

Deliverable #9

Final Report

Agro Business Planning, Technologies and Marketing Advice and Implementation Support under Livestock and Dairy Development Project (LDDP)

Package: SD-67

**Department of Livestock Services (DLS),
Ministry of Fisheries and Livestock,
Government of Bangladesh**

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Abbreviations

ABFL	Aftab Bohumukhi Farms Limited
ACDI	Agricultural Cooperative Development International
ACI	Advanced Chemical Industries
AFC	Agriculture and Finance Consultants
AHCAB	Animal Health Companies Association of Bangladesh
AI	Artificial Insemination
AITVET	Ahsanullah Institute of Technical and Vocational Education and Training
AMR	Antimicrobial Resistance
BAPARD	Bangabandhu Academy for Poverty Alleviation and Rural Development
BARD	Bangladesh Academy for Rural Development
BBS	Bangladesh Bureau of Statistics
BDDF	Bangladesh Dairy Development Forum
BDFA	Bangladesh Dairy Farmers' Association
BLRI	Bangladesh Livestock Research Institute
BLRI	Bangladesh Livestock Research Institute
BMMDP	Bangladesh Micro Insurance Market Development Program
BMPCUL	Bangladesh Milk Producers Co-operative Union Limited
BP	Business Proposal
BPICC	Bangladesh Poultry Industries Central Council
BRAC	Bangladesh Rural & Advancement Committee
CNA	Capacity Need Assessment
CRC	Chittagong Red Cattle
CRME	Climate Resilient Manure Entrepreneurs
DEO	DLS Extension Offices (DLS Field Offices)
DLO	District Livestock Officer
DLS	Department of Livestock Services
DNCC	Dhaka North City Corporation
DOHS	Defence Officers' Housing Scheme
DSCC	Dhaka South City Corporation
EOI	Expression of Interest
FAO	Food and Agricultural Organization
FFS	Farmers Field School
FOs	Farmers Organizations
FY	Fiscal Year
GHG	Green House Gases
GOB	Government of Bangladesh
GRC	Governance, Risk, and Compliance
GRC	Grant Review Committee
GVC	Global Value Chain
HF	Holstein Friesian
HRD	Human Resource Development
HYV	High Yielding Variety
IAPP	Integrated Agricultural Productivity Project
ICT	Information and Communication Technology
IDCOL	Infrastructure Development Company Limited
IFAD	International Fund for Agriculture and Development
ILO	International Labour Organization
ILST	Institute of Livestock Science and Technology
IR	Inception Report

KII	Key informant interview
LDDP	Livestock and Dairy Development Project
LGED	Local government Engineering Department
LPD	litres/day
LRI	Livestock Research Institute
LSP	Livestock Service Providers
LSPF	Livestock Sector Partnership Fund
LSU	Live Stock Units
M&E	Monitoring and Evaluation
MFI	Micro Finance Institutions
MG	Matching Grants
MGS	Matching Grant Scheme
MoFA	Ministry of Foreign Affairs
MoFL	Ministry of Fisheries and Livestock
MSME	Small and Medium Enterprises
NATP	National Agricultural Technology Programme
NGO	Non-Governmental Organization
NIPM	National Institute of Personal Management
PG	Producer Groups
PIU	Project Implementation Unit
PKSF	Palli Karma Sahayak Foundation
PMU	Project Management Unit
PO	Producer Organizations
PPP	Public-Private Partnership
PPPA	Public-Private Partnership Authority
PRAN	Programme for Rural Advancement Nationally
PSBF	Prani Sampad Bikash Foundation
RDA	Rural Development Academy
SDG	Sustainable Development Goals
SME	Small and Medium Enterprise
SMP	School Milk Program
SSIL	Services and Solutions International Ltd.
TMR	Total Mix Ration
TNA	Training Need Assessment
ToC	Theory of Change
TOT	Training of Trainers
TQM	Total Quality Management
ULO	Upazila Livestock Officer
USA	United States of America
USD	United States Dollar
VC	Value Chain
VMCC	Village Milk Collection Centres
VOCA	Volunteers in Overseas Cooperative Assistance
VTI	Vocational Training Institute
WTO	World Trade Organization
YTC	Youth Training Centers

Executive Summary

Currently, livestock farming in Bangladesh is facing number of challenges such as low genetic potentiality, inadequate nutrition and feeding, insufficient health care services, climatic hazards, unorganized marketing and value chain etc. To address these issues, the Livestock and Dairy Development Project (LDDP) was launched with the overall objective of characterizing different livestock farming systems, identifying opportunities and addressing challenges to improve livestock production in the country through broader perspectives.

