Sustainable Family Farming in Livestock Sector for Attaining UNDFF and the SDGs in South Asia

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SAARC Agriculture Centre conducted a three-day regional workshop on "UN Decade of Family Farming 2019-2028: Sustainable Family Farming in Livestock Sector for Attaining the SDGs in South Asia" held in Kathmandu, Nepal on 11-13 August 2025 with the participation of national focal experts from Member States, international experts' entrepreneur and other stakeholders.

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December, 2025

Published by SAARC Agriculture Centre, BARC Complex, Farmgate, Dhaka 1215, Bangladesh (www.sac.org.bd).

A catalogue record for the book is available from the SAARC Agriculture Centre Library, BARC Complex, Farmgate, Dhaka, Bangladesh.

ISBN: 978-984-35-8653-7

Citation

Md. Younus Ali, Md. Harunur Rashid, AHM Taslima Akhter and Md. Abul Bashar (Editors) 2025. Sustainable Family Farming in Livestock Sector for Attaining UNDFF and the SDGs in South Asia. SAARC Agriculture Centre, Dhaka, Bangladesh, Pp 1-119

This book contains the country papers and proceedings of the SAARC Regional Workshop on " UN Decade of Family Farming 2019-2028: Sustainable Family Farming in Livestock Sector for Attaining the SDGs in South Asia " on 11-13 August 2025. The experts for the country paper presentation were the representative of their respective government of SAARC Member States. The opinions expressed/ images used/tables presented in this publication are those of the authors and do not imply any opinion whatsoever on the part of the SAARC Agriculture Centre, specifically regarding the legal status of any country, territory, city or area or its authorities.

Cover design: Ms. Shanjida Akter

Printed by: Natundhara Printing Press, Dhaka, Bangladesh

Price: 08 USD in SAARC Countries

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Foreword

I am delighted to know that the outcome of the regional present proceeding titled "*Sustainable Family Farming in the Livestock Sector for Attaining UNDFF and the SDGs in South Asia.*" This timely work arrives at a moment when the livestock sector is gaining unprecedented importance in addressing the interlinked challenges of food security, nutrition, employment, climate adaptation and rural livelihoods in our region. As South Asian countries navigate population pressures, climate-induced stresses and evolving market demands, family farming emerges as a critical foundation for sustainable agricultural transformation. This proceeding offers a comprehensive overview of how family-based livestock production can drive progress toward the Sustainable Development Goals (SDGs).

Family farms are the backbone of livestock production in South Asia. In Bangladesh, Nepal, Bhutan, India, Pakistan and Sri Lanka, the vast majority of milk, meat and eggs is produced by smallholder and family farmers. These farms not only contribute to national economies but also uphold traditional knowledge systems, enable women's leadership, foster community resilience and support vibrant rural societies. Their contributions directly advance SDGs related to poverty reduction, food and nutrition security, gender equality, decent work, inequality reduction and climate action. Strengthening family farming is therefore essential for building a more just, prosperous and resilient South Asia.

This document rightly highlights that despite their immense contributions; family farmers face persistent constraints. Limited access to quality feed, animal health and extension services, climate-resilient technologies, market linkages and affordable financing continue to hinder their full potential. Overcoming these barriers demands not only national commitment but also meaningful regional cooperation. In this regard, the SAARC Agriculture Centre (SAC) has been working dedicatedly to promote collaborative research, capacity building and knowledge exchange among Member States. This publication reinforces that regional solidarity is key to unlocking sustainable livestock development.

I commend the authors and contributors for producing a document that is practically relevant. The analysis, insights and recommendations presented here may help policymakers, researchers, development practitioners and program designers to develop more inclusive, evidence-based and resilient livestock initiatives. It maps the current landscape and outlines actionable pathways for leveraging family farming to meet regional and global goals.

I would also like to acknowledge the valuable cooperation of SAARC Member States, the Ministry of Agriculture and Livestock Development of Nepal and the Asian Farmers' Association for Sustainable Rural Development (AFA). My sincere appreciation to Dr. Younus Ali, Senior Program Specialist (Livestock), SAC, for his leadership in organizing the regional workshop and for his dedication in preparing this proceeding. I am confident that this piece of publication will help researchers, policymakers and extension personnel working in the livestock sector and will inspire renewed commitment to strengthening family farming across South Asia.

Dr. Md. Harunur Rashid
Director

UN Decade of Family Farming 2019-2028: Sustainable Family Farming in Livestock Sector for Attaining the SDGs in South Asia

(Date11-13 August 2025. Kathmandu, Nepal)

Joint Communique

Preamble

We, the participants from SAARC Member States namely Bangladesh, Bhutan, Maldives, Nepal, Pakistan and Sri Lanka and Asian Farmers' Association (AFA), Farmers' Organizations from Bangladesh, India, Nepal, with guests from Kyrgyzstan, Mongolia and Tajikistan and Heifer International, gathered in Kathmandu, Nepal for a three -day regional workshop titled "*Sustainable Family Farming in Livestock Sector for Attaining UNDFF and the SDGs in South Asia*" on 11-13 August 2025, would like to present this Joint Communique.

Context

South Asia is home to approximately 1.9 billion people around 24 percent of the global population and has the largest youth labor force in the world. Nearly 65 percent of the region's population lives in rural areas, where the majority are smallholder family farmers engaged in integrated farming systems that combine agriculture, livestock, forestry and fisheries (FAO and IFAD, 2019). Family farmers in South Asia contribute to at least 70 percent of the region's food production, with women playing a vital role, accounting for up to 80 percent of farm labor.

Livestock farming, as well as pastoralism in highland areas of the region, contributes to the attainment of the SDG goals and play a crucial role to enhance livelihood, generating employment for women and youth in production, processing and marketing livestock products (SDG 1,5,8); provide healthy, nutritious food and promotes soil health, land restoration and biodiversity through animal manure used for composting, managed grazing and silvopastoralism (SDG 2,3,12,13,15); The Livestock wealth of the South Asian region is enormous : 271 million cattle (18% of global population), in addition to 257 million goats (25% of global population). The demand for livestock products particularly meat, milk and milk products in South Asia reflects an increasing trend due to population growth, economic prosperity, consumer awareness and health consciousness especially among the younger generations.

However, SAARC member states are still struggling to meet the domestic requirements for livestock and its products. Smallholder family farmers are facing with challenges of degraded lands and competing land use; high costs and untimely supply of feeds, other inputs, supply of climate resilient and low-methane producing breeds ; inadequate storage , transportation and marketing facilities; animal pests and diseases including trans-boundary diseases worsened by inadequate supply of vaccines and veterinary services and facilities; poor access to markets and weak finance support; marginalization and exclusion of women and young farmers in decision making and in accessing technological and financial services; and climate change where increasing frequencies of droughts and floods and warmer temperatures lead to sharper declines in livestock productivity and health and consequently farming profitability; thus making livestock farming and pastoralism unattractive to the youth. These challenges threaten the region's food, nutrition security as well as the environment's health.

To respond to these challenges, the participants put forward the following recommendations:

1. We recommend the governments to enact policies that promote sustainable livestock and pastoralism management, at the same time improve income and resiliency of farmers as well as protect the environment. Programs to be taken to implement these policies and should be adequately funded to reach majority of smallholder livestock family farmers and pastoralists, thereby creating solid impact at both the farm and at the national level. Moreover, policies should be crafted and programs must be implemented with significant involvement of farmers' organizations and cooperatives as key partners in both decision-making, implementation and provision of services.

   Many current programs can be scaled up to reach a larger majority of livestock farmers and pastoralists, as well as scaled up to broaden and integrate different initiatives into a comprehensive and holistic approach of sustainable livestock family farming and pastoralism which should deliver the following results to livestock family farmers and pastoralists:

   a. **Improved Climate Resiliency:** securing rights and access of smallholder women, men and young farmers to their farms and pasturelands; selection, breeding, sexed semen insemination and culling of improved varieties of livestock especially, low-methane

producers; developing natural hay land; rotational grazing; mixed farming for resource efficiency and nutrient and waste recycling; manure management for biogas production; tree planting for shade and fodder; animal health insurance;

b. **Healthy Livestock:** implementation of One Health Approach; national vaccination programs; bio-secure digital advisory services as well as training of community technicians and para-veterinarians; finding suitable and cheaper alternative to antimicrobials;

c. **Improved Access to Markets:** build transhumance and infrastructure facilities such as trails and water facilities; improve the quality of domestic products according to regional/global standards; provide clear projection on production and market prices and subsequent advisory notes to farmers;

d. **Improved Access to Finance:** provision of low interest or collateral-free loans; subsidized inputs and cost-sharing mechanisms; price guarantee schemes;

e. **Stronger Inclusion and Empowerment of Women and Young Farmers:** recognize and register farmers' organizations as legal entities; provide incentives to organized groups such as distribution of equipment, livestock breeds and loans; give scholarships ; implement capacity building modules on livestock/pastoralism management business/ entrepreneurship planning; partner with farmers' organizations in proposal preparation and project implementation; provide funding to organizations and cooperatives to federate their members and conduct their own capacity building and policy engagement activities.

2. We recommend the SAARC Agriculture Center (SAC) to-

   a. Conduct at the regional level various policy fora, expert consultations and/or planning sessions with SAARC Member States, partner farmers' organizations and cooperatives, to share best experience, exchange ideas and harmonize standards and policies, especially on

      i. access to credits with specialized agriculture banks, promoting local /regional products;

      ii. guidelines to trans-boundary diseases;

iii. building the capacities including family farmer's organizations, women and young farmers in policy and program implementation; and in value addition, enterprise management, marketing, etc.

b. Develop a regional proposal on sustainable, integrated, climate resilient livestock /pasture management focusing One Health Approach and that can be implemented at the national level and coordinated at the regional level, in partnership with farmer organizations and NGOs. This proposal can be submitted to potential financial partners.

3. We recommend to farmers' organizations to-

   a. build their capacities for organizational management, sustainable livestock and pasture management and increase the visibility of their work so that governments and other partners perceive/see them as credible and legitimate partners.

   b. continue to organize men, women and young livestock /pastoralist farmers into enterprising groups and cooperatives to serve as channels for input delivery, advisory and business development services, financing and marketing support.

   c. strengthen policy engagement with governments to provide sound perspectives, messages and recommendations emanating from their own consultations and policy analysis.

Way forward

Short term plan of action

- Implementation of One Health Approach and national vaccination programs
- Implement capacity building modules on livestock, pastoralism management business and entrepreneurship planning
- Guidelines for trans-boundary animal diseases
- Youth and women in livestock farming

Midterm plan of action

- Animal health Insurance
- Provision of low interest or collateral-free loans
- Building the capacities for family farmer's organizations,

- Women and young farmers policies in livestock rearing
- Value addition, enterprise management and marketing

Long term plan of action

- Develop a regional proposal on sustainable, integrated, climate resilient livestock
- Strengthen policy engagement with governments to provide sound perspectives
- Access to market thorough improving the quality of domestic products according to regional/global standards

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Chapter 1

Sustainable Family Farming in Livestock to Achieve the SDGs in South Asia: Challenges and Opportunities

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Introduction

South Asia is identified as one of the fastest growing regions globally and is of great importance for sustainable development. Located in eight countries including Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka, the South Asia is globally significant due to its large population, vibrant markets and economic influence. The region accounts for about 1.8 billion people, which is roughly 24% of the world's population and it possesses the world's largest youth manpower as human resource (FAO, 2019). Approximately 65% of South Asians live in rural areas, with most engaged in smallholder family farming (FAO, 2019). These farmers typically practice integrated systems that include agriculture, livestock, forestry and fisheries.

Family farmers in South Asia contribute to at least 70% of the region's food production, with women performing a significant portion of the farm labour, ranging from 60 to 98% (FAO, 2019). Despite, South Asia being the second fastest-growing economy worldwide, it faces severe challenges, with 216 million people living below the international poverty line of US$1.90 per day and 14.9% of the population suffering from undernourishment (FAO, 2019). Poverty in the region is predominantly rural. Family farmers deal with issues such as low agricultural productivity and limited access to essential resources like affordable quality seeds, fertilizers, technology, financial services, infrastructure, poor veterinary services, inputs and markets. Additionally, they face difficulties due to limited participation in decision-making and governance, the impacts of climate change, social and political conflicts. Furthermore, about half of the unemployed population are youth, who are reluctant to engage in agriculture despite its potential to generate employment. South Asia, covering 3% of the world's land area yet supporting 24% of its population, is the most densely populated region. Around 67% of its population depends on agriculture, fisheries and forestry, with 80% of women engaged in farm work (FAO, 2019). Family farmers produce

70% of the region's food; however, 66% of the world's poor live in rural South Asia, which experiences high food and nutrition insecurity and increased vulnerability to climate change and other shocks (FAO, 2020).

South Asia: The regional context

Reports of FAO (2020) and IFAD (2019) display the significant contribution of each South Asian country to total livestock numbers. India leads the region in livestock holdings across nearly all species, including cattle, buffalo, sheep, goat and poultry. With over 192 million cattle and nearly 110 million buffalo, India stands as a global giant in dairy and draught animal production (FAOSTAT, 2020). Pakistan is the next major contributor, particularly in buffalo (41 million), goats (78 million) and poultry (851 million), reflecting its livestock centric agricultural economy. Sheep and goat populations are also heavily concentrated in India and Pakistan; vital for meat, wool and rural income generation (FAOSTAT, 2020). Countries like Nepal, Bangladesh and Afghanistan maintain a modest, yet crucial flocks aligned with local food and livelihood needs. The poultry sector is especially significant, with India having over 1.4 billion poultry, followed by Pakistan and Bangladesh, supporting both nutrition and rural employment (FAOSTAT, 2020). Overall, the total livestock population in South Asia is nearing 2.8 billion, which plays a central role in food supply, income and employment, particularly for rural smallholders (FAOSTAT, 2020). However, this abundance also signals challenges for disease control, productivity enhancement, sustainable feed sourcing and environmental management for the future.

The growth trends in milk and meat production across South Asia, drawing from the latest available data from the Ministry of Fisheries, Animal Husbandry and Dairying, India (2024) and FAOSTAT (2025) highlighted the steady upward trend in milk production in South Asia from 2014 to 2023. India overwhelmingly leads on milk production in the region, currently producing around 247.87 million metric tons (m MT) annually; representing per capita milk availability at the tune of 485 g/day. Pakistan, while a distant second, contributes significantly with 62.56 m MT. Bangladesh and Nepal produce 10 m MT and 2.5 m MT respectively, while Sri Lanka, Afghanistan and Bhutan contribute less than 2 m MT each, reflecting the pronounced concentration of dairy activity in a few key countries (FAOSTAT, 2020). The region's overall milk production trend is robust, with the increase clearly driven by Indian dairy expansion as well as moderate growth in Pakistan and Bangladesh. Such consistent growth underscores the crucial role of the dairy sector in food security and rural livelihoods in South Asia.

Meat production follows a similar pattern of concentration. India again is the leading producer, accounting for 10.5 million tons annually, while Pakistan produces 4.7 million tons and Bangladesh 2.0 million tons. Nepal, Sri Lanka,

Bhutan, Afghanistan and the Maldives each contribute much smaller shares. Collectively, the data highlights the dynamism of South Asia's livestock sector, especially dairy, as a key pillar for food production, employment and rural economic stability. Growth in these sectors is aligned with rising consumer demand, improved production technologies and increased policy focus on agricultural livelihoods.

Economic significance and GDP contributions of livestock sector

The livestock sector has a substantial economic footprint in the region. As per the DAHD's Annual Report for 2023-2024, livestock accounts for 5.50% of the total GDP and a remarkable 30.23% of agricultural GDP in India, underlining its centrality within Indian agriculture. According to Department of Livestock Services, Ministry of Fisheries and Livestock, Government of Bangladesh**,** Bangladesh's livestock sector contributes 1.80% to its national GDP for 2023-24, reflecting a growing but smaller share relative to the overall economy. According to economic survey 2023-2024, livestock sector in India experienced robust growth, with a 12.99% compound annual growth rate (CAGR) from 2014-15 to 2022-23, showcasing a rapid expansion in production, income and sector capacity (GOI, 2024). In terms of employment and livelihoods, livestock remains a cornerstone for rural and peri-urban families. Globally, over 500 million people rely on livestock for their livelihoods and in South Asia, it is often the main source of income among smallholder and landless households. The sector supports food security, provides draft power, manure and financial resilience and plays a crucial role in women's economic participation and empowerment.

Livestock and Sustainable Development Goals

Aligning with global sustainability priorities, the livestock sector is closely linked to the United Nations Sustainable Development Goals (SDGs). It makes direct/ indirect contributions to most of the SDGs, with especially strong positive impacts on poverty alleviation, hunger eradication, good health & wellbeing and gender equality. At the same time, the sector faces complex sustainability challenges, necessitating sustainable approaches to maximize benefits while minimizing trade-offs for environment and society (World Bank, 2021; ADB, 2022)

Sustainable Development Goal 1: No poverty

Livestock is positioned as a crucial financial asset for rural households, directly supporting SDG 1 by reducing poverty. Livestock ownership provides multiple streams of income from milk, meat, eggs and even dung (used for fertilizer or fuel or compressed biogas). These outputs not only supplement household income but also act as insurance and financial buffers during financial emergencies, since animals could be sold or bartered in times of need. This

economic resilience is especially important for smallholder and landless family farmers, for whom, the livestock represents the main wealth.

Sustainable Development Goal 2: Zero hunger

In combating hunger, livestock plays a vital role as explained under SDG 2 (Zero hunger). Animal derived foods are rich in high quality protein and essential micronutrients that are often lacking in plant sourced food items. Livestock manure further boosts food security by enhancing soil fertility and increasing crop productivity. Mixed crop-livestock systems are particularly encouraged, optimizing resource use and farm resilience. Globally, livestock provides 40% of all protein consumed by people and 18% of total calories, underlining its irreplaceable nutritional and dietary contribution, especially in rural South Asian contexts (FAO, 2020).

Sustainable Development Goal 3: Good health and well-being

Livestock enhances human nutrition by providing high quality proteins through foods such as meat, milk and eggs. These animal products are pivotal in combating micronutrient deficiencies and improving dietary diversity, which are critical for the health of children and pregnant women. The veterinary health sector also plays a significant role in supporting public health systems, ensuring both animal and human populations are safeguarded against diseases. The concept of "One Health," which integrates the health of people, animals and the environment, is especially important in livestock management. This holistic approach is crucial for the prevention and control of zoonotic diseases, that can transfer from animals to humans, requiring joint efforts from veterinary and medical professionals.

Sustainable Development Goal 5: Gender equality

Regarding SDG 5, livestock farming empowers rural women and promotes gender equality in South Asia. Women are central to managing small ruminants and poultry and income generated from livestock enables their economic participation and decision-making power within households. Furthermore, livestock supports female entrepreneurship across value chains, enabling women to run small production and processing enterprises and gain financial independence. Notably, 70% of rural women in South Asia are involved in raising livestock, underlining the sector's importance for women's livelihoods and rural community stability (FAO, 2023).

Sustainable Development Goal 8: Decent work and economic growth

Livestock farming is a major engine of employment and income in rural areas, driving the SDG 8. Millions of people work across the dairying, meat and animal feed sectors. The diverse livestock market provides accessible entry-level

employment, especially important for youth and women and spurs rural enterprise development and diversification of income streams. By creating value-added opportunities along the supply chain from production to marketing and services, livestock boosts rural enterprise and helps communities adapt to changing conditions.

Sustainable Development Goal 12: Responsible consumption and production

In terms of environmental sustainability, the livestock sector is closely aligned with SDG 12. The industry supports efficient use of agricultural by-products and crop residues, converting potential waste into valuable cattle feed and manure. Manure recycling is integral, as it not only reduces environmental waste but also replenishes soil fertility, contributing to sustainable crop production. This approach supports a broader bio-economy in agriculture, minimizing waste and maximizing productivity by channelling organic resources back into the production system.

Sustainable Development Goal 13: Climate action

Livestock is a significant source of greenhouse gases (GHGs) emissions, especially methane, which contributes to global climate change. However, the sector also presents valuable opportunities for climate change mitigation. Improved feeding technologies and better manure management practices can substantially reduce these GHGs emissions. Climate-smart livestock practices support both mitigation and adaptation, allowing production systems to be more resilient to climate variability and extremes such as drought or heat waves.

Sustainable Development Goal 15: Life on land

Manure produced from livestock, when well-managed and applied to fields, enhances soil fertility and increases soil carbon content, contributing directly to improved soil health. In addition, well-managed grazing systems play an essential role in maintaining pasture biodiversity and ecological balance. Adopting silvo-pastoralism integrating trees, forage and livestock, which reduces land degradation, supports carbon sequestration and helps restore degraded landscapes, thus aligning closely with SDG 15’s focus on protecting, restoring and promoting sustainable use of terrestrial ecosystems.

Major challenges and limitations of the livestock family farming

Initial input costs

One of the foremost challenges is the burden of initial costs, which are often compounded by limited credit access and insufficient gender support mechanisms. Many rural families, particularly women and smallholder farmers, find it difficult to secure the financial resources and institutional backing

necessary to invest in livestock or expand their operations. These barriers hinder entry and growth for vulnerable groups in the sector.

Knowledge and training

Knowledge and training deficits further restrict productivity and innovation. Weak extension services, a persistent gender gap in access to information and a largely untrained manpower limit the widespread adoption of modern animal husbandry, health care and business practices.

Climate and infrastructure available

Climate and infrastructure pose significant hurdles as well. The sector is highly sensitive to environmental challenges like heat stress, feed scarcity and the spread of trans-boundary diseases, all exacerbated by climate change. Inadequate infrastructure in rural areas including inconsistent veterinary coverage, insufficient cold chain facilities, poor waste management and gaps in vaccination programs reduces animal health and the quality of livestock products.

Market access

Market access is another critical limitation. For many rural producers, there are barriers to entering higher-value or urban markets due to an underdeveloped supply chain, lack of quality certification and logistical constraints. This restricts profitability and market expansion for smallholder farmers.

Policy support

Effective policy support becomes indispensable, as focused policies, incentives and targeted credit programs can help unlock rural enterprise potential, encourage adaptation ownership and build sectoral resilience.

Opportunities

Women at the centre of the Livestock Economy

Women play a vital role in global agriculture, making up 36% of the agricultural workforce (FAO, 2023). In South Asia, their contribution is particularly notable; in Nepal, for instance, women comprised 64% of agri-food system workers as of 2019 (FAO, 2019). Despite providing the majority of labour in livestock production, women often have limited access to training and essential credit facilities, which constrains their productivity and potential for advancement in the sector. Empowerment opportunities through livestock farming are significant. The sector offers pathways for women's economic independence, allowing them to generate income, build assets and support household well-being. Livestock farming also helps diversify household income and provides resilience against economic shocks, making it a powerful tool for elevating rural women's status.

Cooperative models, such as self-help groups and farmer producer organizations, have shown particular success in empowering women farmers. These collectives provide training, facilitate credit and strengthen bargaining power, thereby enabling women to participate more actively and profitably along the agricultural value chain (FAO, 2020; GASL, 2022).

Financing and investment system

Small farmers often struggle with significant credit access barriers, which limit their ability to invest in livestock and improve productivity. These barriers include limited access to formal financial services, as rural banking infrastructure is often weak or inaccessible to marginalized groups. Additionally, lending institutions frequently set high interest rates and require cumbersome administrative procedures that deter small-scale applicants. The lack of acceptable collateral further excludes many livestock farmers from traditional loan offerings, making it difficult for them to scale or upgrade their operations.

Microfinance institutions and group lending models, such as those built around Self-Help Groups (SHGs) or Farmer Producer Organizations (FPOs), provide small loans with flexible terms, collective guarantees and community-based support, making credit more accessible to smallholders. Insurance products for livestock and crop protection also serve as vital risk management tools, helping farmers recover from losses due to disease, natural disasters or market shocks. Public-private partnerships are another promising avenue for value chain development. By integrating the resources and expertise of both private enterprises and government bodies, these partnerships can finance infrastructure, provide technical support and create stronger market linkages. Such collaborative models accelerate adoption of best practices and technology, ultimately enhancing investment capacity and sector resilience.

A 'Phygital' (Physical + Digital) ecosystem for service delivery

Adopting a ‘phygital’ approach integrating both physical and digital service channels opens up new avenues for delivering veterinary services, extension support and financial products. Digital platforms increase the reach of advisory services, market access and information dissemination, benefiting even remote rural farmers.

Foster robust regional cooperation and scaling up

Lastly, fostering robust regional cooperation is vital in the face of shared challenges such as climate change, zoonotic disease threats and trade barriers. Cross-border collaboration allows for exchange of best practices, harmonization of policies and coordinated action, thereby elevating regional livestock development and resilience.

Regional initiatives

Regional initiatives play a foundational role in pool resources, knowledge and technologies across countries. The regional action plan for the "UN Decade of Family Farming" prioritizes strengthening smallholders. This is complemented by cross-border collaboration in animal health and disease control and technology transfer mechanisms that facilitate innovation and best practices among neighboring nations. Such collaboration is essential for tackling shared challenges like trans-boundary animal diseases and market access barriers.

International support

International support significantly enhances regional and local capacities. FAO's "Global Agenda for Sustainable Livestock" provides essential technical assistance to South Asian countries, while the International Fund for Agricultural Development (IFAD) invests in smallholder dairy development, focusing on improving productivity, livelihoods and gender equity. The Asian Development Bank (ADB) supports the creation of inclusive and adaptive livestock farming models to ensure benefits reach marginalized groups.

Priority actions and policy integration

Priority actions highlighted for strengthening extension services, establishing farmer's field schools for climate adaptation and investing in rural infrastructure. Promoting women's participation in livestock value chains and supporting the development of climate-resilient animal breeds and sustainable feeding systems are crucial for sustainable growth. Establishing platforms for regional cooperation to share knowledge and coordinate disease control is also emphasized as a means to achieve long-term sector resilience. Further the need to support producer organizations and cooperative development, as these grassroots structures enable effective scaling up and inclusive progress in the livestock sector.

Farmer collectives as service delivery ecosystems

The growth of farmer collectives, like Farmer Producer Organizations (FPOs) and Self-Help Groups (SHGs), creates powerful ecosystems for service delivery. Such collectives enhance bargaining power, facilitate access to markets and inputs and enable knowledge sharing. This collaborative model strengthens the bargaining power and market reach of small farmers in increasingly competitive value chains.

Sustainability strategies and market development

Sustainable intensification approaches such as silvopastoral systems are proving effective for carbon sequestration and enhancing biodiversity. By combining

trees, pastures and livestock, these systems capture more atmospheric carbon, support wildlife diversity and make agricultural landscapes more resilient. Integrated crop-livestock systems further enhance resource efficiency, allowing waste and by-products from one operation to be utilized in another, thus minimizing losses and maximizing outputs. Methane reduction is also a key focus, with innovative feeding (like seaweed, probiotics and biochar) and genetically resilient breeding reducing livestock emissions while maintaining productivity.

On the conservation front, livestock production can actually foster biodiversity, particularly through well-managed grazing schemes that preserve native grasses and habitats. Implementing circular economy principles in mixed farming systems ensures nutrient recycling, reduces environmental pollution and creates economic synergies between livestock, cropping and allied enterprises.

Despite these advances, there are persistent market access challenges. Farmers frequently receive only a fraction about one-third of the final product price, with the majority of profits captured by intermediaries. Limited local processing capacity and underdeveloped quality standards hinder value addition and deficient rural infrastructure restricts efficient linkages between producers and markets. These barriers impede the equitable sharing of benefits and slow the adoption of sustainability innovations at scale (FAO, 2020; Keeling et al., 2019).

Climate vulnerability and adaptation needs

Climate change is imposing multiple stressors on agricultural systems. Persistent droughts further exacerbate poor crop and animal productivity, while rising temperatures and unpredictable monsoon patterns undermine the reliability of traditional farming cycles. These challenges create dire risks for rural livelihoods and regional food security.

In response, farmers are adopting a range of adaptation strategies. Many reduce herd sizes through selection, enhance water collection and storage methods and use supplementary feeding to buffer livestock against resource scarcity. Embracing climate-smart practices such as rotational grazing, improved livestock breeds and integrating adaptation-focused technologies helps safeguard productivity and sustainability amidst environmental shifts (FAO, 2020; GASL, 2022).

