



Odisha livestock master plan 2022/23–2026/27

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Odisha livestock master plan 2022/23–2026/27

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A Technical Advisory Committee chaired by Secretary Sri Prasad periodically reviewed and made recommendations related to ensuring progress in achieving the outputs of the LMP project. It was comprised of the heads of key livestock departments and other relevant government and academic agencies of Odisha state, as well as representatives from civil society organizations, development agencies and farmer groups. Once completed, the livestock sector strategy was reviewed by eminent livestock experts within and outside ILRI and scientists from the Indian Council of Agricultural Research (ICAR). They were found credible and defensible.

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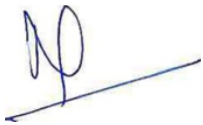
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Senior agricultural economist, ILRI, and project leader, Odisha livestock master plan (O-LMP)

Foreword

Livestock plays a vital role in the rural economy of Odisha. The Odisha livestock master plan developed with the support of the Bill & Melinda Gates Foundation and International Livestock Research Institute (ILRI) provides long-term outlook and investment options for the development of livestock and animal husbandry sectors in Odisha. The livestock master plan will be helpful for various stakeholders in strategizing and planning livestock development in the state.

I compliment the efforts of the Bill & Melinda Gates Foundation and ILRI in bringing out the Odisha livestock master plan.



Shri R. Raghu Prasad,
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Foreword

Close to 83% of the people in Odisha live in rural areas, and about 61.8% i.e., 17.5 million, are employed in agriculture - solely depending on agriculture and livestock sector for their livelihoods and incomes. Working together with the Government of Odisha, the Bill & Melinda Gates Foundation supports the goal of a smallholder-led, inclusive agricultural transformation. The foundation focuses on diversification and market access, the two primary factors that drive agricultural and income growth in the State.

Over the past 10 years, Odisha's agricultural growth has outpaced that of India as a whole – (GDP) annual growth of 4.5% versus 3.1% national average. The livestock sector's contribution to the state's GDP has been rising year-on-year. In India, Odisha has the highest level of agriculture sector diversity. Livestock production accounts for 21% of the nation's GDP (agricultural and related sectors).



I am pleased to note that, Bill & Melinda Gates Foundation, in partnership with the Government of Odisha's Fisheries and Animal Resources Department (FARD) and Samagra Governance, have engaged the International Livestock Research Institute (ILRI), to support Odisha's livestock sector analysis and livestock master plan (Odisha LMP). A high-level Technical Advisory Committee, comprised of representatives from the government, private sector, and civil society, provided insights for the creation of the Odisha LMP by identifying key problems facing the sector and help crafting the overarching framework.

I would like to deeply congratulate the Government of Odisha, Odisha's Fisheries and Animal Resources Department, Samagra Governance, the Odisha LMP team and ILRI experts for completion of Odisha's livestock master plan and presenting it to the government.

This master plan will help the Odisha government further modernize the sector so that it can improve the objectives and outcomes of the livestock farmers and make sustainable contributions to the government's development goals.

A handwritten signature in black ink, appearing to read 'Enock Chikava'.

Enock Chikava
Interim director- Agriculture Development
Bill & Melinda Gates Foundation

Foreword

The International Livestock Research Institute (ILRI) and its partners have, since 2013, provided technical support to interested countries in Africa and Asia to develop livestock master plans (LMPs). An LMP is an investment plan prepared to help governments identify, verbalize and prioritize their livestock development strategy objectives. The plan is designed as an evidence-based quantitative analysis of the livestock sector, including a baseline livestock sector analysis, a 15-year livestock sector strategy, and a five-year sector investment plan. This includes financial and human resource analysis and a budget that guides the development of a country's sustainable livestock sector.

The Odisha LMP initiative began with an aim to provide an investment plan which would complement the livestock sector development budget in a bid to help further modernize the livestock sector, enabling it to make an even more substantial contribution to the state's development goals. I am delighted to note that we now have a comprehensive document to facilitate the development progress of the livestock sector.

In Odisha, livestock is an important economic activity only next to crop farming, with over 80% of the rural population owning livestock, which generates up to 30% of their income. Although crop production is the principal activity, livestock is an essential secondary income source for many small-scale, marginal and landless farmers, who may own only a few animals. This initiative is intended to help increase appropriate investments in the livestock sector and boost livestock contributions while streamlining and regulating the sector.

The LMP will also inform the development planning of the government of Odisha and other agencies within its livestock sector, development partners/donors, non-governmental organizations, civil society organizations, private sector actors and development banks. It offers alternative investment technologies and innovations that, when combined with effective policy changes, will spur the state's comprehensive and sustainable development by attending to the recommended interventions, investments, policies and institutions needed to develop the livestock sector further.

The choice of livestock value chains is informed by their significance in contributing to the state's development objectives. The priority livestock value chains within the Odisha LMP are dairy, poultry, sheep and goats. The LMP is expected to provide a more detailed and complete set of value chain investment and development plans, which will, in return, help to achieve the broad targets of the livestock road map.



This work has been generously funded and supported by the Bill & Melinda Gates Foundation (BMGF) through Samagra Governance, and was undertaken by a joint team of experts from the Odisha government institutions—the Fisheries and Animal Resources Department, veterinary college, district officers—in collaboration with ILRI livestock and planning experts.

Four nations, namely Ethiopia, Tanzania, Rwanda and Uzbekistan, as well as the Indian states of Bihar and Odisha have, over the years, benefitted from ILRI's expertise in developing LMPs, some in collaboration with the Food and Agriculture Organization of the United Nations (FAO) and the French Agricultural Research Centre for International Development (CIRAD). The Gambia and Kenya are among those that are currently developing LMPs.

ILRI will continue to partner with governments and related livestock stakeholders to establish and build strategic partnerships that unlock catalytic investments, critical for the successful implementation of LMPs. This work responds to the growing demand from governments, donors, and the private sector for empirical guidance on where best to invest in the livestock sector. Now it is upon public and private livestock sector actors in Odisha State to take up the plan and invest in sustainable livestock solutions.



Jimmy Smith
Director general
ILRI

Abbreviations/acronyms

ADRI	Animal Diseases Research Institute
AGSDP	Agriculture gross state domestic product
AHD	Animal Health Department
AI	Artificial insemination
ARD	Animal Resources Development
ASF	Animal-source food
AVAS	Additional Veterinary Assistant Surgeon
BAU	Business as Usual
BMC	Bulk Milk Cooler
BMGF	Bill & Melinda Gates Foundation
BYP	Backyard Poultry
CBC	Crossbreed Backyard Chicken
CDVO	Chief District Veterinary Officer
CIRAD	Centre de coopération internationale en recherche agronomique pour le development
CPR	Common Property Resources
CVSc &AH	College of Veterinary Science and Animal Husbandry
DAH and VS	Directorate of Animal Husbandry and Veterinary Services
DBC	Desi backyard chicken
DOC	Day-old chick
FAO	Food and Agriculture Organization of the United Nations
FARD	Fisheries and Animal Resources Department
FMD	Foot-and-mouth Disease
FNS	Food and nutrition security
FPOs	Farmers Producer Organizations
FSSAI	Food Safety and Standards Authority of India
GDP	Gross domestic product
GoO	Government of Odisha
GSDP	Gross state domestic product
HESM	Herd and Economic Sector Model
HH	Households
HORECA	Hotel/restaurant/catering
HRD	Human Resource Development
ICAR	Indian Council of Agricultural Research
ICAR-CIWA	ICAR-Central Institute for Women in Agriculture
ICAR-DPR	ICAR-Directorate of Poultry Research
ICT	Information Communication Technology

IDBC	Improved Desi Backyard Chicken
IEC	Information Education and Communication
ILRI	International Livestock Research Institute
KVK	Krishi Vigyan Kendra
LMP	Livestock master plan
LPM	Livestock Production and Management
LSA	Livestock Sector Analysis
LSIPT	Livestock Sector Investment and Policy Toolkit
LSS	Livestock Sector Strategy
MCC	Milk collection centre
MPCs	Milk Producer Cooperative Society
NGO	Non-governmental organization
NPVs	Net Present Values
OBPI	Odisha Biological Product Institutes
OLMP	Odisha livestock master plan
OMFED	Orissa State Cooperative Milk Producers' Federation Limited
ORMAS	Odisha Rural Development and Marketing Society
OUAT	Odisha University of Agriculture and Technology
PPPs	Public–private partnerships
PPR	Peste des petits ruminants
SCC	Specialized commercial chicken
STT	State Technical Team
TAC	Technical Advisory Committee
VOTI	Veterinary Officers' Training Institute
WI	With intervention
WSHG _s	Women self-help groups

1 Introduction

Odisha is the 8th largest state by area and 11th most populous state in India, while it falls 26th rank in terms of per capita income. In 2019, about 32.59% of the state's population was below the poverty line (NITI Aayog 2019). Close to 83% of its people live in rural areas, and about 61.8% of its 17.5 million workforce are employed in agriculture, including livestock (Government of Odisha 2020). Odisha is prone to natural calamities such as cyclones, floods and droughts. The primary sector (agriculture and allied sector) contributes 21% to the state's GDP (Government of Odisha 2021) and livestock production is an essential component (World Bank 2016). The Odisha agriculture GDP has nearly doubled in real terms since 2000, with an average annual growth rate of about 4.5%, higher than all India's average of 3.1%.

The share of the livestock in Agricultural Gross Domestic Product (AGDP) has been increasing faster than the crops in the past decade due to the rising demand for livestock products resulting from growth in income, population and urbanization. The contribution of livestock production to total and agricultural GDP is somewhat lower in Odisha than in India. The livestock value in Odisha comprised 3% of GSDP compared to 4.5% nationally and 23% of agricultural GDP compared to 25.5% for all of India (Government of Odisha 2020). However, livestock, particularly goats, play a vital role in reducing poverty among marginal communities and women. At the same time, Odisha has made significant progress in dairy and is particularly recognized for its high milk production from cows.

The importance of the dairy, goat and poultry value chains makes livestock one of the principal sectors considered to have the potential to help achieve the state's development goals. The growth and performance of the dairy subsector in Odisha are not growing like other Indian states and neighbour states like Andhra Pradesh and Bihar. The Orissa State Cooperative Milk Producers' Federation Limited (OMFED), which the government supports, has played a key role in developing the dairy subsector, raising dairy cow productivity, milk production and farmer's income. Thus, increasing livestock productivity and production is seen by the government of Odisha (GoO) and its Department of Fisheries and Animal Resources Development (FARD) as a key means of improving per capita incomes and reducing poverty. According to Randolph et al. (2007), besides contributing to the agricultural GSDP, livestock production has an essential role in reducing poverty because many rural and urban poor keep livestock and use them in various ways beyond income generation. Multiple development frameworks view the livestock sector as other capital assets that can be reproduced to generate wealth (Carlson-Bremer et al., 2018).

1.1 Livestock master plan (LMP) to support the Odisha livestock sector

To increase the support for the livestock sector, the Department of Fisheries and Animal Resources Development (FARD) of the government of Odisha decided to carry out an LMP. The LMP includes a thorough and systematic analysis of the Odisha livestock sector (LSA), a Livestock Sector Strategy (LSS) and a value chain specific investment roadmap. The investment roadmap is a detailed 5-year livestock sector investment plan meant to help increase and better target public and private investments. Through the FARD department, the government of Odisha requested

the Bill & Melinda Gates Foundation (BMGF) through Samagra governance¹ to support the engagement of the International Livestock Research Institute (ILRI) to provide technical assistance in developing LMP for Odisha. The objective of the LMP initiative is thus to provide an investment plan which could help further modernize the livestock sector, enabling it to make an even more substantial contribution to achieving the Odisha state development goals.

This effort has been generously funded and supported by BMGF through Samagra. The Odisha livestock master plan (OLMP) was undertaken by a joint team of experts from the Odisha government institutions (FARD department, veterinary college, district officers) and ILRI livestock and planning experts. The analytical work was carried out under the guidance of Sri R. Raghu Prasad, IFS, the Principal Secretary, Department of FARD, the government of Odisha. A Technical Advisory Committee (TAC) chaired by the secretary periodically reviewed and made recommendations related to ensuring progress in achieving the outputs of the LMP project. The TAC comprised the heads of key livestock departments and other relevant government agencies of Odisha and representatives from the private sector, civil society organizations and development agencies. Once completed, the commodity value chain investment roadmaps of the LMP were also reviewed by eminent livestock scientists of ILRI, ICAR and an external reviewer who were found to be credible and defensible. The roadmap presented here is a series of five-year investment plans for the development of priority livestock value chains, chosen through the sector analysis and based on their potential for impacting the development objectives of the government of Odisha. Each roadmap includes a specific vision and targets, challenges, opportunities and strategies; recommended technology and policy investment interventions, with expected outputs as well as impacts and outcomes on the state development objectives. The roadmaps are also fully budgeted and include timed and sequenced activity plans (or Gantt charts). The findings of the livestock sector analysis (LSA) and the livestock sector strategy of Odisha are presented in separate publications.

1. Samagra governance: <https://www.samagragovernance.in/>

2 Executive summary

2.1 The LMP's support to the FARD department

The Odisha livestock policy (Government of Orissa 2002) identified livestock as a poverty reduction instrument (over 80% of rural households own livestock, which generates up to 30% of their income). Although crop production is the principal activity, livestock is an important secondary income source for many small-scale and marginal farmers in Odisha who may own only a few animals. Livestock products such as milk, meat and eggs provide important macronutrients (proteins and fats) and micronutrients (vitamins and minerals) to farm households.

To facilitate increases in public and private investment and budget allocations for livestock development, the FARD department, Government of Odisha (GoO), through Samagra governance, requested ILRI to provide technical assistance to develop a livestock master plan for Odisha. The objective of the LMP initiative is to provide an investment plan which would complement the livestock development budget in Odisha to help further modernize the livestock sector, enabling it to make an even more substantial contribution to achieving state development goals. This effort has been generously funded and supported by the BMGF, South Asia Agriculture Program. This initiative is meant to help increase appropriate investments in the livestock sector and improve livestock contributions to achieving state development goals.

2.2 The added value of LMP

Using the most recent available data, livestock experts from the FARD department and ILRI staff employed the livestock sector investment and policy toolkit (LSIPT) to develop a herd and economic sector model (HESM) for the Odisha livestock sector and carried out a baseline assessment of the current status of livestock development in Odisha. The baseline is documented in the LSA. This HESM was used to assess the potential long-term or 15 years impacts of combined technology and policy interventions on Odisha-designated development objectives and prepare the LSS. The results of the LSS then formed the basis for developing the five-year 2022/23 to 2026/27 value chain specific investment roadmaps. The value chain specific roadmap is a five-year development investment plan to be used to complement and help the livestock investment and sector budget of the government of Odisha. The main objective of the Odisha LMP is to provide evidence based justification for public and private investments in a set of recommended priority commodity value chains of the Odisha livestock sector. The value chains and investment interventions are chosen based on quantitative analysis of the returns on investment (ROIs) from investments in new and/or additional combined technology and policy interventions. The LMP is also meant to inform the development planning of the FARD department, the government of Odisha, together with other Odisha government agencies working on livestock sector development in the state, as well as the investment planning of development partners or donors, non-governmental organizations (NGOs), civil society organizations, private sector actors and development banks.

In carrying out the LMP, to choose the investment and policy interventions to be implemented in the 5 years of the LMP or sector investment plan for Odisha, the alternative investments in new technologies and innovations combined with policy changes were tested to show their impact or contribution to the following specific development objectives (through measurable indicators) chosen by Odisha livestock experts and confirmed by the FARD department:

- *Poverty reduction*: improved household incomes that move some households above the poverty line;
- *Economic growth*: increased contribution of the livestock sector to Gross State Domestic Product (GSDP);
- *Food and nutrition security (FNS) of rural people, especially women and children*: increased availability and access to animal source foods to women and children with food access below recommended levels;
- *Export potential*: increased value of livestock products provided to the rest of India and neighbouring countries;
- *Social equity*: reduced inequality in household and post production incomes, greater empowerment of women, employment and investment opportunities for women, youth and specific minority ethnic groups.

Investments in each commodity value chain in the LMP were analysed based on the projected impacts of livestock improvement strategies and interventions chosen based on past research and recommended by the experts from the livestock sector of Odisha.

The LMP adds value to the livestock annual budget and investment planning of Odisha, including analysis of:

- five-year investment returns for the livestock interventions chosen in the LSS
- the challenges and opportunities facing each commodity value chain
- projected investment impacts on five-year production and income
- projected investment impacts on meeting produced quantities for the commodities and ASFs demanded in future
- most importantly, the impacts of the investments on indicators for achieving the state development objectives outlined above.

2.3 Key results of the LMP analysis

Although many efforts have been made to enhance livestock production and create a vibrant sector, livestock productivity is still very low compared to the national average. The livestock of Odisha faces different technical and institutional challenges, including poor animal genetic potential, high incidence of diseases, lack of access to quality feed, inadequate animal health services, lack of organized livestock markets and inadequate extension and training. Additionally, the sector is constrained by low public and private investments.

2.3.1 Major interventions to address existing challenges

To tap the opportunities and address these challenges, additional investments in livestock improvement interventions are needed in the areas of feed, health, genetics, extension and marketing and processing.

2.3.2 The priority interventions to address the challenges the sector faces in modernizing are:

- Improve the availability of quality feed by promoting new and improved varieties of green fodder, increasing the area under green fodder cultivation, enhancing farmers' knowledge, and updating and establishing a feed quality testing lab.
- Genetic improvement through the selection of local breeds and crossing locals with improved exotic breeds, AI and sexed semen.
- Increase the quality and quantity of animal health services and livestock producers' access to these services through private and/or private–public partnerships to decrease mortality and morbidity.

- Design and implement policies and institutional interventions to encourage private investment, especially in livestock production, input and output marketing and processing.
- Prepare and implement policies and institutional interventions that ensure social inclusiveness and investment opportunities for women and other minority groups.
- Improve technical and business skills of farmers through training that promotes greater gender and social inclusion.

2.3.3 Priority livestock value chains of the LMP

The Odisha LMP sets out livestock sector investment interventions that include better genetics, feed and health inputs and services and complementary policy support which could help the FARD department meet its objectives and targets by improving productivity, production, incomes and employment in the key livestock value chains of dairy from cattle; goat and sheep for red meat; poultry for white meat and eggs.

The commodity value chains recommended for investment in the LMP, in order of priority, are:

- Dairy value chain
- Chicken meat and eggs value chain
 - Desi backyard chicken meat and eggs value chain
 - Commercial layer eggs and broiler meat value chain
 - Crossbreed backyard chicken meat and eggs value chain

Goat and sheep meat and skin value chain

2.3.4 Key recommendations for each LMP value chain

2.3.4.1 Dairy value chain

Cow based dairy is the main source of income and employment for the rural, urban and peri-urban communities in Odisha. It contributes to about 81% of the state livestock GSDP and 9.1% of the agricultural GSDP. Dairy from cattle will continue to be the key commodity value chain that can help the most to achieve the development goals of the state, especially poverty reduction, improved food and nutritional security, economic growth, and increased contributions to dairy export to other Indian states and neighbouring countries and improved social equity. In Odisha, about 37 lakhs households own dairy cattle directly depending on the dairy sector for their livelihoods. The LSS and the dairy roadmap show there is still much potential for further expansion of dairying in Odisha.

The main technology and policy interventions requiring more investment during the 5 years of the LMP are:

- Educating farmers to improve the feed (concentrate and forages) production based on available local resources and feeding practices (feeding chopped straw, adding mineral mixture) to improve the milk yield and ensure these practices are made available for women.
- Strengthening the existing semen bank, breeding farms, and AI centres as well as increasing use of sexed semen through improved availability of quality semen.
- Establishing a new Animal Science University and improving the capacity of the existing veterinary profession.

Providing training and refreshment training to AI technicians and public and private feed providers as well as farmers for:

- Strengthening the capacity of diagnostic laboratories and Odisha Biological Product Institutes (OBPI) by recruiting additional staff and training existing staff.

Increasing the veterinary dispensary, mobile veterinary unit and livestock aid through:

- Establishing additional powder plants for processing surplus milk for the lean season.
- Introducing milk midday meal programs to increase milk consumption among the poor.
- Establishing functional linkages between private milk traders, MCCs, cooperatives and processing plants will improve milk collection, processing and distribution.

2.3.4.2 Chicken meat and egg value chains

The chicken subsector is an emerging sector in Odisha and comprises both the backyard systems (BYP) and the commercial and specialized production of broilers and layers. Backyard poultry can effectively enhance access to micronutrients and protein rich foods, especially for combating malnutrition in children and anaemia in women. It is an appropriate traditional activity for women because chickens are valued for various socio religious ceremonies in tribal households. Notably, these poultry birds are among the few assets that a woman farmer owns and has decision-making power on sales and usage of the income accrued. On the other hand, commercial broiler and layer production increased due to a bigger demand for eggs and meat.

The potential contribution of the chicken industry to improve food and nutritional security, household income and state economic growth is thus enormous, including a 239% increase in GSDP contribution in 5 years. With additional investment, Odisha is expected to continue being self-sufficient in eggs and possibly become a net exporter of the slight excess of eggs to neighbouring states.

The main investment and policy interventions requiring more investment during the five-year LMP are:

- Increasing the number of commercial layers and broiler chicken production to meet the chicken meat and egg demand in the state.
- Establishing new hatcheries for day old chicks (DOC) production to meet the growing demand for chicks in the state.
- Improving the quality and quantity of chicken feeds by strengthening the existing feed quality control laboratory in five years.
- Increasing the vaccination cover of all Desi and improved backyard poultry in the state.
- Promoting hygienic chicken slaughter facilities by incentivizing all meat marts and registering as well as establishing two modern (one organic and one for regular proceed) chicken slaughtering and processing plants.
- Engaging and encouraging private integrators to provide DOC and help farmers with the necessary inputs.

2.3.4.3 Red meat value chains

Goats and sheep play a crucial role in the livelihood of over 30% of the rural population in Odisha. They are reared predominantly by women, the landless and marginal farmers, including nomadic and ethnic tribal groups. They are regarded as poor man's cows and serve as an important occupation in dry/upland land farming. Small ruminants, particularly goats, have been seen as an important source for improving rural poor's livelihood, particularly in the Hilly and Mountain and North-West zones. Therefore, goats show much potential for further public investment, mainly to help in reducing poverty and achieving equality, especially for women and others from marginal ethnic groups. The major focus of the goat interventions is to increase the productivity of goats rather than impacting production through population increase. This is because of the serious current and projected feed shortage in the state.

The main investment and policy interventions requiring more investment during the 5 years of LMP are:

- Ensuring the availability of quality fodder and feed supplement (concentrate feed) for does and ewes one month before parturition to improve the birth weight of kids.
- Improving the local goat and sheep breeds through selective breeding by strengthening existing breeding farms and promoting private breeding farms.
- Promoting AI for goats and sheep in collaboration with the research institutes.
- Ensuring 100% vaccination for critical diseases such as Peste des petits ruminants (PPR), goat pox, enterotoxaemia and FMD.
- Decreasing mortality of animals from flooding and cyclones by improving the early warning and awareness systems.
- Establishing a total of 3 goats and sheep abattoirs (Model scientific abattoir) in three major cities of Odisha (Bhubaneswar, Cuttack and Rourkela) along with 120 formal livestock markets in Mandis at the Block level in the coming five years.
- Ensuring credit for goat and sheep farming since these are mainly held by very poor women from marginalized communities under risky climate and market conditions.

2.3.5 Key policies and institutional support recommendations across the value chains

Policies and institutional interventions need to be designed and implemented throughout all the value chain roadmaps to enable the private and private–public investments in animal husbandry, input production and supply, delivery of services and output marketing and processing (for more details, see the Odisha LSA (Bahta et al., 2022a)). Some of the major recommendations identified through the LMP analysis include:

- Revisiting and properly implementing the breeding policy, privatizing AI services, reinforcing the genetic improvement, encouraging public–private partnerships (PPPs), ensuring adequate expertise and infrastructure and establishing livestock breeders’ associations and societies.
- Upgrading the quality and availability of animal health services and policies that target more women in ‘One Health training’ to ensure better compliance with control strategies for zoonotic disease.
- Improving feed quality standards and regulation enforcement and upgrading feed quality testing and regulatory control through PPP.
- Mainstreaming gender and social inclusion programs and incentives at all levels.

2.3.5.1 Main entry points for improving gender mainstreaming and social inclusion

Given that women share more than three-fourths of the labour requirement in livestock production, developments in the livestock sector can promote the twin goals of economic growth with more significant equity and gender empowerment. It is important to acknowledge the primary role of women in livestock rearing by policymakers, line departments and implementers. Addressing gender in tertiary curricula of veterinary education could be considered as this would address gender concerns. For instance, Makerere University in Uganda has a course unit on veterinary sociology (with a large focus on gender) in its veterinary curriculum. Until this is done, gender sensitization training for AHD should be done, and sex disaggregated data collected to enable the drafting of policies and programs taking into account the different needs of men and women.

At the ground level, interventions in three key domains livestock production, livestock disease management and food safety; livestock marketing and processing can serve as platforms to initiate equitable gender responsive actions to ensure women and youth can increase incomes, food security, wellbeing and improved intra-household decision-making. Training women farmers in new technologies related to feeding, breeding and providing basic preventive health care can easily double the production and incomes as well as improve household nutrition through consumption of ASF. However, gender blind livestock intensification interventions can lead to substantial gains but can result inadvertently in women losing control over the very assets and products under their domain (e.g. chicken, goats) to their partners. Investments also need to be made to build a robust extension system including extensive use of ICT, recruit a gender focal person and provide gender sensitization training to all staff, ensure doorstep services reach women farmers (e.g. Prani Mitras²) and have convergence with various departments to ensure women have access to CPRs for feed and fodder, WSHGs for training, Farmers Producer Organizations (FPOs) for marketing etc.