The agribusiness consortium through its team of international and national experts had delivered seven reports so far as per the Terms of Reference (ToR). These include D#1 Inception report, D#2 Slaughtering facility report, D#3 Value chain analysis report, D#4 Livestock and dairy business structure analysis report, D#5 Farmers' Capacity Development report, D#6 Critical Structures and Grant Modalities report and D#7 Partnership development report. This final report (D#9) summarized the works carried out from these works by the agribusiness consortium.

A variety of methodological approaches have been used to collect data and insights for the preparation of these deliverables including brainstorming, literature review, focus group discussions (FGDs), key informant interviews (KIIs), Questionnaire-based surveys and field visits. More than 170 documents/references covering journals, books, reports, monographs, conference proceedings and newspaper articles were referred to for assessing the sector context and development needs. The experts' team spent around 450 person days on the field visiting farms, processing facilities, institutions, etc. Inputs were collected from over 1,300 respondents reached out through surveys, KIIs and FGDs. Orientation programs were conducted under the matching grant scheme support.

Bangladesh gained self-sufficiency in the production of eggs and meat during the seventh five-year plan period (2016-20). But for milk, there is still a demand supply gap which is managed by the import of milk and dairy products. The availability of meat per person is 137.38 grams per day based on production versus population. However, it is observed that the actual consumption per capita could be less due to challenges in the market supply chain. Though the overall meat consumption is growing, the infrastructure for slaughtering facilities is less developed. There are two to three slaughterhouses in big cities, although they are typically underutilized and dilapidated. Almost 90% of the beef market is distributed through informal marketing channels with unorganized, unscheduled, and unhygienic slaughtering practices.

Shortage of feeds and fodder including high feed price is one of the major constraints in livestock and dairy development in Bangladesh which increases the production cost and makes it uncompetitive in the global market. Inefficient business and market structure leads to uncompetitive prices of milk and meat in the country. High production costs, low production, and low product quality force major dairy processing units to use imported milk powder. Inadequate health care and veterinary services are serious constraints to sustainable livestock development in the country. Other key challenges to be addressed include low productivity, poor genetic make-up of native breeds, high feed cost and high incidence of diseases, and climate change effects.

As an enabling environment the Government of Bangladesh (GoB) has outlined several rules, regulations and acts for the development of the livestock industry and to supply safe food to the nation. The Slaughterhouse Act 2011, Animal Feed Act 2011 and the Food Safety Act 2013 are the vital acts which regulate the related activities. However, these acts and policies are not working properly due to lack of enforcement, shortage of technical manpower, inadequate awareness, etc. The government has taken a proactive stance in promoting both public and private sectors to mitigate the challenges in the livestock and dairy sector through plethora of initiatives. The public-private partnership (PPP) approach till now proved to be one of the most efficient instruments to blend technology and enabling policy to transform the rural economy in the country. However, the PPP model is not being practiced in the livestock and dairy sector. The private sector often perceives working directly with smallholder producers as non-remunerative, costly and wasteful. While smallholders often accuse private companies of offering low prices and stiff conditions they cannot cope with.

To achieve the twin targets of Sustainable Development Goals (SDGs) by 2030 and Bangladesh Vision 2041, a massive development drive must be undertaken with utmost importance by the Government of Bangladesh (GoB), respective ministries/departments in close coordination with the private sector and other organizations. It is imperative the current best practices from within the country and world over are scaled up to become the standard practise of the livestock sector. Bangladesh will need to leverage private sector capital, galvanize public service delivery, and attend to many gaps identified in this report. Keeping these in view, five pillar strategies such as a) livestock productivity, b) product marketing, c) capacity building, d) financial services and investment, and e) climate-smart strategies are suggested to be adopted in the next 3-5 years' timeline to achieve the objectives of competitiveness in developing the livestock and dairy sector in Bangladesh.

Key recommendations made in this report is clubbed under five pillars. These relate to:

- Pillar 1: Strategies for improving livestock productivity
- Pillar 2: Strategies for improving efficiency of livestock commodity value chains
- Pillar 3: Strategies for enhancing capacity building
- Pillar 4. Strategies for improving financial services and investment opportunities, and
- Pillar 5. Strategies for promoting climate-smart infrastructure and technologies.