Technology and innovation present a powerful frontier in building resilience. AI-driven applications support climate-smart decision-making and on-farm practices, enabling real-time risk assessment and targeted interventions. Mobile technology extends the reach of advisory services and market linkages to even the most remote farmers. Precision agriculture tools allow for optimized utilization of water, nutrients and feed critical under conditions of scarcity. Efforts to boost superior fodder yields, advance genetic resources for climate

resilience and promote balanced nutrition strategies further enhance productivity while mitigating emissions from livestock (FAO, 2020; GASL, 2022). Overall, these integrated approaches combining practical adaptation with cutting-edge technology are essential for transforming vulnerability into resilience and ensuring sustainable livelihoods for South Asian livestock farmers.

Successful models and case studies

Cooperative success stories

One of the most celebrated examples is India's Amul Model, a farmer-owned cooperative, which has become the global benchmark for dairy sector development. The cooperative structure empowers smallholder producers by allowing them to pool resources, collectively process and market milk and negotiate for better prices. In Bangladesh, similar cooperative models especially those involving women have led to significant increases in farmer incomes through the power of collective action and group bargaining.

Several key factors underpin this success: strong institutional and policy support, effective development of market linkages for input and output flows and ongoing capacity building and training for cooperative members. These elements enable producers not only to boost productivity and quality but also to access better markets and embrace new technologies. Government policy frameworks further reinforce these advances. India's "21st Livestock Census" in 2024 marked a major investment (200 crore) in comprehensive data collection to inform future policies and programs. The "Rashtriya Gokul Mission" focuses on genetic improvement of livestock (DAHD, 2014), while Bangladesh's development policies aim to support smallholder integration into formal value chains. Both countries emphasize infrastructure advancements in cold chain and agro-processing, research on climate-resilient livestock breeds and continuous strengthening of extension and advisory services to ensure the sector remains robust in the face of evolving challenges. These cases illustrate how a blend of cooperative action, institutional backing and targeted government investment creates an enabling environment for livestock sector growth and inclusive rural development.

Farmer producer organizations (FPOs)

Farmer producer organizations (FPOs) have emerged as a significant force, with over 10,000 such entities registered and benefitting more than 8 million farmers nationwide. FPOs help reduce input costs for members by leveraging bulk purchasing power for seeds, equipment and other agricultural necessities. They also facilitate direct selling to buyers, enabling farmers to realize prices 10-20% higher than what would be possible through traditional intermediaries. By pooling resources, FPOs improve bargaining power, foster better market access and help smallholders transition from subsistence to more market-oriented agriculture.

Self-Help Groups (SHGs) are another critical model, with 12 million SHGs under the DAY-NRLM scheme, involving over 140 million women. These groups have facilitated cumulative bank linkages valued at 6.9 lakh crore (2024), greatly expanding the access of rural women to credit and financial services. The SHGs play a key role in advancing women's participation in activities such as dairy, goat rearing, poultry and rural handicrafts. The *Kudumbashree* initiative in Kerala stands out as a model for supporting women entrepreneurs in livestock and food processing industries, providing a pathway to increased income and business ownership.

Lakhpati Didi

An outstanding example of women-focused entrepreneurship is the "Lakhpati Didi" initiative under DAY-NRLM. It aims to enable rural women SHG members to earn at least 1,00,000 annually by linking them with sustainable livelihood and micro-enterprise opportunities. Achievements include connecting over one crore SHG women to a variety of income-generating activities; ranging from livestock and food processing to value added rural trades. The scheme emphasizes skill training, market facilitation through FPOs and "Rural Hats" and mentoring. This multifaceted approach has led to measurable impacts: improved household income and living standards, enhanced financial literacy and greater decision-making power for rural women.

Future outlook and transformative potential

Projected growth in the sector is robust, with India's livestock industry expected to see global demand for its products rise by 20% by 2050. South Asian markets are also forecasted to expand rapidly, propelled by climbing household incomes and increasing urbanization. The pace of technology adoption is expected to create substantial opportunities for efficiency gains, enabling producers to streamline operations, reduce costs and improve product quality.

Transformation opportunities are abundant and timely. Sustainable intensification applying advanced breeding, feeding and resource management practices can help meet rising demand for livestock products while simultaneously lowering environmental impacts. The ongoing digital revolution presents new avenues for precision farming and seamless market access, potentially revolutionizing how inputs, services and products are managed and distributed. Furthermore, active youth engagement in modern livestock enterprises ensures long-term sectoral vitality and innovation.

A clear call to action is directed at stakeholders across the sector. The private sector is urged to develop inclusive value chains that prioritize smallholder farmers, invest in processing and marketing infrastructure and adopt sustainable sourcing practices. Development partners are encouraged to scale up well proven models such as cooperative dairy systems, support women's empowerment and

facilitate regional cooperation for sustainable transformation. Policymakers, for their part, should prioritize smallholder livestock initiatives, invest in climate-resilient infrastructure and technologies and strengthen institutional capacity for extension and supporting services. Together, these actions will unlock higher productivity, greater inclusivity and enhanced sustainability in the South Asian livestock sector (FAO, 2020; United Nations, 2023).

Conclusions

The principles of "Integrate, Don't Isolate," "Turn Waste into Wealth," "Build Resilient Landscapes," and "Prioritize Native Resilience" collectively underscore the profound benefits of Integrated Crop-Livestock Systems (ICLS). These systems promote sustainable farming by linking crop and livestock production to recycle nutrients, reduce waste and diversify income sources, increasing productivity and improving soil health. Transforming livestock manure into biogas or high-quality fertilizer enables circular economy practices that minimize waste, lower input costs and boost crop yields, while reducing environmental pollution. Moreover, silvopasture integrates trees, forages and animals, enhancing fodder availability, reclaiming degraded land and providing significant environmental benefits like carbon sequestration and biodiversity improvement, thereby increasing farm resilience to climate extremes. The focus on indigenous, climate-adapted animal breeds builds resilience at the farm level by reducing resource needs and management risks, supporting smallholder livelihoods amid climate change. Together, these principles advocate a holistic approach to farming that enhances sustainability, resilience and profitability of rural agriculture, particularly for smallholders in South Asia and similar regions. Implementing these integrated and circular strategies cultivates more productive, environmentally friendly and economically stable farming systems for the future.

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Chapter 2

Sustainable Family Farming on Livestock Sector for Attaining the SDGs: Country perspective of Bangladesh

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Bangladesh is predominantly an agriculture-based country, where the livestock sector plays a pivotal role in the rural economy by contributing to food security, nutrition, income generation and employment creation. This sector encompasses a wide range of species, including cattle, buffaloes, goats, sheep, chickens, ducks and other poultry. Notably, the majority of these animals and birds are reared by smallholder and family farmers, underscoring the sector's close association with rural livelihoods and community-based agricultural systems. In recent years, the livestock sector has received increased policy and research attention due to its critical contribution to achieving multiple Sustainable Development Goals (SDGs), particularly those related to poverty alleviation, food security, gender equality and climate resilience. According to recent estimates, the livestock sector contributes approximately 1.81% to the national GDP and 16.54% to the agricultural GDP of Bangladesh, with a monetary value exceeding Tk. 910.36 billion (BDT). It accounts for around 56.14% of the country's total animal protein intake and provides substantial employment opportunities within rural communities.

More than 80% of rural households in Bangladesh are engaged in family-based farming systems that incorporate livestock rearing. Consequently, livestock serves as a multifaceted asset: providing food, nutrition, income, savings organic manure, draught power and various social and cultural benefits. The sector is particularly significant for improving smallholder livelihoods, generating employment opportunities (especially for women) and enhancing household food and nutrition security. Recognizing its socio-economic importance, the Government of Bangladesh, through the Department of Livestock Services (DLS) has implemented several initiatives to promote sustainable family farming practices. These initiatives include livestock breed improvement programs, farmer capacity-building and training activities, value chain development projects and the adoption of climate change adaptation and mitigation strategies. The current endeavor aims to analyze the current status of the livestock-based family farming sector in Bangladesh, identify key challenges and propose a future roadmap for strengthening its contribution to sustainable rural development and national food security.

Livestock sector in Bangladesh

The livestock sector in Bangladesh represents a crucial component of the national agricultural economy, playing a significant role in enhancing food security, reducing poverty and improving rural livelihoods. The country sustains a considerable population of livestock species, the majority of which are managed under traditional, smallholder-based farming systems. These systems are characterized by mixed crop-livestock integration, family labor dependence and limited resource inputs, yet they remain central to rural household income and nutrition. According to the Department of Livestock Services (DLS) Report for 2024-2025, the estimated population of major livestock species in Bangladesh is enormous and presented in Table 1.

Table 1. Livestock Population in Bangladesh (2024-2025)

Livestock Species	Population (Million)
Cattle	25.17
Buffalo	1.53
Goat	27.29
Sheep	3.98
Chicken	336.07
Duck	70.58

The livestock sector in Bangladesh is experiencing a steady annual growth rate of 3.19%, indicating consistent progress supported by targeted interventions from both governmental and non-governmental organizations. This growth underscores the sector's critical role in ensuring a stable supply of key animal protein sources, namely milk, meat and eggs and thereby contributing to national food and nutrition security. The current production levels of these major livestock products are summarized in Table 2.

Table 2. Milk, meat and egg production in Bangladesh (2024-2025)

Products	Production
Milk (Million metric tons)	15.54
Meat (Million metric tons)	8.95
Eggs (Billion number)	24.41

Employment generation remains one of the most significant contributions of the livestock sector in Bangladesh. It is estimated that approximately 20% of the population is directly and about 50% is indirectly, dependent on livestock for

their income and livelihoods. The sector is predominantly characterized by smallholder and family-based farmers, who operate within backyard and mixed crop livestock production systems, where livestock are often integrated with crop cultivation to maximize resource efficiency and farm sustainability. Livestock rearing also serves as a crucial pathway for gender empowerment, as rural women play an active role in managing poultry, goats and dairy cattle, thereby contributing to household income and nutritional well-being. Furthermore, youth employment and agro-entrepreneurship are expanding within the sector, driven by growing investments in dairy farming, beef fattening and commercial poultry production. Beyond its economic contributions, the sector plays an essential role in ensuring nutritional security through household-level consumption of milk, meat and eggs. Although, livestock production in Bangladesh is gradually transitioning toward more commercialized and market-oriented systems, it remains deeply embedded within traditional family-based farming structures. With strategic investments, innovative technologies and enabling policy frameworks, the livestock sector possesses immense potential to serve as a transformative driver in achieving Bangladesh's Sustainable Development Goals (SDGs) by 2030.

Types of livestock production systems in Bangladesh

Bangladesh demonstrates a diverse array of livestock production systems, influenced by variations in land availability, socio-economic conditions, agro-ecological characteristics and long-standing farming traditions. Broadly, the major livestock farming systems prevalent across the country can be categorized as follows:

1. Smallholder backyard farming (Family-Based System)

This represents the most prevalent livestock production system in rural Bangladesh. Under this system, poultry, goats and cattle are typically reared within household premises and managed primarily by women and elderly family members. The products obtained, such as milk, eggs and meat are largely intended for household consumption, while any surplus is marketed locally. This production system plays a crucial role in enhancing household food security, improving nutrition and contributing to income diversification among rural families.

2. Mixed crop-livestock farming system

This system is commonly practiced by medium scale farmers, who integrate livestock production with the cultivation of rice, wheat or vegetables to optimize land use efficiency and resource utilization. Cow dung is applied as organic fertilizer to improve soil fertility, while crop residues are recycled as feed for livestock. This circular approach to resource management promotes environmental sustainability, reduces production costs and enhances the overall resilience and productivity of mixed farming systems.

3. Commercial intensive farming system

This system is rapidly expanding across peri-urban and urban areas, with a primary focus on broiler and layer poultry production, as well as dairy farming. It operates under a high-input, high-output model that incorporates modern housing systems, nutritionally balanced feed, systematic vaccination programs and advanced management practices. Farms under this system are well integrated into organized value chains and formal markets, facilitating efficient production, processing and distribution of livestock products.

4. Semi-intensive farming system

This system represents an intermediate stage between traditional backyard farming and fully commercial livestock production. Animals are typically housed in sheds and managed through a combination of controlled grazing and supplemental feeding. The system is widely practiced in goat rearing, beef fattening and duck or chicken production, offering a semi-intensive approach that enhances productivity while retaining key elements of traditional management.

5. Pastoral or transhumant system

The pastoral or transhumant livestock system is practiced in limited areas of Bangladesh, primarily within the coastal "Charland" and "Haor" regions. In this system, animals, predominantly cattle, buffaloes and horses are seasonally moved across different grazing areas to access pasture or to safeguard them during periods of flooding. This mobility not only ensures adequate feed for the livestock but also facilitates their use as draught animals for ploughing, transportation and other agricultural activities. The system is highly adaptive to the ecological and climatic conditions of these regions, enabling farmers to optimize resource use in flood-prone or marginal lands where stationary farming is less feasible. Although, it involves a relatively small proportion of the population, the transhumant system plays a vital role in sustaining livelihoods, conserving genetic diversity and preserving traditional livestock management practices in these vulnerable areas.

6. Cooperative Livestock Farming

Cooperative livestock farming is an emerging model in several districts of Bangladesh, including Sirajganj, Bogura and Tangail. In this system, farmers organize into groups to collectively produce, process and market dairy and meat products, thereby improving operational efficiency, reducing costs and enhancing access to formal markets. These cooperatives are often supported through initiatives led by non-governmental organizations (NGOs) and public-private partnerships. Notably, many producer groups have been established under the Livestock Development for Dairy Production (LDDP) project of the Department of Livestock Services (DLS)**,** which provides technical assistance, capacity building and access to essential resources. By fostering collaboration among

smallholder farmers, cooperative livestock farming not only strengthens rural livelihoods but also promotes sustainable production practices and facilitates the integration of smallholders into formal livestock value chains.

Family farming in Bangladesh

Family farming refers to a form of agriculture that is primarily managed and operated by a household, with production largely dependent on family labour. In Bangladesh, over 80% of rural households are engaged in small scale, low input, livestock-based family farming systems. These farms are highly diverse, ranging from backyard poultry and goat rearing to integrated crop-livestock systems. According to the Food and Agriculture Organization (FAO), family farms are defined as "agricultural holdings which are managed and operated by a household and where family labour is predominantly used."

In the Bangladeshi context, family farms function not only as economic units but also as vital social and cultural institutions. They play a crucial role in ensuring household food and nutritional security by producing a range of livestock products for consumption and sale. Beyond their economic significance, family farms contribute substantially to the conservation of indigenous livestock breeds, thereby safeguarding unique genetic resources that are well adapted to local agro-ecological conditions.

These farms also serve as centres for the transmission of traditional knowledge and farming practices across generations, preserving cultural heritage and sustaining local agricultural traditions. Furthermore, family farms promote social inclusion and empowerment by actively involving women and youth in livestock management, supporting gender equity and fostering skills development among younger generations. Through these multifaceted roles, family farming remains a cornerstone of rural livelihoods, food security and sustainable livestock development in Bangladesh.

Key characteristics of family farming in Bangladesh

1. Small scale landholding

Most family farms in Bangladesh operate on small landholdings, typically less than two acres. Livestock rearing on these farms is generally integrated within the homestead or household yard, enabling families to manage animals alongside crop cultivation and other household activities efficiently. This close integration allows for optimal use of available resources: crop residues are commonly utilized as livestock feed, while animal manure is recycled as fertilizer for crops, creating a circular and sustainable farming system. The small-scale nature of these farms encourages labor-intensive practices, with family members, particularly women and the elderly playing a central role in daily management activities such as feeding, milking and animal care. These practices ensure a

steady supply of animal-sourced food products, including milk, eggs and meat, for household consumption, while surplus products provide an important source of supplementary income through sales in local markets. Through this combination of resource efficiency, multi-purpose production and family labor utilization, smallholder family farms maintain both economic viability and household food security, while simultaneously preserving traditional knowledge and farming practices.

2. Multi-functional roles

Family farms in Bangladesh fulfill multiple functions beyond food production. Livestock provide essential products such as milk, meat, eggs and manure and they often serve as draught animals for ploughing or transportation. In many households, animals also hold cultural and religious significance, being integral to traditional ceremonies and ritual sacrifices. These roles highlight the deep social, economic and spiritual value of livestock within rural family farming systems.

3. Family labor dominance

These farms predominantly rely on family labor, with women, children and elderly members assuming essential responsibilities in daily livestock management, including feeding, cleaning and general care. Hired labor is infrequently engaged and is typically limited to specialized tasks, such as vaccination or veterinary interventions.

4. Lower investment with greater dependence on nature

Investment in these farms is generally limited, with most farmers relying on traditional feed resources and local breeds that are well adapted to the prevailing environmental conditions. Nevertheless, they frequently face constraints in accessing veterinary services, financial facilities and credit support.

5. Gender inclusive

Investment in these farms is generally limited, with most farmers relying on traditional feed resources and local breeds that are well adapted to the prevailing environmental conditions. Nevertheless, they frequently face constraints in accessing veterinary services, financial facilities and credit support.

6. Knowledge transmission

Knowledge of livestock rearing is passed down informally from one generation to the next, with little or no formal training. Local wisdom shapes decision-making in areas such as animal health, disease prevention and feeding, displaying enduring community-based practices.

7. Integration with crop farming

Family farms are often integrated with crop production, forming a mutually beneficial and sustainable system. Animal by-products, such as cow dung, are

applied as organic fertilizer to enhance soil fertility, while crop residues are repurposed as livestock feed. This cyclical exchange of resources not only reduces external input costs but also promotes environmental sustainability and efficient farm management.

8. Vulnerability to risks

Despite their critical role, family farms remain highly vulnerable to a range of risks. They are particularly susceptible to disease outbreaks, market price fluctuations and the adverse impacts of climate change. The absence of adequate insurance mechanisms and limited access to institutional support further constrains their capacity to recover from shocks, including natural disasters. Nevertheless, these farms exhibit remarkable resilience, adapting through traditional knowledge, resourcefulness and community networks and continue to constitute a cornerstone of Bangladesh's rural economy and food security system.

Significance of family farming on national agriculture

Family farming constitutes the backbone of Bangladesh's agricultural economy, with over 85% of farms classified as small or marginal and predominantly managed by the family members. These farms contribute a substantial share of the nation's crops, vegetables and livestock, ensuring a reliable food supply year-round at both household and community levels. They play a pivotal role in maintaining the traditional crop livestock integration system, in which crop cultivation and livestock rearing are managed in a complementary and mutually supportive manner. Through practices such as intercropping, recycling crop residues and utilizing organic inputs like cow dung, family farms enhance soil fertility, reduce dependency on chemical fertilizers and promote sustainable agricultural practices. This diversified and circular approach also increases their resilience to climate variability and environmental stress.

Beyond their ecological contributions, family farms are major providers of rural employment, engaging household labor across all age groups throughout the year. They also serve as custodians of cultural heritage, preserving traditional practices such as seed saving, home gardening and agricultural rituals that have been transmitted across generations. By producing both for self-consumption and local markets, these farms strengthen food sovereignty, enhance community-level food security and reduce dependence on external food systems. Collectively, family farms exemplify a model of sustainable, socially embedded and economically significant agriculture that underpins both livelihoods and the broader rural economy in Bangladesh.

Significance of family farming on livestock

Family farms occupy a dominant position in Bangladesh's livestock sector, accounting for over 80% of the country's total livestock production. Their

extensive presence across rural areas underscores their central role in sustaining both the nation's food system and rural economy.

In Bangladesh's dairy sector, smallholder family farms are the primary source of the country's milk supply. Typically managed within homestead settings, these farms provide a steady supply of fresh milk for household consumption while supplying local markets, thereby supporting both nutrition and rural livelihoods. In recent years, women's participation in dairy farming has increased markedly, with female-led initiatives emerging as catalysts for economic empowerment, income diversification and social recognition. By engaging in milk production, processing and marketing, women not only contribute to household incomes but also enhance their decision-making roles within families and communities. This growing gender-inclusive involvement highlights the broader socio-economic significance of smallholder dairy farming in promoting rural development and advancing gender equity in Bangladesh.

In Bangladesh, backyard family poultry farming plays a crucial role in enhancing rural nutrition and generating income, particularly for women. Chickens and eggs produced on these small-scale family farms are often preferred by consumers for their superior taste, freshness and perceived safety compared to commercially produced alternatives. These farms not only provide an accessible source of high-quality protein for household consumption but also offer women opportunities for entrepreneurship and income generation through the sale of poultry and eggs in local markets. By integrating poultry rearing with household livelihoods, family farms contribute to both food security and socio-economic empowerment, reinforcing their importance within rural communities.

Meat production in Bangladesh is predominantly supported by rural family farms, particularly through goat and cattle fattening initiatives. Seasonal events, such as "Eid-ul-Adha", provide significant income-generating opportunities, as families rear and sell sacrificial animals, contributing both to household livelihoods and the local economy. Trends in milk, meat and egg production during the recent past are summarized in Table 3.

Table 3. Milk, meat and egg production during recent past (Livestock Economy at a glance, DLS, 2025)

Livestock products	Fiscal year		
	2015-16	**2020-21**	**2024-25**
Milk (Lakh Metric Ton)	72.75	119.85	155.38
Meat (Lakh Metric Ton)	61.52	84.40	89.54
Egg (Crore number)	1191.24	2057.64	2440.65

Manure management represents a critical component of sustainable family farming in Bangladesh. Cow dung and poultry droppings are commonly recycled

as organic fertilizers, enriching soil fertility and reducing the reliance on chemical inputs. Additionally, these organic wastes are increasingly used for biogas production, providing a renewable source of energy for cooking and household needs. By integrating manure utilization into farm operations, family farms adopt a circular and resource-efficient approach that lowers production costs, minimizes environmental impact and promotes long-term agricultural sustainability.

In terms of breeding, family farms play a crucial role in the conservation of indigenous livestock breeds, such as the "*Deshi*" chicken and *Black Bengal* goat. These native animals are well adapted to local climatic conditions and exhibit natural resistance to common diseases, making them particularly suited to low-input, resource-constrained farming systems. By maintaining and propagating these breeds, family farms not only support productivity but also preserve genetic diversity, safeguard rural livelihoods and enhance resilience to climate variability. Consequently, the role of family farms extends beyond food production, encompassing biodiversity conservation, employment generation and the strengthening of sustainable livestock systems, thereby positioning them as a cornerstone of Bangladesh's long-term livestock development strategy.

Socioeconomic profile of family farmers in Bangladesh

Family farmers in Bangladesh come from diverse socioeconomic backgrounds, although the majority belong to poor or lower-middle-income groups. They frequently confront multiple challenges, including limited landholdings, low levels of formal education and restricted access to input and output markets. These socioeconomic constraints strongly influence their farming practices, decision-making processes and livelihood strategies. Understanding the characteristics, constraints and resource endowments of these households is essential for designing policies and interventions that enhance productivity, sustainability and resilience. Key indicators of the socioeconomic profile of family farmers are summarized below:

A. Gender roles and participation

Gender roles are central to the functioning of family farms in Bangladesh. Women contribute more than 60% of the labor in livestock-related activities, including poultry rearing, goat husbandry and dairy cow milking. Despite their substantial involvement, women often have limited decision-making authority and rarely hold formal land ownership, which constrains their influence over farm management and resource allocation. However, an increasing number of households are now female-headed, often due to male migration, widowhood or other socioeconomic factors. In these households, women assume greater responsibilities, including leadership in farm operations, financial management and strategic decision-making. Recognizing and strengthening the role of women in family farming is therefore crucial, not only for improving productivity and

livelihoods but also for promoting gender equity and empowering rural communities.

B. Age and labor force

In terms of age distribution, most active family farmers in Bangladesh are between 35 and 60 years old. However, both elderly members and younger adults aged 18-35 years play an active role in farm operations, particularly in emerging areas such as commercial dairy, poultry production and technology-driven livestock services. The growing participation of youth signals a generational shift, introducing innovative practices, entrepreneurial approaches and modern techniques to traditional farming systems. Promoting youth engagement not only enhances productivity and farm modernization but also supports the long-term continuity and sustainability of family-based agriculture in rural Bangladesh.

C. Landholding status

With respect to landholding status, approximately 70% of family farmers in Bangladesh are smallholders, cultivating less than 1.5 acres of land. About 20% are landless and rely on common grazing areas, rented plots or leased land to sustain their livestock activities. Backyard livestock farming is particularly prevalent among landless and marginal households, serving as an accessible means to generate income, improve nutrition and enhance livelihood resilience despite limited land resources. These patterns highlight the importance of land access and management strategies in shaping livestock production practices and the overall sustainability of family-based farming systems.

D. Education and training

Education levels among family farmers in Bangladesh remain generally low, particularly among women, which limits their access to information, technology and institutional support. Much of the existing agricultural and livestock knowledge is transmitted informally across generations through practical experience and community-based learning. However, in recent years, both government agencies and non-governmental organizations (NGOs) have increased their efforts to improve farmers' technical capacity through training, extension services and awareness programs on modern livestock management, animal health and sustainable production practices. These initiatives are gradually bridging knowledge gaps, fostering innovation and empowering farmers, especially women to adopt improved techniques that enhance productivity and livelihood resilience.

E. Income and livelihoods

Income from livestock farming accounts for approximately 25% to 40% of total household earnings among smallholder families in Bangladesh. However, these earnings are often seasonal, with income peaks occurring during religious festivals such as *Eid-ul-Adha* or periods of high market demand for milk, meat or

eggs. This seasonality exposes households to income fluctuations and financial uncertainty throughout the year. To stabilize their livelihoods, many family farmers diversify their income sources by engaging in complementary agricultural activities, such as crop cultivation, fisheries or vegetable production or by participating in non-farm sectors, including wage labor, small-scale trade or migration-based remittances. Such livelihood diversification is essential for enhancing income stability, reducing vulnerability to market and climatic shocks and ensuring the long-term sustainability of family farming systems in rural Bangladesh.

F. Social capital and cooperatives

Strong social capital characterizes family farming communities in Bangladesh, where traditional networks and collective practices play a pivotal role in sustaining livelihoods. Increasing participation in cooperatives and producer groups, particularly those led by women has strengthened collaboration, knowledge exchange and collective bargaining power among smallholders. Community-based platforms such as Milk Vita and BRAC's dairy initiatives exemplify this growing cooperative engagement, providing farmers with improved access to markets, fair pricing mechanisms and capacity-building opportunities. These social and institutional networks not only enhance economic resilience but also foster empowerment, inclusivity and long-term sustainability within the rural farming landscape.

Policy and institutional framework for family farming in livestock sector

National policies and programs supporting family farming

The Government of Bangladesh has acknowledged the pivotal role of livestock-based family farming in promoting food security, generating rural employment and reducing poverty. In recognition of this importance, a range of national policies, strategic plans and development programs have been implemented over the years to strengthen the livestock sector and enhance the capacity of smallholder farmers. These initiatives aim to improve productivity, expand market access, promote sustainable resource management and ensure the inclusion of women and marginalized groups in the growth of the rural economy.

Key policies and strategic plans

National Livestock Development Policy 2007

The National Livestock Development Policy (NLDP) 2007, currently under revision, emphasizes sustainable, small-scale livestock farming. It focuses on genetic improvement of livestock breeds, expanding fodder cultivation, strengthening veterinary services and enhancing market access for family farmers.

7th and 8th Five Year Plan

The 7th and 8th Five Year Plans have identified the livestock sector as a priority sub-sector for accelerating agricultural transformation and rural development. Recognizing its significant contribution to household income, nutrition and employment, the plans emphasize the expansion of livestock production and productivity through improved breeding, feeding and animal health services. They also seek to promote inclusive economic growth by creating rural employment opportunities, particularly for women and youth and by supporting the development of smallholder and commercial livestock enterprises. In doing so, the plans aim to strengthen livelihood resilience, enhance food and nutrition security and contribute to poverty reduction in rural communities.

Livestock Extension Policy

A draft livestock extension policy is currently under development to strengthen the delivery of livestock-related advisory and support services. The policy proposes the establishment of targeted and demand-driven extension services tailored to the needs of smallholder farmers**,** with a focus on improving productivity, animal health and farm management practices. It further emphasizes the training, certification and deployment of community-based livestock health workers to enhance service outreach and ensure timely access to basic animal healthcare, particularly in remote and underserved areas**.**

National Agricultural Policy and Food Policy

The National Agricultural Policy and the National Food Policy both recognize the crucial role of the livestock sector in achieving food and nutritional security. These policies promote the adoption of integrated farming systems that combine crops, livestock and fisheries, aiming to optimize the use of land, water and other resources. By encouraging diversified production and sustainable resource management, the policies seek to enhance farm productivity**,** stabilize household incomes and ensure year-round availability of nutritious food for rural and urban populations alike.