2.3.5.2 Joint government and private sector actions required to ensure the LMP succeed:

- Improve the availability of feeds through increasing the quality of crop residues, especially underutilized residues (i.e. maize stover, groundnut haulm), increasing green fodder production and concentrate feed availability, and ensuring the quality of feeds and fodder seeds through an improved PPP.
- Allocating more resources to strengthen AI and synchronization facilities and community-based selection programs.
- Encouraging the private sector to invest in animal health. Since the department focuses on dairy animals, Prani Mitras and other private players interested in providing services should be supported. Similarly, Mission Shakti created SHGs could be a good platform for engaging with women livestock farmers for extension and training. Private clinic pharmacies can also be promoted to encourage self-employment of veterinary graduates and private veterinary service deliveries.
 - Support milk producer cooperative societies and encourage private investors to invest in milk processing and marketing.
 - Strengthening existing livestock research institutes and improving the extension delivery and training of farmers. Encouraging the private sector to take part in providing training, delivering inputs and marketing services.

2.3.6 Funding the LMP

Although livestock contributes about 23% agricultural GSDP of Odisha, the current budget allocated for the sector is only 1.8% of the state agricultural budget. The differences in the investment costs of the different components of livestock development of the agricultural and rural development (ARD) budget and LMP have been assessed to see the degree of complementarity between the two budgets for the year 2022/23.

Table 1 below presents the summary of the differences in 2022/23 investment interventions and costs for each priority livestock value chain. The ARD budget's total investment cost is about 1,036.25 crores, while it is about 879 crores in LMP, which is 15% less. However, the LMP does not include administrative and program management costs, which is about 42% of the cost in the ARD budget. Thus, the 2022/23 LMP budget is 44% higher than the ARD budget when the cost of livestock improvement interventions is compared.

2. Prani Mitras are ground staff recruited under Odisha livelihood mission to work in livestock development at Gram Panchayat level.

Table 1. Budget comparison between ARD and LMP for 2022/23 (amount in INRa crores)

Component	ARD budget (2022/23), Government of Odisha	LMP (2022/23)
Investments to improve feeding	8.36	25.01
Breeding investments	34.7	14.80
Research and extension	62.65	212.74
Healthcare management	401.77	174.80
Dairy and marketing	160.76	452.50
Others	368.01	0
Total	1,036.25	879.85

Indian Rupee. On 18 April 2022, USD 1.00 = INR 76.2469.

2.3.7 Investment costs by value chain

2.3.7.1 Dairy value chain budget

The total investment budget of the dairy roadmap for the five-year LMP period (2022–26) is about INR 3,200 crores. Most of this investment, about 92%, has to come from the public sector since a large portion of the investments is for the construction and upgrading of the public extension, research, breeding and marketing and processing infrastructures and facilities. The private sector accounts for about 8% of the total dairy investment. The dairy roadmap investment is subdivided into feeding, breeding, health, research, extension and marketing. The investment budget allocated for interventions that will improve milk marketing and processing is the largest, with about 53% of the total dairy investment. The health improvement interventions accorded a second largest budget, followed by research and extension improvements.

2.3.7.2 Red meat value chain budget

The total red meat value chain roadmap investment cost for 2022/23 to 2026/27 is INR 220 crores. The private sector is expected to fund about 32% of the total budget and the public sector will finance the rest. About 86% of the investment is allocated for marketing and processing. The estimated investment cost coming from public funds amounts to INR 149 crores. The corresponding amount from the private sector is INR 71 crores and this is associated with the strengthening and promoting the establishment of private breeding farms, slaughterhouses, abattoirs, meat processing plants and tanneries. Some of the feed improvement investments of the red meat value chain are captured in the dairy value chain roadmap.

2.3.7.3 Chicken value chain budget

The total chicken value chain roadmap investment cost for the five LMP years (2022/23 to 2026/27) is INR 342 crores. Except for the health and extension and research services, the other investment categories are predominantly private sector investments which indicate the great responsibility of the private sector in transforming the chicken industry in the state of Odisha. The private sector accounts for about 56% of the total investment and the rest, 44% of the total chicken roadmap investments, is expected to come from the public sector (government, NGOs). The marketing and processing investments take the largest share of the investment, almost half of the total investments, followed by feeding and breeding investments. The private sector is expected to contribute about 43% of the processing and marketing investment and 100% of the investment in integrators for broilers and layers.

2.3.7.4 Share of the total five-year OLMP investment cost by budget source

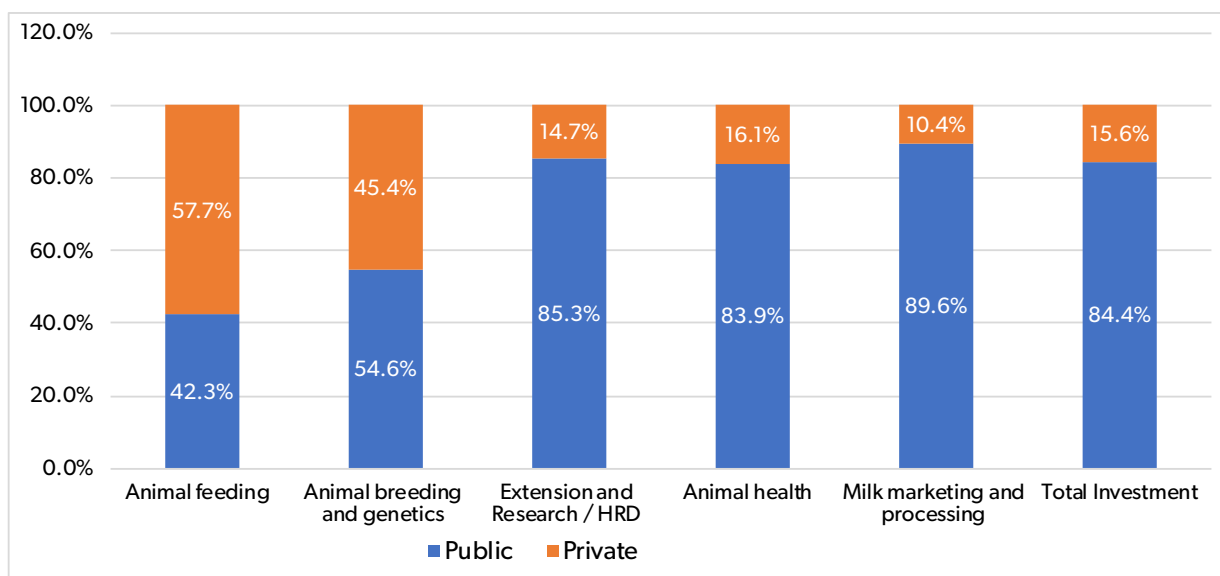
The total investment cost for the dairy, red meat and chicken roadmaps in Odisha is about INR 3,775 crores.

Table 2. Total investment cost by intervention areas

Investment categories	Investment cost (INR crores)			Proportion of total investment
	Public	Private	Total	
Animal feed	56.8	77.4	134.2	3.6%
Animal breeding and genetics	102.2	85	187.2	5.0%
Extension and research/HRD	578.2	100	678.2	18.0%
Animal health	537.7	103.5	641.2	17%
Milk marketing and processing	1,911.5	223	2,134.5	56.5%
Grand total	3,186.4	588.9	3,775.3	100.0%

The investment cost allocated for the marketing and processing intervention area takes the largest share of the total investment, followed by animal health and extension and research intervention areas. Regarding the source of the investment, about 84% of the total investments are expected to be funded by the public sector, while the private sector will fund the remaining 16%. The highest private sector investments come from chicken feed and breeding improvement interventions. The prominent intervention areas that contributed to the public sector investment are the extension and research and health intervention areas and school midday egg and milk meal investments categorized under the marketing and processing intervention areas (Figure 1).

Figure 1. Investments by intervention areas and source of investments (midday milk and egg budget included).



3 Dairy value chain roadmap (2022 to 2026)

3.1 Livestock sector strategy (LSS) dairy-related results and conclusions—the basis for the dairy value chain roadmap recommendations

Cow based dairy farming in Odisha accounts for 81% of livestock GSDP and 9.1% of agricultural GDP. About 37 lakhs households in Odisha own cattle and directly depend on the dairy sector for their livelihoods (Government of India 2020). Some significant growth has been witnessed in the dairy sector thanks to efforts by the government to enhance the performance of the livestock sector in Odisha. These efforts have been in the form of policies, institutions and investments to support the improvement of animal breeds, enhanced farmers' access to extension and animal health services and interventions addressing a key challenge to production imposed by the scarcity of livestock feed. An important question facing the Odisha state government is the implication of continuing with the current level of effort/policy in the dairy sector vs whether there is a need for change.

To address the question of whether there is a need for change, the Odisha LSS conducted a foresight analysis of the impacts of two contrasting policy scenarios in the dairy sector, that is, Business as Usual (BAU) vs With Intervention (WI). The BAU scenario represents the base case scenario where no additional investment or change in the types of investment is envisaged. It shows the impacts of continuing the current type and level of investment and recurrent spending on milk production and contribution to Gross State Domestic Product (GSDP) throughout the LSS analysis over 15 years. On the other hand, the WI scenario represents a situation where additional dairy improvement investments are envisaged. The additional investments proposed in the LSS include improving genetics through AI; enhancing research and extension; improving animal health and feeding; processing and marketing milk. The WI scenario aims for the state to investigate the possibility of meeting future milk consumption requirements through local production.

Findings of the foresight analysis showed that:

- WI, the annual level of milk production will increase by 140% from 201.1 crores litres in 2020/21 to 483.4 crores litres in 2035/36 compared to an increase of only 32% (264.9 crores litres) in the BAU scenario.
- WI, annual milk production from crossbred cattle will increase by 177% (from 146.3 crores litres in 2020/21 to 406 crores litres) compared to only 45% (211 crores litres) in the BAU scenario. Additionally, milk production from indigenous cattle will rise by 35% in the WI scenario but fall by 13% in the BAU scenario.
- Farm households engaged in commercial dairy will earn a higher income/cattle per year than the traditional family dairy farming system. Commercial dairy farmers with more than 30 cattle will earn INR 47,055 per head of cattle, while farmers with 5–30 cattle will make INR 37,805 per head of cattle in both WI and BAU scenarios. The

family dairy farming system having indigenous cattle will earn a meagre income per head of cattle/year compared to those having crossbred animals. For example, in the Coastal Plain zone, a family dairy farming system having crossbred cattle will earn INR 28,305 per head of cattle in the BAU scenario and INR 36,405 per head of cattle in the WI scenario, while farmers having indigenous cattle will make lower, about INR 3,314 in the BAU scenario and 5,124 in the WI scenario.

- The net present values (NPVs) for the family and commercial dairy farming system are positive in all production zones, indicating the investments' positive impact. The NPVs are highest in the commercial dairy farming system. Higher NPVs are observed among farms having crossbred cattle than indigenous breeds.
- The GSDP contribution of cow dairy will grow from INR 16,359 crores in the base year to 22,517 with additional investments (WI) compared to just INR 17,547.5 crores for the BAU scenario. The growth in contribution to GSDP with the additional investments (WI) represents a 38% increase compared to just a 7% increase for the BAU scenario.
- From 2020/21 to 2035/36, milk demand and production under the BAU scenario are expected to increase annually by 8.3% and 2%, respectively. With the current production rate (BAU), supply slightly exceeds demand and the situation is projected to continue for 5–6 years, after which consumption is expected to overtake production in 2025/26.

3.2 Five-year LMP vision for the dairy value chain

The vision is to increase the income from dairy cattle by up to INR 5,700 per animal for farmers adopting dairy improvement intervention and raise the state cow milk production by 48% from the current 217 crores litres of milk to 321 crores litres by 2026/27. The contribution of cow milk to the state GSDP will increase from INR 5,086 crores by 2021/22 to INR 7,854 crores by 2026/27.

3.3 Investment scenarios analysed

In the 5 years context of the LMP, the dairy value chain investments for cows are analysed in two scenarios; BAU and WI, which represents the scenario considered in the LSS.

- The BAU scenario represents the base case or existing scenario with the analysis showing the impacts of continuing the current type and level of investment and recurrent spending on milk production, income per animal, and contribution to GSDP throughout the LMP analysis period of 5 years.
- The WI scenario represents an increase in the investments in indigenous and crossbred cattle to improve their productivity, in addition to raising milk production by increasing the population of crossbred cattle. This scenario is ultimately aimed at meeting the milk consumption requirement of the state in 15 years.

3.4 Description of the dairy production systems

The dairy value chain includes both indigenous and crossbred cattle. A description of the base year dairy production system describes the productivity parameters of the farm systems in the three designated livestock production zones: Hilly and Mountain, North-West and Coastal Plain (Table 3). The classification of livestock production systems in the three regions considers dominant species, feeding practices and potential for future improvement. Cattle dominate in the Coastal Plain. There are large differences in feed management between the production zones. Farmers in the Coastal Plain mostly depend on commercial feed, while unimproved grazing dominates in the Hilly and Mountain zone. Compared to other zones the landholding size is small (0.77 ha) in the Coastal Plain where stall feeding predominates. However, the Coastal Plain also has better irrigation facilities and thus much-improved access to water than the other two zones.

The dairy system in Odisha is characterized mainly by small household herds. The average herd size of the indigenous and crossbreed family dairy farming system varies from 2.5 to 3, while the herd size for peri-urban dairy farming varies from 12 to 65. In the Hilly and Mountain zone, the average herd size of the indigenous and crossbreed family dairy system is similar, with 3 cattle per household. In the Coastal Plain, the average herd size is 3 and 2.5 cattle per household for households that keep crossbreed and indigenous breeds, respectively. The parturition rate for indigenous cattle varies from 0.55 to 0.57, while for crossbreed cattle, it ranges from 0.74 to 0.75 and is 0.85 in the peri-urban dairy system. The parturition rate is higher in the Coastal Plain than in other livestock production zones. Cattle in Coastal Plains are more productive compared to other zones. The average milk yield of indigenous cattle is 2 litres/day in the Coastal Plain zone compared to 1.6 litres/day in the North-West zone and 1 litre/day in the Hilly and Mountain zone. A similar pattern is observed in crossbreed cattle, with yield averaging 7 litres/day in the Coastal Plain zone and 6 litres/day in the Hilly and Mountain zone. The average milk yield in peri-urban dairy farming is 10 litres/day for small farms (having 5–30 animals) and 11 litres/day for large farms (more than 30 animals) (Table 3).

Table 3. Dairy cow production system—average productivity parameter

	Hilly and Mountain		North-West		Coastal Plain		Urban and peri-urban dairy	
	Indigenous breed family dairy	Crossbreed family dairy	Indigenous breed family dairy	Crossbreed family dairy	Indigenous breed family dairy	Crossbreed family dairy	Small (5–30)	Large (>30)
Herd size	3	3	2.5	2.5	2.5	3	12	65
Parturition rate	0.55	0.74	0.55	0.75	0.57	0.75	0.8	0.85
Mortality rate (per year)	4.7%	7.9%	4.5%	7.2%	4.0%	6.3%	5.8%	5%
Weight kg (female juveniles)	50	75	60	80	60	80	100	100
Weight kg (male juveniles)	60	75	70	80	70	90	90	90
Weight kg (female sub adult)	130	200	140	220	150	230	250	260
Weight kg (male sub adult)	130	150	150	150	140	160	200	200
Weight kg (female adult)	200	270	220	300	220	320	350	370
Weight kg (male adult)	230	280	250	280	260	300	450	450
Lactation length (days)	200	300	200	300	200	300	300	300
Daily average milk production (litres)	1	6	1.6	6.5	2	7	10	11
Annual production (litres)	200	1,800	320	1,950	400	2,100	3,000	3,300
Share female population	36%	66%	45%	76%	80%	94%	93%	93%
Share male population	64%	34%	55%	24%	20%	6%	7%	7%

3.5 Overall LMP targets under the intervention scenario

3.5.1 Overall targets at the state level

- In the LMP base year (2021/22), there are about 17.9 lakhs crossbreed dairy cattle in Odisha, and the number is targeted to increase to 23 lakhs by 2026/27. There will be a 28.5% increase (see Table 4).
- The indigenous cattle population in 2021/22 is about 73.7 lakhs and is targeted to reach 66.9 lakhs by 2026/27, a decrease of 9.3% (Table 4).

- In 2021/22, cow milk production was about 217.4 crores litres, and it is targeted to grow to 321.1 crores litres by 2026/27, a 47.7% increase over the 5 years (Table 9).
- The contribution of cow milk to GSDP is about INR 5,086.2 crores in 2021/22 and is expected to increase to INR 7,853.9 crores in 2026/27, a 54.4% increase (Table 10).

3.5.2 Overall targets at zonal animal levels

The animal and herd level targets that could be achieved by farmers adopting the proposed dairy improvement technologies for indigenous and crossbred cattle are as follows:

- There will be a 3-percentage point increase in the parturition rate of cows.
- Farmers practising sexed semen/sex fixer when cows are inseminated will have about an 80% chance of getting females compared to the normal 50% chance (Mohteshamuddin 2017).
- Lactation length (in days) of indigenous cattle in all livestock production zones will increase from the current 200 days to 250 days.
- Daily milk production of indigenous cattle in farmers adopting the dairy improvement interventions will increase from the current 1, 1.6, and 2 litres/day in the Hilly and Mountain, North-West, and Coastal Plain to 2.25, 2.8 and 4 litres/day, respectively (MAFW 2017; Vaidya 2017).
- Daily milk production of crossbred cattle increases from the current 6, 6.5 and 7 litres/day in the Hilly and Mountain, North-West and Coastal Plain to 9, 9.5 and 12 litres/day, respectively (while MAFW 2017 and Vaidya 2017 reported for every litre of milk 0.4 kg of concentrate is required, keeping genetics in mind).

Table 4. Cattle population targeted for 5 years under the WI scenario (in lakhs)

Production zones	Breed	Livestock population (in lakhs)						Change in %
		2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	
Hilly and Mountain	Indigenous	21.1	20.7	20.3	20	19.6	19.2	-8.9%
	Crossbreed	2.9	3.1	3.2	3.4	3.5	3.7	27.8%
	Subtotal	24	23.8	23.5	23.3	23.1	22.9	-4.5%
North-West	Indigenous	27.3	26.7	26.2	25.7	25.2	24.7	-9.2%
	Crossbreed	4.2	4.4	4.6	4.8	5.1	5.3	27.3%
	Subtotal	31.4	31.1	30.8	30.5	30.3	30	-4.5%
Coastal Plain	Indigenous	25.4	24.9	24.4	23.9	23.4	22.9	-9.8%
	Crossbreed	10.5	11.1	11.6	12.2	12.9	13.6	28.9%
	Subtotal	35.9	36	36	36.1	36.3	36.3	1.2%
Commercial dairy	Crossbreed	0.3	0.3	0.3	0.3	0.4	0.4	31.7%
Total population	Indigenous	73.7	72.3	70.9	69.5	68.2	66.9	-9.3%
	Crossbred	17.9	18.8	19.8	20.8	21.8	23	28.5%
Grand total population		91.6	91.1	90.7	90.3	90	89.6	-2.2%

Source: Odisha LMP analysis.

3.6 Opportunities, challenges and strategies

The livestock sector plays a vital role in the economic development and poverty reduction in Odisha. The importance of the livestock sector is raising over the years as the contribution of the sector to agriculture and state GSDP increases. The demand for milk and milk products within the state increases with growing urbanization and a rise in per capita income. An increase in milk production and income from sales would substantively benefit marginal and landless households, besides providing additional employment to rural women (Jaiswal et al. 2018). However, the sector is facing several limitations, including lack of availability of improved germplasm, inadequate supply of quality semen, frequent occurrence of diseases, acute shortage of feed and fodder, frequent occurrence of floods and cyclones and low-level market linkages. Furthermore, many socio-economic and institutional factors such as shrinking common lands for grazing, lack of access to markets, credit and information about livestock technologies restrict farmers from realizing the production potential of their animals. Improving livestock productivity, supply of quality germplasm, availability of quality feed and fodder at lower cost and improving the market infrastructure will help the sector achieve higher growth.

3.7 Dairy improvement interventions

3.7.1 WI scenario—dairy improvement targets and interventions

3.7.1.1 Feed interventions

The feed balance assessment study results reported in the previous publication of the same work revealed two significant findings: a huge energy deficit in ruminants' diet and potential areas that can significantly improve the feed deficiencies (Bahta et al., 2022b). The most important potential areas identified to improve the feed insufficiencies in the state are the following:

- increasing the use of crop residues as animal feed
- improving the quality and nutritional value of crop residues
- increasing fodder production
- improving the availability of concentrate feeds.

3.7.1.2 Increase the use of crop residues as animal feed

Farmers should be encouraged to increase the number of crop residues they use as livestock feed. It is recommended that farmers raise the percentage of crop residues used to the recommended level (Table 5 below) will get tremendous improvements in the feed supply to their animals.

Table 5. Current and targeted per cent use of crop residues as animal feed

	Current crop residue use (percentage)			Crop residue used as feed intervention adopting farmers (percentage)		
	Hilly and Mountain	North-West	Coastal Plain	Hilly and Mountain	North-West	Coastal Plain
Rice	64	64	68	60	60	60
Wheat	5	3	NA	50	50	NA
Maize	28	43	30	50	50	50
Ragi	45	40	NA	50	50	NA
Green gram	44	53	58	70	70	70
Black gram	32	57	58	70	70	70

	Current crop residue use (percentage)			Crop residue used as feed intervention adopting farmers (percentage)		
	Hilly and Mountain	North-West	Coastal Plain	Hilly and Mountain	North-West	Coastal Plain
Horse gram	33	49	36	70	70	70
Cowpea	40	50	55	70	70	70
Groundnut	34	45	50	60	60	60
Sugarcane	15	13	12	50	50	50

Source: Bahta et al., 2022b

3.7.1.3 Improve the nutritional quality of crop residues fed to animals

This will involve:

- Educating farmers about the feeding of chopped crop residues to animals.

It is advised to promote chopping crop residues before feeding. As a constraint, there is no company producing choppers and no repair service provided in Odisha. It is important to provide special packages to the chopper manufacturing industry that wants to establish a company in Odisha.

- Promoting urea–molasses treatment of crop residues.

Two feed block units can be installed in the Coastal Plain and western Odisha. The wastage from crop residues can also be used to prepare a complete feed block Total Mixed Ration (TMR). In TMR, all feed ingredients, including roughages, are proportioned, processed and mixed into a uniform blend.

3.7.1.4 Increase fodder production

Currently, there is about 4,521 ha of land under fodder production in Odisha. Out of this, about 3,876 ha is owned by private farmers, while 645 ha is owned by government fodder farms. It is possible to increase the fodder production land owned by the private farmers by providing intensive extension services and encouraging farmers to use all available lands, like backyards, hedges, areas around houses, live fences, etc.

- Educating farmers to produce green fodder, including perennial fodder trees in all available lands, like backyard, hedges, areas around houses, live fences etc. is needed. If a farmer uses all available land for fodder production, an average of about 0.05 ha of land may be used for fodder production by the adopting farmers.
- The land area under permanent pasture/grazing/cultivable waste land during 2020/21 was about 869 thousand ha. It is planned to engage community development groups or WSHGs to improve the productivity of this land by sowing it with improved grass and leguminous forage seeds and use of fertilizer where applicable. It is targeted to increase rehabilitated permanent pasture/grazing land in North-West and Hilly and Mountain to be 30% of the total permanent pastureland by 2026/27.
- Forest area development should be done in consultation with the animal husbandry department. The periphery of the forest area should be planted with fodder trees for cattle.
- Improve production, marketing, quality control and certification of forage seeds, forages and concentrates through strengthening existing regulatory bodies.
- There are 8 government fodder seed production farms in Odisha. These fodder farms shall be strengthened in the coming three years and become up to 90% operational (manpower, machine, infrastructure—irrigation fences, etc.). The farms will produce fodder and quality fodder seed and serve as demonstration sites for farmers. These farms can be developed in a PPP model.

3.7.1.5 Improve the availability of concentrate feeds

To increase the productivity of lactating cows, additional concentrate feed supplementation is advised for both indigenous and crossbred cows with the cautious observation of their response to the supplementation in terms of milk production increase. Since women are responsible for feeding and taking care of the cattle, they need to be made aware of the benefits of feeding concentrates to cattle through training.

Lactating crossbred cows shall receive an additional about 1.2 kg concentrate feeds (0.6 kg oil cake and 0.6 kg bran) per day in Hilly and Mountain and North-West zones. In the Coastal Plain zone, lactating crossbred cows shall receive about 2 kg (1 kg oil cake and 1 kg bran) per day and lactating cow. It is also targeted that 30% of the farmers will adopt this intervention by 2026/27.

Lactating indigenous cows shall be provided with an additional about 0.5 kg concentrate feeds (0.25 kg oil cake and 0.25 kg bran) per day in Hilly and Mountain and North-West zones. In the Coastal Plain zone, lactating indigenous cows shall receive about 1 kg (0.5 kg oil cake and 0.5 kg bran) per day. It is targeted that 30% of the farmers will adopt this intervention by 2026/27.

Due to the predominance of the indigenous and crossbred cow supplementation interventions, the additional indicative amount of concentrate that may be required by the 5th year (by 2026/27) of this LMP period will reach about 260,681 t.

3.7.1.6 Genetic improvement interventions

The genetic improvement endeavour in Odisha mainly uses AI, using semen of improved breeds. The total number of inseminations performed in Odisha during 2020/21 is about 12.24 lakhs, out of which about 667,006 inseminations were conducted under the National Insemination Program (NIP). These inseminations involved 682 thousand animals, which shows the rate of insemination repeats to be approximately 1.79 times. In the same year, the number of kids born is about 413 thousand (Bahta et al., 2022b).