The rationale behind the recommended action and activities proposed under each of these pillars are explained in detail in the report.

• **Pillar 1: Strategies for improving Livestock Productivity**

❖ **Rationale for action:** In Bangladesh, livestock productivity is low due to occurring and reoccurring, poor animal husbandry practices, low penetration of high-yielding breeds and shortage of feed and fodder.

❖ **Recommended activities:**

- **Transfer knowledge of breeding and fertility management to farmers.** Farmer preference for different breeds, criteria used for selection of breeds, the sources of information used in the process of breed selection and management, farmers' assessment about performance of different breeds in rural environment can help to design scientific research on particular traits and formulating messages for extension and farmer education.

- **Address nutritional management:** Because of the high price of concentrate feeds, particularly soybean and fish meal the farmers should be encouraged to grow soybean as poultry feed and fishmeal should be produced in-country using fish wastes at the port city of Chittagong and Cox's Bazar.
- **Control morbidity and mortality:** Morbidity and mortality is a major problem for livestock profitability. The DLS is making its efforts to reduce the incidence which however need more concerted efforts and collaboration with private sector, research institutes and civil society.
- **Increase artificial insemination coverage:** The artificial insemination (AI) process is the most cost effective and reliable option in breed improvement. Currently, the AI service providers are DLS, Milk Vita, and 5 private sector stakeholders (BRAC, Lal Teer, ACI, Ejab and ADL). Keeping in view the low success rate, the number and AI doses (which is around 10.5 million presently) need to be increased.
- **Updating of farmer knowledge of practical feeding systems,** nutritional requirements & feed commodity options for dairy, beef, buffalo, goats, sheep & poultry. Vitamin & Trace Element Premixes, plus additives such as 'Bovaer', to help reduce enteric **methane emissions** from ruminants.

Pillar 2: Strategies for improving efficiency of livestock commodity value chains

- ❖ **Rationale for action:** From a long-term perspective, strengthening competitiveness and promoting participation in global value chains would help the GOB achieve its goals for inclusive, export-led growth.
- ❖ **Recommended activities:**
 - **Product and process upgrading** in the dairy sector to produce adulteration free products
 - **Functional upgrading** occurs when farmers involved in a VC enter another closely related one, such as when milk producers expand their activities to cattle fattening.
 - **Upgrading of coordination and contractual business relationships** between actors in different VC segments, such as between dairy farmers and milk processors like Milk Vita, Aarong Dairy, etc.

Pillar 3: Strategies for enhancing capacity building

- ❖ **Rationale for action:** There is insufficient manpower both at DLS offices and training institutions. For various reasons, the main pedagogical tool for training used is classroom lectures, while producer groups look for more hands-on practical training.
- ❖ **Recommended activity:**
 - **Training need assessment (TNA):** A thorough TNA of target groups is required so that training is demand led not supply driven.
 - **Improved infrastructures of training establishments:** A large number of training institutions remain underutilized due to lack of adequate programs and funds. In some cases, the resources like land are not in use due to shortage of funds.
 - **Organisation of on-site training:** Farmers prefer onsite training rather than classrooms. Major advantage of farmer field schools and *uthan-baithaks* are that farmers animal shed/barn, animals/birds, fodder farms can used for practical demonstration and training.

- **IT based capacity development tool:** Digital platforms which could be an effective approach in delivering benefits and effective dissemination of information on technological advancements.

Pillar 4. Strategies for improving Financial Services and Investment Opportunities

- ❖ **Rationale for action:** Access to finance is a major challenge to the growth of livestock and dairy sector enterprises (classified as agriculture and MSME sector).
- ❖ **Recommended activities:**
 - **Establish autonomous agency:** One of the key reforms needed is to improve the investment climate for transformation. For this purpose, it is suggested that the government may establish a dedicated and autonomous agency as *Prani Sampad Bikash Foundation* (PSBF) as a government company under the Companies (Bangladesh) Act, 1994. The PSBF will create an ecosystem which is friendly for the growth of livestock related SMEs and producer organisations.
 - **Create suitable financial products for the customer segments in livestock and dairy sector. Farmer connect with financial institutions will increase if the need for document is lightened, the requirement for collateralizable assets minimized, flexible instalment schemes introduced, and loan applications are quickly disposed.** Interestingly, Aarong, MilkVita, PRAN, and Bengal Meat have sporadically engaged with embedded financing facilities wherein the farmers were provided inputs in advance and the loan amount was deducted from the produce they supplied to these companies.
 - **Raise capital to establish and run the autonomous agency (PSBF):** It is proposed that the PSBF may be provided with an initial corpus of USD 300 million contributed by LDDP, multilateral and bilateral donors, development finance institutions (Asian Development Bank, World Bank etc.). The PSBF may also approach the investors for equity and debt (both junior and senior) funds and may try to source funds as donations from the philanthropic foundations/charities.