Vision 2041 and SDG Framework

The livestock sector of Bangladesh plays a transformative role in achieving the sustainable development goals (SDGs) and realizing Vision 2041. Guided by the Ministry of Fisheries and Livestock (MoFL), the government has prioritized the modernization of livestock systems, promotion of digital technologies and the strengthening of small-scale family farms. With a strong emphasis on climate resilience and gender equity, the sector contributes significantly to SDG 1, SDG 2, SDG 3, SDG 5, SDG 8, SDG 10, SDG 13 and SDG 15. In terms of poverty eradication (SDG 1), livestock provides a reliable source of livelihood for rural households. In FY 2024-2025, the sector generated a GDP of BDT 91,036 crore,

employing approximately 20% of the population directly, while another 50% are partially dependent on livestock related activities. Women in rural areas raise poultry, goats and cattle under backyard systems, playing a critical role in lifting their families above the poverty line. The sector is also central to achieving zero hunger (SDG 2) and promoting good health and well-being (SDG 3). In 2024-2025, Bangladesh produced 15.538 million metric tons of milk, 8.954 million metric tons of meat and 24.41 billion eggs. These high protein animal sourced foods enhance national food security and help reduce malnutrition, particularly among children and pregnant women.

Gender equality (SDG 5) is being advanced through increased participation of women in livestock production. Many smallholder farms are entirely managed by women, who receive training, microcredit and inputs from the government, enabling them to become decision-makers and significant contributors to household income. The sector also drives decent work and economic growth (SDG 8). With an annual GDP growth of 3.19%, the livestock value chain creates employment opportunities across rearing, processing, transport and marketing. It further encourages youth entrepreneurship in the dairy and meat industries, fostering inclusive and sustainable economic development.

To address inequality (SDG 10), targeted interventions have been designed for landless farmers, ethnic minorities and female-headed households, enabling marginalized communities to build resilience and enhance their standard of living. Climate change adaptation (SDG 13) is also a key priority under Vision 2041, which promotes climate-smart livestock practices such as heat-tolerant breeds, improved manure management and low-emission technologies. These measures not only reduce greenhouse gas emissions but also strengthen the long-term sustainability of the sector.

In pursuit of life on land (SDG 15), the livestock sector contributes to biodiversity conservation and ecosystem services through sustainable pasture management organic farming and integration with agroforestry systems. In summary, with strong policy support, innovative approaches and inclusive strategies, the livestock sector is emerging as a cornerstone of Bangladesh's sustainable development agenda, improving livelihoods, empowering women and building climate resilience, thereby paving the way for a prosperous and sustainable future.

Institutional support system

Department of Livestock Services

The department of livestock services (DLS) serves as the principal government agency responsible for the development and regulation of the livestock sector. Its mandate encompasses a wide range of activities, including the provision of veterinary healthcare, extension and advisory services, artificial insemination

(AI), capacity-building and training programs and disease prevention and control initiatives. To strengthen livestock health and productivity nationwide, the DLS implements several national-level programs such as the Foot and Mouth Disease (FMD) Control Program, the Peste des Petits Ruminants (PPR) Eradication Program and the Livestock. These initiatives aim to reduce disease prevalence, enhance animal welfare and improve the overall resilience of the livestock subsector. In recent years, the expansion of artificial insemination services delivered through both DLS facilities and private sector partnerships is playing a pivotal role in genetic improvement and breed upgradation. This has contributed significantly to higher productivity, better milk yields and increased income opportunities for rural livestock farmers, thereby supporting national goals of food security and rural development.

Bangladesh Livestock Research Institute

Bangladesh Livestock Research Institute (BLRI) is the country's leading institution for scientific research and innovation in the livestock sector. Its work focuses on livestock breed improvement**,** disease diagnosis and control**,** feed and fodder development and the promotion of sustainable, smallholder-oriented livestock production systems tailored to the needs of family farms.

NGOs and development partners

A number of non-governmental organizations (NGOs) and development partners, namely, BRAC**,** Heifer International**,** Regional Integrated Multi Hazards Early Warning System and the Food and Agriculture Organization (FAO) play a vital role in supporting family-based livestock farmers. Their interventions encompass training and capacity building**,** financial assistance through grants and credit facilities and technical support aimed at improving livestock management practices. These organizations also actively promote climate-smart and sustainable livestock systems while encouraging women's participation, entrepreneurship and leadership within the sector.

Cooperatives and producer groups

The Bangladesh Milk Producers' Cooperative Union Limited (Milk Vita) is the leading organization in the country's dairy sector. It provides smallholder farmers with access to an integrated network for milk collection, processing and marketing, enabling them to participate effectively in the formal dairy value chain. Through this cooperative system, farmers benefit from collective bargaining power, bulk sales and fair and stable pricing for their produce.

Community Animal Health Workers (CAHW)

Community Animal Health Workers (CAHWs) play a crucial role as intermediaries between formal veterinary services and smallholder farmers.

Operating at the village level, they deliver essential services such as basic animal healthcare and first aid, vaccination and practical husbandry advice. By improving access to timely animal health interventions, CAHWs significantly contribute to better livestock productivity, reduced disease incidence and enhanced livelihoods for family-based farming households.

Sustainable livestock management practices by family farmers in Bangladesh

Given Bangladesh's high vulnerability to climate change (including recurrent floods, cyclones, salinity intrusion and heat stress), family-based livestock farmers are increasingly adopting climate smart and sustainable livestock practices. These practices emphasize low cost, locally adapted and knowledge-based approaches that reduce production risks and strengthen farm resilience. In coastal regions, farmers cultivate salinity tolerant fodder species such as Napier and Para grass, while making efficient use of crop residues like rice straw and lentil husks. Many communities have established fodder banks and adopted silage making techniques to ensure a steady feed supply throughout the year. Farmers also prefer hardy native breeds, including *Black Bengal* goats, *Deshi* chickens and *Red Chittagong* cattle; which are naturally disease-resistant, require less feed and are well adapted to local climatic conditions. To mitigate the effects of heat stress and flooding, farmers construct improved livestock sheds with adequate ventilation and drainage and in flood prone areas, animals are housed on raised platforms to prevent water logging. Many follows integrated farming approaches, using cow dung as compost and crop residues as animal feed, thereby improving nutrient recycling and reducing waste. The installation of small-scale biogas plants further supports clean energy use, reduces dependence on fuel wood and enhances farm sanitation. Community vaccinators, trained by NGOs and the Department of Livestock Services (DLS) conduct regular immunization programs against diseases such as Peste des Petits Ruminants (PPR), Foot and Mouth Disease (FMD) and Newcastle Disease (ND); significantly lowering mortality rates. Farmers also use traditional herbal remedies, such as neem leaves, turmeric and garlic, for treating minor ailments. To protect animals from extreme weather, they construct shades/ shelters using bamboo, hay and other local materials. In recent years, digital technology has become an important support tool. Many farmers now use mobile applications and SMS services to receive weather forecasts, disease alerts and market price updates. Both DLS and private service providers are expanding remote advisory and extension services, making climate-smart livestock farming more accessible and sustainable for rural families.

Success story of self-reliant woman using livestock platform

Behula Begum, a resident of the remote char area of Kunderpara under Kamarjani Union in Gaibandha Sadar Upazila, has faced years of hardship and

uncertainty. She is the mother of three daughters and one son. Because of extreme poverty, Behula was unable to send her two elder daughters and her son to school and was compelled to marry them off at a young age. Her husband's modest income as a daily wage laborer was barely enough to cover the family's most basic needs. The thought of educating her youngest daughter seemed impossible when survival itself was a struggle. Living in a flood-prone area, the family's home was repeatedly destroyed by annual floods, forcing them to rebuild every year and trapping them in a cycle of poverty. Their daily life was marked by constant hardship, tension and family disputes, with little hope for change.

A turning point came when the Upazila Livestock Office of Gaibandha Sadar selected Behula as a beneficiary of the "Integrated Livestock Development Project in 86 Disadvantaged Border Areas and Riverine Char Areas of the Northern Region." Through the project, she received training in scientific sheep rearing and was provided, free of cost, with a sheep shed and three sheep (two females and one male) on 13 July 2023. Applying the skills and knowledge gained from her training, Behula began to manage her small farm with great care and dedication. She maintained the shed properly, ensured the animals' health and nurtured them attentively. When her sheep began to reproduce, her efforts started to bear fruit; marking the beginning of a new chapter of self-reliance and hope in her life.

Livestock enterprise of Behula Begum

A livestock field facilitator (LFF) assigned to the union level regularly monitored Behula Begum's farm, ensuring timely vaccination and deworming of her

animals. The LFF maintained continuous communication with the Upazila Livestock Office, promptly addressing any challenges that arose and providing ongoing technical guidance to support her progress. Behula's efforts soon began to yield results. On 5th December 2023, her sheep gave birth to two lambs for the first time, followed by two more lambs on 21st December 2023. After carefully raising three of the lambs, she sold them on 17th November 2024 for BDT 12,500/-. With the income, she purchased a sewing machine for BDT 8,500/-, using the remaining amount for household expenses. Today, Behula Begum not only manages her livestock but also earns an additional BDT 3,000-4,000 /- per month by sewing clothes for herself and others in the community.

This newfound source of income has made her increasingly financially self-reliant and empowered within her family. Her opinions are now valued in household decisions and she has even re-enrolled her youngest daughter in school, covering all her educational expenses. The daughter is currently studying in the second grade. With greater financial security, Behula could now meet her family's daily needs and fulfill small personal aspirations without depending on her husband. Peace and happiness have returned to their home. At present, she owns four sheep: two lambs and two pregnant ewes and plans to help her husband repair their house before the next rainy season. Her inspiring journey has drawn attention at higher levels. On 21st March 2025, Dr. Anjan Kumar Dev Roy, Additional Secretary of the Agriculture, Water Resources and Rural Institutions Division of the Planning Commission, along with Dr. Nand Dulal Tikadar, the Project Director, visited Behula Begum's home. They inspected her sheep and shed, commended her dedication and expressed satisfaction with her remarkable success.

Success story on application of digital innovation for duck farming

Badarkhali, a barefoot man, trudging through muddy rice fields with a laptop might not seem revolutionary until you hear the story behind it. In the aftermath of climate disasters such as Cyclone Sidr**,** rural livelihoods across southern Bangladesh were left shattered. Yet today, people like Rafiq Mridha and Nupur Akhter are rewriting the success story applying the power of digital agriculture services.

The couple manages a 0.5-hectare integrated farm near the Bay of Bengal, where they rear ducks, fish, cows and vegetables. After years of climate induced losses, their perseverance and new knowledge have paid off and earning them over USD 14,800 from their farm last year. Their turning point came with the establishment of a local digital service Centre, a one stop hub, where farmers can access real time support on weather forecasts, livestock health, crop management and marketing through mobile applications or in-person consultations.

Digital assistance to resolve a duck-rearing issue

Whenever, Nupur (woman duck farmer) noticed a sudden drop in duck egg production, she reached out to the digital service center. The digital assistant quickly identified the problem as poor feed quality and provided practical guidance to resolve it. Thanks to this timely intervention, their daily income of BDT 700-800 from duck eggs was stabilized. "The digital centre has made our lives easier and our business more profitable," Nupur said. "We are no longer in the dark; we could now solve problems with confidence." Her husband, Rafiq, added, "We've already expanded the farm and next year we plan to build a brick house." Their story is a powerful testament to how digital technology, when made accessible to climate-vulnerable communities, can drive meaningful transformation in rural Bangladesh. With the right combination of support, knowledge and connectivity, even the most remote smallholder farmers can rebuild their livelihoods and lead the way toward sustainable and resilient agriculture.

Challenges and constraints of family farming in the livestock sector

Family farming within Bangladesh's livestock sector holds immense potential, playing a vital role in ensuring food security, reducing poverty and sustaining rural livelihoods. Small and marginal households commonly rear poultry, goats, cattle and sheep around their homesteads, which contributes to household income

generation and promotes self-reliance. However, despite its potential, the sector faces numerous and multifaceted constraints that hinder its growth, sustainability and profitability. Major challenges include limited access to modern livestock technologies, shortages of skilled manpower, inadequate veterinary and extension services and restricted availability of quality inputs. Furthermore, weak market linkages, inequitable pricing of livestock products and insufficient institutional support exacerbate these issues. The sector is also increasingly vulnerable to the adverse effects of climate change, such as erratic weather patterns, recurrent flooding and frequent disease outbreaks, which further threaten productivity and resilience. Without comprehensive and strategic interventions to overcome these barriers, achieving sustainable and resilient family-based livestock farming in Bangladesh will remain a significant challenge. The key challenges can be summarized as follows:

Limited access to veterinary and extension services

In many rural areas of Bangladesh, timely and reliable veterinary services remain largely inadequate. There is a pronounced shortage of qualified veterinarians and trained livestock field officers, particularly in remote and hard-to-reach regions. Consequently, farmers often depend on untrained local healers or rely on outdated and unscientific traditional practices to treat their animals. This situation frequently results in delayed or inappropriate treatment, leading to higher livestock morbidity and mortality rates, reduced productivity and significant economic losses for rural households. Moreover, the absence of professional veterinary guidance limits farmers' ability to adopt modern husbandry techniques, implement effective disease prevention and control measures or maintain proper animal nutrition and welfare standards. Strengthening veterinary service delivery, expanding outreach programs and building local capacity are therefore critical for enhancing livestock health and improving the overall resilience of family-based farming systems in Bangladesh.

Inferior quality feeds and fodder

The supply of quality livestock feed in Bangladesh is often inadequate, while higher market prices make it unaffordable for many small and marginal family farmers. As a result, livestock frequently suffer from nutritional deficiencies that lead to poor growth rates, reduced milk and meat yields, delayed reproduction and increased vulnerability to diseases. Most rural farmers also lack adequate knowledge and training in fodder cultivation, feed formulation and silage preparation techniques. Consequently, animals are often fed low-quality crop residues or imbalanced diets that fail to meet their nutritional requirements. This not only hampers animal health and productivity but also undermines the profitability and sustainability of smallholder livestock farming systems. Strengthening feed supply chains, promoting on-farm fodder production and enhancing farmers' technical capacity in feed management are therefore essential

for improving livestock performance and ensuring better returns for rural households.

Disease outbreaks and mortality

Bangladesh's livestock sector is frequently affected by outbreaks of infectious diseases such as Peste des Petits Ruminants (PPR), Foot and Mouth Disease (FMD), Avian Influenza and Newcastle Disease. These diseases cause substantial economic losses, with particularly high mortality rates observed among poultry and goats, two of the most commonly reared livestock species among rural households. Despite the availability of vaccines for most major diseases, vaccination coverage across the country remains significantly below the required level due to inadequate resources, limited cold-chain facilities and a shortage of trained personnel to administer vaccines. Consequently, disease transmission continues to pose a serious threat to animal health, productivity and farm income. Recurrent outbreaks not only diminish livestock populations but also undermine farmers' confidence and discourage further investment in the sector. To mitigate these risks, it is essential to strengthen disease surveillance systems, expand vaccination and extension programs and enhance farmers' awareness of biosecurity and preventive health management practices. Such measures are critical for safeguarding livestock assets and ensuring the sustainable growth of Bangladesh's livestock sector.

Market barriers and price fluctuation

Family farmers in Bangladesh often face significant challenges in accessing profitable markets for their livestock and animal products. Due to the absence of organized marketing channels, smallholders are typically dependent on intermediaries or middlemen, who frequently exploit their weak bargaining power by offering lower farmgate prices. The lack of transparent pricing systems and formal market infrastructure further exacerbates this issue, leaving farmers with limited opportunities to negotiate fair returns for their produce. Additionally, the absence of livestock insurance schemes or mechanisms to stabilize prices exposes producers to substantial market and production risks, contributing to income volatility and financial insecurity. As a result, many smallholders struggle to sustain or expand their livestock operations. Strengthening market linkages, establishing producer cooperatives, ensuring fair pricing mechanisms and promoting access to market information can greatly enhance farmers' profitability and overall resilience within the livestock value chain.

Limited financial services

Access to affordable credit and insurance services for livestock farmers in Bangladesh remains severely limited. Formal financial institutions are often

reluctant to lend to small and marginal farmers due to perceived risks, lack of collateral and insufficient financial documentation. While microfinance institutions provide an alternative source of funding, their loans frequently carry higher interest rates that burden farmers and reduce profitability. The absence of livestock specific insurance schemes further exposes producers to financial losses resulting from disease outbreaks, natural disasters or market fluctuations. Consequently, many smallholders are unable to invest in improved breeds, modern production technologies or better housing and feed management practices. Expanding access to affordable and inclusive financial services through credit guarantees, tailored loan products and livestock insurance programs is essential to enable farmers to adopt innovations, increase productivity and strengthen the resilience of the livestock sector.

Climate change impacts

Climate change poses a growing threat to Bangladesh's livestock sector, particularly for smallholder and family farmers. Increasing salinity intrusion, recurrent floods, prolonged droughts and rising temperatures adversely affect fodder availability, water resources and overall animal health and productivity. Extreme weather events often result in the loss of livestock, destruction of shelters and disruption of feed and veterinary supply chains, causing severe economic hardship for rural households. Moreover, most rural areas lack climate resilient infrastructure such as elevated animal housing, safe water sources and feed storage facilities necessary to withstand these environmental stresses. Without adequate adaptation measures, the frequency and intensity of climate-induced shocks are likely to undermine the long-term sustainability of livestock-based livelihoods. Strengthening early warning systems, promoting climate-resilient livestock practices and investing in adaptive infrastructure are therefore essential to mitigate the impacts of climate change and safeguard rural communities.

Gender and youth exclusion

Women play a crucial role in livestock farming in Bangladesh, contributing extensively to daily animal care, feeding, milking and product processing. Despite their substantial involvement, they often lack control over productive resources, decision-making and access to income generated from livestock activities. This gender disparity limits their ability to benefit fully from their labor and to reinvest in farm improvements. At the same time, rural youth are showing declining interest in livestock farming due to limited access to modern technologies, inadequate training opportunities and low-income prospects. This generational disengagement threatens the long-term sustainability and innovation capacity of the sector. Promoting the active participation and empowerment of women and youth through targeted training, access to credit and technology and inclusive value chain development is therefore essential. Their meaningful

engagement can serve as a catalyst for innovation, productivity and sustainable growth in Bangladesh's livestock sector.

Inadequate policy implementation

Even though, Bangladesh has formulated several policies to support livestock development, their implementation at the grassroots level remains weak and poorly localized. Policy measures often fail to address the diverse needs of smallholder and family-based farmers, resulting in limited impact on productivity and rural livelihoods. Moreover, the livestock sector continues to receive comparatively lower budget allocations than the crop sector, constraining investment in research, extension, infrastructure and disease control programs. This imbalance hinders the sector's overall growth and restricts its potential contribution to national food security and poverty reduction. Strengthening institutional capacity, ensuring effective policy enforcement and increasing public investment in the livestock sector are therefore essential to drive sustainable development and unlock its full potential.

National action plan to address challenges of family farmers of livestock

The national action plan for mitigating the challenges of family farmers engaged in livestock sector is outlined in in Table 4. It also encompasses timeline, responsible agencies, outcomes.

Pillar	Action Steps	Timeline	Responsible Agencies	Outcomes
Pillar 1: Improve policy environment	Review and update national livestock and family farming policies incorporating climate adaptation, gender inclusiveness and youth engagement	2025-2026	Ministry of Fisheries and Livestock, Department of Livestock Services (DLS), Policy Think Tanks	Updated, inclusive and actionable policies for family farmers
Pillar 2: Strengthen institutional support	Expand access to extension, veterinary and AI services through mobile clinics and union-level livestock centers	2025-2027	DLS, Livestock Research Institutes, NGOs	Improved animal health and productivity, wider outreach
Pillar 3: Ensure access to finance and market	Develop microcredit schemes tailored for family farmers and promote digital livestock marketplaces	2025-2028	Banks, Microfinance Institutions, ICT Ministry	Increased investment in sustainable practices, better price realization

Pillar	Action Steps	Timeline	Responsible Agencies	Outcomes
Pillar 4: Capacity building of family farmers	Organize regular training and demonstration programs on improved husbandry, feed management and climate-smart practices	2025-2030	DLS, Agricultural Universities, NGOs	Skilled family farmers, enhanced sustainable productivity
Pillar 5: promote climate smart and resilient farming	Scale-up climate-adaptive breeds, disaster preparedness and fodder cultivation projects among vulnerable family farms	2025-2030	DLS, Local Government, Climate Funds	Reduced loss from floods/droughts, improved livestock resilience
Pillar 6: Strengthen value chain and traceability	Establish milk and meat producer cooperatives, set up traceability mechanisms, strengthen cold chain logistics	2025-2030	Cooperatives, Private Sector, Export Agencies	Minimization of post-harvest loss, better traceability and greater market access

Recommendations

1. Mainstreaming family farming in livestock policies

Family farming remains the backbone of rural livelihoods, yet it is often overlooked in livestock policy frameworks. The National Livestock Development Policy should be revised to explicitly recognize family farms as a central pillar of rural development. Adequate budgetary support must be allocated to strengthen family-based livestock programs. Policy formulation and implementation should be inclusive, ensuring the active participation of women, youth and marginalized groups. To enhance coordination, a dedicated Family Farming Desk should be established within the Department of Livestock Services (DLS) to oversee planning and program execution.

2. Expand climate-smart livestock practices

To address rising climate risks, livestock systems must become more adaptive and resilient. The promotion of salinity- and drought-tolerant fodder varieties, alongside climate-resilient indigenous breeds such as the *Black Bengal* goat and *Red Chittagong* cattle, is essential. Adoption of technologies including biogas units, low-emission livestock housing and water-harvesting systems should be scaled up to support sustainable production. Government-backed incentives,

coupled with targeted training programs, will facilitate uptake among smallholder farmers.

3. Strengthen veterinary and extension services

Limited veterinary support constrains livestock productivity in rural areas. The recruitment and training of local youth and women as Community Animal Health Workers (CAHWs) should be expanded to strengthen frontline services. Establishing union-level service points, complemented by mobile outreach units, will improve access to veterinary care. Integration of e-health solutions, including digitized vaccination schedules and real-time disease alerts, can modernize extension services. Additionally, a specialized cadre focused on smallholder livestock systems is needed to address the unique challenges of these farms.

4. Promote women and youth led livestock enterprises

Empowering rural women and youth has the potential to transform the livestock economy. Targeted training programs in livestock value chains, including dairy, goat farming and hatcheries should be widely accessible. Supportive measures such as microcredit schemes with relaxed collateral requirements, incubation centers and entrepreneurship grants will foster innovation and enable the growth of youth and women led enterprises.

5. Enhance market access through cooperatives

Smallholder farmers often face exclusion from formal markets. Organizing them into cooperatives can enhance their bargaining power and collective efficiency. Provision of infrastructure, such as chilling plants and mobile meat vans along with strengthened linkages to institutional buyers, is essential. Additionally, the development of contract farming models and standardized pricing frameworks will help ensure fair and equitable market participation for smallholders.

6. Develop livestock micro-insurance and credit schemes

Risk mitigation is essential to encourage investment by smallholder livestock farmers. Affordable, species-specific insurance products for cattle, goats and poultry should be introduced. Bundled services that integrate credit, insurance and training delivered through microfinance institutions and banks hold the potentiality to reduce can reduce farmers' vulnerability. In addition, establishing a **"**Livestock Disaster Fund" will enhance resilience against climate- and disease-related shocks.

7. Invest in ICT and E-extension services

Digital tools can revolutionize livestock extension. Mobile apps, Bangla-language videos and voice help lines should be developed to share information on markets, diseases and weather. A national livestock portal and "digital livestock kits" combining smart phones and training should be introduced to bridge knowledge gaps, especially for youth and remote farmers.

Digital tools have the potential to transform livestock extension services. Mobile applications, Bangla-language instructional videos and voice help lines should be developed to provide timely information on markets, disease management and weather conditions. A national livestock portal**,** along with **"**digital livestock kits**"** that combine smart phones with training resources, should be introduced to bridge knowledge gaps, particularly for youth and farmers in remote areas.

8. Encourage Public-Private Partnerships

Public private partnership (PPP) models can enhance service delivery and accelerate infrastructure development in the livestock sector. These partnerships should prioritize investments in animal feed processing, veterinary services, artificial insemination (AI) technologies and cold-chain systems. The private sector can also play a key role by co-investing in livestock hubs, training centers and export-oriented production systems.

9. Promote research and innovation

Tailored research is crucial to meet the needs of smallholder farmers. Key priorities include improving indigenous breeds, developing alternative feed sources such as azolla and insects and designing climate-resilient livestock shelters. Establishing university-led innovation hubs that conduct farmer-participatory field trials will help generate and scale context-specific solutions.

10. Integrate livestock into school curricula and youth programs

To foster future engagement in the livestock sector, education should begin early. Integrating animal husbandry modules into school curricula and establishing "Livestock Clubs" in rural schools can provide practical learning opportunities, inspiring youth to view livestock farming as a viable and rewarding career path.

Conclusion

Family farming in Bangladesh's livestock sector is more than a production system, rather, it is a way of life that intertwines food, culture, livelihoods and sustainability. With over 80% of rural households engaged in livestock rearing, family farms play a crucial role in ensuring nutrition, generating employment and enhancing climate resilience. Despite challenges such as disease outbreaks, climate stress, limited services and market barriers, family farmers continue to sustain the rural economy through their resilience and traditional knowledge. With the right support, through targeted policies, access to technology, credit, training and markets, they could become powerful agents of transformation in achieving the Sustainable Development Goals (SDGs) by 2030. Strengthening family-based livestock farming is therefore vital not only for rural prosperity but also for building a just, inclusive and climate-resilient food system across Bangladesh and South Asia.

Chapter 3

Sustainable Family Farming on Livestock Sector for Attaining the SDGs: A country perspective of Bhutan

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Livestock sector of Bhutan

Situated in the Eastern Himalayas, Bhutan is a mountainous and landlocked country, where livestock farming constitutes a fundamental component of the agricultural sector and rural livelihood systems. The livestock subsector remains deeply embedded in Bhutan's socio-cultural fabric and continues to play a critical role in enhancing food security, nutritional well-being and income generation for rural households. For a majority of smallholder farmers, livestock rearing operates within integrated mixed-farming systems in which crop and animal production are closely interdependent. These systems are largely subsistence-oriented, prioritizing household consumption and local exchange over commercial-scale production. Despite its predominantly small-scale nature, the livestock sector contributes substantially to the national economy, accounting for approximately 5.28% of Bhutan's Gross Domestic Product (GDP) during 2022. Beyond its economic significance, livestock farming also underpins rural resilience by providing a stable source of livelihood, promoting diversification of income and supporting the socio-economic stability of agrarian communities across the country.

As of 2024, Bhutan recorded 50,902 livestock-rearing households, of which 99.9 percent are classified within the smallholder farming sector. These households manage a diverse range of livestock species, including cattle, yaks, pigs, poultry, sheep and goats and also participate in aquaculture and apiculture, predominantly through small-scale, mixed-farming systems. Typically, family-operated, these farms are deeply rooted in traditional knowledge systems that have long sustained Bhutan's agricultural landscapes while maintaining significant genetic and species diversity. Although historically characterized as low-input and subsistence-oriented, contemporary smallholder systems increasingly rely on external inputs such as commercial feed, veterinary pharmaceuticals and improved breeding technologies, particularly in piggery and poultry production. The close integration of livestock and crop enterprises on limited landholdings, often under five acres, exemplifies Bhutan's adaptive agro-ecological practices and resource-efficient farming strategies.

Bhutan's highly heterogeneous topography, ranging from subtropical lowlands to alpine highlands, profoundly shapes the spatial and functional dynamics of livestock rearing. Within this diverse ecological setting, smallholder and subsistence-based systems predominate, with households operating under constrained resource conditions to sustain their livelihoods. Livestock production serves a multifunctional role, providing not only food and income but also fulfilling important social, economic and cultural functions within rural communities. Despite persistent land and resource limitations, Bhutanese farmers have historically adopted diversified, ecologically resilient and knowledge-intensive production systems that integrate livestock with crop cultivation. Such systems reflect a long-standing reliance on traditional ecological knowledge to manage risks, enhance productivity and strengthen household and community resilience.

Among domesticated livestock species, *Jersey* cattle represent the most prevalent breed, reared by approximately 22,157 households nationwide. Poultry production follows closely, with 19,808 households engaged in the sector, while indigenous cattle breeds such as the *Nublang* are maintained by 15,464 households. Districts (Dzongkhags) including Samtse, Trashigang and Mongar continue to serve as the key centers of cattle farming, reflecting both agro-ecological suitability and strong local traditions of livestock rearing. Despite this continued prominence, Bhutan has experienced a gradual decline in the overall cattle population between 2006 and 2024. This trend signifies a deliberate policy shift from herd expansion toward genetic improvement and productivity enhancement, primarily achieved through selective breeding programs and the widespread adoption of artificial insemination technologies.