MFAHD (2021)³, in its annual 2020/21 report, stated that the per cent of cattle in Odisha that received AI stands at about 22%. In the same year, about 3,373 sexed semen inseminations were performed, 0.3% of the current total inseminations (Bahta et al., 2022b).

- Currently, the AI coverage in Odisha is about 22%. It is targeted to raise the coverage to 30% in the 5th year (2026/27).
- Odisha has one government owned frozen semen bank. Increase the capacity of the existing bank in the coming 5 years.
- The number of AI performed during 2020/21 was about 12.24 lakhs. It is targeted to raise the number of AI services to 27.53 lakhs in the 5th year (2026/27).
- There is one semen production centre in Odisha with a capacity of 10 lakhs doses of semen straw/year. The existing semen production centre capacity will be increased to 20 lakhs with the improvement of the station (only purchase of bulls land for feed production is required) in the coming five years. Also, one additional semen production centre with a capacity of about 15 lakhs straws/year will be established in the first five years.
- In Odisha, there are 4,297 AI centres (541 veterinary dispensaries and hospitals, 2,783 livestock aid centres and 973 OMFED (Odisha State Cooperative Milk Producers Federation) AI centres).⁴ Out of the total AI centres, 3,086 are under the DAH and VS, of which 60% are functional. Out of the total AI centres, NGOs manage 285 AI centres. The AI centres available in Odisha should be enough⁵ to cater to all breed-able cattle and buffalo.

3. MFAHD 2021. Department of Animal Husbandry and Dairying, Government of India. 2021. Annual Report—2020/21.

4. However, all AI centres are not working properly due to lack of technical expert (Discussion with OMFED personnel).

5. Assumptions used include, one AI centre serves for 800 to 1,000 breed-able cattle.

Therefore, the recommendation is not to add new AI centres but to upgrade the non-functional AI centres and make them functional. These AI centres will cater to both cattle and buffalo (one AI centre covers 800 to 1,000 breed-able animals). Staffing is one of the major interventions.

- There are eight cattle breeding farms under the DAH and VS. All cattle farms are not fully functioning. By 2026/27, all the existing breeding farms should be functional and upgraded. High-grade animals should be included on the farms. One farm to be used for embryo transfer, sexed semen and molecular genetic purposes.
- There is One Liquid Nitrogen (LN₂) storage point, which is under DAH and VS. It is targeted to improve the existing one and add 3 plants in the coming five years.
- Use of sexed semen/sex fixer. Currently, the percentage of sexed semen or sex fixer used over the total inseminations in Odisha is only about 0.3%. The target is to increase the ratio of sexed semen (sex fixer) to total insemination use to 30% by 2026/27.
- More mechanized agriculture will be promoted, facilitating the increase in the number of crossbreed cows and a decrease in the number of indigenous cattle.

3.7.1.7 Research and extension interventions

- New and existing training centres with different capacities and at different administrative levels will be used to give extension and training services. The veterinary college and the proposed Animal Science University will focus on high-level training for graduate and undergraduate extension service providers. Research and excellence centres will do certificate and diploma level training, while Krishi Vigyan Kendras (KVK) centres will provide training to farmers, women and unemployed youth. Block level training centres will be giving training to farmers and other input suppliers.
- The target is to give farmers more intensive and continuous training/exposure visits in managing cattle (feeding and nutrition, breeding, deworming, disease control, hygienic milk collection, handling, value addition, transport etc.). By 2026/27, the percentage of farmers receiving this type of consistent and intensive dairy improvement training will reach about 30%. Ensure 30% of the trainees are women dairy farmers.
- There are 31 KVKs⁶ in Odisha. Only 7 KVKs have animal scientists. By 2023 each KVK will have one animal scientist.
- To improve the block level extension service, 1 extension officer should be allocated to each block (314 blocks) in the coming 3 years.
- Private extension service providers will be promoted. In the coming five years, certified private extension service providers will be available at the subdivision level and extending it to the block level may not be achievable in the coming five years (in the LMP period).
- In the first two plan years, the necessary acts, regulations, guidelines, and manuals will be developed/improved to make private extension service providers grow faster, and the bureaucratic and hindering procedures to start and continue the service are eased. Controlling unregistered input, advisory and marketing service providers is also critical for the survival of the legally registered private extension service providers.
- The public sector found in the different strata will be involved in providing public extension services and supporting, controlling and regulating the private extension services.
- Strengthen the telecommunication extension service. Introduce ICT for mobile clinics and AI intervention using SMS/WhatsApp.
- Currently, it is only the veterinary college that conducts livestock research. Over the next five years, the capacity of the college should be strengthened for research in all livestock. Multi sectoral research, especially related to one health, zoonosis and gender in livestock, should also be prioritized.

6. A KVK is an agricultural extension centre in India. The name means 'farm science centre'

- One regional livestock research centre will be established⁷ in the coming five years. In the research centre, there will also be technology transfer stations and high-level training centres (certificates and diplomas).
- One animal science and fisheries university will be established. Under this, one dairy science college and one dairy research centre that can serve as a dairy excellence centre will be established.
- There is one Animal Disease Research Institute (ADRI) in Odisha serving as a state level referral diagnostic laboratory.
- Intensive research in dairy, feed and nutrition, health, extension and marketing and processing of livestock products will get due emphasis.

3.7.1.8 Health interventions

- In Odisha, there are 30 district veterinary hospitals, 541 veterinary dispensaries, 314 mobile veterinary service units and 3,239 livestock aid centres. By the end of the fifth year (2026/27), it is targeted to make the 30 district veterinary hospitals fully functional and increase the number of veterinary dispensaries to 650, mobile veterinary service units to 450, and livestock aid centres to 4,000 which also includes the proposed Gaushalas. With the increase in these veterinary infrastructures and better staffing, it is expected that the health service will improve and also prevent zoonosis with the addition of the Gaushalas, which would accommodate stray and old cattle. Cattle receiving a vaccination for the important diseases (Foot and Mouth Disease, Brucellosis, Hemorrhagic Septicemia, Black Quarter and Anthrax) will reach 90% by 2026/27. It is important to make timely vaccination campaigns.
- Farmers that adopt the recommended rate of external and internal parasite control treatments will reach 80% in the coming 15 years.
- Private veterinary service providers will be promoted.
- Mastitis control and prevention technologies will be promoted.
- The Odisha Biological Products Institute and its satellite will be strengthened, re-equipped and modernized with the necessary infrastructure and skilled manpower to produce high-quality vaccines.
- There are 30 diagnostic laboratories in Odisha. Improving diagnostic laboratories by strengthening the capacity of the diagnostic laboratories by replacing old and non-functional laboratory equipment, additional staffing and improving the facilities.
- The mortality of animals from flooding and cyclones will decrease by improving the early warning and awareness systems. Livestock shelters will be established in cyclone/flood prone districts.

3.7.1.9 Processing and marketing interventions

There are currently 6,053 registered Milk Producer Cooperative Societies (MPCS) in Odisha in which 2.57 lakhs farmers have been enrolled, out of which 1.5 lakhs are enrolled as women farmers. OMFED has organized to manage 261 Tribal Women Dairy Society, enrolled 9,619 farmer members and collected 8,936 litres of milk per day.

Out of the total MPCS, 15–20% have their building for milk collection, milk testing and payment, while the rest are rented from a private person. (All centres do not have electronic milk testing machines, while only 1,100 MPCSs have milk testing machines). The milk collection capacity of OMFED is about 6.7 lakhs litres/day.⁸ If we take the installed capacity of OMFED only, the state can process about 10% of the total milk produced in the state. OMFED is increasing its installed capacity by constructing a fully automated 5 lakhs litres/day capacity milk processing plant.

7. 50–100 acres of land needs to be allocated for each research centre.

8. Department of Animal Husbandry and Dairying, Ministry of Fisheries, Animal Husbandry and Dairying, Government of India. 2021. Annual report – 2020/21.

When this plant is completed, the processing capacity in the state, considering OMFED only, will grow to about 15%. In addition to OMFED, there are multiple small-scale processors and two large processors. The two large processors, namely Pragati and Milk Mantra, also collect milk through their network of farmer producers centres assisted by their agents/staff. The private sector has a total combined capacity of 6 lakhs litres per day, accounting for approximately 30% of the total capacity. With both public and private sectors considered, the total processing capacity is about 22%, while the same is about 40% elsewhere in the country.

- There may be a necessity to add one more powder plant to produce dairy whitener and condensed milk in the 5 years under the private sector mainly to balance/store the excess milk collected during the flush season of August to February coinciding with the monsoon.
- The state's current installed milk processing will increase from the current about 13%⁹ of the total milk produced in the state to 22–25% in 2026/27.
- Increase the functional capacity and use of existing MCCs.

A bulk milk collection system will be established to collect raw milk from producers and bulkers. About 140 bulk milk collection centres will be established in the coming 5 years under the private sector.

- Encourage the private sector to take part in the marketing and processing of milk.
- Establish modern retail trade points to promote milk products by the industry about 100 per year over the next 5 years.
- Enhance the capacity of MCCs to test antibiotic residues.
- Establish functional linkage between private milk traders, MCCs, cooperatives and processing plants.
- Midday meal scheme for children and nursing mothers. Each to get 100 ml milk per day for 200 days. About 20 litres of milk per person and the number of beneficiaries to be 0.5 crores. This will lead to enhanced consumption patterns and add to improved nutrition.
- Promote local products by incentivizing the hotels, restaurants and cafeterias (HORECA) segment in the first five years.
- Improve the collection system by incentivizing the farmers in the Hilly and Mountain production zone and putting the unused assets of Bulk Milk Colour (BMCs) back on track in the first five years.

Consumers prefer products produced outside Odisha and the reason attributed is that the products of Odisha are of inferior quality. To improve consumer confidence and also to get better accountability among the producers and processors, a quality enhancement program comprising the introduction of automated milk analysers, a quality based payment system for milk producers and running quality contests are envisaged. This would ensure better remunerative pricing to farmers while ensuring a quality product for consumers. The Food Safety and Standards Authority of India (FSSAI) shall be strengthened and given more administrative powers to get this on the ground.

9. Currently 10 lakhs litres/day collected/processing capacity by OMFED and 3.7 lakhs litres/day by private processors; a total of 13.7 lakhs litres/day milk is collected/processed per day in Odisha. A 200 working day in a year is also used for the calculation.

3.8 Investment budget

Table 6. Investment interventions and costs in feed/breeding/health/research and extension/Marketing improvements in crores

S/ No.	Investment intervention	Years					Total for 5 years	Public	Private
		2022	2023	2024	2025	2026			
1	Investments to improve feeding	12.6	12.6	12.6	12.6	14	64.5	29.1	35.4
	Strengthen the existing pasture/forage seed quality control laboratories. Investments are needed for enhancing quality checks and ensuring proper distribution. One crores per year for the next 5 years	1	1	1	1	1	5	5	0
	13 fodder demonstration farms and 8 fodder seed production farms will be strengthened in the coming five years and will become up to 90% operational (manpower, machine, infrastructure—irrigation, fences etc.)	3	3	3	3	3	15	15	0
	Encourage private investment in fodder production such as alfalfa, and hybrid Napier for sourcing by the dairy industry. Government support in the form of land	2	2	2	2	2	10	0	10
	Private fodder seed production farms that supply quality fodder seeds (28, 47 and 66 ha fodder seed production land in the first, second and third five years, respectively)					1.4	1.4	0	1.4
	Use of crop residues and conversion to feed blocks. 20 machines per livestock production zone. Each machine costs INR 8 lakhs	4.8	4.8	4.8	4.8	4.8	24		24
	Promote silage making program in Hilly and Mountain and North-West livestock production zones under disaster management program for use in the Coastal Plain zone. For 10 t production/year—the total maize cost is 61 thousand. The government gives a 90% subsidy	1.8	1.8	1.8	1.8	1.8	9.1	9.1	0
2	Breeding investments	7	30	15	10	20	82	82	0
	Increase the capacity of the existing semen bank in the year 2022 and add one more new semen bank in the year 2026. The existing semen production centre capacity will increase to 20 lakhs straws/year by improving the station (only purchase of bulls—land for feed production is required). It is targeted to add one more semen production centre with a capacity of about 15 lakhs straws/year in 2026/27	2				5	7	7	0
	By 2026/27, all the existing 8 breeding farms will be functional and upgraded. High-grade animals should be included in the farms. One farm to be used for embryo transfer, sexed semen and molecular genetic purposes	5		5		5	15	15	0
	Upgrade the existing facility at Cuttack to a liquid nitrogen production plant in 2023 and create 3 liquid nitrogen storage plants in the coming five years, one per zone		30	10	10	10	60	60	0

S/ No.	Investment intervention	Years					Total for 5 years	Public	Private
		2022	2023	2024	2025	2026			
3	Animal health investments	174.8	148.5	133.5	108.5	112.9	678.2	578.2	100
	The number of veterinary dispensaries will increase from the current 541 to 650 by 2026/27. The cost of establishing a veterinary dispensary is INR 2 crore	58	40	40	40	40	218	218	0
	The current number of mobile veterinary service providers are 314 and will increase to 450 by 2026/27. Subsequently 30 mobile clinics per year for the next 10 years	10.8	7.5	7.5	7.5	7.5	40.8	40.8	0.0
	Increase the number of aid centres in Odisha to 3,239 by 2026/27, 4,000 by 2030/31 and 5,000 by 2035/36. Additional 20 Gaushalas per year to be considered under this budget under the subsidy scheme	60	60	60	60	64.4	304.4	304.4	0
	Improve the capacity of Odisha Biological Products Institute and its satellite will be strengthened, re-equipped and modernized with the necessary infrastructure	5		5			10	10	0
	Under the Odisha industrial policy, promote three veterinary pharmaceutical manufacturing facilities to meet the need of the state. Companies may be provided with additional incentives in the form of a veterinary pharma and biological park where the necessary vaccines can also be manufactured. The incentives can be in the form of subsidies for land and a common effluent treatment system	40	40	20			100	0	100.0
	Improve the capacity of the 30 diagnostic laboratories in Odisha	1	1	1	1	1	5	5	0
4	Education, research and extension services	211	161.7	112.45	63.25	64.11	612.5	512.2	100
	One regional livestock research centre will be established. The cost of establishment would be about INR 10 crores per centre. In addition, the recruitment of VAS and Pashu Sahayaksto, 100 people. The recruitment cost has to be factored into the operational budget and is likely to cost the exchequer about INR 9.5 crores per year.	10	10.7	11.5	12.3	13.1	57.5	57.5	0
	Establish one Dairy Science College under the proposed Animal and Fishery Science University that can serve as a dairy excellence centre. It shall have undergraduate and diploma programs besides catering to farmer training		50				50	50	0
	Strengthen the telecommunication extension service. Introduce ICT for mobile clinics and AI intervention using SMS/WhatsApp	1	1	1	1	1	5	5	0
	Establish Animal Sciences and Fisheries University in the state of Odisha (as per the proposal already in action) and investment in veterinary college in the private sector (Siksha O Anusandhan)	200	100	100	50	50	500	400	100

S/ No.	Investment intervention	Years					Total for 5 years	Public	Private
		2022	2023	2024	2025	2026			
5	Marketing and processing investments	44	50	55.6	60.6	65.9	276.1	250	26.1
	Promote local products by incentivizing the HORECA segment in the first five years	10	10	10	10	10	50	50	0
	Quality enhancement program for the industry. This include the proposed auto milk analysers to be attached to the BMCs of OMFED	10	10	10	10	10	50	50	0
	Improve the collection system by incentivizing the farmers in the Hilly and Mountain region and put the unused assets of BMCUs back on track in the first five years starting from 2022	20	25	30	35	40	150	150	0
	Bulk milk collection system to collect raw milk from producers and bulkers. In the first 5 years 140 to be initiated by the private processors	2	3	3.6	3.6	3.9	16.1	0	16.1
	Modern retail trade points for promoting milk products by the industry. 100 per year over the next 5 years	2	2	2	2	2	10	0	10
6	Other marketing	300	300	300	300	300	1,500	1,500	0
	Midday meal scheme for children and mothers in family as well as nursing mothers. Each to get 100 ml milk per day for 200 days. 20 litres of milk per person and the number of beneficiaries to be 50 lakhs	300	300	300	300	300	1,500	1,500	0
7	Grand total	749.4	702.8	629.1	554.9	576.9	3,213.2	2,951.8	261.4

Source: Odisha LMP analysis.

The investment costs of dairy improvement interventions are categorized into six major intervention areas feed, genetics and breeding, animal health, education, research and extension services, marketing and processing and other marketing costs (Table 6). The total investment budget of the dairy roadmap for the five year LMP period (2022–2026) is about INR 3,200 crores.

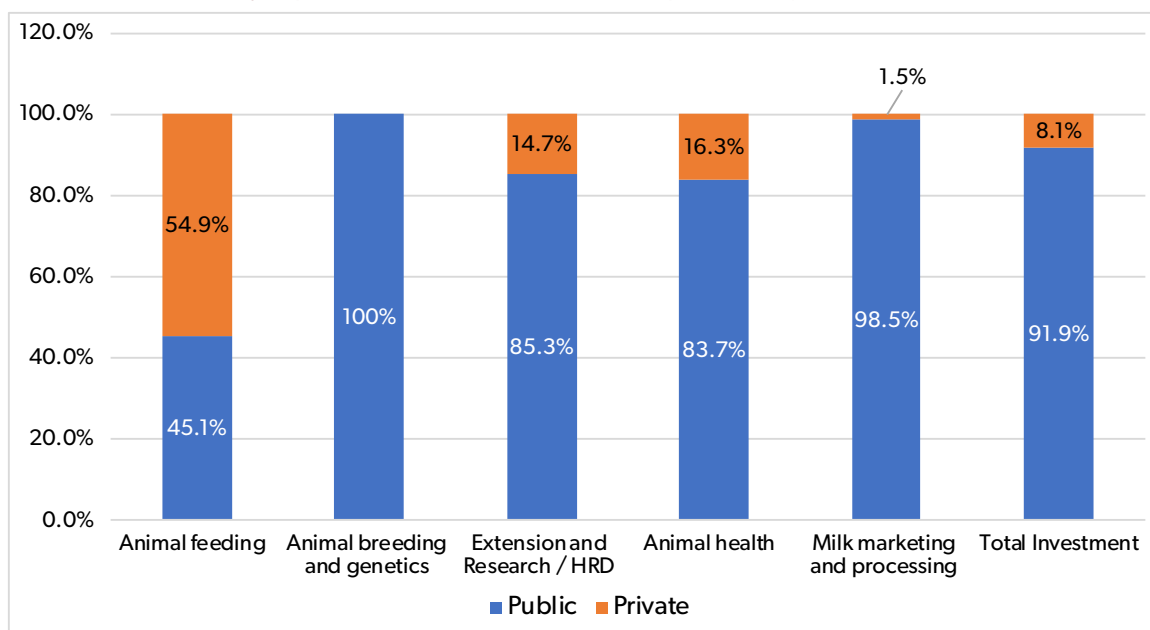
Table 7. Total dairy roadmap investment, costs from public and private sources and proportion by investments categories (2021/22 to 2026/27)

Investment categories	Investment cost (INR crores)			The proportion of total investment
	Public	Private	Total	
Animal feeding	29.1	35.4	64.5	2.0%
Animal breeding and genetics	82	–	82	2.6%
Extension and research/HRD	578.2	100	678.2	21.1%
Animal health	512.5	100	612.5	19.1%
Milk marketing and processing	1,750.0	26.1	1,776.1	55.3%
Grand total	2,951.8	261.5	3,213.3	100.0%

Source: Odisha LMP analysis.

Most of this investment, about 92%, has to come from the public sector since a large portion of the investments is for construction and upgrading the public extension, research, breeding and marketing and processing infrastructures and facilities (Figure 2). The private sector accounts for about 8% of the total dairy investment. The investment budget allocated for interventions that will improve milk marketing and processing is the largest, with about 55% of the total dairy investment. The health improvement interventions accorded a second largest budget, followed by research and extension improvements.

Figure 2. The share of dairy improvement investment costs from public and private sources (2021/22 to 2026/27).



3.9 Impacts of interventions

3.9.1 Returns on investment (ROI) over 15 years

Due to the long-term growth of livestock investments, the ROI analysis was conducted over 15 years. Under a WI scenario, a higher internal rate of return (IRR) is observed among commercial dairy farming systems compared to indigenous breeds. Crossbreeds in the Coastal Plain zone are projected to record the highest IRR of 36% compared to North-West's 26% and Hilly and Mountain zone's 25%. This illustrates how financially viable investments in relation to dairy improvements interventions in commercial breeds are compared to indigenous breeds.

3.9.2 Projected income increases per animal in 5 years

The annual income per animal from investing in the WI scenario is compared with the income under BAU for the 5th year of the LMP 2026/27, to identify the percentage changes in dairy animal income associated with WI over BAU for crossbreeds and indigenous animals (Table 8). The per cent changes in annual dairy animal income associated with WI over the BAU investment scenario are positive and significant. The annual income increase per animal for crossbreeds is higher in all zones and more attractive than for indigenous animals. Meanwhile, not surprisingly, in terms of absolute income amounts, the highest incomes per animal under either scenario (WI or BAU) is observed to be in commercial dairying, followed by crossbred cows in the Coastal Plain zone (with its preferable agro-ecological conditions for dairying) and North-West zone.

Table 8. Cattle income per animal under BAU (2026/27) and WI (2026/27) in INR

Production zone	Species	Annual income per animal (in INR) in 2026/27			
		Base year (2021/22)	BAU (2026/27)	WI (2026/27)	Change in % between BAU and WI (2026/27)
Hilly and Mountain	Indigenous	1,262	1,347	1,568	16%
	Crossbreed	14,749	15,245	17,093	12%
North-West	Indigenous	2,417	2,533	2,900	14%
	Crossbreed	20,766	21,732	23,815	10%
Coastal Plain	Indigenous	3,301	3,314	4,448	34%
	Crossbreed	27,450	28,305	33,235	17%
Commercial	Crossbreed large size	44,180	45,563	47,055	3%

Source: Odisha LMP analysis.

3.9.3 Milk production

The projected milk production under a WI scenario for 5 years is summarized in Table 9. From the analysis, several observations can be made:

For cattle, milk production increases from 21,739.25 lakhs litres in 2021/22 to 32,106.5 lakhs litres in 2026/27, representing a 47.7% increase over the 5 years for all breeds of cattle in all production zones.

Total milk production for indigenous cattle breeds over the 5 years increases by 30% from 5,353.8 lakhs litres in 2021/22 to 6,962.6 lakhs litres in 2026/27, an increase of 30%.

Total milk production from indigenous cattle breeds in absolute value is highest in the Coastal Plain production zone than in the other two zones though it has a lower percentage change than the Hilly and Mountain zone.

Table 9. Cattle and goat milk production projected for 5 years under WI scenario (in lakhs litres)

Species	Production zone	Breed	Milk production (in lakhs litre)						Change in %
			Baseline 2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	
Cattle	Hilly and Mountain	Indigenous	607.9	651.6	698.6	748.9	802.8	860.6	41.6%
		Crossbreed	1,757.8	1,905.5	2,065.6	2,239.2	2,427.3	2,631.2	49.7%
		Subtotal	2,365.8	2,557.3	2,764.3	2,988.1	3,230.1	3,491.6	47.6%
	North-West	Indigenous	1,505.3	1,576.4	1,650.8	1,728.7	1,810.3	1,895.7	25.9%
		Crossbreed	3,337.2	3,612.9	3,911.3	4,234.4	4,584.2	4,962.9	48.7%
		Subtotal	4,844.8	5,192.9	5,566	5,965.9	6,394.5	6,853.9	41.5%
	Coastal Plain	Indigenous	3,240.2	3,413.9	3,597	3,789.9	3,993.2	4,207.4	29.8%
		Crossbreed	10,860.9	11,881.6	12,998.3	14,219.9	15,556.3	17,018.3	56.7%
		Subtotal	14,108	15,306.7	16,607.3	18,018.4	19,549.4	21,210.5	50.3%
	Commercial dairy	Crossbreed	419.1	443.1	468.5	495.3	523.7	553.7	32.1%
Cattle subtotal production	Indigenous	5,353.8	5,642.7	5,947.2	6,268.1	6,606.2	6,962.6	30.1%	
	Crossbreed	16,376.5	17,845.5	19,446.3	21,190.6	23,091.5	25,162.9	53.7%	
	Total	21,739.2	23,502.4	25,408.7	27,469.6	29,697.7	32,106.5	47.7%	
Goat	Odisha	Indigenous	6.2	6.2	6.2	6.2	7.4	7.7	23.7%
Total			21,745	23,509	25,415	27,476	29,705	32,114.1	47.7%

Source: Odisha LMP analysis.

Crossbred total milk production witnesses an increase of approximately 54% over the 5 years, increasing from 16,377 lakhs litres in 2021/22 to 25,163 lakhs litres in 2026/27.

Total milk production from crossbred cattle in the Coastal Plain (17,018 lakhs litres) is higher by 3 times from the North-West zone (4,963 lakhs litres) and by 5 times from Hilly and Mountain (2,631 lakhs litres). The percentage increase in milk production indicated that a higher percentage increase is observed in Coastal Plain (approximately 50%) followed by Hilly and Mountain (47.6%) and least in North-West (approximately 41.5%), over the 5 years.

Total milk production from commercial dairy breeds has the lowest in terms of absolute value, increasing from just 419 lakhs litres in 2021/22 to 553.7 lakhs litres in 2026/27, representing a 32% increase.