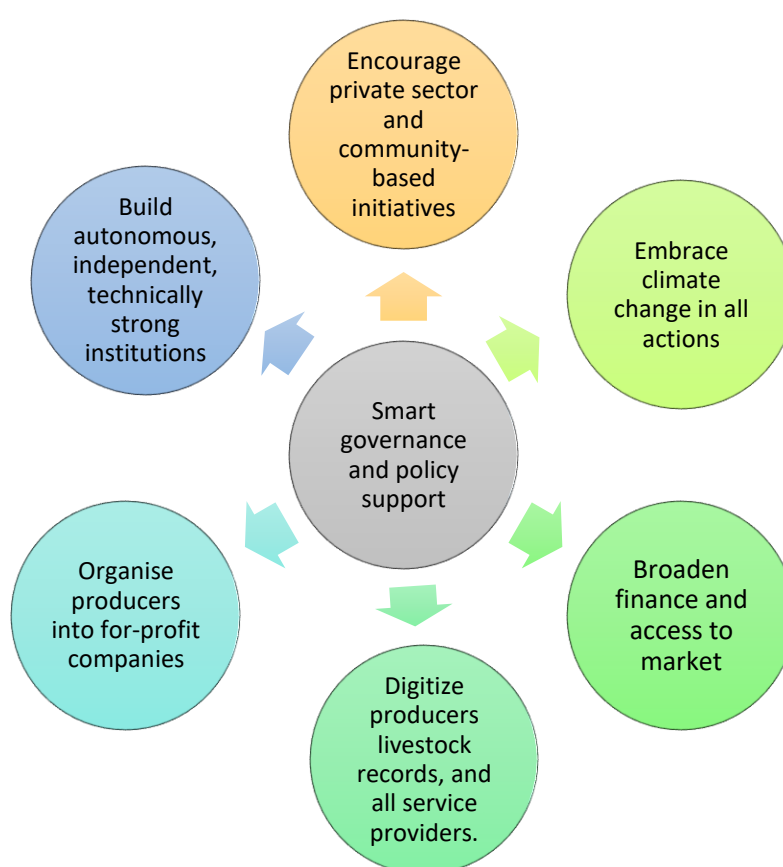
Pillar 5. Strategies for promoting Climate-smart infrastructure and technologies

- ❖ **Rationale for action:** Bangladesh is one of the most vulnerable countries due to extreme weather events. 85 million people (53% of the population) live in areas with subject to “very high” exposure. In recent years global attention has highlighted the large amount of methane emission from the livestock population. With this background, it is clear that the choice of adaptation and mitigation options in the livestock sector should be considered as one of the top priorities of the policymakers of Bangladesh.
- ❖ **Recommended activity:**
 - R&D to develop technologies for reduction of methane emission in livestock and to create sufficient data and information for recommending early warning and mitigation measures against climate disasters.
 - Build adequate number of animal disaster shelter homes and fodder depots co-located with the livestock service centres.
 - Rehabilitate and upgrade hospitals and livestock centres while incorporating green building features.

Livestock and dairy farming is a livelihood activity and is critically important for the food and nutritional security of the majority of the population in Bangladesh. Nevertheless, livestock

farming operates far below the optimum production potential, mainly due to demographic, biophysical, economic, environmental, and sociopolitical challenges. To address these issues, the LDDP project was launched with the overall objective of characterizing different livestock farming systems and identifying challenges and opportunities to improve livestock production in the country through broader perspectives.

The tasks of ensuring livestock development, production and health coverage, and extension services to meet nutrition requirements as well as to create employment opportunities through rearing livestock and poultry, and the marketing and processing of their products have largely fallen on the DLS and the GOB. The growth of private sector and civil society organizations in Bangladesh presents a new opportunity for opening the doors for investment in the sector, tap into their expertise, and deepening the outreach among all sections of the population. Livestock sector development does require an infusion of large amounts of capital, technology, and capacity building of people and their institutions, however, these alone are not sufficient. A paradigm shift towards a more collaborative, pluralistic ecosystem is required which treats private sector and civil society as equal partner to the government (see figure below).