In recent years, the dairy, piggery and poultry subsectors have gained increasing prominence across several potential Dzongkhags in Bhutan. These enterprises are emerging as critical components of the livestock economy, primarily due to their relatively short production cycles, higher turnover rates and expanding domestic demand. Consequently, this report concentrates on these three subsectors, namely dairy, piggery and poultry as pivotal drivers of growth, commercialization and structural transformation within Bhutan's smallholder livestock sector.

In 2024, Bhutan produced 1,555 metric tons of pork and 1,208 metric tons of chicken meat, while egg production reached 98 million units, indicating both growing domestic demand and the capacity of these systems to enhance household incomes, improve family nutrition and reduce reliance on imports. Backyard piggery and poultry operations, frequently managed by women and youth, have proven instrumental in diversifying rural livelihoods, augmenting family income and improving local food availability.

Despite these achievements, it is important to note that the vast majority of Bhutan's piggery and poultry farms, like other livestock systems in the country, continue to operate at a subsistence level. These smallholder units are typically

characterized by low-input, low-output systems that are intricately linked to household food security strategies. The production figures cited "1,555 metric tons of pork, 1,208 metric tons of chicken meat and 98 million eggs" are not the result of industrial-scale operations but rather represent the aggregated output of thousands of small-scale farms dispersed across Bhutan's rural communities. Collectively, these farms constitute the invisible backbone of the nation's livestock sector, significantly enriching Bhutan's food basket, enhancing dietary diversity and sustaining food security at the grassroots level.

To accelerate improvements in both productivity and quality, government-led initiatives have emphasized the introduction of improved livestock breeds, the enhancement of animal healthcare services and the promotion of better feeding and husbandry practices. These strategies are designed to strengthen the performance of smallholder farms, which remain the foundation of Bhutan's predominantly subsistence-oriented livestock sector. Such interventions align with national priorities to promote food self-sufficiency, reduce rural poverty and improve nutritional security. Support mechanisms, including breeding centers, veterinary extension services and targeted input subsidies continue to reinforce the structural and operational capacity of the livestock sector, ensuring its long-term sustainability and resilience.

The livestock sector in Bhutan is predominantly shaped and sustained by smallholder farmers, who constitute the majority of agricultural producers. Even at a subsistence level, these systems play a critical role in supporting household welfare and contributing to national food security. As Bhutan progresses under the 13th Five-Year Plan and beyond, continued investment in smallholder livestock systems through enabling policies, essential infrastructure and innovative practices will be essential to drive rural economic development. Beyond their economic significance, these systems also hold the potential to preserve Bhutan's rural heritage, enhance community resilience and advance inclusive and sustainable development.

Livestock farming systems in Bhutan

In Bhutan, the livestock farming remains a fundamental component of rural livelihoods and the broader agricultural economy. Farming systems across the country vary according to agro-ecological zones and can be broadly classified based on geography, scale and production intensity. In the lowland regions, farmers have traditionally practiced mixed crop-livestock systems, integrating livestock rearing with crop cultivation. Such systems provide mutual benefits, including the use of livestock manure to fertilize fields and the feeding of animals with crop residues. These operations are typically subsistence oriented and small scale. In recent years, however, there has been a discernible shift toward more specialized livestock enterprises, particularly in piggery and layer poultry production. Driven by their comparatively faster economic returns, many

farmers are transitioning from traditional mixed systems to livestock-focused farming, often adopting more formal organized and commercially oriented production models.

In contrast, highland communities, especially those residing in the 10 designated highland Dzongkhags predominantly practice pastoral and semi-pastoral systems. These systems are characterized by seasonal migration and the rearing of animals such as yaks, sheep and horses in extensive rangeland environments. Highland livestock farming remains a key source of income and plays a vital role in sustaining the livelihoods of these remote highland communities.

Livestock farms in Bhutan could be broadly classified into three primary levels: (i) subsistence, (ii) semi-commercial and (iii) commercial, depending on farm infrastructure, herd or flock size and market orientation. Subsistence farms are typically household managed and primarily aim to meet the family's basic consumption needs. Semi-commercial farms combine household use with modest market sales and may employ limited hired labor. Commercial farms, in contrast, operate at a larger scale with improved infrastructure and labor beyond the household and are most commonly observed in piggery and poultry production. Dairy farming, however, largely remains at the smallholder and subsistence level, with most farms maintaining fewer than 10 cows due to limited landholdings that constrain the development of improved pastures and fodder cultivation. Consequently, the scalability of dairy enterprises remains limited, particularly in regions where fodder availability is a key constraint.

Characteristics of family farms in Bhutan

Given Bhutan's small population of fewer than one million and the corresponding scale of national consumption of livestock products, the majority of livestock farms operate at either subsistence or semi-commercial levels. In recent years, however, there has been a gradual shift toward commercial-oriented livestock farming, driven by the growing market potential of these enterprises. Pig and poultry farming have emerged as some of the fastest-growing sectors within the livestock industry. Despite this growth, over 60 % of pig and poultry farms continue to function at smaller scales. In pig farming, subsistence-level operations typically maintain fewer than 10 pigs, whereas semi-commercial farms may hold up to 50 pigs. In the poultry sector, farms with fewer than 500 birds are generally classified as subsistence-level, while semi-commercial farms maintain between 500 and 1,000 birds. This scale-based classification provides a critical framework for the design and implementation of targeted policy interventions, technical support and resource allocation suitable for each category of farming enterprise.

In Bhutan, dairy farming is predominantly a smallholder-driven enterprise, with most farms operated by families and maintaining modest herd sizes, primarily due to limitations in land availability for fodder cultivation. Larger, commercial-

scale dairy operations remain extremely limited and the average herd size per household typically ranges from five to six cattle. Smallholder farmers not only rely on livestock for their own livelihoods and income generation but also make a significant contribution to the national food supply, given that the majority of farms are small-scale and subsistence-oriented. To support the sustainability of these enterprises, the government provides subsidies and targeted strategic interventions. Key measures aimed at strengthening smallholder livestock farms include:

1. Provision of subsidized inputs to enhance livestock production

To enhance livestock production and strengthen smallholder-based systems, the Royal Government of Bhutan, through its nucleus farms, provides a range of subsidized inputs and services to farmers nationwide. These include live inputs such as high-quality piglets (for breeding and fattening), layer day-old chicks (DOCs), bovine semen and fodder seeds and seedlings, alongside extension services including capacity-building and training programs. In support of genetic improvement and dairy intensification, artificial insemination (AI) services are promoted through the training of community-based AI technicians, thereby enhancing accessibility and outreach at the grassroots level. Over the past two financial years (2023-2024 and 2024-2025), the government farms supplied a total of 824,847-layer DOCs (538,980 in 2023-2024 and 285,867 in 2024-2025) to poultry farmers. In the piggery sector, 4,504 breeding piglets (2,439 in 2023-2024 and 2,065 in 2024-2025) were distributed to support the production of high-quality fattening pigs.

To promote sustainable livestock feeding systems, more than 150 metric tons of fodder seeds and seedlings were provided to farmers for the development of improved pasturelands. Additionally, a total of 71,653 litres of liquid nitrogen (LN_2) was supplied to AI centres across all 20 Dzongkhags in 2023-2024, a critical effort for the preservation and effective utilization of bovine semen, a key component of Bhutan's dairy breed improvement strategy. Among these, the Department is currently promoting Jersey pure sexed semen to produce more high-quality heifers and enhance milk production within the existing dairy herd. Collectively, these interventions are instrumental in boosting the productivity of smallholder livestock systems, contributing to national objectives of food self-sufficiency, rural income enhancement and the overall sustainability of Bhutan's livestock sector.

2. Provision of veterinary medicines and drugs

To ensure the sustainability of Bhutan's livestock production systems and safeguard animal health, the Royal Government of Bhutan continues to provide veterinary medicines and drugs to livestock farmers free of charge, maintaining them as public goods. This critical support is intended to sustain a disease-free livestock population, prevent the incursion and spread of both endemic and trans-

boundary animal diseases and uphold biosecurity measures while protecting public health.

The procurement and distribution of veterinary inputs are centrally coordinated by the Department of Livestock (DoL) in collaboration with the Dzongkhag Livestock Sectors. Allocation is determined based on livestock population dynamics, local disease prevalence and seasonal risk assessments. These inputs include essential medicines for common livestock ailments, vaccines for disease prevention (e.g., FMD, PPR, Newcastle disease) and other critical veterinary supplies such as anthelmintic, disinfectants and micronutrient formulations. By ensuring that veterinary inputs are affordable and accessible, particularly for smallholder farmers who face financial and logistical constraints, the program supports early disease detection, timely treatment and effective outbreak containment. It further contributes to maintaining the health and productivity of livestock herds, thereby safeguarding rural livelihoods and enhancing food safety and security at the national level.

In recent years, the Department of Livestock has placed greater importance on preventive animal health services, including the expansion of vaccination coverage and the promotion of farmer awareness through regular extension programs. The introduction of mobile veterinary clinics and outreach services has further enhanced access to animal healthcare in remote and highland areas, where service delivery was historically limited. Collectively, these measures strengthen Bhutan's veterinary service delivery system, support the country's One Health agenda and contribute to broader national objectives of enhancing livestock productivity, reducing production losses due to disease and building resilience in the livestock sector. As Bhutan advances its efforts to modernize animal health infrastructure under the 13th Five-Year Plan, the continued provision of veterinary medicines and drugs as public goods remains a strategic priority.

3. Strengthening smallholder livestock farming through the cost sharing mechanism

Under the Cost Sharing Mechanism (CSM) 2025, the Ministry of Agriculture and Livestock, Royal Government of Bhutan has identified dairy, piggery and poultry farming as priority livestock subsectors for targeted support. The intervention aims to facilitate the transition of farmers from subsistence level operations to more structured and economically viable enterprises, thereby enhancing productivity, sustainability and resilience. In the dairy sector, support under the CSM emphasizes enabling smallholder farmers to scale up their operations. Measures include the provision of breed able *Jersey* heifers at subsidized rates, with higher government contributions for smaller farms. To strengthen genetic improvement, artificial insemination (AI) services are being expanded through the free supply of bovine semen and liquid nitrogen. Additionally, to promote climate-resilient dairy infrastructure, support is provided for the installation of cooling and ventilation systems and floor mats in dairy sheds. Complementary

measures include the provision of barbed wire fencing to protect improved fodder plantations and the establishment of "Total Mixed Ration" (TMR) units in key dairy clusters to enhance animal nutrition and reduce dependence on commercial feeds.

For piggery development, the CSM provides comprehensive support to enhance both breeding and fattening operations. The government offers artificial insemination (AI) free of cost to introduce modern breeding technologies and improve genetic performance. Existing and new pig breeding farms are supported through the provision of parent stock, including weaners, gilts and boars, under a cost-sharing arrangement. To strengthen on-farm biosecurity, critical infrastructure such as fencing, signboards, foot dips and disposal pits is subsidized to prevent disease outbreaks. Recognizing the vulnerability of subsistence farmers, who rely entirely on pig farming for their livelihoods, the government provides one-time targeted support, including improved pig sheds and a starter set of piglets at no cost. Large-scale pig fattening farms are also eligible for output-based support through government pricing and guarantee schemes, ensuring both sustainability and profitability.

In the poultry sector, the CSM supports the production and distribution of layer day-old chicks (DOCs) from government input farms at subsidized rates, with higher support allocated to smallholder farmers. To promote farm hygiene and disease prevention, poultry farmers receive assistance to establish essential biosecurity infrastructure, including fencing, signboards and sanitation facilities. Newly established farms are further supported to procure basic equipment, such as feeders, drinkers, brooders and debeaking machine. For commercial and large-scale farms, semi-automated systems, including nipple drinkers and pan feeders, are promoted to address labour constraints and improve production efficiency. Additionally, output-based support, including price guarantee schemes, is being implemented to encourage the development of large-scale broiler farms, ensuring steady production and market stability.

Collectively, the interventions under CSM 2025 aim to modernize Bhutan's livestock sector by empowering smallholders, enhancing access to critical inputs, promoting biosecure and climate-resilient infrastructure and fostering commercial growth in priority livestock commodities. This approach reflects the government's broader commitment to food self-sufficiency, rural livelihood improvement and inclusive economic development.

4. Role and significance of family farming in national agriculture

Family farming forms the cornerstone of Bhutan's agricultural landscape, representing the predominant production system nationwide. The majority of Bhutanese farmers operate at the household or smallholder level, managing limited landholdings, diversified crops and integrated livestock systems. Their contributions are critical not only for household food security but also for advancing national self-sufficiency and promoting rural economic development.

The 13th five-year plan of the Ministry of Agriculture and Livestock reaffirms the centrality of family farms in Bhutan's agricultural transformation. It notes that over 90% of the farming population cultivates small parcels of land, positioning them as key agents in achieving national targets for cereal, vegetable, fruit and livestock production. The plan also identifies challenges faced by family farmers, including land fragmentation, limited access to agricultural inputs and vulnerability to climate change, while outlining targeted interventions to address these constraints and enhance the productivity and resilience of smallholder systems.

To complement the policy directions of the 13th five-year plan (FYP), the Cost Sharing Mechanism (CSM) 2025 functions as a strategic financing instrument designed to improve access to essential agricultural inputs and services for family farms. The CSM provides subsidized support for seeds, irrigation, post-harvest equipment, fencing materials, farm mechanization and crop protection measures, with higher government cost-sharing allocated to small and marginal farmers. These interventions aim to enhance productivity, reduce labor burdens, improve farm resilience and enable smallholders to participate more effectively in formal markets. Family farms are also recognized as vital custodians of Bhutan's agro-biodiversity and traditional knowledge, whose practices contribute to the ecological integrity of national farming systems and align with Bhutan's commitment to sustainable, climate-resilient agriculture. As the country seeks to increase domestic production of key commodities such as rice, maize, potatoes, apples and vegetables, the achievement of these targets depends on the empowerment and support of family farmers. In essence, family farming constitutes not only the foundation of Bhutan's agricultural production but also a critical pathway toward inclusive growth, rural prosperity and national food sovereignty. The 13th FYP and CSM 2025 jointly underscore that strengthening family farming systems is pivotal for realizing Bhutan's vision of a productive, sustainable and resilient agricultural economy.

5. Role and significance of family farming in national livestock production

Family farming forms the backbone of Bhutan's livestock sector, with the vast majority of farms operating at the smallholder level. These farms are typically household-managed, characterized by limited landholdings, modest herd or flock sizes and a high degree of integration between livestock and crop systems. Despite their small scale, family farms play a critical role in sustaining national food security, supporting rural livelihoods and preserving traditional farming knowledge and practices.

In the dairy sector, approximately 85% of farmers operate at the subsistence level, typically managing only 1 to 2 improved cows, yet these smallholders contribute nearly 90% of the country's total milk production. The 13th five-year plan has set a national target of 73,984 metric tons of milk by 2029, a goal that will depend heavily on improving the productivity and resilience of smallholder dairy farms.

Similarly, in the piggery sector, over 87% of more than 5,000 pig-rearing households are smallholders, each managing fewer than 10 pigs. Achieving the national target of 60% self-sufficiency in pork production, increasing output from 1,590 MT in 2023 to 1,845 MT by 2029, will rely predominantly on the performance and expansion of these family-operated farms. In recognition of their importance, the government has introduced targeted support under the Cost Sharing Mechanism (CSM) 2025, including subsidized parent stock, enhanced biosecurity infrastructure and pilot artificial insemination (AI) services.

In the poultry sector, out of approximately 19,800 poultry-rearing households, the majority operate at subsistence or semi-commercial levels. Bhutan has set ambitious targets to double table egg production from 86 million to 174 million units and to achieve 50% self-sufficiency in chicken meat production by 2029. Realizing these objectives will depend primarily on the collective efforts of smallholder poultry farmers, supported through targeted interventions such as subsidized Layer Day-Old Chicks (DOCs), improved housing systems, provision of essential farm-level equipment and strengthened biosecurity measures. The aggregated contribution of family farms is thus central not only to national livestock production but also to ensuring equitable access to nutritious food across Bhutan's regions. In recognition of this, the Royal Government of Bhutan, through the Cost Sharing Mechanism (CSM) 2025, has prioritized support for smallholder farmers. This includes subsidized input delivery, access to improved genetics, veterinary services, biosecurity enhancements and climate-resilient infrastructure.

Evidently, achieving the national production targets for milk, pork and poultry outlined in the 13th five-year plan is contingent upon strengthening and empowering Bhutan's family farmers. Their contributions extend beyond the economy and food systems to encompass the cultural and ecological fabric of the nation. Ensuring that smallholder farms remain productive, resilient and economically viable is therefore a strategic national imperative.

7. Policy and institutional framework supporting family farmers

The sustainability and productivity of Bhutan's family farming sector are closely linked to supportive policies and robust institutional frameworks. Recognizing the critical role of smallholder farmers in ensuring national food security, rural livelihoods and agro-biodiversity conservation, the government has prioritized family farming in its strategic planning. Policies such as the 13th five-year plan explicitly emphasize strengthening smallholder systems through targeted interventions in crop, livestock and horticultural production. Policies also aim to mitigate structural constraints faced by family farmers, such as land fragmentation, limited access to credit and vulnerability to climate change. By integrating regulatory, financial and technical support, Bhutan's institutional framework seeks to empower smallholder farmers while promoting inclusive and equitable growth. Ultimately, these policies and institutions form the backbone of

the nation's strategy to strengthen family farming, enhance rural livelihoods and achieve long-term food security. These are as follows:

The livestock act of Bhutan 2001

The legislation currently under amendment serves as the principal legal framework governing livestock production, animal health, breeding and product quality in Bhutan. The ongoing revision aims to modernize the Act, addressing contemporary challenges such as the prevention of transboundary animal diseases, enhancement of biosecurity measures, promotion of animal welfare and the integration of climate-resilient practices.

The food and nutrition security policy of the Kingdom of Bhutan 2023

The Act formalizes the national commitment to providing all citizens with access to safe, nutritious and sufficient food. Within this framework, livestock production is recognized as a critical pathway for enhancing dietary diversity and addressing malnutrition, particularly among rural and high-altitude populations.

Agrifood sector strategy 2034

Long-term growth trajectories for the sector are articulated in the Agrifood Sector Strategy 2034, which envisions a competitive, inclusive and environmentally sustainable agrifood system. Within this strategy, livestock is positioned as a key driver of rural employment, value chain development and economic diversification, while simultaneously promoting environmental stewardship.

Goal setting

The 13th five-year plan (2024-2029) positions livestock development as a central component of Bhutan's broader strategy for rural prosperity and inclusive agricultural growth. The plan emphasizes the adoption of climate-smart and sustainable farming systems that enhance resilience to environmental variability and climate change. In addition, it advocates for market-oriented approaches that strengthen the linkages between smallholder producers and formal value chains, thereby improving income opportunities and economic viability. Modernization of production practices is prioritized, including the promotion of improved breeds, enhanced feeding regimes and bio secure farm management, with a focus on increasing productivity while maintaining ecological balance. The plan also highlights the importance of capacity building for farmers, extension services and access to critical inputs such as veterinary care, artificial insemination services and climate-resilient infrastructure. By integrating smallholders into organized production systems, the plan seeks to reduce subsistence dependency and foster more commercially viable operations. Livestock is recognized not only as a source of food and income but also as a driver of rural employment, youth

engagement and gender-inclusive development. Moreover, the 13th FYP emphasizes the alignment of livestock interventions with national priorities for food self-sufficiency, nutritional security and sustainable resource management. Through these measures, Bhutan aims to enhance the competitiveness, resilience and sustainability of its livestock sector while preserving traditional farming knowledge and agro-biodiversity. Ultimately, the plan underscores the role of livestock as both a socio-economic and ecological asset, essential for achieving inclusive and sustainable rural development.

Cost sharing mechanism for agrifood sector

To facilitate effective resource mobilization and strengthen stakeholder participation, the Guidelines on Cost Sharing Mechanism for the Agri-Food Sector 2025 institutionalize a co-investment model between the public and private sectors. This framework represents a strategic shift toward shared responsibility in financing agricultural development, promoting greater efficiency and accountability in the use of public resources. By encouraging joint investment, the mechanism seeks to leverage private sector innovation and entrepreneurship, while maintaining strong government support for critical public goods such as input supply, extension services and infrastructure development. The approach enhances efficiency in resource utilization, fosters shared ownership among stakeholders and accelerates the scaling-up of key interventions in areas such as livestock housing, feed and fodder production and biosecurity enhancement. Moreover, it aims to expand market access for smallholder farmers by supporting value chain integration, aggregation centers and cold-chain logistics that connect producers to urban and export markets. The co-investment model also plays a pivotal role in promoting financial inclusion, as it encourages farmers to gradually transition from subsidy dependency to more sustainable and market-driven practices. Through these provisions, the Cost Sharing Mechanism 2025 not only strengthens institutional collaboration but also contributes to building a resilient, competitive and inclusive agri-food system in Bhutan.

National development strategy and action plan 2024 for the dairy, poultry and piggery sector

A pivotal policy instrument is the National Development Strategy and Action Plan 2024 for the Dairy, Poultry and Piggery Sector, which provides a comprehensive roadmap for the modernization and sustainable growth of these three priority subsectors.

Sustainable livestock management practices by family farmers

In Bhutan, sustainable livestock management practices are increasingly being adopted by family farmers as part of a broader effort to enhance productivity, resilience and environmental stewardship. These initiatives not only strengthen

farm efficiency but also contribute to climate change mitigation and adaptation, aligning closely with national development priorities and the targets outlined in the 13th five-year plan.

A central strategy in this transition is the promotion of stall feeding and zero-grazing systems for improved dairy cattle. By utilizing locally cultivated fodder crops and crop residues, farmers are able to reduce dependence on community grazing lands, thus mitigating land degradation and promoting more efficient feed use. Complementary efforts in pasture development, including the establishment of high-yield perennial grasses, fodder trees and legumes for ensuring year-round feed availability, while enhancing soil fertility and structure.

The integration of silvopastoral systems, which combine trees, shrubs and pastures, has gained momentum as an innovative and ecologically sound approach. These systems deliver multiple benefits: they support biodiversity conservation, stabilize soils and provide shade that helps livestock cope with heat stress, an increasingly important consideration under changing climatic conditions.

To address greenhouse gas emissions associated with livestock production, farmers are adopting improved housing and manure management systems designed to minimize methane emissions. The introduction of biogas digesters represents a particularly effective dual-purpose solution, supplying renewable household energy for cooking while simultaneously reducing reliance on fuel wood and facilitating the sustainable management of livestock waste.

The use of farmyard manure composting continues to play a crucial role in Bhutan's crop-livestock integrated systems, enriching soils organically and closing nutrient cycles at the household level. Likewise, herbal and traditional veterinary medicines remain important, particularly in remote highland communities where access to modern veterinary services is limited. These indigenous practices not only contribute to animal health management but also preserve valuable ethno-veterinary knowledge.

In the high-altitude yak farming regions, seasonal migration planning is practiced to optimize pasture use and prevent overgrazing in fragile alpine ecosystems. Such adaptive strategies reflect a deep understanding of ecological limits and the importance of balancing livestock productivity with ecosystem health.

According to the Adaptation Fund's Climate-Smart Agriculture Project (2023), more than 80% of Bhutan's smallholder farmers have adopted at least one sustainable livestock practice. This widespread uptake underscores the sector's transition toward low-emission, climate-resilient livestock systems, grounded in both scientific innovation and traditional wisdom.

Collectively, these practices demonstrate the remarkable capacity of Bhutanese family farmers to harmonize modern technologies with time-tested local

knowledge. Their efforts are ensuring not only the long-term sustainability of livestock production but also the preservation of Bhutan's unique environmental heritage and its national vision of Gross National Happiness.

Challenges faced by family farmers in livestock

Bhutanese family farmers face a range of interconnected challenges that collectively undermine the sustainability, resilience and profitability of livestock-based livelihoods. These constraints are multifaceted and deeply interlinked, requiring comprehensive analysis and targeted interventions to ensure long-term sectoral growth. While access to quality feed is generally not a major limitation, the high cost of commercially produced concentrates significantly increases the overall cost of production (COP). This escalation in production costs reduces the competitiveness of domestically produced livestock commodities, thereby encouraging the importation of cheaper alternatives. The resulting market imbalances not only erode the profitability of local producers but also discourage reinvestment in production systems and innovation. Furthermore, seasonal feed shortages, coupled with limited landholdings that restrict pasture development, exacerbate financial and operational pressures, particularly among smallholder farmers.

Farm biosecurity remains another critical area of vulnerability. Despite the availability of veterinary services, on-farm biosecurity measures are often inadequate due to structural and behavioral factors. Weak infrastructure, limited farmer awareness, the practice of swill feeding and the importation of potentially contaminated livestock products, especially pork, heighten the risk of disease outbreaks. Pig and poultry production systems are particularly susceptible given the rapid transmissibility of many pathogens. These challenges underscore the urgent need for enhanced biosecurity protocols, capacity building and stricter regulation of livestock product imports to safeguard national animal health and food security.

Market connectivity remains a persistent constraint, particularly for producers located in geographically remote Dzongkhags. Limited aggregation and storage infrastructure, combined with the absence of reliable cold chain systems, hinder the efficient transport and timely delivery of perishable livestock products. These logistical deficiencies contribute to post-harvest losses, reduced price competitiveness and an ongoing dependence on lower-priced imports. Moreover, livestock value chains remain largely informal and vendor driven, resulting in limited bargaining power for smallholder producers and heightened price volatility. In the dairy sector, inconsistent raw milk quality further constrains market access and limits the potential for value added processing and product diversification.

Climate induced risks are intensifying, posing significant challenges to livestock production systems. Erratic precipitation patterns, prolonged dry spells, cold snaps in high-altitude regions and an increasing frequency of extreme weather events (flood, drought, cyclone, landslides etc) adversely affect pasture productivity, water availability and animal health. These climatic stresses not only reduce feed availability but also create favorable conditions for disease outbreaks, thereby compounding production and livelihood risks.

Demographic shifts further exacerbate these structural challenges. Declining youth participation in livestock farming has led to labor shortages, an aging farming population and the abandonment of productive land. Many young people perceive livestock farming as labor intensive, low income and lacking social prestige as compared to the urban employment opportunities, either industry or academic body or service sectors. This generational disengagement threatens the sector's long-term sustainability and undermines its capacity for innovation, technology adoption and entrepreneurship.

Trans-boundary Animal Diseases (TADs) pose an additional and critical threat to Bhutan's livestock economy. Outbreaks of Lumpy Skin Disease (LSD) in cattle, African Swine Fever (ASF) in pigs and Highly Pathogenic Avian Influenza (HPAI) in poultry have historically caused severe production losses, high mortality rates and trade disruptions. The persistence and rapid spread of these diseases are often facilitated by informal cross border animal movements and inadequate border surveillance. Without robust systems for prevention, early detection and rapid response, such outbreaks have the potential to reverse years of progress in livestock development within a short period.

Action plan for sustainable family farming in livestock sector

Smallholder livelihood support initiatives will prioritize targeted assistance to enhance productivity and resilience among family farmers. Key interventions include the provision of production inputs; improved livestock breeds and enhanced veterinary and extension services. In addition, the program will strengthen pest and disease surveillance systems and introduce an index-based livestock insurance scheme by November 2026 to safeguard farmers against climate and disease related losses. The promotion of climate smart livestock practices, such as improved feed management, low-emission housing and efficient manure utilization will further contribute to productivity gains and household-level risk reduction.

Commercialization and value chain development will focus on expanding large-scale poultry, piggery and fishery enterprises, complemented by the

establishment of modern meat processing plants and cold chain infrastructure. By integrating smallholders into structured and competitive value chains, the initiative aims to achieve 50% self-sufficiency in chicken, 60% in pork and 15% in fish. These efforts will reduce import dependence, stimulate domestic production and enhance rural employment and income opportunities.

Market access and infrastructure development will address systemic bottlenecks in agrifood distribution and marketing. Investments in agri-food economic hubs, coupled with the strengthening of cooperatives, youth groups and private aggregators, will improve supply chain efficiency and price realization for producers. The promotion of digital marketing platforms and enhanced logistics networks will facilitate stronger rural-urban market linkages, reduce transaction costs and ensure timely delivery of perishable products to consumers.