Milk production from indigenous goats remains stable over 3 years and slightly increases from 2024/25. On average, the milk increase from the indigenous breed has about 32.4 increase over the five years. However, between 2021/22 to 2026/27, goat milk production will witness an increase of only 23.7% over the period.

The total milk production from both cattle and goats in the state will increase by 48% over the period 2021/22 and 2026/27.

3.9.4 GSDP of milk

The GSDP contribution of cattle and goat milk under a WI scenario shows that between 2021/22 and 2026/27, a percentage contribution of 54% is witnessed under the 5 years (Table 10). In absolute terms, GSDP contribution of total milk from cattle and goats will increase from INR 5,086 crores in 2021/22 to INR 7,854 crores in 2026/27. Concerning the types of milk produced, the LMP analysis shows that the highest GSDP contribution will come from milk production from family crossbreeds which will increase from INR 4,100 crores in 2021/22 to INR 6,276 crores in 2026/27, representing a 53% increase. Milk from commercial dairy farms has the lowest GSDP contribution in absolute terms, increasing from INR 109.2 crores to INR 143.6 crores (32%).

Table 10. Cattle and goat milk GSDP contribution projected for five years under WI scenario (in crores INR)

Products	GSDP (in crores INR)						Change in %
	Baseline 2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	
Milk—family indigenous	877	967.8	1,068	1,178.8	1,300.7	1,435.4	63.7%
Milk—family crossbreeds	4,099.5	4,464	4,860.8	5,293	5,763.6	6,276	53.1%
Milk—commercial dairy	109.2	115.4	121.9	128.7	136	143.6	31.5%
Total milk	5,086.2	5,547.9	6,051.6	6,601	7,200.2	7,853.9	54.4%
Manure	5,498.5	5,469.8	5,441.2	5,412.7	5,384.4	5,356.3	–2.6%
Traction power	6,053.8	5,941.1	5,830.6	5,722.2	5,615.7	5,511.3	–9%
Total	16,711.5	17,071.9	17,440	17,816.1	18,200.4	18,592.8	11.3%

Source: Odisha LMP analysis.

3.10 Activities timeline and sequencing: Gantt chart

Table 11. Activities timeline and sequencing: Gantt chart for 5 years LMP period

Investment interventions	Activities timeline				
	2022/23	2023/24	2024/25	2025/26	2026/27
Investments to improve feeding					
Strengthen the existing pasture/forage seed quality control laboratories. Investments are needed for enhancing quality checks and ensuring proper distribution					
13 fodder demonstration farms and 8 fodder seed production farms will be strengthened in the coming 5 years and will become up to 90% operational (manpower, machine, infrastructure irrigation, fences etc.)					
Encourage private investment in fodder production such as alfalfa and hybrid Napier for sourcing by the dairy industry					
Private fodder seed production farms that supply quality fodder seeds (28 ha fodder seed production land in the first 5 years)					
Use crop residues and conversion to feed blocks. Twenty machines per livestock production zone					
Promote silage making program in Hilly and Mountain and North-West livestock production zones under disaster management program for use in the Coastal Plain zone					
Breed improvement interventions					
Increase the capacity of the existing semen production centre in the coming 5 years and add one more new semen production centre in the period 2026/27					
By 2026/27, all the existing 8 breeding farms will be functional and upgraded. High-grade animals should be included in the farms. One farm to be used for embryo transfer, sexed semen and molecular genetic purposes					
Upgrade the existing facility at Cuttack to a liquid nitrogen production plant in 2023 and establish 3 liquid nitrogen storage plants in the coming 5 years, 1 per production zone					
Animal health investments					
The number of veterinary dispensaries will increase from the current 541 to 650 by 2026/27					
The current 314 mobile veterinary service providers will increase to 450 by 2026/27. Subsequently, 30 mobile clinics per year for the next 10 years					
Increase the number of aid centres in Odisha to 3,239 by 2026/27					
Improve the capacity of Odisha biological products institute and its satellite will be strengthened, re-equipped and modernized with the necessary infrastructure					
Under the Odisha industrial policy, promote three veterinary pharmaceutical manufacturing facilities to meet the needs of the state. Companies may be provided with additional incentives in the form of a veterinary pharma and biological park wherein the necessary vaccines can also be manufactured. The incentives can be in the form of subsidies on land and a common effluent treatment system					
Improve the capacity of the 30 diagnostic laboratories in Odisha					
Education, research and extension services improvement interventions					
One regional livestock research centre will be established. The establishment cost would be about INR 10 crores per centre. In addition, the recruitment of VAS and Pashu Sahayaksto of 100 people. The recruitment cost has to be factored into the operational budget and is likely to cost the exchequer about INR 9.5 crores per year					

Investment interventions	Activities timeline				
	2022/23	2023/24	2024/25	2025/26	2026/27
Establish one dairy science college under the proposed Animal and Fishery Science University that can serve as a dairy excellence centre. It shall have undergraduate and diploma programs besides catering to farmer training					
Strengthen the telecommunication extension service. Introduce ICT for mobile clinics and AI intervention using SMS/WhatsApp					
Establish Animal Sciences and Fisheries University in the state of Odisha (as per the proposal already in action) and invest in a veterinary college in the private sector (Siksha O Anusandhan University)					
Marketing investments					
Midday meal scheme for children and mothers in the family as well as nursing mothers. Each to get 100 ml milk per day for 200 days. 20 litres of milk per person and the number of beneficiaries to be 5 million					
Promote local products by incentivizing the HORECA segment in the first five years					
Quality enhancement program for the industry					
Improve the milk collection system by incentivizing the farmers in the Hilly and Mountain region and put the unused assets of BMCUs back on track in the first five years starting from 2021/22					
Bulk milk collection system for collecting raw milk from 140 producers and bulkers					
Modern retail trade points will be established (100 per year over the next 15 years) for promoting milk products by the industry					
Other marketing					
Midday meal scheme for children and mothers in the family as well as nursing mothers. Each to get 100 ml milk per day for 200 days. 20 litres of milk per person and the number of beneficiaries to be 50 lakhs					

3.11 Complimentary success requirements

- Ensuring consistent and intensive extension service is delivered to farmers.
- Recruiting enough staff in the Directorate of Animal Husbandry and Veterinary Services and Block Veterinary Offices (BVO) for implementing interventions.
- Collecting and processing milk services in the state are improved.
- Conducive policies, regulations and incentive regimes for private investment in extension, feed, breed, animal health services, milk processing and marketing.
- The coverage and effectiveness of AI services are improved and the use of sexed semen increased.
- Good governance and monitoring framework for the impact of interventions.

3.12 Gender and social inclusion

Smallholders produce nearly 80% of milk in the state, and under the Operation Flood II program, OMFED has organized around 1.5 lakhs women in 1,292 dairy cooperatives. However, gender division of labour places these women dairy farmers in low skilled positions with limited processing and marketing roles as significant gender inequalities exist in the sector. Overcoming these inequalities requires evolving suitable gender and social inclusion strategies that have the potential to generate significant economic and social gains. Some key inequities experienced by women in the dairy sector that need attention are:

- Social and cultural barriers that limit their engagement and voice.
- Gaps in information, knowledge and skills related to livestock production, animal health, food safety, nutrition, biosecurity and zoonosis.
- Lack of market information and limited access to formal markets.
- Gaps in skills and knowledge to participate in all nodes of the livestock value chain and industry.
- Gaps in ownership and control over animals and income derived from them.

Focused interventions and investments are needed that allow marginalized communities and women to participate in and benefit from the dairy sector. Investments in reaching extension to women dairy farmers are crucial and should include approaches that factor in differential needs and capabilities of men, women and youth, including the tribal and marginalized communities. Gender sensitive training for veterinarians and extension workers is needed so that they understand the differential needs of farmers and include both husband and wife in training.

Support gender and social inclusion strategies in marketing chains to ensure the participation of women at various nodes and not just as producers. For this, establish small-scale, hygienic milk collection centres close to producers, develop women as dairy entrepreneurs, link them with milk cooperatives and include them in leadership roles. This has to be duly supported by providing women training in production, leadership, marketing and business skills to ensure equal opportunities. Also, sensitize the livestock industry to recruit women workers and create awareness of the benefits of employing both men and women.

Invest in technologies that reduce women's work time and drudgery to empower them since these technologies/practices allow them to do more productive work. For instance, machinery for chopping fodder, training women dairy farmers in Azolla cultivation, balanced feed formulation, use of moringa leaves for feeding etc. can increase production and subsequent incomes.

Build linkages with Mission Shakti's WSHGs and use this platform to train women dairy farmers on good husbandry practices. Similarly, working with the dairy development department and private sector is recommended to enable training of women on food safety and hygienic milking practices, entrepreneurial and technical skills in product development and Animal Source Foods (ASF) value addition (e.g., ghee, paneer, sweets etc.).

Link the women farmers from WSHGs/producer groups/FPOs to Odisha Rural Development and Marketing Society (ORMAS) to enable them to sell value added livestock products through Pallishree Melas and 'Sisir Saras' at competitive prices.

3.13 Conclusions

The dairy sector plays a vital role in economic development and poverty reduction in Odisha as it is an important source of GSDP, household income and food (milk and other dairy products). The rising demand for milk and milk products with growing urbanization and rise in per capita income in the state presents an opportunity for producers, including marginal and landless households and rural women, to realize improved income by participating in various activities in the dairy value chain. While impressive growth has been witnessed in the dairy sector thanks to efforts by the government, numerous factors limit the growth and performance of the dairy sector, including lack of availability of improved germplasm, inadequate supply of quality semen, the occurrence of diseases, shortage of feed and fodder, frequent occurrence of floods and cyclones and low-level market linkages. Furthermore, many socio-economic and institutional factors, including shrinking common lands for grazing, lack of access to markets, credit, and information about livestock technologies, restrict farmers from realizing the production potential of their animals. The role of the dairy sector in economic development, women empowerment and poverty reduction in Odisha could significantly be improved through additional investments to address these challenges compared to the current level.

Because dairy production in Odisha is found in all areas of the state, the proposed dairy improvement interventions recommend targeting the whole state and both indigenous and crossbred cattle. However, to ensure viability, the recommended interventions are specific to the different production zones and systems. Additionally, in each case, the proposed interventions include those that can easily lead to quick benefits and desired impacts (low hanging fruits) and seek to build and complement previous and ongoing efforts. To address the challenge of lack of feed, proposed activities seek to ensure: an increase in the use of crop residues as animal feed, improve the quality and nutritional value of crop residues, increase fodder production and improve the availability of concentrate feeds. To ensure genetic improvement in dairy animals, increased use of AI and sexed semen will be promoted. Other interventions include investments to enhance research and extension, delivery of animal health services and improvement in milk processing and marketing.

With additional investments to address the prevailing limitations in the dairy sector, the milk supply is projected to rise from 218 crores litres in 2021/22 to 321 crores litres in 2026/27. This will avert a deficit in the milk supply that is projected to occur in the next 5 to 6 years if no additional investments are made. The additional investments are also projected to lead to significant increases (20–35% in indigenous cattle breeds and 15–21% in crossbred cattle) in income per animal. In addition, the additional investments will lead to a 54% increase in the contribution of cattle and goat milk to GSDP.

4 Red meat value chain roadmap (2022 to 2026)

4.1 Key LSS red meat related results and conclusions—the basis for the red meat value chain roadmap recommendations

Small ruminants play a crucial role in the livelihood of over 30% of the rural population in Odisha. Small ruminants are reared predominantly by women, the landless and marginal farmers, including nomadic and ethnic tribal groups (Kumar and Roy 2013). They are regarded as poor man's cows and serve as an important occupation in dry/upland land farming. The density of the small ruminant population positively correlates with the percentage of forest cover and the proportion of scheduled tribes (IFAD 2018).

Odisha is one of the states endowed with many goats and sheep and it ranks 9th in the goat population (Government of Odisha 2021). As in other Indian states, goats and sheep in Odisha are reared in a traditional and subsistence manner (LAVS 2020). This traditional way of keeping goats and sheep is characterized by high mortality and low productivity due to multiple challenges, including poor breeding, lack of access to animal health care and lack of sufficient feeds. Abuse by middlemen during marketing is also a major challenge. The proposed set of interventions for improving the performance of the small ruminants' subsector includes improving animal health, nutrition and breeding service delivery, enhancing the availability of quality feed, effective policy for better use of Common Property Resources (CPRs), strengthening goat breeding and fodder farms and enhancing access to input and output markets by encouraging the formation of FPOs. Also, strengthening women's participation and leadership roles in existing or new livestock-related groups could help in improving the performance of small ruminants in Odisha.

The demand for goat meat has increased over the years due to urbanization and increasing household income. Odisha can enhance meat production to meet this demand from small ruminants using its forest resource, which covers 30% of the state's land and by the adoption of good husbandry practices. Results of the foresight analysis on the impact of the proposed additional investments (WI) vs the business as usual (BAU) scenarios showed that:

- With additional investments, the goat population in Odisha will increase by 75.6% between 2020/21 and 2035/36 compared to a reduction of 1.5% in the BAU scenario. Consequently, with additional investments, goat meat production is predicted to increase by 90% (from 32,223 t in 2020/21 to 61,311.8 t in 2035/36), compared to a decrease of 2% when there is no additional investment.
- In the goats' subsector, the additional proposed investments are associated with a positive net present value (NPV) (INR 5,600–49,500) and internal rate of return (IRR) (23–36%).
- The GSDP contribution of goat meat increases from INR 1,858.7 crores in the base year (2020/21) to INR 3,385 crores in 2035/36, representing an 82% increase in the WI scenario compared to a decrease of 2% (from INR 1,858 crores in 2021/21 to INR 1,822 crores) for the BAU scenario.

- The sheep population is projected to increase by 76% in the 15 years in an investment scenario compared to a 10% decrease in the BAU scenario. With additional investment, there will be a 92% increase in mutton production (from 5,612 t in 2020/21 to 10,7866 t in 2035/36) compared to a 10% decrease in the BAU scenario.
- For sheep in all production zones and systems, projections in the WI scenario show positive values of NPV (INR 8,800–71,500) and IRR (24–44%), confirming that the investments are economically worthwhile.
- With additional investments, the GSDP contribution of sheep production is projected to increase from INR 281.8 crores in the base year (2020/21) to INR 512.9 crores in 2035/36, representing an 82.1% increase compared to a decrease of 11% in the BAU scenario.
- The quantity of goat and sheep meat demanded in Odisha state is projected to increase by 93.53% (from 139 thousand t in 2020/21 to 269 thousand t in 2035/36). The quantity of red meat (both goat and sheep meat) produced is expected to decrease by 2.12% in a BAU scenario compared to an increase of 90.5% in the WI scenario.
- Although goat and sheep meat production is expected to increase significantly with additional investment, due to the projected rapid increase in expected demand for red meat, it will not be possible to close the gap by 2035/36 with the projected impact of the additional interventions.

4.2 Five-year LMP vision for the small ruminant value chain

The five-year red meat value chain improvement intervention vision is to increase the production of goat and mutton to alleviate the red meat production–consumption gap by increasing red meat production in the state. Goat meat and mutton production in the state is planned to grow by 28 and 29%, respectively, in the coming five years (2021/22 to 2026/27). Goat meat and mutton contribution to the state GSDP will also increase from INR 1,937 and 29.3 crores by 2021/22 to INR 2,382 and 36 crores, respectively, by 2026/27, a respective 23 and 22% increase.

4.3 Investment scenarios analysed

In the investment analysis performed to create medium-term or 5-year roadmaps for Odisha, two levels of investment scenarios and their implications for goat and sheep productivity and incomes; goat and sheep meat, milk, and skin production, and the contributions of the goat and sheep subsector to GSDP are examined. This is to provide two choices for the livestock planning unit, and decision-makers in Odisha state: farmers and new goat and sheep keepers, the government, private investors and development partners (donors). These scenarios are referred to us here as BAU and WI.

- **BAU scenario** This is the base case scenario where there will be no additional investment or any change in the types of investment. This scenario analysis shows the impact of continuing the current type and level of investment and recurrent spending on production and contribution to GSDP.
- **WI scenario** This is a scenario where there will be additional red meat investment improvement. This scenario analysis will show the impacts of the additional investments of proposed interventions on production and productivity and contribution to GSDP.

4.4 Description of the red meat production systems

The red meat value chain analysis includes both goat and sheep production in Odisha. A description of the base year goat and sheep production systems describes the productivity parameters of the farm system herds in the three designated livestock production zones (Hilly and Mountain, North-West and Coastal Plain) (Tables 12 and 13).

Classification of livestock production systems in the three regions considers dominant species, feeding practices and potential for future improvement. Goat and poultry dominate in North-West and Hilly and Mountain zones, whereas cattle are dominant in the Coastal Plain zone. There are large differences in feed management between the zones. Farmers in the Coastal Plain mostly depend on stallfeeding and less depend on grazing.

Table 12. Goat production system average productivity parameter

Parameters	Hilly and Mountain		North-West		Coastal Plain	
	Small	Large	Small	Large	Small	Large
Herd size	4.5	15	4.5	23	4	15
Parturition rate	1.5	1.5	1.5	1.5	1.5	1.5
Rate of net prolificacy	1.25	1.25	1.5	1.5	1.5	1.5
Mortality rate (per year)	21.5%	24.5%	20.3%	22.5%	19.5%	23.2%
Offtake rate	50.2%	49.2%	54.7%	53.8%	68%	66.2%
Dressing percentage (%)	50%	50%	50%	50%	50%	50%
Weight kg (female juveniles)	5	5	5	5	5	5
Weight kg (male juveniles)	6	6	6	6	5	5
Weight kg (female subadult)	14	14	14	14	13	13
Weight kg (male subadult)	15	15	15	15	13	13
Weight kg (female adult)	20	20	20	20	18	18
Weight kg (male adult)	22	22	22	22	20	20
Length of milking period (days)	90	90	90	90	90	90
Daily average milk production (litre)	0.002	0.002	0.002	0.002	0.002	0.002
Share female population	66%	67%	63%	63%	74%	74%
Male population	34%	33%	37%	37%	26%	26%

The forest vegetation is the source of feed for small ruminants in Hilly and Mountain. The Coastal Plain has also better irrigation facilities and thus better access to water than the other two zones. The goat and sheep production systems are characterized mainly by small household herds of animals. The parturition rate for goats is 1.5, while it is 1 in the case of sheep. There is no difference in parturition rate among different production zones. However, there is a difference in prolificacy rate, which varies from 1.25 to 1.5 for goats (Table 12) and 1.1 to 1.5 for sheep (Table 13).

Table 13. Sheep production system—average productivity parameter

Parameters	Hilly and Mountain		North-West		Coastal Plain	
	Small	Large	Small	Large	Small	Large
Herd size	4.5	10	5	25	5	15
Parturition rate	1	1	1	1	1	1
Rate of net prolificacy	1.1	1.1	1.1	1.1	1.5	1.5
Mortality rate (per year)	7.6%	7.6%	6.9%	6.9%	15.9%	15.9%
Offtake rate	43.1%	43.2%	41.5%	41.8%	56.2%	56.3%
Dressing percentage (%)	50%	50%	50%	50%	50%	50%
Weight kg (female juveniles)	5	5	5	5	5	5
Weight kg (male juveniles)	5	5	5	5	5	5
Weight kg (female subadult)	13	13	13	13	14	14
Weight kg (male subadult)	17	17	17	17	18	18
Weight kg (female adult)	20	20	20	20	22	22
Weight kg (male adult)	24	24	24	24	25	25
Share female population	68%	68%	63%	63%	76%	76%
Male population	32%	32%	37%	37%	24%	24%

The prolificacy rate for goats is found higher in Coastal Plain and North-West (1.5) compared to Hilly and Mountain (1.25). The net prolificacy rate of sheep is 1.5 in Coastal Plain and 1.1 in Hilly and Mountain and North-West zones. The bodyweight of an adult male goat is higher in Hilly and Mountain (22 kg) while it is 20 kg in the case of Coastal Plain (Table 12).

4.5 Overall targets at the state and animal level

4.5.1 Targets at the state level

In the LMP base year, 2021/22, there are about 66.1 lakhs goats in Odisha and this is projected to increase by 20.6% to 79.7 lakhs by 2026/27 (Table 14).

Amongst the three production zones, the North-West zone is projected to have more increased goat numbers (21.9%) compared to the Hilly and Mountain zone (21.4%) and Coastal Plain production zone (16.6%) (Table 14).

Table 14. Number of goats projected for 2021/22 to 2026/27

Species	Production zone	Average flock size	Livestock population (in lakhs)						Change in %
			Base year 2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	
Goats	Hilly and Mountain	Small (1–10)	13.1	13.6	14.1	14.7	15.2	15.8	20.6%
		Large (>10)	3.3	3.5	3.6	3.8	4.0	4.2	27.3%
		Total	16.5	17.1	17.8	18.5	19.2	20	21.2%
	North-West	Small (1–20)	27.7	28.8	30.0	31.2	32.4	33.7	21.7%
		Large (>20)	7	7.3	7.6	7.9	8.3	8.6	22.9%
		Total	34.7	36.1	37.5	39.1	40.6	42.3	21.9%
	Coastal Plain	Small (1–10)	11.9	12.3	12.7	13.1	13.4	13.8	16.0%
		Large (>10)	3.0	3.1	3.2	3.3	3.5	3.6	20.0%
		Total	14.9	15.4	15.9	16.4	16.9	17.4	16.8%
Grand total population			66.1	68.6	71.2	73.9	76.7	79.7	20.6%

Source: Odisha LMP analysis.

In absolute numbers, the goat population in the North-West zone is projected to be more (40.63 lakhs) than in the Hilly and Mountain zone (19.21 lakhs) and Coastal Plain zone (16.89 lakhs) (Table 14).

The sheep population in 2021 is about 12.1 lakhs and is targeted to reach 14.6 lakhs by 2026, an increase of 62% (Table 15).

Under the Coastal Plain production zone, total sheep production is projected to increase by 25.3% more than in the Hilly and Mountain zone (23.5%) and North-West zone (13.5%) (Table 15).

In all production zones, the sheep population in small farm sizes is projected to increase marginally compared to the sheep population increase in large size farms (Table 15).

In the North-West zone, the sheep population in small farm sizes is expected to increase from 2.5 lakhs to 2.86 lakhs, whereas the sheep population under large size farms will increase from 1.66 lakhs to 1.86 lakhs in five years (Table 15).

Table 15. Number of sheep projected for 2021/22 to 2026/27

Species	Production zone	Average flock size	Base year 2021/22	Livestock population (in lakhs)					Change in %
				2022/23	2023/24	2024/25	2025/26	2026/27	
Sheep	Hilly and Mountain	Small (1–10)	3.6	3.8	3.9	4.1	4.3	4.5	25.0%
		Large (>10)	1.6	1.6	1.7	1.8	1.8	1.9	18.8%
		Total	5.2	5.4	5.6	5.9	6.1	6.4	23.1%
	North-West	Small (1–20)	2.6	2.6	2.7	2.8	2.9	2.9	11.5%
		Large (>20)	1.7	1.7	1.8	1.8	1.9	1.9	11.8%
		Total	4.3	4.4	4.5	4.6	4.7	4.8	11.6%
	Coastal Plain	Small (1–10)	2.5	2.6	2.7	2.9	3	3.1	24.0%
		Large (>10)	0.6	0.7	0.7	0.7	0.8	0.8	33.3%
		Total	3.1	3.3	3.4	3.6	3.7	3.9	25.8%
Grand total population			12.6	13	13.5	14	14.6	15.1	20.5%

Source: Odisha LMP analysis.

Though the Coastal Plain production zone is projected to increase more in percentage terms compared to the other two zones, in absolute sheep numbers, the projected increase (3.13 to 3.74 lakhs) is less than in Hilly and Mountain (4.95 to 6.11 lakhs) (Table 15).

In 2021, meat production from goats, which is about 185.2 t, is projected to increase to 222.6 t by 2026, representing a 29% increase over the 5-year LMP period (Table 18).

Sheep meat production, on the other hand, which is about 43.5 t in 2021, is expected to grow by 37% to 52.5 t by 2026 (Table 18).

The contribution of goat meat to GSDP is about INR 1,858.7 crores in 2021, and it is expected to increase to INR 2,285.1 crores in 2026, representing a 23% increase (Table 19).

On the other hand, sheep meat is expected to contribute 22% to GSDP, increasing from INR 28.2 crores in 2021 to INR 34.4 crores in 2026 (Table 19).

4.5.2 Targets at zonal animal levels

The animal and herd level targets that could be achieved by farmers adopting the proposed red meat improvement technologies, for goats and sheep include are as follows:

- The parturition rate of sheep is expected to increase by 15%. However, the parturition rate of goats may not change as it is already very high at the base year (1.5 per year).
- Mortality of both goats and sheep is expected to decrease by 30–40%.
- The live weight of goats and sheep will increase by 10–15%.
- The price of skins will increase by 20–30% due to improved skin quality resulting from external parasite treatment/control undertaken.

4.6 Opportunities, challenges and strategies

As stated earlier on, small ruminants, especially the goat subsector, can play a crucial role in reducing poverty among the rural population, especially the landless, the poor, women and the marginal farmers, including nomadic and

ethnic tribal groups. Goat farming is widespread and the source of livelihood in Odisha's rural population, especially women. Odisha has the potential to enhance goat meat production as it has more than 30% of land still covered in forest and demand for goat meat has been increasing over the years due to urbanization and a rise in per capita income. About 95% of the population in the state are non-vegetarians (Odishabytes 2019) and goat meat is a popular food in their diet.

