurrence of such fateful incidences are the regular features in Odisha and cause high production and mortality losses. Evacuation of udders of milking animals at regular intervals is essential but during floods and cyclones it becomes difficult. Besides, natural calamities also cause loss to lives. Management of feed and fodder also becomes difficult. These problems cumulatively result in a loss of ₹ 12,251 million.

Overall assessment of priorities: The overall priorities based on quantum of losses caused by different constraints are presented in Table 5. It is imperative that the agenda for livestock research and development (R&D) should be revisited and funds be allocated in accordance with the suggested micro-priorities to increase the efficacy of endeavors being made to boost the livestock production in Odisha.

The evidence discussed in this paper indicates that a silent revolution in dairy sector is emerging in Odisha but it is still constrained with a number of biotic and abiotic constraints. The transformation in dairy sector has taken place through introduction of crossbred cows but the least precautionary measures are taken to minimize indiscriminate breeding, increasing sterility and prevention and control of contagious diseases, particularly in crossbred cows. In order to operationalize the pro-poor potential of livestock, there is a need to allocate funds in generation and dissemination of technologies, improvement of animal health and breeding infrastructure and delivery of services, in development of feed and fodder resources and in markets for live animals and their products. The task necessitates objective articulation of the priorities for research and development. It seems that indigenous cows and buffaloes could not get proper attention both by farming community and government institutions. The productivity of different breeds of these two dominating species has been almost stagnant during last several years in Odisha. Institutional infrastructure to support the emerging dairy development could not be created adequately. In consequence, constraints related to breeding, feeding, health and management inflict substantial economic losses and the state suffers an annual economic loss worth ₹ 68,495 million, which is almost equal to the value of output of livestock of Odisha. Provisions for development and supply of green and dry fodder, progeny tested or at least certified bulls/ bucks for breeding, increasing network of veterinary service providers/ doctors, supply of adequate and quality pharmaceuticals/ medicines, quality semen with adequate cryogenic facilities are some of the initiatives that could help harnessing the potentials of livestock production in Odisha.

It emanates that the cattle will continue to attract significant attention in the livestock research and development in Odisha. On the basis of analysis of micro-information, the lack of progeny bull, mineral deficiency, shortage of green fodder, and sterility emerged as the first four persisting constraint in Odisha, which are adversely affecting the bovine in realizing potential yield. These constraints of dairy production are yet to be addressed properly. Unavailability of clean water is a serious problem for dairy production in a large area of Odisha.In case of small ruminant, indiscriminant/inbreeding due to unavailability of true to breed bucks and rams and lack of fodder/feed is the common constraints for goat and sheep farming in Odisha. However diseases like, dermatitis and parasitic and pox in Odisha are important constraint for goat and sheep farming. Hence it may be inferred that livestock production is seriously constrained in Odisha and needs holistic intervention through research and development endeavours.

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