The breed registration and data systems will focus on enhancing genetic improvement, productivity monitoring and traceability across the livestock sector. Investments will be made in advanced breeding farms, the expansion of artificial insemination (AI) services and the strengthening of community-based breeding programs to improve herd quality and genetic diversity. The establishment of a pig and poultry farm registration system will ensure nationwide traceability and disease control, while the "National Dairy Information System" will provide real time data on production and market trends to support evidence-based planning and decision-making.

Capacity building and youth engagement initiatives will equip farmers with skills in modern husbandry practices, value addition and agribusiness management. Targeted training and incentive mechanisms is expected to encourage youth led enterprises, fostering innovation and entrepreneurship within rural communities. These efforts aim to build a skilled and motivated livestock workforce, revitalize rural economies and reverse the ongoing trend of youth migration away from agriculture.

Climate and ecosystem integration will promote the adoption of biogas technology, improved pasture development and stall-feeding systems with standardized housing designs. These measures will enhance fodder availability, improve animal welfare and contribute to environmental sustainability by reducing land degradation and lowering methane emissions. Collectively, they align with Bhutan's broader goals for climate-resilient, low-emission livestock production systems. Strategic areas, key action points and expected outcome on the above is illustrated in Table 1.

Table 1. Strategic areas, key action points and outcomes

Strategic areas	Key action points	Outcomes
Smallholder Livelihood Support	• Provide targeted production inputs, improved breeds and veterinary services; • Implement pest/ disease surveillance and launch index-based livestock insurance from November, 2026; • Promote climate-smart livestock practices	• Increased household-level productivity; • Financial risk protection for farmers from 2026 onwards
Commercialization and value chains	• Establish large-scale poultry, piggery and fishery farms; • Develop clean meat processing plants and cold chain facilities; • Integrate smallholders into structured value chains linked to institutional buyers and export markets	• 50% self-sufficiency in chicken, 60% in pork, 15% in fish; • Reduced import dependency; • Higher farmer incomes
Market access and infrastructure	• Establish agrifood economic hubs with advanced post-harvest facilities; • Strengthen cooperatives, youth groups and private aggregators; • Leverage digital platforms (AMIS, e-commerce) for direct marketing	• Improved market connectivity; • Enhanced price realization for producers; • Stronger rural / urban supply chains
Breed, registration and data systems	• Invest in high-tech breeding farms for poultry, pigs and fish; • Expand artificial insemination services; • Strengthen community-based breeding programs; • Implement pig and poultry farm registration; system for nationwide traceability and biosecurity • Operationalize the National Dairy Information System (NDIS) for real-time dairy production and market data	• Sustainable supply of quality stock; • Improved productivity and traceability; • Real-time livestock data to guide policy and market decisions
Capacity building and youth engagement	• Train farmers in modern husbandry, value addition and agribusiness; • Provide incentives for youth-led livestock enterprises through concessional loans and land leasing	• Increased skilled workforce in livestock sector; • Greater youth participation and entrepreneurship

Strategic areas	Key action points	Outcomes
Climate and ecosystem integration	• Promote biogas technology for energy and manure management; • Develop improved pastures for sustainable fodder supply; • Implement stall feeding systems with standardized housing to reduce methane emissions and improve animal welfare	• Enhanced environmental sustainability; • Improved fodder availability; • Reduced greenhouse gas emissions

Recommendations

- Strengthen CSA training and outreach, particularly targeting youth and women farmers;
- Scale up digital livestock systems including real-time farm registration;
- Expand access to subsidized inputs, quality breeding stock and veterinary services;
- Support groups and cooperatives in aggregation and value-chain integration;
- Provide incentives for youth entrepreneurship in livestock production

Conclusion

Family-based smallholder dairy, poultry and piggery farms are not only the backbone of Bhutan's livestock sector but also a vital driver for achieving national and global development priorities. By generating steady incomes and diversifying rural livelihoods, these farms make a direct contribution to SDG 1 (No Poverty), helping households reduce economic vulnerability. Through the production of milk, eggs and meat, they play a central role in improving nutrition and food availability, thereby advancing SDG 2 (Zero Hunger) and fostering resilient local food systems. Moreover, with women often at the forefront of livestock management, particularly in dairy and poultry enterprises, these farms promote women's economic participation and empowerment, directly supporting SDG 5 (Gender Equality). When supported with targeted policies, climate-smart practices, inclusive value chains and equitable market access, smallholder livestock households can drive a transformative shift simultaneously strengthening rural economies, safeguarding food security and advancing social equity in Bhutan.

The family-based smallholder dairy, poultry and piggery farms form the foundation of Bhutan's livestock sector and serve as a crucial engine for achieving both national and global development priorities. By generating steady incomes and diversifying rural livelihoods, these farms contribute directly to

SDG 1 (No Poverty) by reducing household economic vulnerability and enhancing rural resilience. Through the sustained production of milk, eggs and meat, they play a pivotal role in improving household nutrition and national food self-sufficiency, thereby advancing SDG 2 (Zero Hunger) and fostering resilient local food systems. Women are often at the forefront of livestock management, particularly in dairy and poultry enterprises making smallholder farming an important pathway for women's economic empowerment and leadership, in line with SDG 5 (Gender Equality). With the right combination of targeted policies, climate-smart technologies, inclusive value chains and equitable market access, smallholder livestock producers could become crucial and powerful stakeholder for transformation. Their contributions extend beyond farm productivity to encompass rural economic growth, food and nutrition security, environmental stewardship and social equity, reinforcing Bhutan's holistic approach to sustainable development and the principles of Gross National Happiness.

Chapter 4

Sustainable Family Farming on Livestock Sector for Attaining the SDGs: Country perspective of Nepal

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Agriculture remains the backbone of Nepal's agrarian economy, contributing significantly to rural livelihoods, employment generation and national food security. Within this sector, livestock production holds a particularly important position. Most livestock farming in Nepal is small-scale and family-run, relying predominantly on low-input production methods, indigenous breeds and long-established traditional farming systems. Cattle, buffaloes, goats, sheep and poultry constitute the core of Nepal's livestock population and the principal products derived from these animals include milk, meat and eggs. Although participation in local markets is gradually increasing, many households still raise livestock primarily for household consumption, maintaining only a small number of animals suited to their land, labor availability and resources. In this context, the livestock sector plays a pivotal role not only as a source of nutrition but also as a means of income diversification, risk management and socio-cultural value within family farming systems. Its contribution is therefore essential to sustaining rural livelihoods and supporting the broader agricultural economy of Nepal.

According to the Economic Survey of Nepal 2024/25, the country's total Gross Domestic Product (GDP) stands at approximately USD 44 billion. The services sector contributes the largest share at 62.01%, followed by agriculture (including agriculture, forestry and fisheries) at 25.16% and industry at 12.83%. Nepal's economic growth for the fiscal year 2024/25 is projected at 4.61%, while agricultural sector output has increased by 3.28%. The per capita GDP and per capita income are estimated at USD 1496 and USD 1517, respectively, underscoring the continued importance of agriculture as the primary source of employment and livelihood for much of the population. The agricultural sector remains a cornerstone of Nepal's economy, accounting for about 24.7% of GDP in 2024/25. Findings from the Agriculture Census 2022 indicate that approximately 62% of households are engaged in agriculture, with female-headed households representing 32% of those involved in the sector. Similarly, the Population Census 2021 reveals that of the economically active population aged 10 years and above, 57.3% are employed in the Agriculture, Forestry and Fishing sector, with women comprising 53.6% of this workforce.

Livestock resources of Nepal

Livestock farming plays a vital role in Nepal's economy and food security. Livestock provide essential products such as milk, meat, eggs and other daily necessities, while also serving as an important source of income and livelihood for rural households. The livestock sector contributes nearly 24% to the agricultural GDP and about 6% to the national GDP, equivalent to approximately USD 2.7 billion annually (Economic Survey, 2024/25). Nepal's livestock population is diverse and substantial. The country houses 5.2 million cattle, 3.3 million buffalo, 15.57 million goats, 0.65 million sheep and 1.57 million pigs. In addition, the poultry population is significant, with around 78 million chickens nationwide. Evidently, the annual production of different livestock products of Nepal is displaying an increasing trend since last three years (Table 1).

Table 1. Annual Livestock Production (Economic Survey 2024/25, Ministry of Finance, Nepal)

Products	2021-22	2022-23	2023-24
Milk (thousand Metric Ton)	2566	2614	2684
Meat (Thousand Metric Ton)	512	430	448
Fish (Thousand Metric Ton)	108	113	123
Eggs (Billion number)	1.33	1.6	1.65
Wool (Thousand kg)	567	381	389

A comparison of livestock data from 2011/12 and 2021/22 shows that the numbers of most livestock and poultry species have increased, with the exception of cattle, buffalo and sheep (Fig. 1). During this period, the number of agricultural holdings raising livestock rose from 3,353.8 thousand to 3,405 thousand. Despite this growth in holdings, the cattle population declined from 6,430 thousand to 4,559 thousand. Buffalo numbers also fell, from 3,174 thousand to 2,923 thousand. In contrast, goat and chyangra populations increased substantially, rising from 10,990 thousand to 14,242 thousand over the decade. The per capita availability of livestock products has been in increasing trends since last decade (Fig. 2).

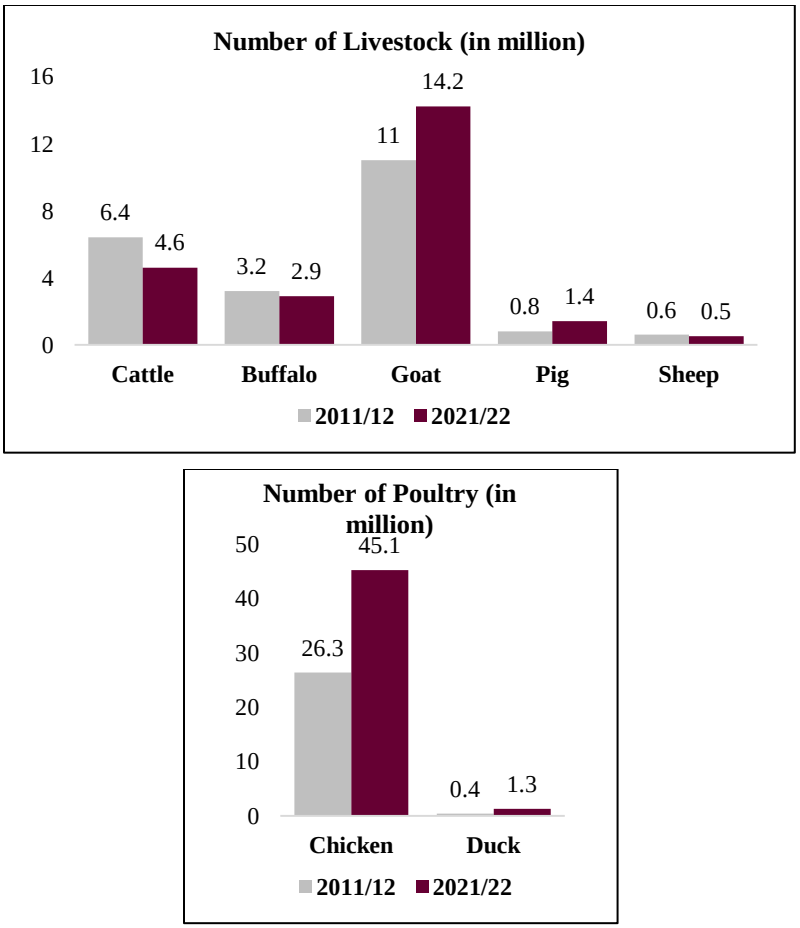

Fig. 1. Number of livestock and oultry (in million)

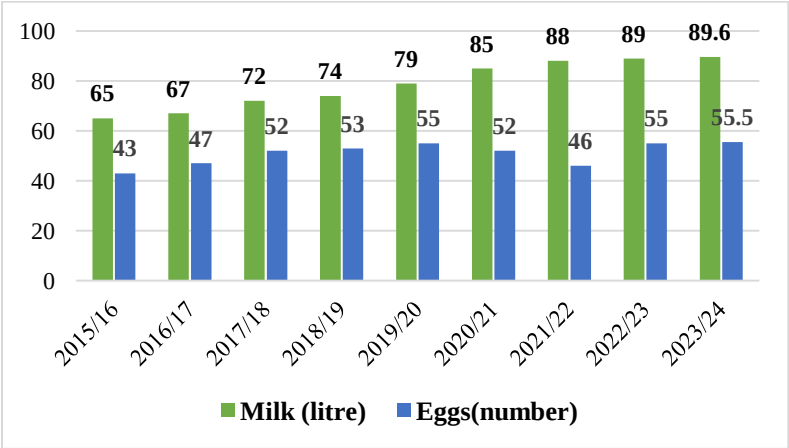

Fig. 2. Per capita availability of milk and eggs in Nepal during 2015/16 to -2023/24

A large portion of Nepal's population, particularly in rural areas, relies on agriculture and livestock farming for their livelihoods. Livestock plays a dynamic role by providing essential food products such as milk, meat and eggs, which contribute to dietary diversity and nutritional security, as well as raw materials like wool and hides for various industries. More than 60% of Nepalese households depend on agriculture and most of them raise livestock. Approximately 80% of agricultural households keep some form of livestock to meet their daily needs. Livestock farming, especially dairy production is also a major source of income for small-scale farmers, supporting economic growth by channeling cash flow from urban to rural areas and creating employment opportunities.

Types of livestock system

Mixed farming system

In Nepal, the dominant livestock production system is mixed farming, where livestock are integrated with crop production, particularly in the middle hills and Terai regions. This system traditionally features strong linkages among livestock, crops and forest resources, which collectively contribute to maintaining and improving soil fertility. Livestock are raised alongside crops, with manure used to enrich the soil and crop residues serving as animal feed. Forests provide fodder, grazing areas and other essential resources for livestock, while livestock by-products, especially manure, support and enhance crop production.

Small holder system

Most farmers in Nepal are smallholders who typically keep 2-5 cattle, 1- 3 buffaloes and 5-10 goats or sheep. These farmers rely on traditional production methods and family labour. This widespread model is characterized by small herds or flocks managed by individual households, often with limited land resources. Smallholder farming primarily focuses on meeting household consumption needs, with additional income generated through sales in local markets.

Pastoral system

In the high hills and mountain regions, many farmers practice pastoral farming. Livestock are moved seasonally to different grazing areas in response to changing feed availability and weather conditions. Migratory pastoral systems are especially common in high altitude areas, where nomadic or semi-nomadic herders raise yaks, sheep and goats. These systems depend on seasonal movement for access to pasture and play a vital role in sustaining mountain ecosystems.

Status of family farming in livestock sector

The livestock sector supports the livelihoods of a majority of Nepal's rural population, with family farms playing a central role. Nepal's livestock sector

includes cattle, buffalo, goats, sheep, pigs and poultry. In family-based farming systems, cattle and buffalo are primarily raised for milk and draught power, while goats and sheep are mainly kept for meat production. Small scale poultry farming is also common, with chickens raised for both eggs and meat. The agricultural household head refers to the individual male or female, who holds primary authority and responsibility for household and agricultural management and is recognized as the head by other members. Most households in Nepal are farm households and about 60% qualify as agricultural households. According to the "Nepal Living Standards Survey IV" and the "2021/22 Agriculture Census", approximately 62% of the country's households are agricultural households and more than one-third of them are female headed.

The 2021/22 census reports a total farm population of 19,447,955, representing 66.7% of Nepal's total population. Of this population, 9,543,825.1 (49.1%) are male and 9,904,130 (50.9%) are female. Among the 4.13 million agricultural holdings, 3.4 million reported to be engaged in livestock farming (Table 2). Goats are the most common livestock species, raised by 2.45 million farm holdings, followed by cattle (1.7 million) and buffalo (1.45 million).

Table 2. Number of holdings reporting livestock

Agriculture	4130789
Livestock	3405014
Cattle	1708421
Yak	9899
Buffalo	1417028
Goat	2451583
Sheep	72736
Pig	422501

Holdings without land	108232
Holding with land	3296782
Under 0.1 ha	251487
0.1 ha and under 0.5 ha	1712542
0.5 ha and under 1 ha	840444
1 ha and above	492309
Total	3405014

Characteristics of family farms in livestock sector of Nepal

Family farms in Nepal are small agricultural units managed primarily by household members. The family owns the land, makes key management decisions and provides most of the labour, with only limited reliance on hired workers. These farms typically keep a small number of animals and use traditional livestock rearing practices that integrate crops and livestock. Smallholder livestock farmers form the backbone of Nepal's agricultural sector, with most farms operating as family-run units. Family farmers often raise local livestock breeds that are well adapted to Nepal's diverse climates and production conditions, thereby helping to preserve genetic diversity. In many hilly and Himalayan regions, farmlands managed by family farmers are organically maintained by default, relying mainly on farmyard

manure and using very little or no chemical fertilizer. Livestock provide a major source of manure and nutrients for crop production, making family farming an important foundation for organic and sustainable agriculture (FAO, 2022).

Socioeconomic status of family farmers

In Nepal, livestock is raised by both household and non-household sectors. Household operated livestock farms generally fall into two categories: (i) subsistence and (ii) commercial. Subsistence farming refers to livestock rearing primarily undertaken to meet the needs of the household and its members. In contrast, commercial farming involves raising livestock with the intent of selling products in the market (Commercial Livestock Integrated Survey, 2021). Most family farmers own very small plots of land. Around 60% of farmers have less than 0.5 hectares and the average agricultural landholding is approximately 0.4 hectares (Fig. 3). Bagmati Province (70.7%) and Madhesh Province (66.5%) have the highest proportions of small landholders with only 0.1 hectares. In comparison, Karnali and Sudurpaschim Provinces show more diverse land distribution patterns, with significant shares of households holding between 0.25 and 1.0 hectares of land.

The proportion of households engaged in agriculture has been steadily declining since 1995, dropping from 73.9% in 2010/11 to 60.3% in 2022/23. This indicates a gradual shift of primary livelihoods away from agriculture. The average agricultural landholding has also decreased

consistently, from 1.1 hectares in 1995/96 to just 0.4 hectares in 2022/23. This trend suggests increasing land fragmentation, which might hinder the adoption of efficient farming practices and limit economies of scale.

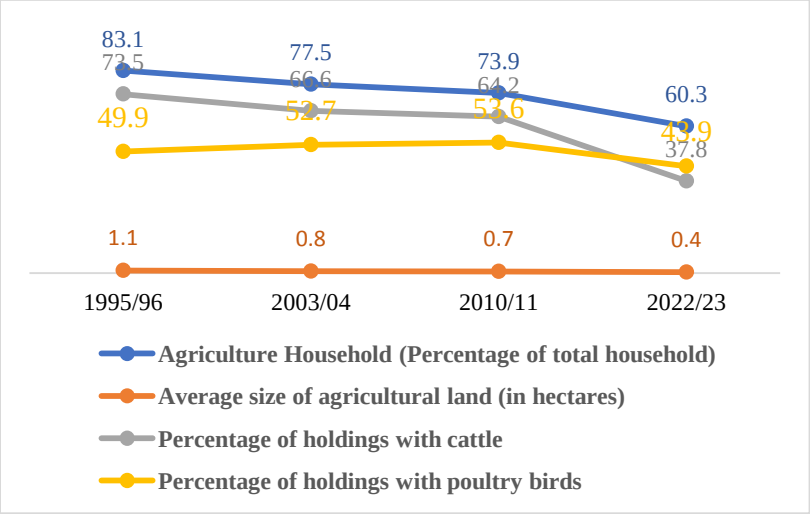

Fig. 3. Selected agricultural indicators during 1995/96 to 2022/23

Women play a central role in livestock management, performing daily tasks such as feeding, milking and cleaning. However, men typically make major decisions regarding the purchase and sale of animals. Women also face constraints in accessing training and credit. According to the "National Sample Census of Agriculture 2021/22", only 31.4% of the agricultural population has ownership or secure rights over agricultural land. A gender-disaggregated analysis shows that 42.9% of adult men in agricultural households hold secure land rights, compared to only 20.8% of adult women. More than one-third of agricultural households are female-headed.

The "Agriculture Census 2021/22" reports that 483,208 agricultural holdings (12%) currently have outstanding agricultural loans. Among these, the largest share (39%) has obtained loans from cooperatives, followed by relatives (14%), women's groups (14%) and other sources. Despite the significant role of livestock farming, only 4.5% (153,962) of livestock-keeping households report having insurance coverage for their livestock-related activities.

Policy and institutional framework

Policies related to livestock sector

Nepal has introduced a wide range of policies, strategies, programs and commodity specific as well as cross cutting initiatives aimed at strengthening the national economy through the development of the livestock sector. These efforts place strong emphasis on smallholder farmers, women, youth and marginalized groups, with the overarching goal of reducing poverty and improving the livelihoods of rural communities. The Government of Nepal's agricultural policies are guided by Article 51(e) of the Constitution, which prioritizes agricultural development, while safeguarding and promoting the rights and interests of farmers. The constitution further supports commercialization, diversification and modernization of the agricultural sector, along with the effective implementation of land use policy to increase agricultural productivity and production.

Through its agriculture and livestock development policies, the Nepalese government has undertaken several initiatives to promote sustainable family farming within the livestock sector:

National Agriculture Policy 2004

It emphasizes the promotion of sustainable agricultural practices, including improved livestock management, with the goal of increasing productivity while maintaining ecological balance. The "National Agriculture Policy" (NAP) seeks to enhance food security and reduce poverty by providing targeted support and special facilities to farmers, particularly those with less than half a hectare of land, as well as Dalits, underprivileged groups and other marginalized farmers and agricultural workers.

The Agriculture Bio-Diversity Policy 2007

This policy emerged following Nepal's accession to the "International Convention on Biological Diversity" (CBD) in 1993. It aligns with the objectives of the "National Agriculture Policy" (NAP) 2004, aiming to conserve, promote and utilize biodiversity while maintaining ecological balance. The policy seeks to reduce poverty and enhance livelihood and food security by preserving and sustainably using genetic resources. Livestock genetic improvements, leveraging this genetic diversity, are expected to contribute to increased livestock production.

The Rangeland Policy 2012

The policy defines rangelands as natural pastures, grasslands and shrublands. It aims to enhance forage and grass productivity while protecting livestock farmers' traditional grazing rights in community rangelands and forests. It emphasizes the proper determination and management of stocking densities to reduce competition between domestic and wild animals. The policy promotes sustainable livestock farming through the year-round, responsible use of natural rangelands.

Agriculture Development Strategy (2015-2035)

Agricultural Development Strategy (ADS) emphasizes sustainable agricultural practices, including livestock management and promotes self-reliance in milk production while encouraging the use of modern technologies to improve livestock productivity. The strategy aims to enhance food and nutrition security, reduce poverty, increase competitiveness and provide higher and more equitable incomes for rural households, while safeguarding farmers' rights. ADS seeks to sustainably increase national food production by improving productivity and responsibly utilizing natural resources. Its key objectives include strengthening food, feed and seed reserves to reduce smallholder farmers' vulnerability, enhancing emergency preparedness and response and promoting climate-smart agricultural practices. Additionally, the strategy aims to foster micro, small and medium agro-enterprises, particularly those led by women, youth and marginalized groups, thereby encouraging their active participation and empowerment (GoN, 2015a).

The "Animal Health Program Implementation Procedure 2013", was introduced in accordance with the "Animal Health and Animal Service Act 1999" and its associated regulations. It aims to enhance the effectiveness of animal health programs and to promote the production, distribution, consumption and export of healthy livestock key components of effective livestock management. In support of this goal, the government has implemented the "National Animal Disease Control Program" and launched vaccination campaigns to control major livestock diseases, including Foot and Mouth Disease (FMD), Peste des Petits Ruminants

(PPR) and Lumpy Skin Disease (LSD), thereby improving overall livestock health.

Livestock insurance in Nepal is designed to protect commercial and individual farmers against the death or loss of livestock due to diseases, accidents or other risks, thereby securing their investments. The Government of Nepal provides an 80% subsidy on the insurance premium. The Crop and Livestock Insurance Directives of 2013 established insurance coverage based on production costs for crops and the estimated value of livestock, poultry and fisheries. In 2022, this framework was updated and replaced by the Agriculture, Livestock and Medicinal Herb Insurance Directive, which expanded coverage to include medicinal herbs and ensured access to insurance for farmers across all regions. The new directive emphasizes comprehensive livestock insurance, protecting farmers against losses from diseases, accidents and natural disasters, thereby strengthening the sustainability of Nepal's agricultural sector (Thapa et al., 2025).

Institutional support

The Department of Livestock Services, under the Ministry of Agriculture and Livestock Development (MoALD), provides technical support through various government programs, including veterinary services, training programs, subsidies for improved breeds and livestock insurance schemes. In addition, MoALD collaborates with numerous NGOs and INGOs to implement programs targeting smallholder farmers. Several projects have been undertaken to strengthen Nepal's agricultural sector. The "Food and Nutrition Security Enhancement Project" (FANSEP) focus on enhancing climate resilience, improving agricultural productivity and promoting better nutrition practices among smallholder farming communities in eight targeted districts (FAO, 2020). The "Agriculture Sector Development Program" (ASDP), implemented in the geographically remote Karnali Province, aims to improve food security and increase incomes for smallholder farmers and disadvantaged rural groups, while supporting commercial production and the development of marketing systems and value chains for selected high-value commodities.

The World Bank-financed "Nepal Livestock Sector Innovation Project" (NLSIP) promotes climate smart and improved livestock technologies to enhance productivity, resilience and value addition within selected livestock value chains (Shrestha et al., 2021). Similarly organizations such as Heifer International and the World Bank are implementing programs to support smallholder livestock farmers by improving productivity, resilience and value addition across livestock value chains in Nepal.

Nepal has implemented the "United Nations Decade of Family Farming" (UNDFF) in partnership with civil society organizations. Guided by the seven pillars defined by UNDFF, the government has developed various action plans

and policies to strengthen family farming in the Nepalese context. The initiative, led by the Ministry of Agriculture and Livestock Development, seeks to promote sustainable and resilient family farming systems. Implementation is carried out at the local level, rural municipalities and municipalities in coordination with "Small Farmer Agriculture Cooperative Ltd." (SFACL), as facilitated by the Nepal Agricultural Cooperative Central Federation Ltd. (NACCFL). Additionally, the "Assuring Resiliency of Family Farmers Fund" (ARISE), provided through an IFAD regional grant, was utilized by NACCFL to support UNDFF activities in 15 local levels during the fiscal year 2023/24.

Sustainable livestock management practices

Sustainable family farming in the livestock sector is vital for ensuring food security, conserving biodiversity and supporting the economic wellbeing of rural populations. In Nepal, the concept is gaining increasing attention due to its role in enhancing rural livelihoods, improving food availability and mitigating environmental impacts. Sustainable livestock family farming integrates practices that maintain ecological balance, ensure long-term productivity, promote animal welfare and improve the socio-economic status of smallholder farmers, particularly in rural areas. The concept of sustainable family farming in Nepal is framed around three key dimensions: economic sustainability, social sustainability and ecological sustainability. As a least-developed country, where agriculture underpins the economy providing 60% of employment opportunities and contributing approximately 24% to the national GDP (Neupane et al., 2023), Nepal is highly vulnerable to climate impacts, particularly in the Himalayan region. This underscores the necessity of embedding sustainable agriculture principles into agricultural development policies. Sustainability in family farming is therefore essential for the long-term viability of both farming households and the broader ecosystem. The concept of sustainable family farming in Nepal encompasses:

Economic sustainability

Livestock farming serves as a crucial source of income, food and overall resilience for rural households in Nepal. For smallholder farmers, it is an integral component of mixed farming systems, where crop cultivation and animal husbandry are closely intertwined. Livestock provide multiple benefits: they supply milk, meat, eggs and other animal products for household consumption and local markets, while also generating cash income that can support education, healthcare and other family needs. Beyond economic contributions, livestock play a key role in enhancing food security by providing a consistent source of protein and essential nutrients. They also contribute to the sustainability of farming systems through the provision of manure, which enriches soil fertility, supports crop production and reduces dependency on chemical fertilizers. Furthermore, livestock act as a safety net during periods of crop failure or

economic hardship, helping households maintain resilience in the face of environmental and market fluctuations. By supporting both livelihoods and ecological sustainability, livestock farming is central to the well-being of rural communities and the overall resilience of Nepal's agricultural systems.

Social sustainability

Livestock farming not only supports livelihoods but also strengthens community cohesion and preserves traditional knowledge, particularly among indigenous and rural communities. Practices such as communal grazing, collective care of animals and sharing of breeding knowledge foster social bonds and intergenerational transfer of skills, ensuring that traditional livestock management practices are maintained and adapted over time. Women play a central role in livestock care and management, including tasks such as feeding, milking, cleaning and maintaining animal health. Their involvement gives livestock farming significant gender dimensions, as it provides women with opportunities for income generation, decision-making and skill development. By actively participating in livestock-related activities, women gain greater autonomy and influence within their households and communities. This not only enhances household welfare but also contributes to the broader empowerment of women in rural areas, promoting gender equality and social inclusion in agricultural development.