However, small ruminant keepers face different challenges, including lack of access to veterinary services and information, and lack of access to formal market and quality feed. Previous studies reported that the 27% mortality rate of goats was due to major diseases like PPR, brucellosis and endoparasites. The productivity of goats is less than the average Indian goat meat yield of 10 kg/goat, mostly due to poor housing conditions, poor feeding (quantity and quality), and high mortality due to diseases, which in turn are caused by insufficient prophylactic measures (vaccinations), lack of access to veterinary service for proper diagnosis and treatment and poor knowledge of husbandry practices. Many smallholder goat keepers rely to a large extent on grazing on common property resources (CPR) such as Gochala/community land, forests etc. which bear the imminent risk of environmental degradation. The use of CPRs only for feeding provides an insufficient base for balanced nutrition, particularly during the dry season and has a high labour requirement.

Proper breeding (genetic selection) is not a priority of the smallholders as there is high demand for male kids for slaughter. This results in a genetic drain. Even though Odisha has some good goat breeds like Ganjam and Black Bengal, efforts and investment for proper breed improvement are minimal. The LSA of the OLMP found that more than 70% of goat owners use stray bucks for breeding purposes which have led to inbreeding and poor productivity. The supply/production part of the value chain is highly fragmented with little access to service providers and is linked to the market very often by a chain of middlemen/traders. More than 75% of farmers sell their goats at village markets or from their homes to traders as and when they need money and therefore have weak bargaining power. The price of a goat is fixed based on visual examination and not on body weight. Therefore, improving healthcare facilities, feed management and improved market will have a positive impact on the red meat value chain in Odisha.

4.7 Red meat improvement interventions

There are several interventions that can be adopted to improve the production of red meat in Odisha. These interventions cut across the areas that were identified as challenging to the red meat value chain in Odisha. The proposed interventions are described below.

4.7.1 Feed improvement interventions

1. The potential feed improvement intervention areas are summarized into three:
2. Increase the proportion of crop residues used as animal feed and improve the nutritive value of crop residues
3. Increase fodder production and improve pasture/grazing areas
4. Strategic concentrate feeding of goats and sheep.

4.7.2 Increasing the proportion of crop residues used as animal feed and improving the nutritive value of crop residues

All the interventions presented in the cow dairy improvement interventions are equally relevant for goats and sheep (please refer to the feed section in the cow dairy improvement interventions).

4.7.3 Increase fodder production and improve pasture/grazing areas

- Promote Azola propagation and use by farmers.
- Introducing the use of spineless cactus varieties.
- The forest department should consult the livestock department and where possible, plant fodder trees during afforestation and tree plantations drive to increase the availability of animal feed.
- The area of land under permanent pasture/grazing, cultivable waste and barren land during 2020/21 was about 17 lakhs ha. It is planned to improve the productivity of this land by over sowing with improved grass and leguminous forage seeds and use of fertilizer where applicable. It is targeted to increase rehabilitated permanent pasture/grazing land to 30% of the total permanent pastureland by 2026/27.
- Improve production, marketing and quality control of forage seeds, forages and concentrates through strengthening existing regulatory bodies.

4.7.4 Strategic concentrate feeding of goats and sheep

- The total indicative amount of concentrate required in Odisha for cows, goats, and sheep is presented in the feed section of cow dairy improvement interventions.
- Does and ewes to be fed 200 g of concentrate daily for one month before and after parturition to increase the birth weight of the kids and milk production to improve survival of kids.
- During peak summer, when feed is scarce, milking ewes and does in the Coastal Plain zone will be supplemented with 100 g/day concentrate.
- Farmers adopting the additional supplementary concentrate feeds will reach 50% by 2026/27.

4.7.5 Genetic improvement interventions

- Improving local breed goats and sheep through selective breeding.
- In Odisha, there are six goats and one sheep breeding farm under the Directorate of Animal Husbandry and Veterinary Services (DAH and VS), Government of Odisha. Strengthening these breeding farms in the coming five years to improve their capacity to develop and multiply improved local goat and sheep breeds; with genetic screening of goat and sheep population for identification of best animal for further improvement.
- Strengthening and promoting private breeding farms to generate improved goats and sheep. Breeding of goats and sheep continues as per the 2002 Orissa State Livestock Sector Policy.¹⁰
- A specific breeding policy should be developed for goats and sheep.
- Involving women in community-based goat and sheep breed improvement programs to increase the productivity of indigenous goats and sheep; community-based in situ breed improvement strategies should include women given their vast knowledge and experience (best farmer award for breed improvement in each district, and exchange of best buck through animal 'mela' or show, etc.).
- Building awareness among women farmers to improve the availability of quality breeding bucks in a flock. According to Singh and Chauhan (2017), the current buck to breeding female ratio in India is about 1:100, against the recommended 1:40. In the LSA,¹¹ about 1 to 60 male to female ratio is observed in Odisha (Bahta et al., 2022b).

10. Government of Orissa 2002. Department of Fisheries and Animal Resources Development. Orissa State Livestock Sector Policy.

11. LSA–livestock sector analysis document produced as part and prior to developing this LMP document.

- Training farmers to retain the best buck for breeding and avoid selling them for slaughter. To prevent inbreeding, it is advisable not to use these bucks for breeding for more than two years in the same village. Farmers from different villages may exchange breeding bucks.
- Implementing AI for goats and sheep in collaboration with research institutes.

4.7.6 Research improvement interventions

- Research improvement interventions given in the cow dairy improvement intervention will also cater to all other species, including goats and sheep, keeping women and men beneficiaries in mind when defining livestock technology research and development agenda.

4.7.7 Extension improvement interventions

- Focus on reaching out to women and marginalized communities and provide training to WSHGs at venues closer to their homes, have daycare facilities for young children and have separate bathrooms. In this context, ICTs can strengthen the linkage between extension, research, and farmers, and DAH and VS need to acquire appropriate communication and training material to make use of ICT tools (smartphones, cell phones, radio, TV, internet) for reaching extension and advisory services to women farmers). There is a need to introduce ICT for mobile clinics and feeding interventions using SMS/WhatsApp.
- All the training centres (the new and the old training centres), which are to be established or improved) depicted in the dairy development section will also provide training in goats and sheep production improvements. The trainers will receive gender sensitization training to be sensitive to differential training needs of men, women and youth and provide need-based training.
- Coverage of consistent goats and sheep improvement training will reach 50% by 2026/27. Farmers will receive more intensive and continuous training about goats and sheep management (feeding, breeding, deworming, disease control etc.).

4.7.8 Health improvement interventions

- Veterinary hospitals/polyclinics, veterinary dispensaries, and veterinary aid centres presented in the cow dairy improvement intervention options will cater to all species, including goats and sheep.
- Goats and sheep will receive vaccinations for critical diseases such as PPR, goat pox, enterotoxaemia and FMD.
- Currently, about 80% of goats are receiving vaccinations against PPR and FMD through public campaign programs. It is targeted to have full vaccination coverage against these diseases by 2026/27. Adopting vaccinations against other diseases like ET goat pox is targeted to increase to 50% by 2026/27. To facilitate the vaccinations, a Prani Mitra would be used.
- Farmers adopting the recommended external and internal parasite control treatments will reach 50% in the coming 5 years.
- Private veterinary service providers, including Pashu Sakhi/Prani Mitra, would be supported by the government.
- Decreasing mortality of animals from flooding and cyclones by improving the early warning and awareness systems. Livestock shelters in the cyclone/flood prone districts would be established.

4.7.9 Processing and marketing interventions

A total of 25 small slaughterhouses with a capacity of 20–30 animals per day will have to be established in the coming 5 years. About 5 small-scale goats and sheep slaughterhouses would be established per year in the municipalities and urban bodies and subsequently, all the district HQs shall have this type of certified slaughterhouses. In total, 25 slaughterhouses would be established by 2026/27.

Establish a total of 3 goats and sheep abattoirs (model scientific abattoir) in the coming 5 years. Establish 3 abattoirs by 2026/27 in Bhubaneswar, Cuttack and Rourkela mainly to meet the needs of the new E-commerce model of meat delivery.

One incubation centre for the start-up of the animal protein market will be established under the proposed Animal Science and Fisheries University.

A total of 120 livestock markets in Mandis at the block level will be established in the coming 5 years. The long-term plan is to establish one livestock market at each block level. Each mandi/market will have spaces allocated for live animal/bird trade. It shall also have a small slaughterhouse where goats can be slaughtered, and consumers can purchase clean meat directly. For this, impart training to butchers on safe and hygienic slaughtering and handling of meat.

One goat and sheep meat processing plant will be established in the coming 5 years. The experience of the Falcon model¹² would be used.

New retail outlets for selling meat/animal protein will be established with subsidy components from the government. The plan is to establish 100 outlets per year. The investment from the self-employed youth would be INR 80 thousand per outlet.

Promoting the local breed of Black Bengal by naming it as superior meat for export is to be promoted as being done by Bakri (Himalayan goat) in Uttarakhand. Urban and export markets for niche 'near organic goat meat' can be targeted since goats are mostly reared on forests and pastures that are not treated with chemical fertilizers.

Two tanneries for handling the hides and skins will be established by 2026/27. Each tannery is expected to have the capacity to treat 5,000 skins of sheep/goats per day. The collection system shall be created to prevent loss of raw material by training the butchers to clean and salt/turmeric treatment as well as prevent moisture.

4.8 Investment budget

Table 16. Investment budget for red meat value chain between 2022/23 to 2026/27

S/ No.	Investment intervention	Investment in INR crores					Total	Share	
		2022/23	2023/24	2024/25	2025/26	2026/27		Public	Private
1	Feed improvement investments	0.2	0.2	0.2	0.2	0.2	1	1	
i.	All the feed improvement investments indicated in the dairy improvement will also cater for sheep and goats (please refer to investment subsection of the dairy section)	0	0	0	0	0	0	0	0

12. Falcon Chilika Fresh is a retail chain set up by Falcon to provide fresh sea fish to consumers at reasonable price through both online and offline while maintaining hygiene. Staff at the retail outlets are fully trained and have extensive knowledge of seafood products. The company has entered into an agreement with the government of Odisha to expand this outlet in urban centre.

S/ No.	Investment intervention	Investment in INR crores					Total	Share	
		2022/23	2023/24	2024/25	2025/26	2026/27		Public	Private
2	Breeding investments	5.5	5.5	5.5	5.5	5.5	27.5	15	12.5
i.	Strengthen the existing 6 goat and 1 sheep breeding farms to improve their capacity to develop and multiply improved local goat and sheep breeds. The investment needed for every 5 years would be about INR 10 crores	2	2	2	2	2	10	10	0
ii.	Strengthen and promote the establishment of private breeding farms to be used to generate improved goats and sheep. Five farms per year by incentivizing the number of kids distributed. A budget layout of 1 crore per year as a subsidy. Establishment costs are to be borne by private investors. SHG option may be explored. The cost of setting up a proper breeding farm with housing and medical facilities would be INR 50 lakhs per farm. $0.5 * 5 * 5 = 12.5$ crore	3.5	3.5	3.5	3.5	3.5	17.5	5	12.5
3	Animal health investments	0	0	0	0	0	0	0	0
i.	Veterinary hospitals/ polyclinics, veterinary dispensaries and veterinary aid centres presented in the cow dairy improvement investment options section will cater to all species, including goats and sheep	Presented in the AH/dairy section							0
4	Research and extension services	0.5	0.5	0.5	0.5	0.5	2.5	2.5	0
i.	Research improvement interventions given in the cow dairy intervention will also cater for all other species, including goats and sheep (please refer to the investment subsection of the dairy section)	Presented in the AH/dairy section						0.0	0
ii.	All the training centres (the new, which are to be established or old training centres) that give high-level training for graduate, diploma and graduate extension workers will also give training in goats and sheep production improvements (refer to investment subsection of the dairy section)	Presented in the AH/dairy section						0	0

S/ No.	Investment intervention	Investment in INR crores					Total	Share	
		2022/23	2023/24	2024/25	2025/26	2026/27		Public	Private
5	Marketing investments	59.2	40.2	27.4	39.9	22.7	189.4	130.9	58.5
i.	Livestock markets in Mandis at the block level. In total 360 with 314 in blocks and another 56 in other areas where the mandi/regulated markets flourish. Each of such mandi to have spaces allocated for live animal/ bird trade. It shall also have a small slaughterhouse where consumers can purchase directly from the farmers and have them processed. The additional infrastructure would cost about 1 crore per such mandi/regulated market space. Proposed to set up 120 in the first five years	25	25	25	25	20	120	120	0
ii.	Establish 5 goats and sheep small-scale slaughterhouses per year to start within the municipalities and urban bodies. Subsequently, all the district HQs shall have certified slaughterhouses. In total, 25 small abattoirs with a capacity of 20–30 animals per day will have to be created by 2026/27	1	1	1.2	1.2	1.5	5.9	5.9	0
iii.	Establish three goats and sheep abattoir (model scientific abattoir) in 2026/27, in Bhubaneswar, Cuttack and Rourkela, mainly to meet the needs of the new E-commerce model of meat delivery. The cost of each abattoir would be INR 10 crores and will have a capacity to slaughter over 200 animals per day	10	10	0	10	0	30	0	30
iv.	One incubation centre for the start-up of the animal protein market under the proposed ASF university	0	3	0	0	0	3	3	0
v.	One goat/sheep meat processing plant (EOU) will be established in the first five years using the experience of the Falcon model	20	0	0	0	0	20	0	20

S/ No.	Investment intervention	Investment in INR crores					Total	Share	
		2022/23	2023/24	2024/25	2025/26	2026/27		Public	Private
vii.	Two tanneries will be established by 2026/27. Each tannery can treat 5,000 hides of sheep/goats per day. The collection system shall be created to prevent loss of raw material by training the butchers to clean and salt/ turmeric treatment as well as prevent moisture	2			2.5		4.5	0	4.5
Total		65.4	46.4	33.6	46.1	28.9	220.4	149.4	71

Source: Odisha LMP analysis.

The total red meat value chain roadmap investment cost for 2022/23 to 2026/27 is INR 220 crores (Table 17). The major investment in infrastructure for red meat improvement relates to breedings, animal health research and extension. Some of the feed improvement investments of the red meat value chain are already captured in the dairy value chain roadmap.

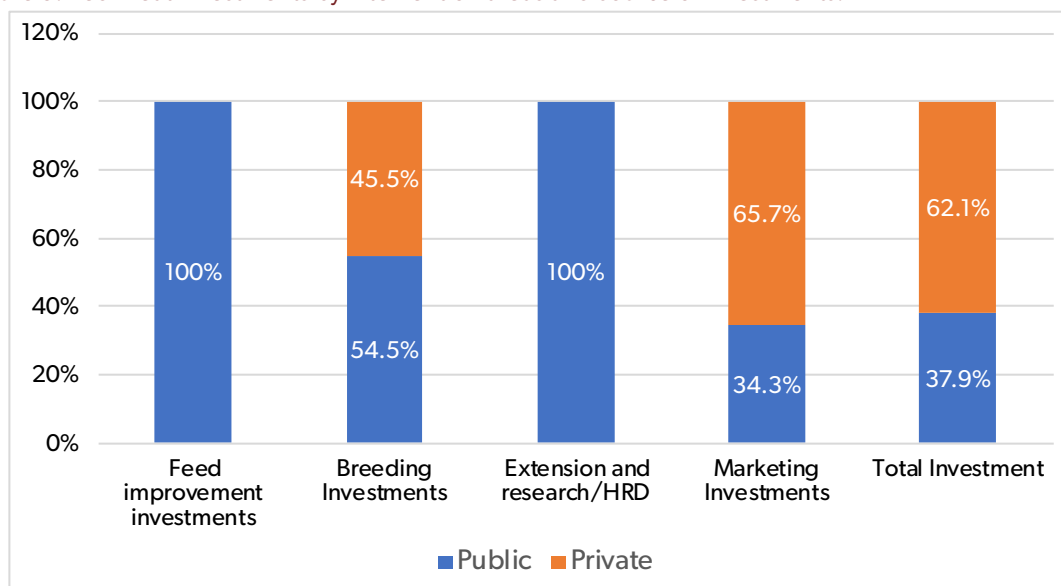
Table 17. Red meat roadmap investment cost by intervention areas

S/No.	Investment intervention	Investment in INR crores			Share of investments by category
		Public	Private	Total	
1	Feed improvement investments	1	0	1	0.45%
2	Breeding investments	15	12.5	27.5	12.5%
3	Animal health investments	0	0	0	0%
4	Research and extension services	2.5	0	2.5	1.1%
5	Marketing investments	130.9	58.5	189.4	85.9%
Total		149.4	71.4	220.4	100%

Source: Odisha LMP analysis.

Hence, the investments depicted in the red meat roadmap do not entirely reflect the total investment needed for the red meat improvement if the red meat improvement is considered a separate investment.

Figure 3. Red meat investments by intervention areas and source of investments.



The private sector is expected to fund about 32% of the total budget and the public sector will finance the rest. About 86% of the investment is allocated for marketing and processing. The estimated investment cost coming from public funds amounts to INR 149 crores. The corresponding amount from the private sector is INR 71 crores, and this is associated with the strengthening and promoting the establishment of private breeding farms, slaughterhouses, abattoirs, meat processing plants and tanneries.

4.9 Impacts of interventions

4.9.1 Meat production

The projected meat production between the period 2021/22 to 2026/27 with intervention shows total red meat from sheep and goats will increase from 32.2 thousand t to 48.5 thousand t, representing 28% (Table 18). The highest increase is projected to be recorded in the Hilly and Mountain zone with an estimated 32% increase in meat production within the period, followed by North-West (27%) and least by the Coastal Plain zone (26%). In absolute meat production, the North-West zone is projected to produce more red meat than the other two zones combined, with production increasing from 19.1 thousand t to 24.3 thousand t with intervention. Meat production in the Hilly and Mountain zone is expected to be higher than meat production in the Coastal Plain zone in 2026/27. The reason for the higher red meat in the North-West zone is due to the higher goat population in the zone. Despite this, meat from sheep is projected to witness a higher percentage increase (29%) than from goats (28%) across the period, which is also significant in the Hilly and Mountain and Coastal Plain zones.

Manure production across Odisha is projected to increase by 20% within the period (from 228.76 thousand t in 2021/22 to 275.09 thousand t in 2026/27). Goat production is projected to produce 4 times the manure produced by sheep. Similarly, skin production from goats is projected to be 10 times more than from sheep in both the base year and in 2026/27.

Table 18. Change in red meat (goats and sheep meat) production with the intervention

Products	Production zone	Production (in t)						Change in % (Base year to 2026/27)		
		Base year 2021/22			2026/27			Goats	Sheep	Total
		Goats	Sheep	Total	Goats	Sheep	Total			
Meat (t)	Hilly and Mountain	7,892.1	2,263.5	10,155.7	10,357	3,074.5	13,431.1	31.2%	35.8%	32.3%
	North-West	18,159.9	1,869	20,029.9	23,296.1	2,200	25,494.3	28.3%	17.7%	27.3%
	Coastal Plain	7,803.3	1,768.1	9,571.8	9,698.8	2,326.2	12,024.3	24.3%	31.6%	25.6%
	Total	33,856.2	5,902.4	39,758.6	43,350.1	7,597.4	50,947.4	28%	28.7%	28.1%
Manure (000' t)	Odisha	192.1	45.2	237.4	230.9	54.5	285.4	20.2%	20.6%	20.3%
Skins (t)	Odisha	2,562.6	258.8	2,821.5	3,300.6	354.9	3,655.4	28.8%	37.1%	29.6%

Source: Odisha LMP analysis.

4.9.2 Gross State Domestic Product (GSDP)

GSDP contribution from both goat and sheep meat is projected to increase by 23% across the period, from INR 1.9 thousand crores in 2021/22 to INR 2.3 thousand crores in 2026/27 (Table 19). GSDP contribution from goat meat alone is projected to be 65 and 66 times more than the contribution from sheep meat in 2021/22 and 2026/27, respectively. GSDP contribution from meat from both goats and sheep is expected to increase by 26% in the Hilly and Mountain zone, 24% in the North-West zone, and 20% in the Coastal Plain zone. Much of this contribution is projected to come from goat meat from the North-West zone due to its high goat population across Odisha. Contribution from goat meat from the North-West in 2026/27 (INR 1.2 thousand crores) is more than a combined contribution from both Hilly and Mountain and Coastal Plain zones (INR 1.1 thousand crores).

GSDP contribution from manure is projected to increase by 20% (from INR 2.9 crores in 2021/22 to INR 3.5 crores in 2026/27), with the highest contribution projected to come from goat production, which is 4 times the contribution from sheep. Similarly, GSDP contribution from skin production is projected to increase by 29% across the period (from INR 1.4 crores to INR 1.8 crores), with the largest contribution coming from goats

Table 19. Change in contribution to GSDP of goat meat production with intervention (INR crores)

Products	Production zone	GSDP (in INR crore)						Change in % (Base year to 2026/27)		
		Base year 2021/22			2026/27			Goats	Sheep	Total
		Goats	Sheep	Total	Goats	Sheep	Total			
Meat	Hilly and Mountain	425.1	10	435.1	533.2	12.8	546	25.4%	27.9%	25.5%
	North-West	1,012.1	9.7	1,021.8	1,251.4	10.8	1,262.2	23.6%	12.1%	23.5%
	Coastal Plain	499.8	9.7	509.5	596.9	12.2	609.2	19.4%	26.2%	19.6%
	Total	1,937.1	29.3	1,966.4	2,381.5	35.8	2,417.2	22.9%	22%	22.9%
Manure	Odisha	2.5	0.6	3	3	0.7	3.7	20.3%	19.3%	20.1%
Skins	Odisha	1.4	0.1	1.5	1.8	0.1	1.9	28.9%	40%	28.4%
All products	Odisha	1,941	30	1,971	2,386.2	36.6	2,422.8	22.9%	22%	22.9%

Source: Odisha LMP analysis.

4.9.3 Income per animal

Across the three production zones, large flock size from the North-West zone is projected to witness the highest increase in income per animal. The increase in income per animal is slightly higher in the large flock sizes compared to the small flock sizes.

The net income per animal for small size (3 flocks, the most prevalent) ranges between INR 2,675 and 3,392 in the North-West and the Coastal Plain zones, respectively (Table 20). The interventions bring about a 2% change in annual income per animal compared to the BAU scenario (Table 20).

Table 20. Goats' income per animal under BAU (2026/27) and WI (2026/27) in INR

Production zone	Flock size	Annual income per animal (in INR)			Change in % between BAU and WI (2026/27)
		Base year 2021/22	BAU (2026/27)	WI (2026/27)	
Hilly and Mountain	Small (1–10)	2,625	2,631	2,675	2%
	Large (>10)	2,514	2,516	2,582	3%
North-West	Small (1–20)	2,920	2,919	2,973	2%
	Large (>20)	2,766	2,762	2,840	3%
Coastal Plain	Small (1–10)	3,370	3,363	3,392	1%
	Large (>10)	3,282	3,274	3,326	2%

The change in sheep per animal income is due to intervention showing a similar pattern as in the case of goats (Table 21). The intervention is projected to record more income changes per animal across the Coastal Plain and North-West production zones. The interventions bring about on average a 3% and 4.5% change in annual income per animal comparing the base year for the small and large sheep farm sizes, respectively.

Table 21. Sheep income per animal under BAU (2026/27) and WI (2026/27) in INR

Production zone	Flock size	Annual income per animal (in INR)			Change in % between BAU and WI (2026/27)
		Base year 2021/22	BAU (2026/27)	WI (2026/27)	
Hilly and Mountain	Small (1–10)	1,903	1,905	1,950	2%
	Large (>10)	1,745	1,747	1,805	3%
North-West	Small (1–20)	2,109	2,088	2,149	3%
	Large (>20)	1,966	1,911	2,006	5%
Coastal Plain	Small (1–10)	3,000	2,979	3,115	5%
	Large (>10)	2,854	2,813	2,978	6%

Source: Odisha LMP analysis.

4.10 Activities timeline and sequencing: Gantt chart

Table 22. Activities timeline and sequencing: Gantt chart

Investment intervention	Activities timeline				
	2022/23	2023/24	2024/25	2025/26	2026/27
Investments to improve feeding					
The area of land under permanent pasture/grazing, cultivable waste, and barren land during 2020/21 was about 17 lakhs ha. It is planned to improve the productivity of this land by over sowing with improved grass and leguminous forage seeds and use of fertilizer where applicable. It is targeted to increase rehabilitated permanent pasture/grazing land to 50% of the total permanent pastureland by 2026/27, 70% by 2030/31 and 80% by 2035–37. In addition to this, the option of forest grazing and plantation of forage trees should be explored. It may involve a cost of 20 lakhs per year					
Breed improvement interventions					
Strengthen the existing 6 goat and 1 sheep breeding farms to improve their capacity to develop and multiply improved local goat and sheep breeds. The investment needed for every 5 years would be about INR 10 crores					
Strengthen and promote the establishment of private breeding farms to be used to generate improved goats and sheep. Five farms per year by incentivizing the number of kids distributed. The budget layout of 1 crore per year as a subsidy. Establishment costs are to be borne by private investors. SHG option may be explored. The cost of setting up a proper breeding farm with housing and medical facilities would be INR 50 lakhs per farm. $0.5 * 5 * 5 = 12.5$ crores ($12.5/5 + 1 = 3.5$ crores per year)					
Research and extension services					
Provide 100 Pashu Seki and Prani Mitra training sessions every year. The cost is INR 50 thousand					
Marketing investments					
Livestock markets in Mandis at the block level. Total 360, with 314 in blocks and another 56 in other areas where the mandi markets flourish. Each of such mandi/markets has spaces allocated for live animal/ bird trade. It shall also have a small slaughterhouse where consumers can purchase directly from the farmers and have the same processed. The additional infrastructure would cost about INR 10 million per such mandi/market space. It is proposed to set up 120 in the first five years					

Investment intervention	Activities timeline				
	2022/23	2023/24	2024/25	2025/26	2026/27
Establish 5 goats and sheep small-scale slaughterhouses per year to start within the municipalities and urban bodies. Subsequently, all the district HQs shall have certified slaughterhouses. A total of 25 small abattoirs with a capacity of 20–30 animals per day will have to be created by 2026/27					
Establish three goats and sheep abattoir (model scientific abattoir) by 2026/27, in Bhubaneswar, Cuttack and Rourkela, mainly to meet the needs of the new E-commerce model of meat delivery. The cost of each abattoir would be INR 10 crores and will have a capacity to slaughter over 200 animals per day					
One incubation centre for the start-up of animal protein market under the proposed ASF university					
One goat and sheep meat processing plant (EOU) will be established in the first five years. To use the experience of the Falcon model					
New retail outlets for selling meat/animal protein. The budget to start a modern meat outlet would be INR 100 thousand with a subsidy component of INR 20 thousand per outlet. The plan is to establish 100 outlets per year. The investment from the self-employed youth would be INR 80 thousand/outlet. The subsidy component is INR 2 million per year					
Promotion of the local breed through labelling as superior meat for export is being done by Bakri (Himalayan goat) in Uttarakhand. It may be budgeted at INR 20 lakhs per year					
Two tanneries will be established by 2026/27. Each tannery can treat 5,000 hides of sheep/goats per day. The collection system shall be created to prevent loss of raw material by training the butchers to clean and salt/turmeric treatment as well as prevent moisture					

4.11 Complimentary success requirements:

- Having synchronized plans and targets with the Odisha State Forest Department to ensure the sustainable use of communal grazing lands and forests.
- Consistent and timely vaccination of sheep and goats for important diseases. Actively engaging community animal health workers like Peshu Sakis.