Environmental sustainability

The adoption of organic farming practices and the sustainable management of pasturelands, water resources and animal health play a crucial role in both conserving and optimizing the use of natural resources. By reducing reliance on chemical inputs, promoting natural feed and maintaining healthy livestock, these practices help preserve ecosystems, protect biodiversity and ensure the long-term productivity of agricultural land. Livestock farming also significantly contributes to soil fertility management. Manure from animals, along with composting practices, enriches the soil with essential nutrients, improves soil structure and enhances moisture retention, leading to higher crop yields and sustainable land use. In mixed farming systems, the integration of crop and livestock production creates a closed nutrient loop, reducing waste and promoting ecological balance. This sustainable approach not only supports the productivity and resilience of farms but also ensures that natural resources are preserved and utilized efficiently for future generations.

Climate smart practices

The family farmers of Nepal practice several climate-friendly methods. These are:

- Improved animal shelters to protect from vagaries of weather;
- Better feeding practices using local feed resources;

- Water conservation techniques;
- Manure management for biogas production;
- Planting trees for shade and fodder

With regard to resource management, the farmers of Nepal practice:

- Rotational grazing to maintain pasture health
- Mixed farming to use resources efficiently
- Recycling of farm waste
- Community management of common grazing lands

Opportunities for sustainable family farming in livestock

Promotion of organic farming

Nepal's organic farming sector is steadily growing, driven by rising consumer demand for organic dairy and meat products. This trend offers family farmers opportunities to access niche markets and boost their income by producing high-quality, sustainably raised livestock.

Agro-ecology and integrated farming system

Promoting integrated crop-livestock systems is an effective strategy for achieving sustainable agriculture. These systems enhance farm resilience, boost productivity and optimize the use of available resources.

Climate smart agriculture

Adopting climate smart agricultural practices, such as rainwater harvesting, improved fodder management and the use of drought-resistant livestock breeds could help mitigate the impacts of climate change on livestock farming.

Value chain development

Strengthening livestock value chains, including better processing and packaging techniques, provides opportunities to improve market access and increase farmers' incomes.

Public private partnerships

Building strong partnerships among the government, NGOs, the private sector and local family farming communities can improve resource mobilization, facilitate technology transfer and strengthen market linkages.

Case study

Jamuna Devi Pandey, aged 36 years, from Bardiya District in Lumbini Province, grew up in a family of farmers. She used to raise two buffaloes and spent long hours collecting feed from nearby forests, a task that became increasingly difficult due to urbanization and declining forest cover. Through the World Bank financed Nepal Livestock Sector Innovation Project (NLSIP), she received perennial high yield grass seeds and began cultivating nutritious forages such as Berseem and Napier near her home. These high yield green forages have significantly reduced her livestock feeding costs and lowered greenhouse gas emissions from her cattle.

Through the Digopan Samajik Mahila Uddhymi Cooperative, a women's farmers' group supported by NLSIP, Jamuna and other members received 38 cross bred cows and 30 cross bred buffaloes, along with training in climate smart livestock practices, which has helped boost milk production. They also constructed upgraded animal sheds and received an automatic milk analyser, 350 kilograms of forage seeds and other farm equipment through NLSIP support. Specifically, Jamuna received four cross-bred Murrah buffaloes and two cross-bred cows under the project, enabling her to sell 30 litres of milk per day.

Challenges of family farming in livestock sector

Limited access to resources

Limited access to high quality livestock breeds, veterinary services, affordable feed and modern farming technologies continues to constrain the productivity and long-term sustainability of family farms. In addition, many farmers face inadequate access to credit and financial support, limiting their ability to invest in sustainable equipment and essential infrastructure.

Climate change and environmental degradation

Nepal's livestock sector is highly vulnerable to climate related events such as droughts, floods and temperature fluctuations, all of which directly affect animal health, fodder availability and water resources. Additionally, overgrazing, deforestation and inadequate land-management practices contribute to soil erosion and declining agricultural productivity.

Inadequate infrastructure and market access

Poor infrastructure including inadequate roads and limited market facilities restricts farmers' ability to efficiently sell their livestock products. Smallholder farmers often struggle to access formal markets due to weak linkages between producers and buyers, which contributes to the dominance of informal markets where prices are low and farmer incomes remain limited. Furthermore, the absence of cold storage and processing facilities reduces opportunities for value addition and further constrains the profitability of livestock production.

Disease outbreaks

Livestock diseases, both infectious and parasitic pose a major challenge in Nepal. In recent years, emerging and re-emerging "Trans-boundary Animal Diseases" (TADs) have become a critical threat to family farmers. Limited access to veterinary services in remote areas, weak animal health surveillance systems and the risk of cross border disease transmission further exacerbate the problem, reducing productivity and causing significant economic losses.

Lower technological adoption

Limited access to information on modern technologies and improved livestock management practices hinders the adoption of sustainable farming methods. Contributing factors include inadequate technical knowledge, insufficient training opportunities, the absence of demonstration farms and weak extension services, particularly in remote areas.

Gender inequality

Despite women playing a central and often labor-intensive role in livestock farming, their contributions remain undervalued and underrecognized. Many women face limited access to education, financial resources, extension services and training opportunities, which reduces their ability to adopt improved livestock management practices or invest in productive assets. Social norms and restricted participation in household and community level decision-making further constrain their leadership and influence in livestock-related activities. As a result, women are unable to fully leverage their potential, which not only limits their empowerment but also restricts the overall productivity and development of the livestock sector.

Action plan address challenges of family farmers

The Global Action Plan of the "United Nations Decade of Family Farming 2019-2028" aims to accelerate collective, coherent and comprehensive efforts to support family farmers, who are recognized as key contributors to sustainable development (FAO and IFAD, 2019). Nepal, in collaboration with civil society organizations, is actively participating in the implementation of the "United Nations Decade of Family Farming" (UNDFF). To make family farming in the livestock sector more productive, profitable, attractive, prestigious and sustainable, it is essential to establish and implement supportive policies, targeted programs and effective action plans.

Pillar 1. Develop an enabling policy environment to strengthen family farming

Outcomes	Outputs	Indicative actions	Indicators	Time frame
NAP implemented with special provisions for smallholder livestock farmers	National Agriculture Policy, 2004 revision.	Strengthening family farming Integrated development of family farmers through policy, technological and innovative interventions	Inclusion of policies for family farmers in the policy document	1 year

Pillar 2. Support youth and ensure the generational sustainability of family farming

Outcomes	Outputs	Indicative actions	Indicators	Time frame
Attraction of youth in agriculture and their retention	Youth involvement in livestock farming	• Farm mechanization, capacity development and easy access to soft loan and market;	• Number of youths in livestock farming;	2 years
Livestock Product Diversification	Processing Facilities	• Establish milk processing plants; • Develop meat processing centers	• Number of facilities established; • Number of facilities established	3 years

Pillar 3. Promote gender equity in family farming and leadership role of rural women

Outcomes	Outputs	Indicative actions	Indicators	Time frame
Women farmers as entrepreneurs in lead role.	Women entrepreneurs with access to resources and market	• Women friendly technology development and dissemination, • Capacity building	Number of women entrepreneurs in livestock farming.	2 years

Pillar 4. Strengthen family farmers' organizations and capacities to generate knowledge, represent farmers and provide inclusive services in the urban-rural continuum

Outcomes	Outputs	Indicative actions	Indicators	Time frame
Strong family farmers' organizations and their involvement in agricultural activities.	Farmers Group and Cooperatives strengthened	Provide management training to group and cooperatives with the support in their registration, operation	Number of farmers group and cooperatives registered and functional	Continuous

Pillar 5. Improve socio- economic inclusion, resilience and wellbeing of family farmer, rural households and communities.

Outcomes	Outputs	Indicative actions	Indicators	Time frame
Improved livelihood of family farmers.	Increased access on animal feed resources, inputs, markets	Improved Fodder cultivation program; Improved Animal Breeding Programs; Milk Collection Centers and live Animal Markets at rural areas	Increase in Family farmer's income	2 years

Pillar 6. Promote sustainability of family farming for climate resilient food system

Outcomes	Outputs	Indicative actions	Indicators	Time frame
Sustainable and climate resilient farming technologies adopted.	Sustainable and climate resilient farming technologies developed and disseminated.	• Improved animal shelters; • Better feeding practices using local feed resources; • Manure management for biogas production	• Number of improved animal shelter; • Number of communities pasture land; • Biogas plant established	2 years

Pillar 7. Strengthen the multidimensionality of family farming to promote social innovations contributing to territorial development and food systems that safeguard biodiversity, the environment and culture

Outcomes	Outputs	Indicative actions	Indicators	Time frame
Biodiversity conservation and increased productivity	Feed and Fodder Development	• Establish community pasture lands; • Renovation and Improvement of Rangeland	• Number of communities pasture land; • Area of rangeland used	2 years

Recommendations

Improved extension services and training

Provide comprehensive and accessible training programs for smallholder farmers that cover sustainable livestock management practices, climate resilient farming techniques and emerging market opportunities. These programs should include practical, hands-on sessions, demonstrations and locally tailored curricula to ensure relevance across diverse agro-ecological zones. Strengthening farmers' knowledge in areas such as improved breeding, animal health, fodder cultivation, waste management and value addition will enhance productivity and resilience. Additionally, integrating training on market trends, quality standards and business skills can empower farmers to make informed decisions, improve market access and increase their overall profitability.

Investment in rural infrastructure

Improve rural infrastructure such as transportation networks, market facilities and collection centers to enable farmers to access broader and more competitive markets while enhancing the overall efficiency of livestock value chains. Upgrading rural roads reduces transportation costs, minimizes product losses and allows timely delivery of livestock and livestock products. Strengthening market facilities by establishing well-equipped marketplaces, cold storage units and processing centers can support value addition and improve product quality. These investments not only increase farmers' income and bargaining power but also stimulate rural economic activity and encourage private-sector participation in the livestock sector.

Policy reforms

Update agricultural policies, enhance the effectiveness of subsidy delivery systems and strengthen regulatory frameworks to better support sustainable livestock development.

Research and development

Sustainable livestock farming should be promoted through the development of climate-resilient animal breeds, research on locally available feed resources and enhanced animal health management practices.

Access to credit and financial support

Enhance smallholder farmers' access to credit, subsidies and insurance schemes, enabling them to invest in sustainable farming practices, improve livestock health and strengthen the resilience of their operations.

Promote indigenous livestock breeds

Promote the conservation and selective breeding of indigenous livestock breeds, which are naturally adapted to local environmental conditions and more resilient to the impacts of climate change.

Support for women and marginalized farmers

Strengthen programs that empower women and marginalized communities, ensuring they have equitable access to resources, training and participation in decision-making processes within the livestock sector.

Monitoring and data collection

Establish comprehensive data collection and monitoring systems to track livestock productivity, health and environmental impacts, providing evidence-based insights to guide policymaking and promote sustainable farming strategies.

Conclusion

Sustainable family farming in Nepal's livestock sector is vital for food security, economic stability and environmental sustainability. The sector faces key challenges, including limited access to resources, climate change impacts, disease management and market constraints. Strengthening resilience requires a multi-stakeholder approach, with government, private sector, NGOs and local communities collaborating through supportive policies, improved services, infrastructure investment, capacity building and promotion of climate smart practices. Such efforts can create a more sustainable, equitable and profitable livestock sector that benefits smallholder farmers and contributes to national development.

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Chapter 5

Sustainable Family Farming of Livestock Sector for Attaining the SDGs: Country perspective of Pakistan

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Livestock sector of Pakistan

In Pakistan, the agriculture sector demonstrated resilience in 2025, recording a growth rate at the tune of 0.56%, primarily driven by the livestock subsector. Agriculture occupies a central position in the national economy, contributing about 25% to the GDP and providing employment to nearly 50% of the country's workforce. Within this sector, livestock has emerged as the largest and most dynamic component. The livestock subsector contributes approximately 14.97% to the national GDP and accounts for about 63.60% of the total agricultural output (Anonymous, 2025).

Livestock serve as a "Live Bank" for farmers, enabling them to meet emergency financial needs (Riaz et al., 2008). For many households, livestock rearing is a subsistence activity that helps meet food requirements and supplement farm income. In rural Pakistan, nearly every household owns livestock and men, women and children all participate in its management. Women, in particular, play a key role by cleaning sheds, collecting farmyard manure, stall-feeding animals, providing water, cutting fodder, chopping feed and performing milking activities (Ali and Khan, 2013). The livestock population of the country is presented in Table 1.

Table 1. Livestock population of Pakistan

Species	Population (million)		
	2022-23	2023-24	2024-25
Cattle	55.4	57.5	59.7
Buffalo	45.0	46.3	47.7
Sheep	32.3	32.7 1	33.1
Goat	84.7	87.0	89.4
Camels	1.1	1.2	1.2
Horses	0.4	0.4	0.4

Average livestock holdings range from 2-5 cattle per household, collectively accounting for more than 80% of Pakistan's total livestock population (Riaz et al., 2008). Approximately 8 million rural families, representing a substantial portion of the rural population, depend directly or indirectly on the livestock sector for their livelihoods. For these households, livestock contributes between 35% and 40% of total income. Overall, the livestock sector plays a crucial role in agricultural value addition and national economic growth. It not only supplies essential raw materials to various industries but also serves as a significant market for industrial products, reflecting its importance as both a producer and consumer within the economy.

Major livestock production systems of Pakistan

Pastoral/nomadic & transhumant system

This system is characterized by the seasonal movement of herds and herders in search of water and pasture. It relies almost entirely on grazing natural rangelands, including meadows, forests, foothills and deserts. The subtypes are as follows:

a. **Nomadic**: Characterized by continuous movement throughout the year without a fixed home base. Nomadic herders are primarily found in arid and semi-arid regions, including the deserts of Balochistan (e.g., Chagai), Sindh (e.g., Thar) and parts of South Punjab (e.g., Cholistan, Muzaffargarh).

b. **Transhumant (semi-nomadic**): They undertake seasonal migration between fixed summer and winter pastures, typically moving to highland areas in summer and returning to lowland regions in winter. This pattern is common in mountainous regions such as the Northern Areas, Khyber Pakhtunkhwa (KPK), Azad Jammu and Kashmir (AJK) and the foothills of the Salt Range and the Suleiman Range. Their economy is based on subsistence, supplemented by the sale of animals, wool, hair and milk. However, this system is highly vulnerable to drought and the degradation of rangelands.

Agro-pastoral system

In this system, livestock rearing is integrated with crop production, relying primarily on grazing on common lands, fallow fields, crop residues and some cultivated fodder. It is practiced alongside rain-fed (barani) or limited irrigated farming. Although, farmers are more settled compared to those in purely pastoral systems, they still engage in some local or seasonal movement of animals. This system is common in the rain-fed uplands of Punjab, Khyber Pakhtunkhwa (KPK), Balochistan and marginal irrigated areas, serving as a transitional zone between pastoral and mixed farming systems. Economically, households earn cash income from both crop production often coarse grains and pulses and livestock or animal products. However, their livelihoods remain highly vulnerable due to dependence on rainfall.

Mixed crop livestock farming systems

This is the dominant livestock production system (small holder and medium scale) in Pakistan, where livestock are integrated with crop cultivation on irrigated or high-rainfall lands. Animals are primarily stall-fed or grazed on very limited areas, relying largely on crop residues (e.g., wheat straw, rice straw, maize stover), cultivated fodder crops (e.g., berseem, lucerne, sorghum, maize) and increasingly, purchased concentrates or feed. Key features of mixed crop-livestock farming systems**:**

- ❖ Integration: Livestock provide dung as a source of fertilizer and sometimes traction.
- ❖ Scale: Dominated by smallholders (often defined as owning <5-10 acres of land and/or 2-5 milking animals). Medium scale farmers also operate within this system.

  Sub-types within smallholder are as follows:

  1. Rural smallholder dairy: The backbone of Pakistan's milk production. 1-5 buffaloes/cattle (Riaz et al., 2008) kept primarily for household milk consumption and sale of surplus milk to local collectors/vendors or dairy companies. Highly dependent on family labor.
  2. Small ruminant fattening: Smallholders' farmers purchase young stock (sheep/goats), fatten them for 2-4 months using crop residues and some concentrates and sell for meat purpose (around Eid festivals).
  3. Backyard poultry: Very small flocks (5-50 birds) kept for eggs/ meat for home consumption and local sale. Mostly indigenous breeds.

Specialized commercial (landless/ peri-urban) intensive systems

Focused on high-output production (milk, meat, eggs) with minimal or no land base for fodder production. The farms are located near urban centers to supply fresh products. Relies heavily on purchased feed (concentrates, fodder, total mixed rations-TMR). In Pakistan, there are two types of specialized commercial and intensive systems. These are as below:

(i) Commercial dairy farms: Range from medium (10-50 animals) to large-scale (>100 animals), primarily stall-fed Holstein-Friesian cattle or high-yield buffaloes. Use mechanized milking, cooling tanks and modern management practices.

(ii) Feedlot operations (beef fattening): It is emerging system in Pakistan. Farmers purchase young cattle (often male dairy calves or culled animals) and fattening them intensively for 3-6 months on high concentrate diets.

These kinds of farming systems are market-oriented, capital-intensive, requires technical knowledge. It is growing rapidly due to urbanization and demand.

Characteristics of family farms in the country context

Family livestock farming refers to the "*raising and management of livestock on farms primarily operated by family units"*, where family labour constitutes the main workforce and activities rely predominantly on non-wage household labour. This form of farming is typically characterized by a strong integration of domestic life and agricultural production, such that the household's economic welfare is closely tied to farm performance. Family-based livestock systems can range from small-scale subsistence operations to larger, commercially oriented enterprises; however, they are unified by the central role of the family in decision-making, labour provision and day-to-day management. The defining feature is the direct and continuous involvement of family members in all aspects of livestock production, reflecting both an economic activity and a livelihood strategy embedded within the family's social and cultural context.

Regarding family farming in livestock sector, 85% of livestock holders are small/ marginal farmers with 1-5 cattle/ buffalo or 10-15 goats /sheep. Essentially, it is the integration of crops (wheat, fodder) and livestock (dairy, goats). Further, animals act as "living savings" sold for emergencies, education or weddings purposes. It is noteworthy to mention that the women manage 60-70% of daily livestock tasks (milking, feeding) (Naz et al., 2023).

Significance of family farming in Pakistan's livestock sector

Family farming forms the foundation of Pakistan's livestock sector and plays a critically important role in the country's agricultural economy. It serves several purposes.

Primary Production Base

- Milk: Family farms contribute more than 80% of Pakistan's total milk output (Usman et al., 2023), positioning the country as the world's fourth-largest milk producer (FAO, 2023).
- Meat: Family-operated systems are the primary source of domestically consumed meat including beef, mutton and poultry-supplying the overwhelming majority of national production.
- Other livestock products: Family farms also make substantial contributions to the production of eggs, hides and skins, manure used as organic fertilizer and draft power through the use of buffaloes and oxen.

Input utilization and resource efficiency

Efficient feed utilization: Family farms make effective use of crop by-products such as straw, stalks and bran as well as household kitchen waste for livestock feed, thereby reducing production costs and minimizing resource waste.

Soil fertility management: They supply essential organic manure for maintaining soil fertility in both their own and neighboring crop fields, helping to decrease reliance on chemical fertilizers (Katyar et al., 2024).

Risk management and livelihood diversification

Risk management and asset security: Livestock serve as an important form of savings and act as a buffer against agricultural shocks such as droughts, floods and pest outbreaks.

Income stability: They provide a steady stream of income, particularly through daily milk sales in contrast to the seasonal and often variable income derived from crops.

Foundation of the rural economy

Employment Generation: Family-based livestock systems create both direct and indirect employment opportunities, supporting occupations such as feed suppliers, milk collectors, veterinarians butchers, transporters and processors.

Value Chain Support: They underpin extensive networks of small-scale milk collection centers, local livestock markets (*mandis*) and informal value chains that are essential to rural and peri-urban economies.

Socioeconomic status of family farmers in Pakistan

The socioeconomic status of family livestock farmers in Pakistan is generally low to moderate, reflecting a combination of structural limitations and resource constraints, despite the sector's critical contribution to rural livelihoods and the national agricultural economy.

1. Economic vulnerability and low income

Dependence: Livestock serves as a primary or supplementary income source for many households; however, earnings are often irregular and highly susceptible to price volatility, disease outbreaks and seasonal shortages of feed and fodder.

Marginalization: Most family livestock farmers are smallholders, typically owning 2-5 cattle or buffaloes or 10-20 goats or sheep. Their limited landholdings constrain on-farm fodder production, increasing reliance on expensive purchased feed and further narrowing profit margins.

Poverty link: A substantial proportion of these farmers live at or below the poverty line. In this context, livestock functions as a vital safety net, providing an asset buffer that helps households cope with economic and environmental shocks.

1. Limited assets and access

Landlessness and Leasing: Many livestock-keeping households are either landless or possess only marginal landholdings. As a result, they depend on communal grazing areas often degraded or on leased pasturelands to sustain their herds.

Limited capital: Insufficient financial capital restricts farmers' ability to invest in improved breeds, veterinary services, appropriate housing and feed storage (FAO, 2019). Limited access to formal credit further compounds these challenges, leading many to rely on informal lenders who charge high interest rates.

2. Social factors and education

Low Education Levels: Educational attainment among livestock farmers, particularly household heads and women actively engaged in livestock management, is generally low. This constrains the adoption of modern husbandry practices; limits understanding of animal health and nutrition and reduces access to technical information and extension services.

Women's Role: Women play a central role in livestock care, including feeding, milking, cleaning and overall herd management. In many households, they effectively manage the entire livestock enterprise (ILRI, 2010), yet their contributions are frequently undervalued. Participation in livestock farming provides rural women with a degree of financial autonomy and enhances their decision-making power within the household.

3. Access to services and infrastructure

Veterinary Services: Access to affordable and high-quality veterinary care is often limited, particularly in remote and rural areas, making disease outbreaks a major source of economic loss for family livestock farmers.

Extension and Training: The provision of effective livestock extension services and training remains inadequate for the large number of dispersed smallholder farmers, restricting their ability to adopt improved practices and technologies.

4. Markets and value chains

Limited bargaining power, poor market access, lack of cold chains and exploitation by middlemen reduce profitability.

Policy and institutional framework regarding family farms

National livestock policy

Recognizes livestock's vital role (especially for smallholders), aims to improve productivity, disease control, marketing and breed improvement.

Prime Minister's Agriculture Emergency Program (Component: Livestock)

It includes:

(i) Cattle insemination program: Subsidized/sometimes free AI services nationwide.

(ii) Fodder development program: Promoting high-yield fodder seeds and cultivation techniques.

(iii) Enhancing milk and meat production: Support for feed, health and management improvements.

Benazir income support program (BISP) / Ehsaas program

While broad social safety nets aim to reduce poverty, many programs include livestock asset transfers (e.g., goats, cows) to ultra-poor rural households, thereby directly supporting family-based livestock farming and enhancing livelihood security.

Provincial livestock and dairy development policies

All provinces (Punjab, Sindh, Khyber Pakhtunkhwa and Balochistan) have developed their own livestock policies and programs, which are generally aligned with national objectives but adapted to address region specific needs and priorities.

Public sector development program (PSDP) projects

Regular funding is allocated for targeted livestock initiatives, such as disease control campaigns, breed improvement programs and related sectoral projects.

Livestock and dairy development board (LDDB)

An apex body that promotes livestock sector growth, facilitates exports and implements national-level projects, indirectly supporting family farmers by enhancing market linkages and access to information.

Institutional support framework

Ministry of National Food Security and Research (MNFS&R-Federal): Responsible for overall policy formulation and coordination.

Provincial Livestock and Dairy Development Departments (LDDDs): Primary implementing agencies. Responsible for: (i) extension services, (ii) veterinary healthcare, (iii) disease surveillance and control, (iv) artificial insemination, (v) breed improvement farm.

Pakistan Agricultural Research Council (PARC): Extend R & D on different aspects of livestock and poultry including animal nutrition, disease resistance, breeds improvement for smallholders.

Veterinary Medical Council (PVMC): Regulates veterinary education and practice, ensuring qualified veterinarians.

Private Sector & NGOs: Their role is increasingly crucial and they undertake community mobilization, training, microcredit and forming producer groups for small livestock holders.

National Rural Support Program (NRSP): They facilitate the formation of Livestock Farmer Enterprise Groups (LFEGs), provide training in improved animal husbandry practices, enable access to livestock-specific microfinance (for animal purchase, feed and housing) and support market linkages. These interventions are crucial for organizing, empowering and enhancing the productivity of smallholder farmers.

Cooperatives: Historically, the livestock sector in Pakistan has received less institutional focus compared to crops. While dairy cooperatives have achieved some success in recent years, their reach remains limited, covering only a small geographic area.

Private-sector and NGO initiatives: Including those by Nestlé, Engro and Olper have supported small-scale milk producers by facilitating collective marketing, improving access to inputs and enabling better price negotiations.

Pakistan has a formal policy framework aimed at supporting family livestock farmers, encompassing national policies, provincial departments providing extension services, veterinary care and artificial insemination (AI), as well as research institutions. Key strengths of this framework include the extensive network of field staff and ongoing disease control initiatives. However, significant challenges remain in implementation capacity, resource allocation and service quality, particularly regarding AI and extension services. The role of the private sector and NGOs in bridging these gaps is becoming increasingly important. While the framework provides a foundation, its effectiveness in addressing the needs of the average family livestock farmer requires substantial strengthening

Success story of family farmer

One of a family farmer practicing sustainable, climate-smart livestock production in Pakistan:

Farmer: Malik Muhammad Asif

Location: Chakwal District, Punjab Province

Malik Muhammad Asif transformed his small, struggling livestock farm in water-scarce area of Chakwal into a model of climate resilience and productivity. Facing erratic rainfall and degraded pastures, he adopted key sustainable practices:

Stall feeding & fodder cultivation: Farmer has transitioned from open grazing to stall-feeding systems and have adopted drought-tolerant fodder crops, such as sorghum-sudan grass hybrids, utilizing conservation tillage and rainwater harvesting techniques.

Manure management: He installed a small-scale biogas plant, converting livestock manure into clean cooking fuel for the household, thereby reducing reliance on LPG and mitigating deforestation. The nutrient-rich slurry produced is applied as organic fertilizer to his fodder fields, enhancing soil fertility and crop productivity.

Improved breeds and health: Introduced higher-yielding, heat-tolerant *Sahiwal* cattle and implemented a regular vaccination/ deworming schedule.

Water efficiency: Constructed small ponds for rainwater harvesting to irrigate fodder and provide drinking water during dry spells.

Results

- Increased Productivity: Milk yields increased by over 40% and animal health improved significantly.
- Enhanced Resilience: Fodder security and water availability buffered the farm against droughts.
- Reduced Emissions: Biogas replaced firewood/LPG and better manure management reduced methane emissions.
- Economic Gains: Savings on fuel, feed and veterinary costs, coupled with higher milk sales, substantially improved family income.
- Soil Health: Organic slurry improved soil fertility and water retention in fodder plots.

Malik Asif's farm illustrates how the integration of water conservation, renewable energy, improved livestock breeds and efficient feed management can enable small family farmers in Pakistan to remain productive, sustainable and profitable despite climate-related challenges. His success has motivated neighboring farmers in Chakwal to adopt similar practices, with technical and advisory support from the Punjab Agriculture Department.

Challenges of family farming

Family based livestock farms being the backbone of Pakistan's livestock sector, yet it faces severe systemic constraints. Here's a prescribed analysis:

Feed scarcity & higher cost of feeds

There is a chronic shortage of quality fodder, particularly during the dry Kharif season and the winter Rabi season. Shrinking grazing lands, resulting from

rangeland degradation and insufficient fodder cultivation have increased reliance on costly commercial feeds, limiting access to affordable nutrition for livestock. Consequently, farmers are often forced to adopt more expensive alternatives to meet their animals' dietary needs (Tulu et al., 2023).

Inadequate animal healthcare and disease burden

Endemic diseases such as Foot-and-Mouth Disease (FMD), Hemorrhagic Septicemia (HS) and Peste des Petits Ruminants (PPR) remain highly prevalent, leading to mortality, reduced productivity and trade restrictions (Lestari et al., 2025). Access to affordable and quality veterinary services is limited, particularly in remote areas, while weak disease surveillance and control programs continue to pose significant challenges to effective animal healthcare.

Poor genetic potential and breeding practices

The majority of livestock in Pakistan are low-yielding indigenous breeds. Access to artificial insemination (AI) services with high-quality semen is limited, especially for small ruminants and in rural areas. The absence of systematic breeding programs and low farmer awareness significantly constrain genetic improvement efforts (Rege et al., 2011).

Limited access to finance and credit

Limited access to formal credit, particularly for small and medium enterprises (SMEs) and rural households, constrains investment and entrepreneurial activity in the livestock sector. Smallholder farmers often lack collateral and formal credit histories, severely restricting access to affordable loans for essential investments such as improved breeds, feed, housing and equipment. As a result, many rely on informal lenders charging high interest rates, which can trap farmers in cycles of debt (IFAD, 2016).

Access to markets

- Infrastructure Deficits: Inadequate transportation networks including roads, railways and ports along with insufficient logistics and cold chain facilities, increase costs, cause spoilage and restrict market access, particularly for perishable livestock products (World Bank Group, 2022).
- Trade Barriers: Complex regulations, bureaucratic inefficiencies and non-tariff barriers hinder both exports and efficient domestic trade, limiting integration of livestock products into global value chains.
- Market Information Asymmetry: Smallholder farmers often lack access to real-time price information and reliable market linkages, leaving them vulnerable to exploitation by intermediaries.

Inefficient marketing and value chains

The livestock market in country's most regions is profoundly dominated by intermediaries, who often capture a disproportionate share of the value generated along the supply chain. As a result, primary producers, particularly smallholder farmers tend to receive only a small fraction of the final market price. This imbalance is reinforced by farmers' limited access to reliable and timely market information, which weakens their bargaining position and leaves them helpless to unfavourable terms of trade. Moreover, smallholders frequently lack direct links to processors, retailers or end consumers, compelling them to rely on middlemen, who control price formation and market access. Structural constraints compound these challenges: poor rural infrastructure, especially inadequate cold chain facilities, limited storage and unreliable transportation systems, restrict farmers' ability to preserve product quality and reach more profitable markets. Price volatility and the absence of formalized contractual arrangements between farmers and buyers further heighten risk and insecurity. Together, these factors create an environment in which smallholders are easily exploited and face persistent income instability, perpetuating cycles of vulnerability within livestock-dependent households and communities (Hellin et al., 2009).

Weak Linkages

Poor coordination among input suppliers, producers, processors, distributors and retailers results in elevated transaction costs, inefficiencies and product losses along the value chain. These breakdowns ultimately erode overall profitability and further diminish the share of value captured by primary producers.

Traceability

A livestock traceability system enhances disease control by enabling rapid identification and tracking of infected animals, thereby helping to contain outbreaks effectively. Such systems also strengthen food safety by allowing the swift detection and removal of contaminated products from the supply chain (Prinsloo and De Villiers, 2017). In addition, livestock identification and traceability platforms can support a range of value-added services, improving efficiency and service delivery across the sector. By providing accurate, real-time information on animal identity and movement, traceability systems also promote greater transparency and accountability within the livestock industry (Becker, 2006).

The limited adoption of digital traceability systems, such as blockchain-based platforms for animals, livestock products and by-products poses significant challenges for accurate data collection, record-keeping, vaccination tracking and other farm operations. Continued reliance on manual, paper-based systems not only reduce the efficiency but also increases the risk of errors, data loss and fraudulent practices.

Recommendations

Recommendations for strengthening Pakistan's family livestock farming, given current challenges such as low productivity, feed scarcity, disease burdens, climate-related stresses and limited market access are as follows:

Upgrade breeds

Promote widespread access to subsidized artificial insemination (AI) services using semen from high-yielding, climate-resilient local breeds (e.g., *Sahiwal* cattle, *Beetal* goats) as well as carefully selected crossbreeds.

Ensure feed & water security

- Support cultivation & storage of high-quality fodder crops (legumes, drought-tolerant varieties).
- Promote community silage/ hay-making units to combat seasonal shortages.
- Encourage ration balancing trainings to optimize feed use.
- Integrate water conservation techniques (drip for fodder, rainwater harvesting).

Strengthen animal healthcare

- Expand vaccination coverage (FMD, PPR) through mobile/community camps.
- Train and deploy more Community Livestock Workers (CLWs) for basic treatment, deworming and farmer education.
- Improve access and decrease the prices of affordable veterinary medicines in rural areas.

Enhance farmer skills

Provide practical and accessible training programs focused on modern animal husbandry, breed improvement, basic animal health care, feed formulation and financial literacy for smallholder farmers.

Improve market linkages

- Facilitate formation of Farmer Producer Organizations (FPOs)/Cooperatives for collective bargaining and bulk selling.
- Develop transparent price information systems accessible via mobile.
- Support development of small-scale local processing (chilling plants, milk pasteurization) to reduce spoilage and add value.

Access to finance

- ❖ Design tailored micro-loan/ insurance products specifically for small livestock farmers (lower collateral, weather-indexed insurance).
- ❖ Simplify loan application processes through collaborations with microfinance institutions.

Promote climate adaptation

- ❖ Disseminate knowledge on heat stress management (shade structures, altered feeding times).
- ❖ Promote breeds tolerant to heat and disease.
- ❖ Encourage diversification (multiple species, fodder trees) to spread risk.

Leverage technology

Promote adoption of basic mobile apps for disease alerts, market prices, vet advice and financial management.

Strengthen extension services

Revitalize government extension with a focus on farmer-centric, participatory approaches and close linkages.

Conclusion

Sustainable intensification of Pakistan's livestock sector anchored in empowering smallholder family farms is vital for achieving the SDGs. Strategic investments in climate-resilient practices, equitable market access, women's empowerment, animal health, feed security and enabling policies can transform family farms into key drivers of national development. Moving forward, success depends on recognizing these farms as the backbone of the sector and supporting them through tailored financing, accessible technologies, stronger extension services, fair market linkages and effective policy frameworks. Coordinated action by government, private actors, researchers and farmer organizations is essential to address climate risks and market inefficiencies. Strengthening the sustainability and resilience of family livestock farmers is ultimately an investment in Pakistan's food security, rural prosperity and progress toward the 2030 Sustainable Development Agenda.

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Chapter 6

Sustainable Family Farming of Livestock Sector for Attaining the SDGs: The country perspective of Sri Lanka

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Sri Lanka is an island nation of approximately 65,610 km² in the Indian Ocean and has a tropical climate characterized by wet, intermediate and dry zones that support a wide variety of agricultural activities. Roughly 30% of the land area is used for agriculture, with the majority devoted to crop cultivation and only a small portion allocated to livestock-only systems (Central Bank of Sri Lanka, 2024). The livestock sector contributes about 1.4% to the national GDP, within the broader agriculture, forestry and fisheries sector, which accounts for approximately 8.3% of the national economy (DAPH, 2023). Rural livelihoods depend heavily on small-scale, integrated livestock systems that provide steady income, nutritional benefits and improved resource-use efficiency through mixed farming (FAO, 2022).

Livestock wealth of Sri Lanka

According to the Department of Animal Production and Health (DAPH, 2023), the total cattle population in Sri Lanka is estimated at approximately 1.57 million, comprising of indigenous, crossbred and purebred animals. Most cattle are concentrated in the dry and intermediate agro-climatic zones, particularly in the Eastern, Northern, North Central, North Western and Central provinces. Dairy cattle are predominantly reared in smallholder mixed-farming systems, where their primary contribution is milk production. Crossbred animals, especially those with European ancestry, are more common in the wet and intermediate zones, while *Bos indicus* crosses are widely distributed in the low-country dry zone due to their superior heat tolerance and disease resistance.

Approximately 0.8 million buffaloes are found in Sri Lanka, with the majority concentrated in the North Central, Eastern and Southern provinces, where extensive and semi-intensive management systems are common (DAPH, 2023). Buffaloes play an important role in rural farming systems, contributing to milk production, draught power, manure and income generation, particularly in areas where cattle are less prevalent. Approximately 0.75 million goats and sheep are reared mainly in the dry zones of the Northern and Eastern provinces. Goat production, dominated by *Jamnapari* crosses and indigenous breeds, serves as an

important source of meat and income for smallholder farmers. Sheep farming is less common but is present in specific pockets, particularly in the Mannar and Jaffna districts. The swine sector is primarily concentrated in the western coastal belt of Sri Lanka, especially in districts such as Gampaha and Puttalam, where medium-scale commercial operations are most prevalent, alongside numerous small backyard units. The total pig population recorded a slight increase in 2023.

Overall, the spatial distribution of livestock in Sri Lanka is strongly shaped by climatic zones, land-use patterns and the availability of feed and water resources. These environmental and socio-economic factors influence the types of production systems adopted in each region, as well as the species and breeds that are best suited to local conditions. Consequently, geographic variation in livestock distribution has important implications for breed selection and improvement programs, feeding and management strategies and the design of effective disease surveillance and control measures. Understanding these patterns is therefore critical for planning sustainable livestock development and enhancing productivity across the country.

In fact, the dairy production in Sri Lanka is largely dominated by smallholder farmers, who typically manage two to five milking cows under semi-intensive or extensive production systems. In 2023, total national milk production declined by 2.5% compared with 2022; however, overall milk output has shown a gradual upward trend over the past decade. Notably, formal milk collection increased by 6% in 2023, reflecting improvements in market integration and supply chain efficiency. National milk production is estimated at approximately 450 million litres per year, meeting only about 40-45% of the country's domestic demand. The remaining requirement is fulfilled through imports of milk powder, primarily from New Zealand and Australia. In 2023, imports of milk and milk products rose by 31% in compared with the previous year, contributing to an increase in annual per capita milk availability from 34.60 L in 2022 to 39.98 L in 2023. Regarding meat production, mutton, the principal output of the goat industry amounted to be approximately 2.75 ('000 MT) in 2023, resulting in a per capita consumption of 0.12 kg per year. Beef production showed a slight decline to 27.28 ('000 MT), with a per capita availability of around 1.23 kg per year. The average retail price of beef was approximately Rs. 2,020.00 per kilogram. Annual swine meat production reached 9.37 ('000 MT), corresponding to a per capita consumption of 0.43 kg in 2023.

Types of livestock farming

Sri Lanka's livestock sector is dominated by smallholder and mixed farming systems, with only a limited presence of large-scale commercial operations (DAPH, 2023; FAO, 2022). In smallholder systems, families typically manage 2 to 5 animals integrated with crop production. These farms make minimal use of mechanization and depend largely on crop residues and natural grazing

resources. Smallholders play a major role in national milk, meat and egg production, with surplus outputs commonly sold through informal marketing channels (DAPH, 2023).

Mixed farming systems integrate livestock rearing with arable crop production and are especially prevalent in the mid and low country agro-climatic zones. In these systems, livestock provide multiple functions, supplying draft power, manure for soil fertility and a source of supplementary income, while benefiting from crop by-products as feed. This close crop -livestock interaction enhances resource efficiency and supports household resilience. Commercial farms, though relatively few, play a crucial role in intensive milk and meat production. These operations typically manage larger herds, utilize improved or high yielding breeds and adopt modern housing, feeding and herd-health management practices. Their higher level of mechanization and adherence to formal value chains enable more consistent production and contribute significantly to meeting the growing demand for livestock products.

Characteristic of family farming in Sri Lanka

In Sri Lanka, family farms form the backbone of the livestock sector. These are typically small-scale operations, with household members providing most of the labor and making key management decisions. Family farming is generally characterized by:

- Ownership or use of marginal lands often unsuitable for large-scale agriculture;
- Reliance on locally available feed resources, including crop residues and natural grazing;
- Multipurpose use of livestock, such as milk, meat, draught power, manure and fulfilling cultural roles;
- Limited access to capital, modern technology and veterinary services;
- A primary focus on subsistence, with occasional sales of surplus products to supplement household income.

Family farmers frequently combine traditional knowledge with emerging practices, adapting livestock rearing strategies to suit local ecological conditions and socio-economic realities.

Significance of family farming on national agriculture

Approximately 25-30% of Sri Lanka's population (equivalent to 5.5 to 6.6 million people) are directly engaged in smallholder or family-based farming, making it one of the most significant livelihood sources in rural areas. Family farmers are responsible for nearly 80% of national food production, underscoring

their central role in maintaining food security, stabilizing local markets and ensuring the continuous availability of diverse food products. Beyond their economic contribution, family farms play a crucial role in conserving indigenous livestock breeds and traditional crop varieties that are well adapted to local climatic and environmental conditions. By maintaining this genetic diversity, they safeguard valuable genetic resources essential for long-term resilience against climate change, emerging diseases and fluctuating market conditions.

Family based farming systems also generate substantial rural employment, often providing year-round work opportunities in areas, where alternative income sources are limited or frugal. They serve as important platforms for the empowerment of women and youth, who participate actively in farm management, value addition and marketing activities. These contributions collectively strengthen household resilience and support poverty reduction by ensuring more stable and diversified income streams (FAO, 2022).

Significance of family farming on livestock production

Family farming forms the backbone of livestock production in Sri Lanka, accounting for the majority of the nation's milk and meat output. Smallholder dairy farms, often integrated with crop production systems, play a particularly significant role. These mixed farming setups ensure a continuous supply of milk, much of which is used for household consumption, with the surplus sold in local markets to generate regular income. A key strength of these systems is their efficient use of low-cost, locally available feed resources, such as crop residues, kitchen waste and agricultural by-products. By converting these materials into high-value animal protein, smallholder farms contribute substantially to both nutrition security and income stability in rural communities.

Family-based livestock production also supports a range of niche markets, including fresh milk, curd, ghee and products derived from indigenous breeds. At the same time, it helps preserve traditional knowledge and cultural practices, which have shaped livestock management for generations. While rooted in tradition, many smallholder farmers are gradually incorporating improved technologies and better management practices, enhancing productivity and resilience. Overall, family farming in livestock not only sustains rural livelihoods and strengthens food security but also fosters social inclusion and promotes the long-term sustainability of Sri Lanka's agricultural sector.

Socioeconomic status of family farmers

Most livestock family farmers in Sri Lanka are smallholders, who own limited land, typically less than 2 hectares and maintain an average livestock holding of 2-5 animals. Gender dynamics play a significant role in these systems, with women actively involved in daily animal care, milk processing and marketing activities. Youth participation, however, is more variable; many young people

migrate to urban areas in search of alternative employment, driven by perceptions of low profitability and the labour-intensive nature of livestock farming (World Bank, 2024). As a result, the majority of family farmers tend to be middle-aged or older, indicating a widening generational gap in the sector.

Land tenure insecurity remains a major constraint (FAO, 2022). Many smallholders operate under customary or state-granted land-use rights rather than formal ownership, which discourages long-term investments in pasture development, housing and other infrastructure. Access to credit is also limited (DCS, 2024), although microfinance programs and government-led credit schemes are beginning to improve financial inclusion among rural livestock keepers. Educational levels vary widely across farming households, prompting the expansion of extension services and capacity-building programs focused on improving skills in breeding, feeding, animal health management and sustainable production practices. These efforts aim to enhance productivity and resilience within Sri Lanka's smallholder livestock sector.

Policy and institutional framework

The Government of Sri Lanka supports the livestock sector primarily through the Ministry of Agriculture, Livestock, Land and Irrigation and the Department of Animal Production and Health (DAPH), together with the nine Provincial Departments of Animal Production and Health (PDAPHs). In addition, semi-government institutions such as the National Livestock Development Board (NLDB) and MILCO (Pvt) Ltd. play important roles in sector development, service delivery and market support.

Several policies and programs guide development, including:

- National Livestock Development Policy (2025): Emphasizes breed improvement, sustainable production and market access.
- National Livestock Breeding Policy: Focuses on genetic improvement, preservation of indigenous breeds and utilization of artificial insemination.
- Livestock breeding project: Implements the breeding activities for genetically upgrading of local livestock population for sustainable production.
- Animal Disease Control Program: gives regular vaccination campaigns and veterinary health services.
- Pasture and Fodder Development Initiatives: To meet fodder requirement of the livestock sector.
- Capacity Building and Extension Services: For imparting training farmers, especially women and youth, on modern livestock management.

Sustainable livestock management practices by family farmers

Family farmers in Sri Lanka are increasingly adopting climate-smart and sustainable practices to enhance productivity, while conserving natural resources (DAPH, 2023; FAO, 2022). These include the installation of biogas units that convert animal waste into renewable energy, the implementation of improved animal health practices such as regular vaccination and disease surveillance and the use of enhanced housing designs that reduce heat stress and improve overall animal welfare. Collectively, these measures strengthen farmers' ability to adapt to climate change, improve resource-use efficiency and support more sustainable and resilient livelihoods.

Challenges

Limited access to improved breeds

Most of Sri Lanka's cattle population is concentrated in the dry zone, where animals must cope with high temperatures, seasonal feed scarcity and a greater incidence of vector-borne diseases. Indigenous cattle breeds are well adapted to these challenging conditions, displaying strong resilience to heat stress, adaptability to low-quality feed and higher disease tolerance. However, their genetic potential for milk production is generally low, limiting overall productivity in smallholder systems. To address this gap, the introduction of high merit *Bos indicus* breeds, which combine adaptability with improved milk yield has been identified as a promising strategy for enhancing national dairy performance. Yet, progress remains slow due to a critical shortage of such breeds within the country. This scarcity is largely driven by strict biosecurity regulations, lengthy approval processes and limited access to international sources of live animals and germplasm. These constraints hinder timely importation and ultimately restrict the effectiveness of genetic improvement programs, slowing the modernization and growth of the livestock sector.

Feed and fodder scarcity

Shortages of quality fodder, combined with the rising cost of concentrate feeds, present a major challenge to maintaining adequate nutrition for cattle in Sri Lanka. During dry periods, the availability of green fodder declines sharply, resulting in poor body condition and reduced milk yields. Greater dependence on purchased feed further increases production costs, making dairy farming less profitable, especially for smallholder farmers who already operate with limited resources.

Animal health issues

Livestock productivity in Sri Lanka is further constrained by reproductive challenges, including repeat breeding, low conception rates and extended calving

intervals. Disease outbreaks, both endemic and emerging, also cause substantial economic losses. Access to veterinary services is uneven, particularly in remote and rural areas, limiting timely interventions for disease prevention and reproductive health management. These gaps continue to impede herd performance and reduce overall productivity in the livestock sector.

Climate vulnerability

Sri Lanka's livestock sector is highly vulnerable to climate change. Prolonged droughts reduce the availability of fodder and water, while floods increase the risk of disease outbreaks and animal mortality. Rising temperatures intensify heat stress, resulting in lower fertility and decreased milk production. Together, these climate-related pressures make livestock production increasingly unpredictable and risky for farmers, particularly smallholders who rely on animals for their livelihoods.

Market constraints

Farmers face unstable milk prices, limited bargaining power and weak market linkages, which constrain their ability to earn consistent income. Inadequate cold chain systems and underdeveloped milk collection infrastructure further limit opportunities to expand the dairy value chain. Consequently, many smallholder farmers struggle to receive fair prices for their products, reducing incentives to invest in herd improvement and productivity-enhancing practices.

Financial barriers

Access to affordable credit, livestock insurance and investment capital remains limited for many farmers. High interest rates and strict collateral requirements discourage them from obtaining loans to invest in improved breeds, feed production or enhanced housing facilities. This lack of financial inclusion hampers long-term growth and modernization of the livestock sector.

Youth disengagement

The younger generation is increasingly shifting away from livestock farming, viewing it as a low-income, labor-intensive occupation with limited career opportunities. Migration to urban employment has reduced the availability of skilled and motivated labor in the livestock sector, posing a long-term challenge to the sustainability and modernization of the industry.

Table 1. Action plan for addressing challenges of family farmers

Pillar	Outcomes	Outputs	Indicative actions	Indicators	Target for Biennium (2020-2030)	Target for South Asia
Breed improvement & genetic resources	Enhanced genetic capacity of family farm livestock	Access to improved germplasm and breeding tools	Importation of high-genetic-merit semen donor bulls under G-to-G arrangement.	1. Number of bulls importing	05 Sahiwal bulls, 02 Nili Ravi bulls	Productivity improvement of livestock farming in 90% among SAARC countries
			Importation of semen from bulls with high-genetic-merit	2. Number of semen importing	3000 doses per annum	
			Production of semen from locally adaptive bulls with high genetic merit and distribution	3. Number of semen doses produced and number	150,000 annually and distribution of 200,000 doses	
			Registration of family farmers as regional clusters	4. Number of farms registered	Annually 50 farmers	
Climate-smart practices	Increased resilience of livestock systems	Adoption of heat-tolerant cross bred especially in dry zone and improved housing	Awareness of farmers on proper cattle management for avoid heat stress, sustainable feed and shelter practices	Number of trained farmers	3,000 trained farmers by 2030	Regional adoption across SAARC zones
			Follow the breeding policy to use different breeds under various management in each agro-climatic zone	% farmers follow breeding policy and number cross bred animals	95% of farmers by 2030 and number of cross bred animals with hybrid vigor	
Animal health	Improved herd health and productivity	Strengthened veterinary networks and service reach	Create regional training hubs for veterinary staff	Number of villages covered, % reduction in disease incidence	Veterinary services reach 80% of rural areas; 25% reduction in disease outbreak	Zero-diseased animal in SAARC countries
			Cross-border disease surveillance linkages			
Extension services	Strengthened and accessible extension services for	Improved capacity of extension officers and farmer	Develop regional training modules for breeding, health, productivity	Number of modules developed	Completion of training module development and annual	At least 50 - 60% of smallholder livestock farmers

Pillar	Outcomes	Outputs	Indicative actions	Indicators	Target for Biennium (2020-2030)	Target for South Asia
	family farmers	facilitators	improvement and management of dairy cattle at different stages		updating	across participating SAARC countries accessing improved extension services by 2030.
		Increased access of farmers to information, technologies and advisory services through web sites, reading materials, you-tube and other channels	Conduct regular capacity-building programs for extension staff and farmer trainers	% of extension staff trained, % of farmers trained	50% of family farmers are accessing improved extension services by 2030	
	Inclusive extension services addressing youth and gender needs	Increased participation of women and youth in extension activities	Develop guidelines for gender- and youth-responsive extension	% of women and youth farmers reached through extension programs	40% women and 30% youth participation in extension programs by 2030	
Market access & value chains	Improved income from livestock products	Enhanced collection, processing and marketing systems	Establish and strengthen local collection centers or cooperatives for farmers	Number of functional collection and processing centers.	2 new centers per year	Integration of value chains across South Asia
			Implement digital record-keeping for collected volumes and quality metrics.	% of collection centers using digital systems	80% of centers using digital record-keeping by 2030	
Women & youth empowerment	Increased participation of women and youth in economic, social and political activities.	Improved access to vocational training and entrepreneurship programs.	Targeted empowerment schemes (e.g., microfinance, Agri-Entrepreneur villages)	% of female and youth beneficiaries; new enterprises established	40% female and youth participation; 15 new enterprises annually	Region-wide similar targets
			Establish skill development and entrepreneurship centers in rural and urban areas.	Number of women and youth completing skill development programs.	1000 women and youth trained in market-relevant skills.	

Recommendations

- ❖ Conceptualization and establishment of "Regional Gene Bank for Livestock". It would facilitate to access tested and proven livestock breed for sectoral development of Member States of SAARC.
- ❖ Revision of National Livestock Breeding Policy of the country and development of SOP for its implementation.
- ❖ Strengthen farmer cooperatives through regional hubs (Dairy hubs) and collection centers to improve access to markets and stabilize prices. Then introducing digital record-keeping systems to track production, quality and distribution for better market planning.
- ❖ Promote targeted vocational training, entrepreneurship programs and microfinance initiatives for women and youth especially in rural areas to encourage youth engagement in modern livestock farming.

Conclusion

Sri Lanka's livestock sector, sustained predominantly by family farmers, plays a pivotal role in rural livelihoods, national food security and the conservation of indigenous breeds. Despite ongoing constraints such as limited access to high-quality genetic resources, inadequate feed and fodder supplies, animal health challenges and growing climate-related risks, the sector holds substantial potential for expansion and modernization. Unlocking this potential will require an enabling policy environment, strategic investments in infrastructure, the adoption of climate-smart and sustainable production practices, strengthened veterinary and extension services and meaningful engagement of women and youth. Strong collaboration among government agencies, private sector actors, research institutions and farming communities is essential for transforming smallholder livestock systems into a more productive, resilient and sustainable component of Sri Lanka's agricultural future.

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Chapter 7

Small Ruminants Production from Pasture Land: Challenges & Opportunities under the Changing Climate in Bangladesh

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Abstract

Small ruminants, particularly goats and sheep, are integral to Bangladesh's rural economy, contributing significantly to income generation, nutritional security and women's empowerment. Representing about 54% of the country's total ruminant population, they provide meat, milk, skin and manure essential resources for food security and sustainable agriculture. Pasture-based rearing systems, especially in char, coastal and fallow lands, offer low-cost opportunities for smallholders but face increasing pressure from climate-induced challenges such as floods, droughts, salinity intrusion and pasture degradation. These environmental stresses directly threaten feed availability, animal health and overall productivity. The study highlights how small ruminant production supports multiple Sustainable Development Goals (SDGs), including poverty reduction (SDG 1), zero hunger (SDG 2), gender equality (SDG 5), economic growth (SDG 8), climate action (SDG 13) and life on land (SDG 15). However, the sustainability of this sector depends on integrating climate-smart practices such as rotational grazing, fodder banking and adoption of heat and disease-tolerant breeds and comfort shelter. Government and NGO initiatives such as the BLRI Climate Resilience Cell, DLS livestock development projects and microfinance programs are enhancing adaptive capacities and resilience among smallholders. Case evidence from char areas demonstrates that family-based goat and sheep farming can serve as a climate-smart livelihood option, providing financial stability and resilience against environmental shocks. To strengthen the sector, policy measures should focus on protecting grazing lands, promoting fodder cultivation, strengthening veterinary services and integrating pasture management into national adaptation strategies. In conclusion, small ruminant farming in Bangladesh presents a practical pathway toward sustainable livestock development, balancing economic viability, environmental resilience and social inclusion under changing climatic conditions.

Introduction

Small ruminants, which include sheep and goats, play a crucial role in the agricultural landscape of Bangladesh. They are a vital source of livelihood for rural households, significantly contributing to poverty reduction and nutritional security. According to the Department of Livestock Services (DLS 2024-2025), small ruminants account for approximately 54% of the country's total ruminant population, underscoring their economic and social importance. Beyond income generation, these animals provide meat, milk, skin and manure, supporting both household needs and local markets.

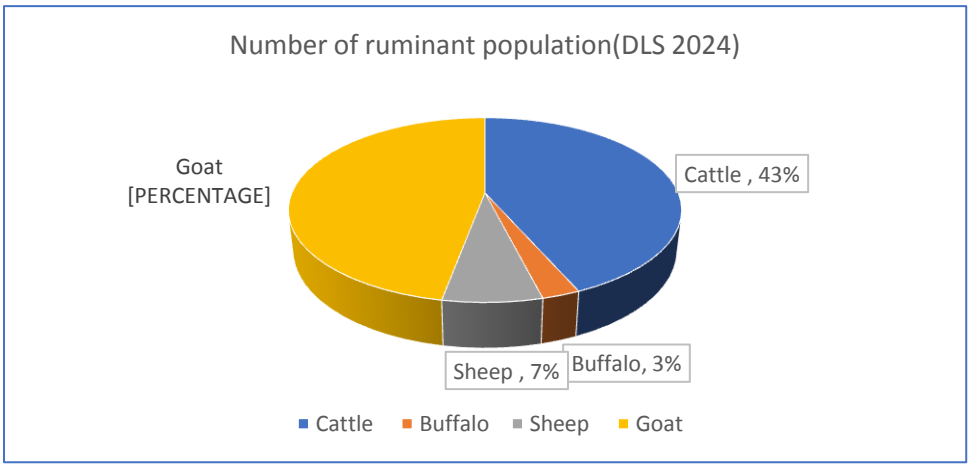


Fig. 1. Number of ruminant population (DLS 2024)

In Bangladesh, small ruminant production is often practiced through pasture-based systems, particularly in river char areas, coastal belts and fallow lands. These environments provide accessible grazing resources with minimal input costs, making them suitable for resource-poor farmers. However, the sustainability of such systems is increasingly influenced by climatic factors, seasonal feed availability and land-use changes. As a result, understanding the challenges and opportunities for pasture-based small ruminant production under a changing climate is essential for ensuring long-term productivity and resilience.