4.12 Gender and social inclusion implications for goat value chain development

Goat farming constitutes the main occupation or livelihood strategy for more than 25% of Odisha's rural population, especially women in tribal regions (Government of Odisha 2021). For most women farmers, goats are a 'moving bank', a cashable asset for education and medical expenses, an animal source of food for household nutrition and a living asset to support agriculture in times of need. Despite the importance of livestock in rural economies, gender roles in livestock activities in Odisha are still not fully researched, documented and recognized in economic terms. Neither does the census collect sex-disaggregated data. This lack of information affects the success of any intervention targeting women beneficiaries whose livelihoods depend on livestock; therefore, the need for sex-disaggregated data cannot be over emphasized.

Institution building—Since women play an important role in goat farming and more than 80% of goat production is in the hands of women farmers, developing women goat farmers as entrepreneurs is a step in the right direction. This can be achieved by forming goat producer groups (FPOs) and integrating them with Mission Shakti. Also, strengthening women’s participation and leadership roles in existing or new livestock-based groups through rules i.e. rotating leadership, 30% reservation in the board allocation etc. can greatly impact women, farmers. Women can also be provided basic numeracy/business management training so that they can market their goats competitively. There is scope for youth from marginalized and tribal communities to take up semi-intensive goat farming as a commercial enterprise. However, government schemes and policies targeted at poor and marginalized livestock farmers should avoid land ownership as a prerequisite to receiving goats, BYP or even cattle, as women and youth rarely have land registered in their names. Since most women and youth lack the needed cash, granting them lower credit requirements (e.g., down payments) will also benefit women farmers.

Breed improvement—Breeder associations with the active involvement of women goat farmers, need to be established, given their considerable knowledge in goat keeping. To improve the genetics of the goat population, AHD could provide quality breeding bucks to WSHGs/village institutions/youth to provide breeding services for 2 years and rotate the buck thereafter. The advantages of AI need to be explained to women to encourage the adoption of the technology by women farmers.

Access to animal health services—An important intervention is to provide oversight and training to women Pani Mitras/Pashu Sakhis to ensure regular vaccinations and deworming of goats and BYP. Also, building the capacity of women goat farmers to identify, prevent and report livestock diseases and adopt vaccinations is needed. Gendered asymmetries in capacity development affect livestock disease prevention and control. Training on ‘OneHealth’ and the inclusion of more women in training is needed to ensure better compliance with control strategies for the zoonotic disease since they work close to animals and are more exposed to zoonotic infections.

Improving animal nutrition—Sensitization of the environment, forest, and climate change department to develop Common Property Resources (CPRs) with WSHGs participation and encouraging them to plant more fodder trees during tree plantation and afforestation to increase fodder production. Access to forests and (CPRs) by women need to be encouraged, and women need to be supported in planting fodder trees and grasses in their backyard field fences for better availability of green fodder and subsequent increase in productivity of goats. Making fodder available closer to home not only reduces labour and time but also increases the safety of women that go out to collect it. Introducing and training them in simple technologies like cultivating and feeding Azolla, and moringa leaves, making mineral blocks, formulating balanced ration, and use of troughs to decrease wastage can reduce feed costs, enhancing productivity and income. Fodder production through ‘hydroponics’ can also be introduced in peri-urban areas.

Gender sensitive extension—The AHD should invest in providing training, extension and technical education to women farmers. Women groups need to be provided with training at a time suitable for them and in venues closer to their homes that have childcare facilities and separate bathrooms. Information Education and Communication (IEC) materials need to be developed and distributed in the local language with appropriate photographs to cater to the differential needs of men and women. Training on small stock should have at least 50% of women participants since they are primary caregivers.

Building synergies with ongoing gender responsive policies, programs and schemes—Many GoO policies, programs and schemes are directed towards increasing incomes and the agency of rural women and have included livestock as livelihood options. These programs can serve as a platform for AHD to increase its outreach and enhance livestock production by women livestock farmers. This convergence is imperative since the activities of the AHD are focused on the health of livestock for increasing the production of milk, meat, and eggs and providing adequate bullock power for agricultural operations but do not necessarily include managing the social aspects to achieve this mandate. The Directorate of Animal Husbandry and Veterinary Services (DAH and VS extension department) can conduct ‘train the trainer’ of other departments to reach out to men and women farmers, share the latest technologies and create awareness on animal health, good husbandry practices etc.

4.13 Conclusions

Small ruminants' production is significant not only to the livelihood of farmers but also to Odisha's economy. It can meet the demand for meat products in Odisha and beyond as the population increases and consumer preferences change. A significant level of investment is needed in the small ruminant sector to meet this growing demand. Good knowledge of future trends is significant to informing the state of the magnitude of investments needed to be made in which production interventions address any differences in production and projected consumption.

Odisha's small ruminant sector is saddled with several challenges such as poor animal breeds, lack of access to animal health care and lack of sufficient feed, which have resulted in high mortality and low productivity. The sector can be strengthened and performance improved to increase production when several interventions are adopted in different areas such as improved animal health, improved nutrition and breeding service delivery, enhancing the availability of quality feed, and effective policy for better use of common property resources (CPRs), strengthening goat breeding and fodder farms, extension services, research, and development and enhancing access to input and output markets by encouraging the formation of FPOs. Since women form most small ruminant farmers in Odisha, the performance of sheep and goats can be enhanced when their participation is strengthened and their leadership roles in livestock-related groups improve. The adoption of these interventions will greatly increase both individual animal and herd productivity which can lead to increased production and quality of red meat to meet local demand, increase incomes and livelihood of small ruminant farmers and meet the state and national development goals.

The goat and sheep population is projected to increase marginally within 5 years, 2021/22–2026/27, with additional investments targeted at red meat improvement. Similarly, additional investment in the proposed interventions will also impact positively on the productivity and contribution of the red meat sector to GSDP. Goat and sheep production will increase by 60 and 62%, respectively, within the 5 years. The highest goat numbers are projected to be recorded by the North-West zone, while the Coastal Plain production zone will record the highest sheep population increase over the period. The interventions will impact significantly on both goat and sheep meat production over the period, increasing by 29 and 37%, respectively. The resulting impact of these increases in the population and quantity of goats and sheep is an increase in GSDP contributions in both value chains, a 23% increase for goats and a 22% increase for sheep. Once the productivity of the animals is improved due to the adoption of the interventions, other products such as milk, manure and skin products will eventually increase. The parturition rate will increase for sheep by 15% while it will remain the same for goats, the mortality rate will decrease and the live weight of the animals will increase.

The opportunities in the small ruminant are not far-fetched when the right investments are made strategically by the state of Odisha. The state has good feeding resources that can significantly impact production but strategies that incorporate better feed management and make available to farmers the right services will need to be focused on as this can lead to proper diagnosis and treatment of diseases. The state also needs to focus on building the knowledge base of farmers, especially women, on husbandry practices, improving the availability of healthcare facilities and improving the market for red meat. A lot can be achieved through synergizing with departments like Mission Shakti to roll out extensions and training using WSHGs.

5 Chicken value chain roadmap (2022 to 2026)

5.1 Key LSS chicken-related results and conclusions—the basis for the chicken value chain roadmap recommendations

Poultry is one of the major livestock systems in Odisha. Types of poultry activities include traditional and improved backyard poultry and commercial layers and broilers production systems. Backyard poultry is an important activity among women and the poor. The state has made significant improvements in egg and poultry meat production. However, the per capita availability of eggs is still very low (54 per annum) compared to the national average (79 per annum) and neighbouring states like Andhra Pradesh (420 per annum). The LSS report reveals the set of additional long-term strategies and investments that need to be made for enhanced performance of the poultry sector. In backyard poultry, the set of proposed interventions includes better feeding, genetic improvement, vaccination, training of farmers and improvement in biosecurity, hygiene and food safety during marketing. Proposed interventions in broiler and layers subsectors include enhancing the availability and quality of feeds to support the growth of the layer and broiler chicken population, the establishment of parent stock farms and hatcheries, strengthening of poultry producers' associations, improvements in processing facilities, the establishment of 'egg for better nutrition' for women and children in the midday meal program among others. Results of the foresight analysis on the impact of the additional investments vs the BAU scenarios showed that:

- With the additional investment, the chicken population will grow to 1,069 lakhs, a 247% increase. Most of the increase (68%) is from the specialized commercial system (both layers and broilers), where populations are projected to grow by 455% and 318%, respectively, by 2035/36.
- With the additional investment, chicken meat production in 15 years is projected to increase by 317% compared to 136% for the BAU scenario. Likewise, in the WI scenario, egg production is expected to grow by 649% (from 217 crores in the base year to 1,135 crores in 2035/36) compared to 412% in the BAU scenario.
- Financial indicators based on the 15-year discounted incremental cash flow analysis indicate that the investment in the backyard and commercial production systems is financially viable, with the IRR ranging from 33% in the backyard Desi (hens) system to 55% in broiler production.
- With the additional investments, the GSDP contribution of the chicken subsector is predicted to rise from INR 1,819.6 crores in the base year (2020/21) to INR 6,170.8 crores in 2035/36, which is equivalent to a 239% increase compared to 87% increase in the BAU scenario.
- With additional investment, Odisha is expected to continue being self-sufficient in eggs and possibly a net exporter of the slight excess of egg production to neighbouring states. In the BAU scenario, in contrast, it is expected that there will be a slight excess of egg production until 2027/28 when demand overtakes supply.

- It will not be possible to close the prevalent gap in chicken meat demand without additional investment. However, with additional investments, the gap in chicken meat demand is expected to close by 2035/36.

5.2 Five-year LMP vision for the chicken value chain

The vision is to increase the income and nutritional security of backyard chicken producers and all other individuals in the state by raising chicken meat and egg production. Chicken meat and egg production in the state is planned to grow by 52 and 73%, respectively, in the coming five LMP years (2021/22 to 2026/27). The contribution of the chicken system to the state GSDP is also expected to increase from INR 1,994 crores in 2021/22 to INR 3,408 crores in 2026/27, a 71% increase.

5.3 Investment scenarios analysed

Similar to the dairy and meat investments, the chicken investments are analysed in two (BAU and WI) scenarios. The BAU and WI chicken investment scenarios are assessed for their implications on chicken productivity, incomes, and chicken meat and egg production and contribution to GSDP. The WI scenario has different implications in the case of Desi and commercial chicken.

The WI scenario in the case of crossbreed backyard, commercial layer, and broiler chickens is mainly of increase in the number of chickens and improvements in the feed, health and processing facilities that match the growing number of chickens.

The WI scenario in the case of Desi chicken, on the other hand, focuses mainly on the per bird egg and meat productivity improvements in addition to the increase in the number of chickens at the state level.

5.4 Description of the chicken production systems in Odisha

The backyard family chicken production system was not divided into three zones like dairy production and the whole state was assumed to be one chicken production system. A description of the base year BYP production systems describes the productivity parameters of the farm system herds in Odisha (Table 23). The baseline results indicated that the average number of hens on a farm is around 2.5, with 1 cock. Hens start laying eggs at the month of seven and give an average 66 number of eggs in a year and lay an egg for 29 months. Adult mortality of BYP is around 40% before reaching the market. On average, about 35 birds are sold or consumed every year by the household.

Table 23. Production and reproduction parameters of backyard chickens–Desi

Parameters	Values
Average number of hens	2.5
Average number of cocks	1
Age of hens at the start of the laying period (months)	7
Duration of the laying period (months)	29
Age of layers at culling (months)	36
Age of cocks at culling (months)	30
Adult mortality (% per year)	12%
Number of eggs laid hen/year	66

Parameters	Values
Eggs sold or consumed on-farm (% eggs laid)	0.5
Eggs available for incubation	75
Egg fertility (%)	80%
Males hatched/year	30
Females hatched/year	30
Mortality in livestock production (% of birds that die before marketing)	40%
Age of males when sold (months)	12
Males raised/year	18
Females raised/year	18
Hens culled/year	1
Cocks culled/year	0.6
Number of females to keep for replacement/year	1.1
Number of males to keep for replacement/year	0.7
Males sold or consumed on-farm/year	17.3
Female sold or consumed on-farm/year	16.8
Average live weight of chickens (growers) sold (kg)	1.2
Average live weight of culled hens (kg)	1.5
Average live weight of culled cocks (kg)	2
Average dressing percentage	65%
Total number of birds kept per farm	16.6
Total number of birds sold or consumed on-farm/year	35.8
Average live weight of birds sold or consumed on-farm	1.2
Animals (hens) sold or consumed on-farm/year	14.3

Source: Bahta et al., (2022b)

5.5 Overall LMP targets under the intervention scenario

5.5.1 Chicken overall targets at the state level

In the LMP base year (2021/22), there were about 41.1 lakhs Desi hens in Odisha and the number is targeted to increase to 52.9 lakhs hens by 2026/27. This will be a 28% increase in the Desi hen population (see Table 24).

In the LMP base year (2021/22), there were about 97.4 lakhs layers in Odisha and the number is targeted to increase to 172.4 lakhs by 2026/27. This will be a 77% increase (see Table 27).

The broiler population in Odisha was about 66 lakhs by 2021/22 and it is targeted to increase to 106.3 lakhs by 2026/27. This will be a 61% increase (see Table 27).

In 2021/22, chicken meat production was about 112,136.6 t and it is targeted to increase to 170,525.7 t by 2026/27, a 52% increase over 5 years (Table 27).

In 2021/22, chicken egg production was about 241.9 crores and it is targeted to grow to 419.2 crores by 2026/27, a 73% increase over 5 years (Table 27 below)

In 2021/22, the contribution of chicken meat and eggs to GSDP was about INR 1,994.3 crores and is expected to increase to INR 3,407.5 crores in 2026/27, a 71% increase (Table 32).

5.6 Improving Desi backyard chicken and expanding crossbreed backyard chicken systems (2021/22 to 2026/27)

5.6.1 Targets for family backyard chicken (Desi backyard chicken and crossbreed backyard chicken)

1. The number of hens in Desi backyard chicken (DBC) grows from 41.4 lakhs in the base year to 52.9 lakhs by 2026/27, a 28% increase.
2. The number of hens in the crossbreed backyard chicken (CBC) grows from 4.2 lakhs to 5.6 lakhs, a 34% increase.
3. Chicken meat production from DBC increases from 46,979.8 t in the year 2021/22 to 64,915.7 t in the year 2026/27, a 38% increase.
4. Chicken meat production from the CBC increases from 400.4 t to 535.8 t between the years 2021/22 to 2026/27, a 34% increase.
5. Total meat from the backyard family chicken system increases from 47,380.3 t to 65,451.5 t, a 38% increase.
6. Egg production from DBC increases from 15.1 crores in the year 2021/22 to 20.5 crores in the year 2026/27, a 36% increase.
7. Egg production from CBC increases from 5.3 crores in the year 2021/22 to 7.1 crores in the year 2026/27, a 34% increase.
8. Total egg production from the backyard family chicken system increases from 20.4 crores in the year 2021/22 to 27.6 crores in the year 2026/27, a 35% increase.

Table 24. Number of chickens and chicken eggs and meat production in Desi backyard chicken and crossbreed backyard chicken projected for 2021/22 to 2026/27

Chicken systems	Unit	Base year 2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	Change in %
DBC hens	Lakhs	41.4	43.5	45.7	48.0	50.4	52.9	27.6%
CBC hens	Lakhs	4.2	4.5	4.7	5	5.3	5.6	33.8%
Total hens	Lakhs	169.6	178.1	187	196.4	206.3	216.7	27.8%
DBC eggs	Crores	15.1	16	17	18.1	19.3	20.5	35.9%
CBC eggs	Crores	5.3	5.6	6	6.3	6.7	7.1	33.8%
Total eggs	Crores	20.4	21.6	23	24.4	25.9	27.6	35.4%
DBC meat	T	46,979.8	50,118.6	53,467.1	57,039.4	60,850.2	64,915.7	38.2%
CBC meat	T	400.4	424.4	449.9	476.9	505.5	535.8	33.8%
Total meat	T	47,380.3	50,543.1	53,917	57,516.3	61,355.7	65,451.5	38.1%

DBC: Desi backyard chicken; CBC: crossbreed backyard chicken.

Source: Odisha LMP analysis.

5.6.2 Targets/assumptions for adopting DBC improvement interventions

The bird and herd level targets that could be achieved by farmers adopting the proposed DBC (Desi chicken) improvement technologies are as follows:

1. The flock size of Desi chicken is targeted to rise from the current 2.5 to 4 hens.

2. The number of eggs laid per Desi hen per year is targeted to increase from the current average of 66 eggs to 70 eggs/year per hen.
3. The mortality rate of Desi chicken before the marketing age is targeted to drop by about 40–50%.
4. The increase in productivity of Desi chicken enables to add a 10% increase in HH consumption of chicken and eggs which will significantly impact the HH health, especially in women and children.
5. The income per hen will increase from INR 4,625 to INR 5,995.

5.6.3 Challenges for backyard family chicken production in Odisha state

The chicken production value chain comprises both production in backyard systems and the commercial and specialized production of broilers and layers. Backyard poultry can be an effective way to enhance access to micronutrients and protein rich foods, especially for combating malnutrition in children and anaemia in women. It is an appropriate traditional activity for women because chickens are valued for various socio-religious ceremonies in tribal households. Notably, these poultry birds are among the very few assets that a woman farmer owns and have decision-making power on sales and usage of the income accrued. Despite these advantages, the poultry production system is facing different problems like poor feeding (quantitatively as well as qualitatively), high losses due to diseases, which in turn are caused by insufficient prophylactic measures (vaccinations), lack of proper diagnosis and treatment and poor husbandry practices, marketing facilities for the egg of BYP. Land area is scarce for scavenging of BYP and a lack of quality commercial feed. Improving the vaccinations, health care facilities and marketing of eggs for BYP will help the sector achieve higher growth.

5.6.4 DBC and CBC improvement priority interventions and targets

All livestock production zones (Hilly and Mountain, North-West and Coastal Plain livestock production zones) are targeted for improvements in the family chicken (DBC and CBC).

5.6.4.1 Feed and feeding

- Scavenging chicken shall be supplemented with up to 15% of their daily requirement with locally available feeds.
- Insect traps, either glue based/water based or light based, can be used to trap insects such as mosquitos' flies and moths that could be used as a protein supplement to scavenge chicken. Another option is to put the food waste in place to attract such insects in a box like a trap and the bottom of the trap collects the insects.

5.6.4.2 Genetics

- Initiate community-based chicken breed improvement programs and train women/men farmers to select the best chicken.
- State government research centres will conserve and select Desi chicken and distribute improved Desi chicken to farmers.
- Brooding and artificial incubation facilities should be introduced to reduce the reproductive wastage of Desi chicken. These facilities may include hay box brooders and small-scale incubators. This could be better practised by the WSHGs.

5.6.4.3 Health

- The chicken will be vaccinated against chicken priority diseases such as Ranikhet, Newcastle disease, and fowl pox.
- Currently, an almost negligible number of Desi chickens are vaccinated against diseases like Ranikhet and fowl pox. It is targeted to increase the percentage of village chickens vaccinated against these diseases to 25% by 2026/27.
- Coverage of chicken disease surveillance, diagnostics and reporting will be improved.
- Increase the efficiency of public and private veterinary services by introducing Pashu Sakhi/Prani Mitras as self-sustaining entrepreneurs.
- Promote Prani Mitras and private chicken veterinary and extension service providers.

5.6.4.4 Extension

- The coverage of intensive training on improved Desi chicken management will reach 50% in the first five years (by 2026/27). Women/men farmers will receive more intensive training on Desi chicken management (feeding, breeding, housing and management).
- Establish one poultry research centre in the proposed Animal and Fisheries Sciences University, which can serve as a poultry excellence centre. It will also be a technology transfer station and high-level poultry training centre (certificates and diplomas).

5.6.4.5 Marketing and processing

- Promote hygienic chicken slaughter facilities.
- Create market spaces for exclusive meat models in blocks and have weekly markets for farmers to trade their produce.
- Educate women/men producers on biosecurity and good hygiene measures for food safety when slaughtering for own consumption or selling from home.
- Organize women in producer groups and district level poultry producers associations for better price realization.
- Establish niche brand promoting near organic Desi chicken, especially catering to urban consumers through supermarket chains. Kalinga could be the brand for promoting backyard chicken eggs and native chicken.

5.6.5 Impacts of interventions on DBC and CBC

5.6.5.1 Production impacts

Table 24 above shows the projected chicken population and chicken eggs and meat production for Desi DBC and CBC between the periods 2021/22 and 2026/27. The total hen population in the family backyard chicken is projected to increase by 28% over the LMP period from 169.6 lakhs to 216.7 lakhs. The DBC system contributes over 90% of hens to the state's total family backyard chicken population.

Similarly, total egg production from the two systems is projected to increase from 20.4 crores to 27.6 crores representing a 35% increase over the period. About 74% of egg production is projected to come from the DBC system. Chicken meat production from the DBC system is projected to increase from 47 thousand t to 64.9 thousand t, an increase of 38%, while meat from the CBC system is projected to increase by 34% from 0.4 to 0.5 thousand t over the five years. Meat production from the DBC system is projected to make up about 99% of the total meat production of the family backyard chicken in the region.

5.6.5.2 GSDP impacts

The DBC meat contributes the highest to the total family backyard chicken GSDP (Table 25). DBC meat GSDP contribution far outweighs that of CBC meat, increasing significantly from INR 1,606.6 crores in 2021/22 to INR 2,808.8 crores, increasing 75% compared to CBC's 34% increase (increasing from INR 5.3 crores to INR 7.1 crores). Similarly, DBC eggs contribute more to GSDP than CBC eggs contributions, increasing from approximately INR 148.6 crores by 2021/22 to INR 200.6 crores by 2026/27. The total family backyard chicken egg contribution to the GSDP increases by about 35% between the 2021/22 and 2026/27 LMP period.

Table 25. Changes in GSDP contribution of the family backyard chicken (DBC and CBC) for 2021/22 and 2026/27

Products	Chicken GSDP 2021/22 (INR crores)	Chicken GSDP 2026/27 (INR crores)	Change in %
DBC meat	1,606.6	2,808.8	74.8%
CBC meat	5.3	7.1	33.9%
Total backyard chicken meat	1,612	2,815.9	74.7%
DBC eggs	148.6	200.6	35%
CBC eggs	11.7	15.7	33.8%
Total backyard chicken eggs	160.3	216.3	34.9%

DBC: indigenous backyard chicken; CBC: crossbreed backyard chicken.

Source: Odisha LMP analysis.

5.6.5.3 The projected income per animal

The projected annual income per animal for DBC and CBC under a BAU scenario compared to a WI investment scenario after 5 years shows that it is more attractive to raise DBC than CBC both under BAU and WI scenarios (Table 26). The income per animal for IBS (INR 4,625 crores) is 5 times more than CBC (INR 865 crores) under a BAU scenario and more than 6 times under a WI investment scenario. Surprisingly, while the percentage change in income per animal for DBC records 16% between the BAU and WI scenarios, there is no change in income per animal for CBC under a BAU and WI scenario as summarized in Table 26.

Table 26. Projected income/hen per bird in the backyard chicken (DBC and CBC) in 5 years—INR (DBC and CBC)

Production type	BAU (2026/27)	WI (2026/27)	Change in %
DBC (per hen)	4,625	5,343	16%
CBC (per bird)	865	865	0%

DBC: indigenous backyard chicken; CBC: crossbreed backyard chicken.

Source: Odisha LMP analysis.

5.6.5.4 Rate of return on investment (ROI)

The return on investment for both DBC and CBC backyard chickens shows that investment in both systems is financially viable. The NPV for the 15-year analysis for DBC (INR 81 thousand) and CBC (INR 1.5 thousand) is positive (Bahta et al., 2022b), indicating the discounted present value of all future cash flows related to investment in both systems of production will be positive and hence attractive. Given the projected cash flows, investment in the backyard CBC will generate a return of 33% over the period.

5.7 Scaling up specialized commercial chicken production (2021/22 to 2026/27)

5.7.1 Specialized commercial chicken (SCC) targets

- The number of layers grows from about 97.4 lakhs in the base year to about 172.4 lakhs by 2026/27, a 77% increase.
- The number of broilers grows from 66 lakhs to 106.3 lakhs, a 61% increase.
- Meat production from SCC increases from 64,694.2 t in the year 2021/22 to 105,205 t in the year 2026/27, a 63% increase.
- Egg production from layers increases from 221.4 crores in the base year 2021/22 to 391.9 crores in the year 2026/27, a 77% increase.

Table 27. Increase in number of chicken and chicken eggs and meat production in SCC systems

Chicken farm types	Unit	Base year 2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	Change in %
Layers	Lakhs	97.4	109.2	122.4	137.2	153.8	172.4	77%
Broilers	Lakhs	66	72.6	79.9	87.9	96.6	106.3	61%
Total	Lakhs	163.4	181.8	202.2	225	250.4	278.6	70.5%
Layers meat	t	6,416.5	7,192.9	8,063.2	9,038.9	10,132.6	11,358.6	77%
Broilers meat	t	58,277.7	64,105.5	70,516	77,567.6	85,324.4	93,856.8	61.1%
Total meat	t	64,694.2	71,298.4	78,579.3	86,606.5	95,457	105,205	62.6%
Layers eggs	crores	221.4	248.2	278.2	311.9	349.6	391.9	77%

SCC: specialized commercial chicken.

Source: Odisha LMP analysis.

5.7.2 Challenges for commercial chicken production in Odisha state

Though there has been increasing commercial chicken production in Odisha, the sector is facing different challenges, i.e. increasing the feed price, lack of availability of quality feed, increasing chick price, high incidence of diseases, frequent occurrence of a cyclones and high mortality rate in the unorganized sector. In addition, the price of chicken meat fluctuates in different seasons. Due to competition, it has become difficult for individual farmers to survive without integrators. Furthermore, there is no proper wastage management practice.

5.7.3 Specialized commercial chicken (SCC) priority interventions

Scaling up the specialized commercial chicken can be practised all over the state and in all of the livestock production zones (Hilly and Mountain, North-West and Coastal Plain).

5.7.3.1 Increase the number of chicken and chicken farms in the SCC

1. Increasing the number of chickens in commercial chicken production.
2. Increasing the number of commercial layers and broiler chicken and farms should be one of the priority targets to meet chicken meat and egg demand in the state.
3. The already implemented 40% subsidy scheme for capital investments of layer and broiler farms with greater than 50 lakhs investments is accelerating the growth of the commercial chicken sector. The scheme needs to continue to maintain momentum.

4. The layer and broiler chicken population are projected to grow with slightly higher annual population growth rates in the WI scenario than in the BAU (the past few years trend) (Table 28).
5. In the additional investment scenario (WI), the layer population will grow from the currently 97 lakhs to 1.5 crores by the 5th year (2026/27) (Table 28).
6. In the WI scenario, the broiler population will increase from the current 66 lakhs to 106.3 lakhs by the 5th year (2026/27) (Table 28).

Table 28. The 'with intervention' scenario targeted population of commercial layer and broilers

	Breed type	Base year population (2021/22)	End of the five-years population (2026/27)	Annual population growth rate
BAU scenario	Layers population	9,738,127	15,389,551	10%
	Broiler population/cycle	6,600,000	9,004,383	7%
'With' scenario	Layers population	9,738,127	17,238,661	12%
	Broiler population/cycle	6,600,000	10,629,366	10%

Large parent stock farms and hatcheries for DOC production need to be established to satisfy the growing demand for DOC.

The total number of commercial DOC that will be required by the 5th year (2026/27) will reach about 8.8 crores (Table 29). For this huge DOC demand, there have to be about 5 additional DOC production centres in the coming five years.

Table 29. Indicative number of day old chicks required by the end of the fifth plan year (2026/27)

Breed type	Base year (2021/22)	End of five years (2026/27)
Annual DOC needed for layers ¹	6,486,294	11,431,066
Annual DOC needed for broilers ²	47,520,002	76,531,440
Total annual DOC needed in the state	54,010,053	87,953,116

¹To do the DOC estimates for layers, the total population of layers in the 5th year and the production cycle per year of about 0.7 cycles/year were used.

²To do the DOC estimates for broilers, the total population of broilers in the 5th year and the production cycle per year of about 7.2 cycles/year were used.

5.7.3.2 Feed and feeding

- Encourage the production of processed chicken feed.
- The total indicative chicken feed demand is estimated to reach about 6.6 lakhs t by the 5th year (2026/27) (Table 30).
- With consideration of the estimated chicken feed demand, the additional commercial feed processing plants required by the 5th year (2026/27) will be about 4 plants. Also, farmers are recommended to produce their processed feed using small plants that can process up to 50 t of feed and cost up to 5–6 lakhs.
- Improve quality assurance of chicken processed feeds by strengthening the existing feed quality control laboratory in the coming five years.

Table 30. An indicative estimate of processed/commercial feed needed by the end of 2026/27

Breed type	End of five years (2026/27)
Annual feed demand of layers (t) ¹	443,974
Annual feed demand for broilers (t) ²	212,587
Total feed required	656,562

1. Twenty-nine kg of average annual feed consumption per layer bird was used. Author calculation.

2. Twenty-two kg of average annual feed consumption per broiler bird was used. Author calculation.

As per the chicken feed assessment, the current chicken and pig population consumes about 34% of the total current maize, sorghum and wheat produced in the state (LSS result Bahta et al., 2022b). This estimate assumes that the only cereal source would be what is produced in the state that could be used as food and feed. As per the panel of experts' recommendations, only up to 40% of the total maize produced in the state can be allocated for feeding chickens and pigs. If this does not satisfy the chicken and pig feed demand, the additional maize and soya bean requirement should be fulfilled by additional maize and soya bean production in the state or should be imported from other states. The current soya bean production in Odisha is very limited (Odisha Agriculture Statistics 2019).

- Encourage private investors to engage in maize and soya bean production.
- Make land available to produce additional maize and soya bean for the production of processed chicken feed.

The additional land that needs to be allocated for maize and soya beans should reach 54 thousand ha by the 5th year (2026/27) (Table 31). A government subsidy scheme is recommended to ensure the production of these crops during the Rabi (winter) season. An INR 2,000 subsidy per hectare is advised for farmers cultivating maize and soya bean in the Rabi (winter) season.

Table 31. An indicative estimate of additional land required to produce maize and soya bean¹

Breed type	End of five years (2026/27)
Additional land for maize production (ha) ²	25,951
Land for soya bean production (ha) ³	27,739
Total land (ha)	53,690

1. It should be noted that it is possible to use different ration formulations that can alter the additional land size proposed here.

2. The current productivity of maize in Odisha is about 2,993 kg/ha (Source: Odisha Agriculture Statistics 2019); 70% of maize in the chicken feed is considered.

3. The current productivity of soya bean in Odisha is about 1,200 kg/ha; 30% soya bean ration in chicken feed is considered.

5.7.3.3 Marketing and processing

- Strengthen and increase the number of poultry producer's associations.
- Promote hygienic chicken slaughter facilities by incentivizing all meat markets and registering under FSSAI INR 1,000/store per quarter. It is targeted to cover about 2,000 outlets per year.
- To cater to the expected huge increase in chicken meat production in the state, a total of two modern chicken cutting and processing plants will be established; one for organic chicken and one for regular processed chicken.
- Egg feeding in the midday meal program for women and children will be implemented. About 4 crores of eggs per year will reach children and women through the Child and Women Welfare Department.
- Social marketing and online delivery platforms will be encouraged to promote chicken and egg consumption.
- Private integrators will be engaged and provide DOC and help farmers with the necessary inputs. Each integrator shall work with 125 farms in the coming 5 years. Currently, 5 integrators are working in the state.

5.7.4 Impacts of interventions on SCC chicken

5.7.4.1 Production

The impacts of scaling up specialized commercial chicken production in Odisha will result in a huge increase in the commercial chicken population and production (Table 27) and GSDP (Table 32). It is projected that the number of layers and broilers will grow from about 97.4 and 66 lakhs in the base year to about 172.4 and 106.3 lakhs by 2026/27, respectively. The chicken meat production from the SCC system will also increase from 64,694.2 t in the year 2021/22 to 105,205 t in the year 2026/27, a 63% increase. Egg production will also increase from 221.4 crores in the year 2021/22 to 391.9 crores in the year 2026/27, a 77% increase.

5.7.4.2 Income per animal

The annual income per animal under both BAU and WI scenarios shows not much difference for the specialized chicken systems. Under both layer and broiler production, the income per animal remains at INR 137 and INR 104, respectively, for both BAU and WI scenarios. However, the size of the farm will determine most of the income in the specialized commercial system of chicken production.

5.7.4.3 GSDP contribution

The GSDP impacts of SCC improvement intervention are depicted in Table 32. During the LMP period, total GSDP from commercialized special chicken increases from INR 221.3 crores to INR 377.1 crores, an increase of 70% (Table 32). The highest percentage increase over the period will be recorded by chicken eggs from INR 85.2 to INR 150.9, a percentage increase of 77% compared to 66% for specialized chicken meat. Notwithstanding that, SP chicken meat contribution to GSDP in 2026/27 is approximately 1.5 more than SP chicken eggs.

Table 32. GSDP contribution from specialized commercial chicken system 2021/22 and 2026/27

GSDP contributions	Chicken GSDP 2021/22 (INR crores)	Chicken GSDP 2026/27 (INR crores)	Change in %
SP chicken meat GSDP	136.1	226.2	66.3%
SP chicken eggs GSDP	85.2	150.9	77%
Total contribution	221.3	377.1	70.0%

Source: Odisha LMP analysis.

5.7.4.4 Return on investment

Similar to the backyard system, the returns on investment under the specialized commercial chicken system show that investing in either layer or broiler production is projected to be financially viable. The 15-year NPV analysis for the layer production (INR 2,364.1 thousand) and broiler production (INR 225.8 thousand) is positive, indicating that the discounted present value of future cash flows related to investment in both systems of production will be positive and hence attractive. The IRR also shows that investment in layer and broiler production will generate a return of 33 and 55%, respectively, over the 15 years.

5.8 Impact of chicken improvement interventions on the total chicken meat and egg production and GSDP contribution

5.8.1 Total chicken eggs and meat production

Table 33 shows the total chicken meat and eggs production with the additional investment. The analysis shows that while total chicken meat production (in t) increases by 52% from 2021/22 (112.1 thousand t) to 2026/27 (170.5 thousand t), total egg production increases by 73% from 2021/22 (INR 241.9 crores) to 2026/27 (INR 419.2 crores). With additional investment, total chicken meat from the SCC system will record more increase than chicken meat from the backyard system both in absolute figures and percentage change.

Table 33. Total chicken meat and eggs production with additional investment

Products	Unit	2021/22	2026/27 with case	Change in %
Total chicken meat from the family backyard systems	T	47,380.3	65,451.5	38.1%
Total chicken meat from SCC system	T	64,698.4	105,205	62.6%

Products	Unit	2021/22	2026/27 with case	Change in %
Total chicken meat production	T	112,136.6	170,525.7	52.1%
Total eggs from family backyard systems	Crores	20.4	27.6	35.3%
Total eggs from SCC layers	Crores	221.4	391.9	77%
Total eggs production	Crores	241.9	419.2	73.3%

SCC: Specialized commercial chicken.

Source: Odisha LMP analysis.

5.8.2 Total chicken GSDP contribution

Total chicken GSDP contribution at the production level obtained from the additional investment in both the family backyard and SP chicken productions will increase from INR 1,994.3 to INR 3,407.5, resulting in a 71% increase over the 5-year LMP period. While backyard chicken meat and eggs contribution to GSDP will record a 71% increase over the same period, GSDP contribution from SP chicken meat and eggs will record a 70% increase (Table 34). In absolute monetary terms, the contribution from the backyard system is about 8 times that of the SP chicken system in both the base and the fifth year. This should be due to the very low production and the very high price of the backyard (Desi) chicken and eggs. The price of a Desi chicken is about INR 476/kg and a Desi chicken egg has a price of about INR 10. However, the price of commercial chicken ranges between INR 85 and 120, which is about 4 times less than the price of Desi chicken. Similarly, commercial chicken eggs are sold for about INR 4, about 2.5 times less than the price of Desi chicken eggs. In terms of the intermediate cost of producing eggs and meat, it is only an average of about 10% for the Desi chicken, while it is about 85% for SP chicken.

Table 34. Total chicken meat and eggs production GSDP contribution with additional investment

Products	GSDP 2021/22 (INR crores)	GSDP 2026/27 (INR crores)	Change in %
Family backyard chicken meat and eggs GSDP contribution	1,773	3,030.4	70.9%
Specialized chicken meat and eggs GSDP contribution	221.3	377.1	70.4%
Total chicken GSDP contribution	1,994.3	3,407.5	70.9%

Source: Odisha LMP analysis.

5.9 Investment budget

Table 35. Five-year chicken meat and egg production improvement investment costs (crores INR, 2020/21–2025/26)

S/ No.	Investment intervention	Investment in INR crores					Total	Share	
		2022/23	2023/24	2024/25	2025/26	2026/27		Public	Private
1	Feed	12.2	14.5	19	19	4	68.7	26.7	42
i	Strengthen the existing feed quality control laboratory in 2021/22 in OUAT animal nutrition laboratory and establish one laboratory per production zone and 3 by the public sector and 3 by the private sector in the 1st five years and establish 10 new laboratories by the private sector as part of the feed processing plant in the 2nd five years. The cost of enhancing the current infrastructure of laboratories would be about INR 2 crores and to establish a new laboratory would be 3 crores	2	6	6	6	0	2	11	9

S/ No.	Investment intervention	Investment in INR crores					Total	Share	
		2022/23	2023/24	2024/25	2025/26	2026/27		Public	Private
ii	Insect traps with light will be made available for purchase by farmers at a subsidized rate. In total, about INR 100 thousand are planned, with INR 50 thousand in the first five years and a balance over the next ten years. The cost of insect traps varies from INR 1,000 to INR 5,000. This could include about 50% subsidy from the government	4	2	2	1	1	10	5	5
iii	The additional land that needs to be allocated for maize and soya bean should reach 186 thousand ha by the 5th year (2026/27) and about 342 thousand ha by the 10th year (2030/31) and 586 thousand ha by the 15th year (2035/36)	1.2	1.5	2	3	3	10.7	10.7	–
iv	The total indicative chicken feed demand is estimated to reach about 5.9 lakhs by the 5th year (2026/27) and about 9.1 lakhs by the 10th year (2030/31) and 14.2 lakhs by the 15th year (2035/36). The additional commercial feed processing plants needed by the 5th year (2026/27) will be about 4 and an additional 6 by the 10th year (2030/31) and about 6 by the 15th year (2035/36) the capacity of plants to varying from 100 to 300 Tonnes per day (TPD). The plant would cost about INR 5 crores for a 100 TPD and INR 9 crores for a 300 TPD	5	5	9	9	0	28	–	28
2	Breeding investments	2.3	4.2	4.3	4.2	0.2	15.2	5.2	10
i	Additional 20-day old chick production farms, of which 4 are for improving the local backyard chicken and 16 for the commercial poultry. The cost of DOC would be about INR 1 crore for a small farm and INR 2 crores for a medium-sized farm	2	4	4	4		14	4	10
ii	Reducing reproductive wastage through introducing brooding and artificial incubation facilities like hay box brooder for backyard chicken and small-scale incubators to be promoted in the Hilly and Mountain region, about 20 thousand brooder boxes. Each brooder box costs about INR 1,000 with a small heater coil	0.2	0.2	0.2	0.2	0.1	0.9	0.9	–
	Three hundred small-scale incubators. The cost of each incubator is INR 20 thousand	0.1		0.1		0.1	0.3	0.3	–
3	Research and extension	1.24	21.24	1.24	1.24	1.24	26.2	22.7	3.5
i	Establish one research centre that can serve as a poultry centre of excellence under the proposed Animal and Fishery Sciences University		20				20	20	

S/ No.	Investment intervention	Investment in INR crores					Total	Share	
		2022/23	2023/24	2024/25	2025/26	2026/27		Public	Private
ii	Increase the efficiency of public and private veterinary services = 100 clinics cum pharmacies to promote self-employment of veterinary graduates. A subsidy of INR 300 thousand may be given to promote such clinics. The cost of setting up a clinic would be about INR 1 million	1	1	1	1	1	5	1.5	3.5
iii	Poultry farmer workshops. Each workshop to cost about INR 2 lakhs. To conduct 12 workshops per year	0.24	0.24	0.24	0.24	0.24	1.2	1.2	–
4	Marketing and processing	49.3	44.3	49.3	44.3	44.3	231.5	96.5	135
i	Promote hygienic chicken slaughter facilities by incentivizing at all meat markets and registering under FSSAI—INR 1,000/store per quarter and holding a competition. Fines to be collected for noncompliance. Estimated to cover 30 thousand outlets over the next 15 years. Over 2,000 outlets per year	0.8	0.8	0.8	0.8	0.8	4	4	–
	New 2,000 outlets per year—cost of setting up is 50 thousand	10	10	10	10	10	50	–	50
ii	Establishing modern chicken processing plants to process the huge increase in chicken meat production. Two in the five years One for organic chicken and 1 for regular processed chicken. The cost of such a processing plant is INR 5 crores	5		5			10	–	10
iv	Egg for better nutrition for women and children in the midday meal program. Four crores eggs per year through the Department of Child and Women Welfare. INR 4/egg	16	16	16	16	16	80	80	–
v	Social marketing and online delivery platforms to promote chicken and egg consumption. To spend INR 5 crores per year in partnership with the National Egg coordination committee (NECC) and the private sector	5	5	5	5	5	25	12.5	12.5
vi	Private integrators working in providing the DOC and helping farmers with the necessary inputs. Each integrator works with 125 farms every 5 years. Currently, 5 integrators are working in the state. Each integrator adds 5 additional farms per year. Each farm working for an integrator needs to put in about INR 0.5 crores for the infrastructure	12.5	12.5	12.5	12.5	12.5	62.5	–	62.5
	Total investment	65.04	84.24	73.84	68.74	49.74	341.6	151.1	190.5

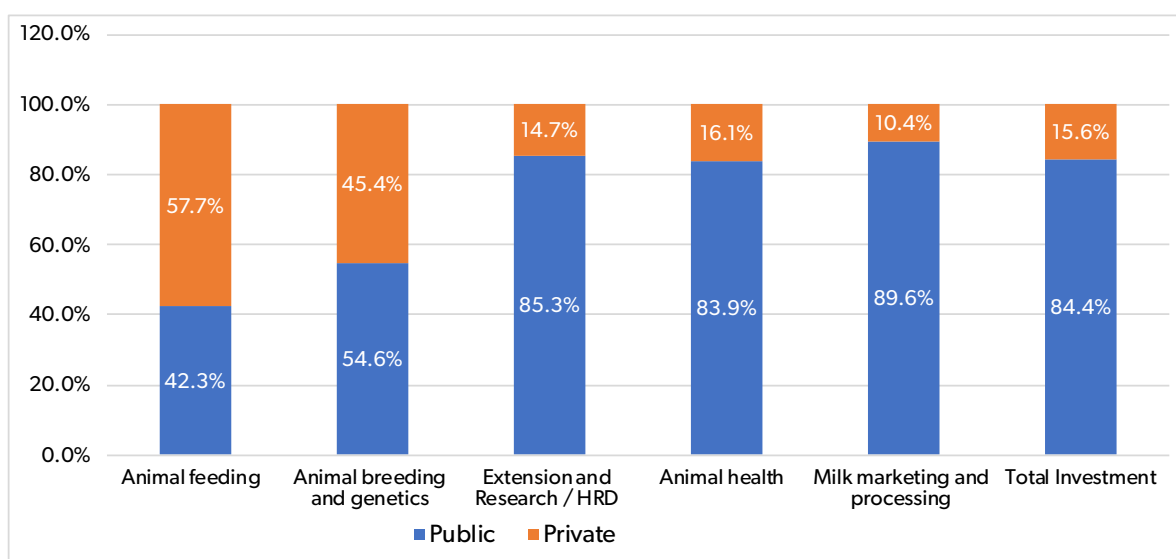
The five-year chicken meat and egg production improvement investment costs (2022/23–2026/27) are categorized into six major intervention areas—chicken feeding, chicken breeding, chicken health, extension and research, marketing and processing and establishment of broiler and layer farms (Table 36). The total chicken value chain roadmap investment cost for the five LMP years (2022/23 to 2026/27) is INR 342 crores.

Table 36. Total investment and recurrent costs for chicken meat and egg production value chain development

Investment category	Investment in INR crores (by the source of funding)			Proportion of total investment (%)
	Public	Private	Total	
Chicken feeding	26.7	42	68.7	20%
Chicken breeding	5.2	10	15.2	4%
Chicken health	Presented in AH. Not considered separately			
Extension and research	22.7	3.5	26.2	8%
Marketing and processing/abattoirs and cooperatives	96.5	72.5	169	49%
Integrators for broiler and layer farms	0	62.5	62.5	18%
Total investments in chicken value chain	151.1	190.5	341.6	100%

Except for the health and extension and research services, the other investment categories are predominantly private sector investments which indicate the great responsibility of the private sector in transforming the chicken industry in the state of Odisha. The private sector accounts for about 56% of the total investment, and the rest, 44% of the total chicken roadmap investments, is expected to come from the public sector (government, NGOs). The marketing and processing investments take the largest share of the investment, almost half of the total investments, followed by feeding and breeding investments. The private sector is expected to contribute about 43% of the processing and marketing investment and 100% of the investment in integrators for broilers and layers.

Figure 4. Per cent contribution of public and private investments by investment areas for improving the chicken meat and egg production value chains.



5.10 Activities timeline and sequencing: Gantt chart

Table 37. Intervention activity timeline and sequencing: Gantt chart

Interventions	Activity timeline				
	2022/23	2023/24	2024/25	2025/26	2026/27
Feed					
Strengthen the existing feed quality control laboratory in 2022 in the OUAT animal nutrition laboratory and establish one laboratory per each livestock production zone by the public (three) and three by the private sector in the 1st five years					

Interventions	Activity timeline				
	2022/23	2023/24	2024/25	2025/26	2026/27
Insect traps with light will be made available for purchase by farmers at a 50% subsidized rate. In total, about 100 thousand are planned, with 50 thousand in the first five years					
The additional land that needs to be allocated for maize and soya bean should reach 186 thousand ha by the 5th year (2026/27)					
Additional 4 commercial feed processing plants will be needed by the 5th year (2026/27)—the capacity of plants varying from 100 TPD to 300 TPD					
Breeding investments					
Additional 9-day old chick production farms will be established, of which 2 are for improving the local backyard chicken					
Reduce reproductive wastages through the introduction of brooding and artificial incubation facilities like hay box brooders for backyard chickens and small-scale incubators					
Encourage the establishment of 150 small-scale incubators					
Research and extension					
Establish one research centre that can serve as a poultry excellence centre under the proposed Animal and Fishery Sciences University					
To increase the efficiency of public and private veterinary services and to promote self-employment of veterinary graduates, encouraging the start of 50 clinics cum pharmacies in the coming five years					
Conduct 12 poultry farmer workshops annually					
Marketing and processing					
Promote hygienic chicken slaughter facilities by incentivizing all meat markets to register under FSSAI with INR 1,000/store per quarter and to hold a competition. Fines to be collected for noncompliance. Estimated to cover 2,000 outlets per year					
Establish 2 modern chicken processing plants that process the huge increase in chicken meat production					
Under a midday meal program, 40 million eggs per year will be made available for women and children through the Department of Child and Women Welfare					
Encourage social marketing and online delivery platforms to promote chicken and egg consumption					
Promote private integrators working in providing the DOC and helping farmers with the necessary inputs. Each integrator to work with 125 farms in the next 5 years					

5.11 Complementary success requirements

- Making land available for the production of maize and soya bean
- Making land and finance available for investors in the commercial chicken system
- Quality assurance of processed chicken feed and feed ingredients
- Do more research on Desi chicken to improve their productivity

5.12 Gender and social inclusion implications for chicken value chain development (Mamta)

Poultry farming is one of the important sources of livelihood for rural poor in Odisha, specifically for women in marginalized communities. They have traditionally been rearing BYP (Desi birds) since these birds are required for various socio-religious ceremonies. Backyard poultry farming has a significant advantage over other livestock activities for women as it can be operated under diverse agro-climatic conditions, requires low capital, and can provide quick returns and continuous income throughout the year to women who rear them. Poultry is among the few assets that women farmers own and have decision-making power on sales and usage of the income accrued. The BYP value chains are highly gender-segregated as the producer level of the value chain is dominated by women, while the trader and processor levels are dominated by men. For commercial poultry value chains, the role of women is limited to caring for and feeding birds and collecting eggs, while men function in more skilled and managerial roles.

Presently, there is a need to acknowledge that the Desi birds (Desi Breed Chicken DBC) and low input technology birds (crossbreed chicken CBC) are two distinct production systems. Economic analysis suggests that DBC rearing is more lucrative than CBC birds from a woman's livelihood enhancement perspective. However, since CBC provides a good number of eggs compared to DBC, promoting CBC can be an excellent way to enhance access to micronutrients and protein rich foods, especially for combating malnutrition in children and anaemia in women. FARD department should take the distinction between DBC and CBC into account when designing public schemes.