Economic & Nutritional Importance

Small ruminant plays a vital role in both the economy and nutrition by providing essential outputs such as meat, milk, skin, wool and manure (Samad, 2021). These products not only contribute to meeting the dietary needs of the population but also support various industries, ranging from food processing to leather and

textile production. Manure, in particular, serves as an important organic fertilizer, enhancing soil fertility and supporting sustainable crop production. Through these diverse outputs, it ensures food security, generates raw materials for value-added products and promotes balanced diets.

Beyond its nutritional contributions, livestock is a significant source of livelihoods, particularly in rural areas. The sector directly employs about 20% of the population and provides partial employment to 50%, especially among marginal and landless farmers (BBS, 2023). Women play a crucial role in this domain, with around 90% of rural goat-rearing managed by them, highlighting livestock's role in empowering women and supporting household incomes. At the macroeconomic level, livestock contributes 1.81% to the national GDP and 16.54% to the agricultural GDP (DLS, 2024-2025), underscoring its importance as a driver of rural development and economic stability.

The Family Farming Model

The family-based, small-scale rearing system for goats and sheep is one of the most prevalent and sustainable livestock models in Bangladesh. The Family Farming Model for goats and sheep is a cornerstone of the rural economy in Bangladesh. The Model of goat and sheep in Bangladesh is characterized by small herd sizes and low-cost, field-based rearing practices, making it well-suited for rural households with limited resources (Rakib et al., 2022; Bhuiyan, 2006). Farmers typically employ supervised grazing on fallow fields and roadsides, along with strategic tethering near crop areas, ensuring frequent relocation to prevent overgrazing and crop damage. The feeding strategy prioritizes natural forage, supplemented with kitchen waste, agricultural by-products, mineral mixtures and adequate water to maintain animal health and productivity. Health management focuses on preventive measures such as regular vaccination, deworming and hoof trimming to reduce disease risks (Prank, 2023). A common example of this model is seasonal grazing on fallow fields after the paddy harvest, allowing farmers to utilize available land resources efficiently while minimizing feed costs.

Sustainable family farming in the small ruminant sector of Bangladesh aligns with several Sustainable Development Goals (SDGs)

SDGs	Relevance
SDG 1: No Poverty Target 1.2	Small ruminant production, particularly goats and sheep, is a significant source of income for small and marginal farmers in Bangladesh. It requires relatively low initial investment, has a fast return on capital and can be managed by landless households. By providing a steady income and a safety net for financial needs, this type of farming directly contributes to poverty reduction.
SDG 2: Zero Hunger Target 2.1;2.3;2.4	Small ruminants provide essential animal protein (meat and milk), which improves nutrition and food security. Sustainable practices in this sector, such as improved animal health and nutrition, genetic improvements and resilient farming systems, increase productivity and help ensure a stable food supply, especially in the face of climate change challenges like floods and droughts.
SDG 5: Gender Equality Target 5.4; 5.5	Women in rural Bangladesh are often the primary managers of small ruminant and poultry production, which provides them with a degree of economic independence. Policies and programs that support this sector through training, access to credit and market linkages can empower women, increase their household income and enhance their role in family and community decision-making.
SDG 8: Decent Work and Economic Growth Target 8.5	The small ruminant sector is a significant employer in rural Bangladesh, creating direct and indirect jobs in farming, feed production, marketing and processing. By promoting its growth, the government can contribute to sustained, inclusive and sustainable economic growth and provide decent work opportunities.
SDG 13: Climate Action Target 13.1	As a low-input system, small ruminant farming can be more resilient to climate shocks than large-scale, intensive agriculture. By promoting climate-smart agricultural practices, such as better feed management and improved manure management, the sector can also contribute to reducing greenhouse gas emissions.
SDG 15: Life on Land Target 15.2	Sustainable small ruminant production can be integrated into mixed crop-livestock farming systems, utilizing marginal lands and agricultural by-products for feed. This reduces pressure on prime agricultural land and helps maintain biodiversity. Implementing strategies that use trees and shrubs as fodder can contribute to improved land management and ecosystem health.

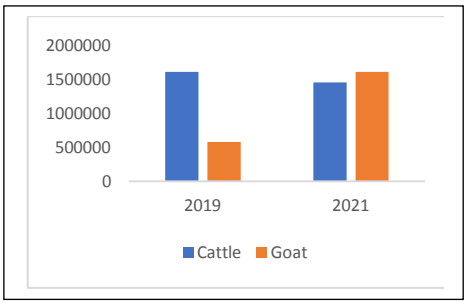
Climate Change Impacts

Climate change poses significant threats to livestock production in Bangladesh, with rising temperatures, erratic rainfall, salinity intrusion and frequent floods or droughts severely impacting animal health and productivity. These climatic stresses reduce pasture growth, increase disease prevalence and lower nutrient levels in meat and milk, undermining food security and rural livelihoods. In 2024, floods in Feni District caused the death of 15,604 goats and 356 sheep (TBS News, 27Aug 2024, https://www.tbsnews.net/banglapublished), highlighting the vulnerability of small ruminants to extreme weather events. In coastal areas such as Kalapara in Patuakhali, approximately 200 hectares of fodder land are lost annually due to salinity intrusion, forcing farmers to rely on saline-affected fodder that often leads to diarrhea, liver fluke infestation and weight loss in livestock. These challenges underscore the urgent need for climate-resilient livestock management strategies to safeguard the sector's sustainability.

Goat rearing increase in chars' areas

Goat rearing in the challenging and uncertain environment of char lands (riverine islands or floodplains) is a practical and highly profitable livelihood option, especially where traditional crop production is often uncertain due to frequent flooding. The hardiness of the Black Bengal goat, its rapid reproduction (kidding multiple times a year) and its ability to survive on local weeds and tree leaves make it ideal for low-capital char land farmers, particularly poor and landless women. Although regular flooding, severe shortage of animal fodder and diseases (such as PPR) pose significant challenges, these risks can be successfully managed by rearing goats in elevated bamboo platforms or 'Machas' (Slatted Houses) and by ensuring proper training and healthcare through NGO or government support, ultimately making poverty alleviation possible through goat rearing with a high net profit (BCR > 1.9).

Goat rearing has increased in about 450 chars areas along 26 rivers including Brahmaputra, Teesta, Dharla and Dudhkumar in Kurigram and Lalmonirhat. However, the amount of cattle rearing has decreased compared to before (https://bangla.thedailystar.net/node/231805). According to the Department of Livestock sources in Kurigram and Lalmonirhat, there are currently 1,455,830 cattle and 657,025 goats in the two districts. Two years ago, there were 1,612,000 cattle and 580,000 goats.



CLIMATIC VULNERABLE LANDSCAPES OF

Bangladesh is characterized by diverse climatically vulnerable landscapes that pose significant challenges to its population and development. Flood-prone areas, including char islands and river basins, frequently experience seasonal inundation, leading to displacement and damage to agriculture and infrastructure. The coastal regions face unique vulnerabilities due to saline soil and water intrusion, frequent cyclones and tidal surges, which threaten livelihoods, particularly those dependent on agriculture and fisheries. Additionally, certain semi-arid zones in the country are prone to drought, resulting in water scarcity and reduced agricultural productivity. These varied landscapes underscore the urgent need for adaptive strategies to build resilience against climate-related hazards in Bangladesh.

The map uses a color-coded system to indicate different types of environmental conditions. Areas marked in red represent regions affected by drought, while green highlights zones experiencing flash floods. Orange is used to denote areas prone to regular flooding. Additionally, the blue shading identifies coastal regions and any area below the red line within this blue zone indicates saline-affected land. This color scheme helps clearly distinguish between drought, flood, flash flood and saline-impacted coastal areas.

Climate-Smart Solutions

In Bangladesh, climate-smart solutions for the livestock sector emphasize sustainable pasture management, water efficiency and resilient production

systems to adapt to changing environmental conditions. Practices such as rotational grazing, establishing fodder banks and producing silage or hay help ensure year-round feed availability, while cultivating saline- and drought-tolerant fodder varieties like Napier and Bermuda grass supports productivity in stress-prone areas. Fodder trees such as *Jiga Gaach* (*Lannea coromandelica*), *Kapila* (*Garuga pinnata*) and *Mandar* (*Erythrina indica*) are also a viable option to mitigate the severe fodder shortage often experienced in flood-prone areas and during the rainy season (Miah and Noman 2003).

Water and housing innovations, including floating pens, solar-powered cooling systems and rainwater harvesting, enhance animal comfort and reduce climate-related losses. The Sorjan method ridge-based farming further optimizes water use in flood-prone regions by integrating crop-livestock systems (https://theclimatewatch.com/climate-resilient-livestock-farming-sustainable-strategies-for-a-changing-environment). Additionally, promoting climate-resilient livestock breeds alongside balanced concentrate feeding enriched with bypass protein improves both productivity and adaptability, contributing to a more sustainable and climate-resilient livestock sector in Bangladesh.

Government & NGO Initiatives

In Bangladesh, both government and NGO initiatives are playing a vital role in strengthening the small ruminant sector and enhancing resilience against climate and disaster-related challenges. The Bangladesh Livestock Research Institute (BLRI) has established a Sheep and Goat Research Division along with a Climate Resilience Cell to promote adaptive farming practices. The Department of Livestock Services (DLS) is implementing key programs such as Peste des Petits Ruminants (PPR) eradication and targeted livestock development projects for vulnerable coastal, char and haor areas. Support systems have also been strengthened through tools like the BLRI Livestock Diary App and fodder development projects implemented by FAO and PKSF. Furthermore, Bangladesh Bank has introduced a special microfinance scheme offering loans at just 4% interest for goat and sheep farming to boost rural livelihoods (https://www.banglanews24.com/economics-business/news/bd/1354222.details).
In response to the 2024 floods, the government allocated huge money for emergency feed, vaccines and grass distribution, ensuring quick recovery for affected farmers and safeguarding livestock productivity. The Department of Livestock Services (DLS) reported that under the flood-rehabilitation programme it has distributed 220 tonnes of cereal animal feed, 75 tonnes of straw, 357 tonnes of silage and 60,000 grass-cutters. The Ministry of Disaster Management and Relief (MoDMR) distributed 3.5 million taka (1USD=110BDT) among flood-affected farmers for purchasing animal feed (https://www.dailycountry todaybd.com/story/floods-cause-loss-of-taka-2%2C327cr-in-fisheries%2C-livestock-sector?utm_source=chatgpt.com).

Major Challenges and Opportunities

Small ruminant production in Bangladesh faces significant challenges, particularly in the context of climate change. Shrinking pastureland due to rapid urbanization and the expansion of crop agriculture has severely reduced the availability of natural grazing areas. Seasonal feed shortages, especially during prolonged dry spells and recurrent floods, further constrain productivity and animal health. The predominance of low-yielding native breeds, coupled with inadequate genetic improvement initiatives, limits the potential for increased meat and milk production. Moreover, weak veterinary and extension services hinder timely disease management, reduce farmer access to improved husbandry practices and slow the adoption of climate-resilient production systems(https://www.tgtglobal.co.in/post/rural-goat-farming-in-bangladesh-opportunities challenges). Addressing these challenges is essential to unlock the opportunities for sustainable small ruminant production while ensuring food security and rural livelihoods in a changing climate. Significant opportunities exist to address these constraints, including the introduction of climate-resilient forage species, the development of heat- and disease-tolerant breeds, community-based pasture management and the promotion of value addition in goat milk and meat products.

Policy Recommendations

Small ruminant production from pasture lands in Bangladesh faces significant challenges due to the impacts of climate change but it also presents unique opportunities for sustainable livestock development. To enhance resilience, it is crucial to scale up climate-resilient pasture systems such as rooftop fodder, floating bed fodder cultivation especially in flood-prone areas where traditional grazing lands are vulnerable (Khan et al., 2019). Protecting existing grazing lands while providing incentives for fodder cultivation can help secure feed resources for smallholders. Strengthening veterinary services, including robust disease surveillance and widespread vaccination against key diseases like PPR, is essential to safeguard animal health. Additionally, promoting climate-risk insurance schemes can provide smallholder farmers with financial protection against climate-induced losses. Integrating pasture management into national policy frameworks, including the National Adaptation Plan (2022) and the Bangladesh Climate Change Strategy and Action Plan (BCCSAP) 2009, alongside targeted farmer training in climate adaptation practices, will ensure that pasture land management is a central component of Bangladesh's climate resilience agenda (https://share.google/4iDQZ1kkrkb0DQFVg; https://share.google/ouRMIjhHb3Z19lKZo).

Case study: Small Ruminant Farming on the Char lands: A Climate-Smart Livelihood for Resilient Family Farmers in the Padma River Basin

In the chars of the Padma River basin, small ruminant production has emerged as a promising livelihood option, offering both economic resilience and nutritional security to rural households. Shefali Begum's success story reflects the potential of goat and sheep farming in these pasture-rich areas, even under the challenges posed by a changing climate. With access to natural grazing lands, she has been able to rear healthy animals at a relatively low cost, generating significant income selling sheep worth 50,000 Taka last year alone. Her diversified livestock holdings, including 14 sheep, 12 cows and 4 goats, not only provide a steady source of cash flow but also act as a financial buffer against climate-induced uncertainties. Shefali's experience highlights both the opportunities and the adaptability of small ruminant production in vulnerable ecosystems. By utilizing pasture land efficiently and integrating livestock into her household economy, she has achieved a level of self-sufficiency that ensures her well-being and strengthens her social standing. Her earnings enable her to afford healthcare, fulfill personal needs and contribute to her family's overall security. This case illustrates how targeted support such as improved breed selection, veterinary care and pasture management could further enhance productivity and sustainability turning small ruminant farming in Bangladesh's char areas into a climate-smart, income-generating enterprise for countless rural families.

Strategy & Action Plan Matrix for Strengthening Family Farming in Goat & Sheep under Changing Climate in Bangladesh

Strategic Area	Strategy	Action Plan
Climate-Resilient Feeding	Promote climate-smart fodder production and preservation	- Rooftop/vertical fodder cultivation - Drought/flood-tolerant forage varieties -Develop of Pasture land in government chars land - Fodder banks
Breed Improvement	Promote heat-tolerant and disease-resistant local breeds	- Support community-based breeding programs - Encourage AI services and mobile breeding units
Health & Biosecurity	Strengthen preventive healthcare and early warning	- Mass deworming and vaccination - Disease surveillance systems - Farmer training on GAHP -Develop community Animal Health Workers (CAHWs)
Housing and Welfare	Promote low-cost climate-adaptive housing	- Design goat-sheep sheds elevated above flood levels - Improve ventilation and shade structures
Water Management	Ensure year-round access to safe drinking water	- Rainwater harvesting - Shallow tubewells in saline/flood zones
Insurance & Risk Mitigation	Develop risk transfer mechanisms for climate shocks	- Pilot livestock insurance schemes - Build capacity on climate risk management
Market Access & Value Chain	Strengthen market linkages and value addition	- Facilitate collection points - Promote small-scale meat/dairy processing units
Gender & Youth Inclusion	Empower women and youth in family farming	- Livestock training for rural youth & women - Access to inputs, services and microcredit
Extension & ICT	Use digital tools and participatory extension	- Mobile advisory services - ICT-based weather and disease alerts
Policy & Institutional Support	Strengthen policy environment and coordination	- Recognize small ruminants in climate policy - Incentivize family-based rearing practices

Conclusion

In conclusion, while the livestock sector faces notable challenges, there are clear and promising pathways to overcome these constraints. Embracing climate-resilient forage species and developing heat- and disease-tolerant breeds can significantly enhance productivity and sustainability. Furthermore, empowering communities through participatory pasture management ensures better resource use and resilience. Finally, promoting value addition in goat milk and meat products can open new market opportunities, improve livelihoods and strengthen the overall livestock value chain. Together, these strategies offer a comprehensive approach to fostering a more resilient and prosperous livestock sector.

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Chapter 8

Report on

Regional Workshop on "UN Decade of Family Farming 2019-2028: Sustainable Family Farming in Livestock Sector for Attaining the SDGs in South Asia" held in Kathmandu, Nepal on 11-13 August 2025

The inaugural session of the SAARC regional workshop titled *"Sustainable Family Farming in Livestock Sector for Attaining United Nations Decade Family Farming (UNDFF) and the SDGs in South Asia"* was held on 11th August, 2025 in Kathmandu, Nepal. The three- day workshop (11-13 August 2025) was jointly organized by the SAARC Agriculture Centre (SAC) in collaboration with the Ministry of Agriculture and Livestock Development, Nepal, Asian Farmers Association (AFA), Philippines and Heifer International, Nepal. The workshop aims to formulate the strategies and action plan for strengthening family farming in livestock and pastoralism. The meeting was attended by the delegates of Six SAARC Member States, namely Bangladesh, Bhutan, Maldives, Nepal, Pakistan and Sri Lanka. Farmer Organization representatives from Mongolia, Tajikistan, Kirgizstan, India also joined in the program. In addition, national and international speakers, panellists, animal science experts, professionals and academia attended the program.

Dr. Govinda Prasad Sharma, Secretary (Agriculture Development), Ministry of Agriculture and Livestock Development, Nepal graced the occasion as the "Chief Guest". Mr. Tanvir Ahmad Torophder, Director (ARD and SDF), SAARC Secretariat, Kathmandu, Nepal and Dr. Ram Nandan Tiwari, Director General, Department of Livestock Services, Nepal joined the program as Special Guests. About 65 participants attended the event from different SAARC Member Countries.

Dr. Hari Bahadur K.C. Joint Secretary, Planning Development Cooperation and Coordination Division, MoALD welcomed the participants on three days family farming in livestock workshop. Dr. Md. Younus Ali, Program coordinator briefed out the objectives of the workshop. This was followed by the address of Neena Joshi, Senior Vice-President for Asia Program, Heifer International and "Guest Honor" of inaugural ceremony. She presented the initiative taken in Nepal on support of family farming in livestock sector in collaboration of Government of Nepal and Heifer International Nepal. Ma. Estrella Penunia, Secretary General, Asian Farmers Association for Sustainable Rural Development (AFA) and "Guest of Honor" of inaugural session, opined that family farming plays an important role in multiple activities of livestock-based food systems including

feeding management, AI, veterinary health care, vaccination, marketing of surplus products etc. Nevertheless, the role of family farming has been underestimated due to lack of proper strategies, incentive, appropriate policies and easy access to finance. Dr. Sachin Kumar, Senior Scientist, Rumen Bio Technology Laboratory, Animal Nutrition Division, ICAR- NDRI, Karnal, Haryana, India gave a presentation as the Key Note Speaker on *"Sustainable Family Farming in Livestock to Achieve the SDGs in South Asia-Challenges and Opportunities"*.

Mr. Tavir Ahmad Torophder, Director (ARD & SDF), SAARC Secretariat, Nepal highlighted the inaugural meeting that the impacts of climate change on livestock and its implications for food security are already alarming and there is an urgent need to support smallholders in adapting to climate change.

H.E. Dr. Govinda Prasad Sharma, Secretary (Agriculture Development), Ministry of Agriculture and Livestock Development, Nepal conveyed his greetings to SAARC Agriculture Centre for undertaking the important expert consultation meeting like family farming. He appreciated the efforts of SAARC Agriculture Centre for executing so many livestock programs and activities encompassing consultation meeting, regional training, exposure visits and workshop for the benefits of the Member States keeping in mind the emerging challenges faced by the livestock farmers. He thanked the SAARC Agriculture Centre for selecting as host country Nepal for this meeting. Joint Secretary, Dr. Pashupati Dhungana, MoALD, Nepal chaired the session and expressed heartfelt thanks to the chief guest, special guests, guest of honor, focal experts of Member States, SAARC Agriculture Centre and other national and international organizations for joining in the workshop. She conveyed special thanks to the Asian Farmers association and heifer international Nepal for partnership in the expert consultation meeting and extending all out supports and cooperation. The workshop was concluded with a set of recommendations and action plans aimed at accelerating the sustainable family farming in livestock.

a. Improved Climate Resiliency: securing rights and access of smallholder women, men and young farmers to their farms and pasturelands; selection, breeding, sexed semen insemination and culling of improved varieties of livestock especially, low-methane producers; developing natural hay land; rotational grazing; mixed farming for resource efficiency and nutrient and waste recycling; manure management for biogas production; tree planting for shade and fodder; animal health insurance;

b. Healthy Livestock: implementation of One Health Approach; national vaccination programs; bio-secure digital advisory services as well as training of community technicians and para-veterinarians; finding suitable and cheaper alternative to antimicrobials;

c. Improved Access to Markets: build transhumance and infrastructure facilities such as trails and water facilities; improve the quality of domestic products according to regional/global standards; provide clear projection on production and market prices and subsequent advisory notes to farmers;

d. Improved Access to Finance: provision of low interest or collateral-free loans; subsidized inputs and cost-sharing mechanisms; price guarantee schemes;

e. Stronger Inclusion and Empowerment of Women and Young Farmers : recognize and register farmers' organizations as legal entities; provide incentives to organized groups such as distribution of equipment, livestock breeds and loans; give scholarships ; implement capacity building modules on livestock/ pastoralism management business/ entrepreneurship planning; partner with farmers' organizations in proposal making and project implementation; provide funding to organizations and cooperatives to federate their members and conduct their own capacity building and policy engagement activities.

Program schedule

Inaugural Program (Day 1: Monday 11 August)

Time	Program Details
09:00-12:30	Program Details: Inaugural Session Inaugural MC: Dr. Asmita Subedi, MOALD Day Facilitator: Dr. Md. Younus Ali, SPS (Livestock) SAC Chair: Joint Secretary, MoALD
09:00-09:30	Registration
09:30-09:35	Lighting of lamp by the dignitaries
09:35- 09:40	National Anthem
09:40- 09:50	Welcome address: Dr. Hari Bahadur K.C. Joint Secretary, Planning Development Cooperation and Coordination Division, MoALD
09:50-09:55	Opening Remarks: Introduction and overview of consultation meeting and Schedule: Dr. Md. Younus Ali, Senior Program Specialist, SAC
9:55 -10:15	Presentation: Initiative taken in Nepal on Support of Family farming in Livestock Sector in collaboration of Government of Nepal and Heifer
10.15-10:25	Opening Remarks: Ma. Estrella Penunia, Secretary General, AFA
10.25-10.35	Opening Remarks: Dr. Asish Kumar Samanta, Assistant Director General, ICAR, India
10.35-10.45	Key Note Speaker: Sustainable Family Farming in livestock to Achieve the SDGs in South Asia- Challenges and opportunities: Dr. Sachin Kumar, Senior Scientist, Rumen Bio Technology Laboratory, Animal Nutrition Division, ICAR-NDRI, Karnal, Haryana 132001, India
10.45-10.55	Address by Special Guest: Mr. Tavir Ahmad Torophder, Director (ARD & SDF), SAARC Secretariat, Nepal
10.55-11:05	Address by Chief Guest: Dr. Deepak Kumar Kharal, Honorable Secretary of Ministry of Agriculture and Livestock Development, Nepal
11.05-11:15	Address by Chair of the Inaugural Session: Joint Secretary, Dr. Pashupati Dhungana, MoALD, Nepal
11.15-11.25	Vote of Thanks: Md. Amirul Islam, AFA
11.25-12.30	Group Photo Lunch

Technical Session:

Time	Program Details
12:30-14:00	Technical Session I: Country Paper Presentations Chair: Director General, Department of Livestock Services Rapporteurs: Dr. Nabin Ghimire, Senior Livestock Development Officer, MoALD Dr. Shishir Bhandari, Senior Technical Officer, NARC
12:30-12:45	Bangladesh: Mosammat Johra Khatun, Joint Secretary, Ministry of Fisheries and Livestock, Dhaka, Bangladesh
12:45-13:00	Bhutan: Mr. Jamyang Tashi Vangdi, Chief Livestock Officer, Department of Livestock, Ministry of Agriculture and Livestock, Thimphu, Bhutan
13:00-13:15	Maldives: Ms. Fazeena Faroog, Agriculture Officer, Ministry of State for Agriculture and Animal Welfare, Male, Maldives
13:15- 14:00	Open Forum and Reflection of the workshop
14:00-16:30	Technical Session II: Country Paper Presentations Chair: Dr. Ashish Kumar Samanta, ADG, ICAR, India Rapporteurs: Dr. Nabin Ghimire, Senior Livestock Development Officer, MoALD Dr. Shishir Bhandari, Senior Technical Officer, NARC
14:00-14:15	Nepal: Ms. Sabina Koirala, Senior Veterinary Officer, National Animal Feed and Livestock, Quality Management Laboratory, Kathmandu, Nepal
14:15-14:30	Pakistan: Dr. Mehtab Ahmed, Deputy Director (Large Ruminants), Livestock and Dairy Development, Government of Balochistan, Pakistan
14:30-14:45	Sri Lanka: Dr. (Mrs.) Ushanthi Dilmini Ramanayake, Deputy Director (Animal Breeding)/VS, Animal Breeding Division, DAPH, Sri Lanka
14:45-15:00	Open Forum and Reflection of the workshop
15:00-15:30	Tea Break
15:30-16:30	Plenary Reflections (Ms. Esther Penunia, AFA)
19:30-22:00	Networking Dinner

Technical Session-Day 2 (12 August 2025)

Time	Program details: Technical Session Day Facilitator: Md. Amirul Islam
09:30-10:45	Technical Session III: Farmers Organizations' Initiatives for livestock Chairperson: CSRC Rapporteurs: Dr. Nabin Ghimire, Senior Livestock Development Officer, MoALD Dr. Shishir Bhandari, Senior Technical Officer, NARC
09:30-10:45	In this session, FAO representatives will discuss their strategies, lessons and recommendations. • Nepal: Nepal Agricultural Cooperative Central Federation (NAFCCL), ANPFA and NLRF for National Committee on Family Farming Nepal- 5 minutes X3 • India: Self Employed Women's Association (SEWA) for National Committee on Family Farming India-10 minutes • Bangladesh- 10 minutes Open Forum (30 minutes Quick) Synthesis: (10 minutes)
10:45-11:15	Tea Break
11:15-11:35	Technical Session IV: Pastoralists (Small Ruminant Production from Pasture Land: Challenges and Opportunities under the Changing Climate) Chairperson: Country Director, Heifer International Nepal Rapporteurs: Dr. Nabin Ghimire, Senior Livestock Development Officer, MoALD Dr. Shishir Bhandari, Senior Technical Officer, NARC
11:35-11:55	Dr. S.M. Rajiur Rahman, Livestock Consultant, World Bank Group, Dhaka
11:55-12:15	Dr. A. B. Sahoo, Director, ICAR-National Institute of Animal Nutrition and Physiology Adugodi, Hosur Road, Bengaluru-560030, Karnataka, India
12:15-12:25	Dr. Chandra Dhakal, Chief (Joint Secretary), The National Livestock Resource Management and Promotion Office
12:25-12.45	Dr. Syed Murtaza Hassan Andrabi, Member, Animal Science, Pakistan Agricultural Research Council (PARC)
12.45-14:00	Lunch break

14:00-15:30	FOs pastoralists -Mongolia (10) -Kygyrztan (10) -Tajikistan (10) Global perspective on Pastoralism and IYRP (15) Open Forum (45 minutes)- Esther, AFA
15:45-17:00	Health Break (30 minutes 15:30-15:45) Group Discussion (15.45-17.00) Country -level discussions for identifying the successful factors, lessons learned and Recommendations from the presentations & Plenary Session: Livestock and Pastoralists Recommendations on a conceptual framework for policy and actions towards Family Farming in Agriculture and Livestock • Research, analysis and tools • Capacity development Discussion issues - Research and policy gap in youth and women in agriculture - Capacity development in youth & women in agriculture - Constraints /challenges and opportunities in Family Farming in agriculture Finally, recommendations above those issues Facilitators: ½ hour will be reporting and 1 hour will be way-forward
17.00 -17.30	Plenary: Dr. Younus Ali, SPS (livestock). SAC

Day-3 (13 August 2025):

Time	Day Facilitator: Dr. Asmita Subedi
07:30-13:00	Site Visit: Best practices on Family Farming activities
13:00-14:30	Lunch
14:30-15:00	Family Farming in Livestock Reflections on the Field Visit by Ma. Estrella Penunia AFA to prepare Joint Communique; Rapporteurs to submit the summary of the session during the night.
14:30-15:00	Joint Communique sharing
15.00 -15.40	Closing of the Regional Consultation and distribution of certificates

Regional workshop on "UN Decade of Family Farming 2019-2028: Sustainable Family Farming in Livestock Sector for Attaining the SDGs in South Asia" to be held in Kathmandu, Nepal on 11-13 August 2025.

Focal points from the SAARC Member States

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978-984-35-8653-7