Capacity building—It is recommended that DAH and VS employ dedicated extension staff for reaching out to women farmers keeping BYP. It is advised that the staff gets gender sensitization training to enable them to reach out to both men and women to be more effective. The Pashu Mitra and Pashu Sakhi (PM/PS) can be trained to increase the extension outreach and create awareness about good husbandry practices along with their core work of providing preventive health care and first aid. Women poultry farmers need to be trained in adopting good husbandry practices, including basic biosecurity and made aware of the nutritional value of poultry and food safety measures. WSHGs could be targeted to impart training in alternate feeding practices like Azolla and white ant feeding, building small cages using locally available materials like bamboo and chick management to minimize losses from predators and mortality.

5.13 Conclusions

Poultry, including both traditional backyard chicken and commercial (layers and broiler production), are important livestock activity in Odisha. Traditional backyard poultry is an important source of livelihood for women and the poor in rural areas. Although Odisha has made significant improvements in egg and poultry meat production, there is a need to address the relatively low level of per capita availability of eggs (54/annum) that is prevalent in the state compared to the average for India (79/annum). Moreover, the demand for both eggs and poultry meat is expected to rise substantially (by about 500 and 250%, respectively) over the next 15 years between 2020/21 and 2035/36.

The poultry sector is constrained by several factors, including inadequate feed resources, poor quality of feeds, limited research in improving local breeds of chicken, inefficient marketing system, inadequate processing facilities, inadequate technical support services, and lack of basic infrastructures such as storage and transportation, lack of proper assessment of investment options and inadequate access to credit.

There is a need for public and private investments to ensure better feeding, genetic improvement, vaccination, training of women farmers, and improvement in biosecurity, hygiene and food safety and marketing in backyard poultry production. Proposed interventions in broilers and layers subsectors include: enhancing availability and quality in feeds to support the growth of layer and broiler chicken population, establishing parent stock farms and hatcheries, strengthening poultry producers' associations, improving processing facilities, establishing 'egg for better nutrition' for women and children in the midday meal program, among others.

Financial analysis over the next five years indicates that in the traditional backyard poultry sector, proposed investments to address the constraints could help raise the levels of eggs and meat production by 35% and 38%, respectively, impacting the livelihoods and nutritional security of millions of women poultry farmers.

6 Complementary and the added value of the LMP to the livestock budget planning of the government of Odisha

The Odisha LMP was prepared to complement and add value to the budget and livestock planning sector. In this section, the complementarities of the Odisha LMP or investment roadmaps to the Odisha livestock budget and agriculture policy Samruddhi is analysed to highlight the added value of the LMP, then any overlaps in livestock budget, and LMP strategies and activities are discussed so that the FARD department can rationalize the budget allocated towards livestock sector and where necessary to improve the implementation potential of investment.

6.1 Odisha livestock perspective plan

The government of Odisha first drafted the 10 years for improvement of the livestock sector, namely the perspective plan for 2010–20. The main objectives of this plan are:

- To improve the income of livestock keepers.
- To make dairying a viable livelihood option for small, marginal farmers and landless persons by strengthening all forward and backward linkages.
- To enable poor farmers to improve the productivity of animals like sheep, goats and pigs.
- To make backyard poultry a popular and viable subsidiary farming activity in rural areas and achieve self-sufficiency/surplus in milk, meat and egg production.
- Enhance availability of feed and fodder for economic dairy farming.
- Provide better services at the doorstep of the farmers.

The plan had suggested interventions based on the SWOT analysis without further detailed quantitative analysis of present and future supply and demand of livestock products like milk, meat and eggs. In addition, the suggested budget is based on assumptions and does not consider possible private sector investments. Though the perspective plan had helped the sector achieve significant development, it failed to achieve its target. For example, the plan targeted achieving 250 g per capita milk availability and 75 eggs per head per annum by 2020. However, the present data indicated that per capita milk availability is only 144 g per day and the per capita egg availability is 54 per annum. There is no roadmap developed for 2020–2030 and the LMP is expected to inform the state livestock sector budgeting and planning.

6.2 Samruddhi agriculture policy

In 2019, the Odisha state released its fourth agriculture policy, Samruddhi-2020, outlining the department of agriculture's five-year strategy. The main vision of this policy is to harness the potential of Odisha's agriculture sector sustainably, aimed at continuously raising farmers' income and welfare while ensuring nutritional security. The policy has targeted increasing milk procurement from 20 to 25% in the next five years. In the case of poultry, low input technology birds suitable to the local climate will be promoted for livelihood support to landless, small and marginal farmers.

The FARD department supports implementing the Samruddhi agriculture policy specifically for livestock. The Odisha LMP is expected to provide a more detailed and complete set of 5 years livestock commodity value chain investment plans, which will help achieve the broad targets of the livestock roadmap of the Samruddhi agriculture policy.

6.3 The Odisha Livestock mater plan (O-LMP)

The Odisha LMP, which includes LSA, LSS, and the investment roadmaps, has been produced through a quantitative analysis using a herd and economic sector model (HESM) developed by the experts from the FARD department and ILRI team. The HESM developed in the LSA and LSS made possible the elaboration of the detailed five-year investment plans, which make up the livestock value chain roadmaps, with each roadmap having focused interventions, investment budgets activity and time plans. As had been explained in the introduction to the LSA, the objective of the Odisha LMP is to provide quantitative and evidence-based justification for greater public and private funding of sector investments. The LSS analysis resulted in recommended and prioritized livestock value chains and investment interventions with the most potential to further modernize the sector. The recommended investments have been chosen based on an analysis of the returns on investment (ROIs) in additional combined technology and policy options. The LSS foresight or future impact analysis resulted in investment roadmaps for dairy, red meat and chicken.

6.4 Value addition of the LMP process

The priority livestock value chains of the Odisha LMP are dairy, poultry, sheep and goats. Odisha is rightly recognized for the growth and development of its dairy value chain and its high total milk production from cows, buffalo and goats. This success has been accomplished largely through the efforts led by the Odisha State Cooperative Milk Producers' Federation Limited. (OMFED), which is supported by the governments of Odisha and India. OMFED has played a key role in raising dairy cow productivity and milk production and raising dairy farmer incomes through the many cooperatives and AI providers it has helped establish and the other complementary services (i.e. health, feed, extension training etc.). The LMP results show that achieving such further improvements will also necessitate investment by private sector dairy processors, particularly in areas where OMFED has not reached and in strengthening public institutions that provide necessary support services.

In preparing the LMP, the FARD department and ILRI team of experts tried not to duplicate the strategies covered in the Odisha livestock perspective plan and Samruddhi, but for the comparative analysis of value chains and interventions, the LMP did include the value chains budget in the 2022/23 Odisha government livestock budget so the prioritization of value chains and interventions could be done and recommendations made which are relevant to the livestock development in the state (highlighted in the Samruddhi agriculture policy). The 2022/23 Odisha government livestock budget activities focus on three livestock values chains: dairy, poultry and small ruminants, as well as development activities for state livestock support institutions and the major cross cutting issues: animal health, AI, fodder production and demonstration and training.

In the LMP, the prioritized set of livestock roadmaps recommended are three and are somewhat differently focused: dairy (from indigenous and crossbreed); poultry (layer, broiler, local and improved backyard chicken);

goat and sheep. The choice of the recommended livestock value chains in the LMP is well explained, as well as the contribution of the livestock sector to the state's development objectives.

The LMP adds a more detailed quantitative analysis of the current state of the livestock sector and proposes future investment interventions which could help achieve the state's future objectives and the Samruddhi agriculture policy's target.

In the LMP, the HESM was used to do the following additional quantitative analyses:

- Projecting the future demand for the priority livestock products and setting production targets to meet this future demand
- Identifying the challenges and opportunities faced in achieving the targets
- Making the links between the interventions chosen and their impacts on LMP and livestock development in the state
- Calculating the expected returns from proposed investments (ROIs) in alternative interventions to achieve the targets
- Calculating the intervention impacts on state development goals: State income growth (GSDP), employment, farmer investment
- Specifying the additional investments (public-private partnership) required to implement the interventions and reach the LMP targets
- Identifying the complimentary success factors needed to achieve the projected impacts
- Identifying policy changes needed to achieve the technology results to be combined with the technology interventions

In the LSS, future demand growth was determined by rates of change in human population and urbanization and per capita income and the income elasticities of demand for the various livestock food products. However, no projection has been made to prepare the government's 2022/23 livestock budget and set the targets in the Samruddhi agriculture plan.

In the LSS/investment roadmaps, the following measures were taken to ensure that the targets and results of the projections were reliable:

- Several sessions of virtual meetings and in state visits for data collection were undertaken, totalling 7 person-months of time, in which the LMP team cross checked the data and model results.
- Estimates of technical productivity parameters, population numbers and economic and financial data, as well as information on the opportunities, challenges and interventions used to specify the HESM model were collected from published literature and cross checked by experts from different organizations working in the livestock sector in Odisha as well as state technical team (STT) from FARD department.
- One-on-one consultations and group level technical discussions were held to get expert agreement on all data and parameters, as well as to ensure realistic model projections and results.
- Data projections were made using the HESM and sensitivity analysis was carried out to identify critical data and parameters impacting the targets and projections of results.
- The experts further cross checked and validated model results at several virtual stakeholder workshops, where the STT and external experts representing government departments, research (e.g. State Institute of Animal Health and Production and ICAR experts), the Odisha University of Agriculture and Technology (OUAT), NGO (BAIF, PRADHAN and others) and private sector attended. All parameters, projections and results were validated and endorsed.

Some of the more important examples of the added value of the Odisha LMP is that LMP has analysed details of the livestock sector of Odisha before proposing any investment. The LMP analyses the impacts of recommended interventions on gender, as well as on the social inclusion of other marginalized group members and provides strategies and activities for the institutionalization of gender and social inclusion sensitive interventions. The LMP, besides presenting impacts of interventions on meeting future demand requirements, presents base year and projected impacts of interventions on HH income (or poverty reduction), GSDP (or state income), food and nutritional security, surplus production for exports, income for investment generation etc. Three livestock production zones were identified and considered in the LMP to contextualize the different opportunities, challenges and interventions.

The base year and projected impacts of interventions on GSDP or state income growth are presented. GSDP contributions are also disaggregated by value chains, agro-ecological zones, species, breed and herd size.

This disaggregation helps to prioritize value chains, species and breeds, as well as allocation of funding. In the Samruddhi, the projected impacts of interventions are not available. Impacts of interventions on livestock population, household income, and GSDP can be traced from animal to state level in the LMP. Furthermore, since the uptake of the proposed investment interventions could be limited by the availability of input resources, especially feed and land, an analysis of feed balance was done to see the potential increase in milk, meat and eggs production given the limitation of land and feed resources.

Table 38. Summary of the value addition of the LMP to Samruddhi agriculture policy and Odisha 2022/23 livestock budget

Samruddhi agriculture policy and Odisha 2022/23 livestock budget	Odisha livestock master plan (OLMP)
No clear link exists between investment and impact and other targets	Targets and impacts can be traced back to animal productivity and forward to state level production.
No base year analysis/situation available	Before proposing the detailed budget, a baseline analysis (LSA) has been conducted
Production targets are not disaggregated by species or genetic potential	<ul style="list-style-type: none"> • Animal, herd and household level impacts of interventions are presented. Changes in productivity and income at the animal, herd and household levels are presented and aggregated to production at the state level • Production is disaggregated by species, size and breed • Milk—from goats and cattle (indigenous and crossbred) • Meat—from goat, sheep and chicken • Eggs from the backyard, improved chickens and layers
Investment interventions are given for dairy, poultry and goats, as well as state livestock support institutions, as well as cross cutting issues: animal health, AI, veterinary services, fodder production and demonstration and training	<ul style="list-style-type: none"> • Investment interventions are disaggregated by species and cross cutting issues: animal health, AI, veterinary services, fodder production and demonstration and training, but not specified in detail for state livestock support institutions • A value chain based approach is used for evaluating interventions. The livestock products improvement interventions focus on the production, processing and marketing of commodities
Interventions impacts on gender and social inclusion (marginalized groups) are not considered	Impacts of interventions on gender and social inclusion of other marginalized group members and institutionalization of gender and social inclusion sensitive intervention are presented

Samruddhi agriculture policy and Odisha 2022/23 livestock budget	Odisha livestock master plan (OLMP)
The impact of interventions on animal productivity, livestock population and state level production targets are based on assumptions	<ul style="list-style-type: none"> Animal, herd and household level impacts of interventions are presented. Changes in productivity and income at the animal, herd and household levels are presented and aggregated to the production zone and the state level. The livestock products improvement interventions focus on the production, processing and marketing of commodities
No analysis of internal rates of return of investments (IRR) and net present value (NPV) and discussion on impacts of investments	Internal rates of return of investment (IRRs) and net present value (NPV) impacts of investments are presented, as well as the expected impact on indicators of state development objectives
Feed balance analysis has not been conducted during population projection	A future projection of livestock population, human population, supply and demand patterns and feed balance was analysed
Discussion on challenges, opportunities and interventions are not disaggregated by production zones	The state is divided into three production zone for better interventions. This enables contextualizing opportunities, challenges and interventions as appropriate due to agro-ecological differences in the zones
No specific investment for red meat and chicken value chain development	<ul style="list-style-type: none"> The roadmap or investment is developed for dairy, chicken, sheep and goats value chains All investments were validated with a specific outcome
No specific discussion on constraints and challenges	Detailed analyses of the impact of interventions on future production and outcome are presented
It does not account and possibly private sector investments	Has detailed budget for public and private sector investments

6.5 Complementarity of the Odisha LMP and livestock budget of the FARD department

The differences in the financial investment costs of the different components of livestock development of the animal resource department (ARD) budget and LMP have been assessed to see the degree of complementarity between the plans. Table 39 below presents the summary of the differences in one year (2022/23) investment interventions.

According to Table 39, the ARD budget's total investment cost (is about 1,036.25 crores, while only about 879 crores in LMP, which is 15% less. However, the LMP does not include administrative and program management costs, which is about 42% of the cost in the ARD budget. Thus, the 2022/23 LMP budget is 44% higher than the ARD budget when the cost of livestock improvement interventions is compared.

Table 39. Budget comparison between ARD and LMP for 2022/23 (amount in INR crores)

Component	ARD budget (2022/23), Government of Odisha	LMP (2022/23)
Investments to improve feeding	8.36	25.01
Breeding investments	34.7	14.8
Research and extension	62.65	212.74
Healthcare management	401.77	174.8
Dairy and marketing	160.76	452.5
Others	368.01	0
Total	1036.25 ^a	879.85

a. In the ARD budget, 42% of the budget is administrative costs and 58% budget is program costs. In LMP, the total budget is for implementing the program.

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Annex

Main financial target intervention activities for livestock activities of the government of Odisha and LMP

Table 40. Budget comparison for dairy development between LMP and livestock budget of the government of Odisha

S/ No.	Name of the schemes/ components	Investment in crores (year one 2022/23)	LMP	
			Name of the schemes/components	Investment in crores (2022/23)
	Feed improvement investments	8.36		12.61
A	Fodder seed farm	3.88	Thirteen fodder demonstration farms and 8 fodder seed production farms will be strengthened in the coming five years and will become up to 90% operational (manpower, machine, infrastructure—irrigation, fences etc.)	3.
B	Utilization of crop residue	1.41	Using crop residues and conversion to feed blocks. Twenty machines per livestock production zone. Each machine costs 0.8 million	4.8
C	Feed and fodder production in different agro-climatic zones for utilization of livestock in Odisha	1.63		
D	Training and demonstration in fodder cultivation and pasture development	1.44		
E			Strengthen the existing pasture/forage seed quality control laboratories. Investments are needed for enhancing quality checks and ensuring proper distribution—10 million per year for the next 15 years	1
F			Encourage private investment in fodder production such as alfalfa, and hybrid Napier for sourcing by the dairy industry. Government support in the form of land	2
G			Private fodder seed production farms that supply quality fodder seeds (28, 57 and 66 ha fodder seed production land in the first, second and third five years, respectively)	0

LMP				
S/ No.	Name of the schemes/ components	Investment in crores (year one 2022/23)	Name of the schemes/components	Investment in crores (2022/23)
H			Promoting silage making program in Hilly and Mountain and North-West livestock production zones under disaster management program for use in the Coastal Plain zone. For 10 t production/year—the total maize cost is 61 thousand. The government gives a 90% subsidy. Establishing the silo costs	1.81
	Breeding investments	24.58		7
A	Sex sorted semen for enhancing milk production	18.4	Increase the capacity of the existing semen bank and add one new semen ban	2
B	Livestock breeding cum dairy farm	6.18		
C		0	Operationalize all 8 government breeding farms by adding improved bulls for semen production	5
D		0	Upgrade Cuttack facility at 20 crores and add 3 new LN2 facilities	0
	Research and extension	62.65		211
A	Information, education and communication	3		
B	In-service training of personnel	1.58		
C	Research and development	10		
D	Sample survey estimation of production of milk, egg, wool and meat	4.97		
E	The Odisha University of Agriculture and Animal Sciences	0.01		
F	Strengthening of Odisha biological product institute	6.59		
G	Upgrading skills in self-employment under ARD	1.78		
H	Preparation of DPR for comprehensive and perspective development plan	1		
I	Capacity development and preparation of a detailed project report (DPR)	0.65		
J	Strengthening disease surveillance by animal research institute	0.7		
K	Capacity building and strengthening of training infrastructure under the ARD sector	1.3		
L	Information, education and communication program	5	ICT in extension and mobile clinic operation and AI services	1

LMP				
S/ No.	Name of the schemes/ components	Investment in crores (year one 2022/23)	Name of the schemes/components	Investment in crores (2022/23)
M	Animal husbandry extension service	5		
N	Establishing a dairy science college	0	Establish a dairy science college under the proposed ASF university	0
O	Establishing Odisha Veterinary, Animal and Fisheries Science University	20	Establish ASF university and veterinary college in Shiksha O Anusandaan	200
P	Training	1.07		
		0	Regional livestock research centres	10
	Health care management	401.77		174.8
A	Biological product institute	4.99	Upgrade OBPI infrastructure	5
B	Hospital and dispensaries	123.29	Veterinary dispensaries will increase from the current 541 to 650	58
C	Livestock aid centres	123.73		
D	Development of know-how for animal welfare	0.48		
E	Upgrading livestock care services	65		
F	Mobile veterinary unit	21	Increase mobile veterinary clinics from 314 to 450	10.8
G	National livestock health and diseases control program	10		
H	Establishment of an animal helpline facility with ambulance services	15		
I	Support private Gaushala	15	Increase veterinary aid centres from 3,239 to 3,900 and add 100 Gaushalas over the next 5 years at a rate of 20 Gaushalas per year, mainly under the central/ state schemes	60
J	Strengthening of livestock and animal husbandry program delivery at the block level	13.28		
K	Animal welfare activities under the animal welfare board	10		
L			Improve the capacity of the 30 diagnostic laboratories	1
M			Promote three veterinary pharmaceutical manufacturing facilities	40
	Dairy and marketing	107.09		344
A	Strengthening dairy organization	15.16	Quality enhancement program for the industry. Converting BMC to automated milk analysers with support from NDP in OMFED owned centres	10
B	Promoting dairy entrepreneurship	0.0001		
C	White revolution	91.92		

LMP				
S/ No.	Name of the schemes/ components	Investment in crores (year one 2022/23)	Name of the schemes/components	Investment in crores (2022/23)
D	Interest subvention on long-term credit support to livestock farmers	0.01		
E			Midday meal scheme for children and mothers as well as nursing mothers. Each to get 100 ml milk per day for 200 days. 20 litres of milk per person and the number of beneficiaries to be 5 million	300
F			Promoting local products by incentivizing the HORECA segment in the first five years	10
G			Improve the collection system by incentivizing the farmers in the Hilly and Mountain region and put the unused assets of BMCUs back on track in the first five years starting from 2022	20
H			Bulk milk collection system for collecting raw milk from producers and bulkers. 140 in the first 5 years	2
I			Modern retail trade points for promoting milk products 100 per year	2
	Others	368.01		
A	Directorate	22.3		
B	District establishment	109.85		
C	Fisheries and animal resources development department	10.48		
D	Grant and assistant	4.71		
E	Miscellaneous	1.13		
F	Zonal administration	3.63		
G	Infrastructure development	100		
H	Rural infrastructure development fund (RIDF)	12		
I	Infrastructure development for livestock services	94.69		
J	Implementing Kalyani project through BAIF	0		
K	Integrated livestock development program	9.22		
Total		972.46		749.41

Table 41. Budget comparison for red meat value chain development between LMP and livestock budget of the government of Odisha

Si/ No.	Name of the schemes/ components	Investment in crores (year one 2022/23)	Name of the schemes/components	Investment in crores (2021–26)
	Feed improvement investments	0		0.2
A			Forest and pasture land development	0.2
	Breeding investments	3		5.5
A.	Genetic upgrading of small animals	3	Strengthen the existing 6 goat and 1 sheep breeding farms to improve their capacity to develop and multiply improved local goat and sheep breeds. The investment needed for every 5 years would be about INR 10 crores	2
B			Strengthen and promote the establishment of private breeding farms to be used to generate improved goats and sheep	3.5
	Research and extension services	0		0.5
A			Provide 100 Pashu Seki and Prani Mitra training sessions every year. The cost is INR 50 thousand	0.5
	Marketing and processing investments	0		59.2
A			Establish livestock markets having slaughter hours in Mandis at the block level	25
B			Establish 5 goats and sheep small-scale slaughterhouses per year to start within the municipalities and urban bodies. Subsequently, all the district HQs shall have certified slaughterhouses. A total of 25 small abattoirs with a capacity of 20–30 animals per day will have to be created by 2026/27	1
C			Establish three goats and sheep abattoir (model scientific abattoir) in 2026/27, in Bhubaneswar, Cuttack and Rourkela, mainly to meet the needs of the new E-commerce model of meat delivery	10
D			One incubation centre for the start up of animal protein market under the proposed ASF university	0
E			One goat and sheep meat processing plant (EOU) will be established in the first five years	20
F			New retail outlets for selling meat/animal protein	1
G			Promoting the local breed through labelling as superior meat for export as being done by Bakri (Himalayan goat) in Uttarakhand	0.2
H			Two tanneries will be established by 2026/27. Each tannery can treat 5,000 hides of sheep/goats per day. The collection system shall be created to prevent loss of raw material by training the butchers to clean and salt/turmeric treatment as well as to prevent moisture	2
	Total	3		65.4

Table 42. Budget comparison for chicken value chain development between LMP and livestock budget of the government of Odisha

S/ No.	Name of the schemes/ components	Investment in crores (year one 2022/23)	Name of the schemes/components	Investment in crores (2021–26)
	Feed	0		12.2
A			Strengthen the existing feed quality control laboratory in 2021/22 in OUAT animal nutrition laboratory and establish one laboratory per production zone three by the public and three by the private sector in the 1st five years	2
B			Insect traps with light will be made available for purchase by farmers at a subsidized rate. It is planned for 50 thousand in the first five years. The cost of insect traps varies from INR 1,000 to INR 5,000. A 50% subsidy may be given by the government	4
C			Promoting soya bean and maize cultivation: 186 thousand ha by the 5th year (2026/27)	1.2
D			Establishing additional commercial feed plant (the total indicative chicken feed demand is estimated to reach about 5.9 lakhs by the 5th year, in 2026/27)	5
	Breeding investments	7.12		2.3
A			Additional 20-day old chick production farms, of which 4 are for improving the local backyard chicken and 16 for the commercial poultry	2
B			Reducing reproductive wastage through the introduction of brooding and artificial incubation facilities like hay box brooders for backyard chicken and small-scale incubators to be promoted in the Hilly and Mountain region. In total, 20 thousand brooder boxes are needed	0.2
C	Poultry breeding farm	7.12	Small-scale incubators 300. The cost of each incubator is INR 20 thousand	0.1
	Research and extension	0		1.24
A			Establish one research centre under the proposed Animal and Fishery Sciences University	
B			Increase the efficiency of public and private veterinary services = 100 clinics cum pharmacies. To promote self-employment of veterinary graduates. A subsidy of INR 300 thousand may be given to promote such clinics. The cost of setting up a clinic would be about INR 1 million	1
C			Poultry farmer workshops. Each workshop costs about INR 2 lakhs. Conduct 12 workshops per year	0.24
	Marketing and processing	53.67		49.3
D	Encouraging commercial poultry entrepreneurs and backyard poultry production	53.67	Promote hygienic chicken slaughter facilities by incentivizing at all meat markets and registered under FSSAI—INR 1,000/store per quarter and to hold a competition. Fines to be collected for noncompliance. Estimated to cover 30 thousand outlets over the next 15 years. 2,000 outlets per year	0.8
E			New 2,000 outlets per year—the cost of setting up is 50 thousand	10
F			Modern chicken cutting and processing plants will be established to process the huge increase in chicken meat production. Two in the five years—One for organic chicken and 1 for regular processed chicken. The cost of such a processing plant is INR 5 crores	5
G			Egg for better nutrition for women and children in the midday meal program. Four crores eggs per year through the Department of Child and Women Welfare. INR 4 per egg	16

S/ No.	Name of the schemes/ components	Investment in crores (year one 2022/23)	Name of the schemes/components	Investment in crores (2021–26)
H			Social marketing and online delivery platforms to promote chicken and egg consumption. To spend INR 5 crores per year	5
I			Private integrators working in providing the DOC and helping farmers with the necessary inputs. Each integrator works with 125 farms every five years. Currently, 5 integrators are working in the state. Each integrator adds 5 additional farms per year. Each farm working for an integrator needs to put in about INR 0.5 crores for the infrastructure	12.5
Total		60.79		65.04

Table 43. Total budget comparison of LMP and livestock budget of the government of Odisha (in crores)

Value chain	Government of Odisha budget for livestock	LMP budget
Dairy	972.46	749.41
Red meat	3	65.4
Chicken	60.79	65.04
Total	1036.25	879.85



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