To achieve the goals of the development of livestock sector by 2041, a massive restructuring of the existing implementation sector of the government and other organizations should be undertaken with utmost importance. Successful implementation of the strategies/recommendations will ensure an export-driven livestock industry that is participating in the global value chain (GVC) and will have the potential to significantly raise living standards, enhance productivity, and create jobs.

1. Introduction

The Livestock and Dairy Development Project (LDDP) is financed by a World Bank loan with the objective of improving livestock and dairy productivity, market access, resilience of smallholder farmers and agro-entrepreneurs by supporting climate smart production systems, farmer empowerment and commercialisation. The project covers 61 Districts, except three Districts in Chittagong Hill Tracts. The total project budget of US\$ 500M is to be implemented over 2019-2023. The expected outcome of the project is to improve the livelihood of economically deprived farmers. Through the project intervention, the Government of Bangladesh aims to remove sector-wide constraints and stimulate private-sector-driven growth. Key sector-wide challenges include (i) the lack of an effective regulatory framework for managing the post-harvest dairy and meat sectors, (ii) inadequate public and private sector capacity for improved livestock management and optimal productivity, (iii) limited readiness to adapt and mitigate climate change risks, and (iv) lack of financial aids and investments.

Global experience underlines the importance of first establishing a core public sector governance framework, and adequate institutional capacity in the public sector before private investment in the livestock sector kicks in, i.e., building the capacity of Department of Livestock Services (DLS) to regulate the livestock sector and stimulate private sector investment. LDDP seeks to promote climate-resilient growth in productivity, enhance market access, and improve risk management among smallholder farmers and agro-entrepreneurs, by providing support for climate-smart production systems, farmer empowerment and commercialization. The project development objective is to improve productivity, market access and resilience of small-holder farmers and agro-entrepreneurs operating in selected livestock systems and value chains in 61 districts of Bangladesh. The technical objectives of LDDP are productivity improvement, market linkages and value chain development, and improving risk management and resilience of livestock production systems.

Agriculture and Finance Consultants (AFC) GmbH, Germany and Services and Solutions International Ltd. (SSIL) consortium (here in after mentioned as “agribusiness consortium”) was contracted in November 2021 to provide technical assistance for agro-business planning, technologies, marketing advice and implementation support under LDDP. Annexure 1 presents the details of agribusiness consortium team. Tenure of contract period is from December 2021 to December 2023 through submission of 9 key deliverables.

Table 1: Status of deliverables of the contract

No.	Deliverables	Submission date
1	D#1 Inception Report	29-12-2021
2	D#2 Slaughtering Facilities Report	10-04-2022
3	D#6 Critical Structure and Grant Modality Report	19-05-2022
4	D#3 Value Chain Analysis Report	25-09-2022
5	D#4 Livestock and Dairy Business Structure Analysis Report	02-01-2023
6	D#5 Farmers' Capacity Development Report	28-03-2023
7	D#7 Partnership Development Report	25-06-2023
8	D#8 Draft Final Report	27-09-2023
9	D#9 Final Report	25-12-2023

In addition, the agribusiness consortium is expected to provide implementation support as specified by the Project Management Unit (PMU), LDDP from time to time. The 9 deliverables of the contract and its status are provided in Table 1. Based on verbal and written requests from the Chief Technical Coordinator (CTC), LDDP, the agribusiness consortium has been providing support to PMU, LDDP on the implementation of the matching grant scheme of the project.

Deliverable#9 (Final Report) was submitted in December 2023. A validation workshop on the final report was conducted on 25 February 2024. The report has been finalized based on the feedback received. To achieve the goal of LDDP project, the agribusiness consortium has presented this final report with the following objectives:

1. Improvement of wet markets and Slaughtering facilities at the district level, developing modern slaughterhouse and cold chains and rendering facilities in the metropolitan areas
2. Study the existing value chain in the selected areas of livestock and dairy sector and suggest models to improve efficiency of value chain, support structures and services for the sector, and the enabling environment.
3. Analyze the existing structure of livestock businesses, competitiveness of the livestock and dairy sector, and recommendations on the future development of livestock and dairy business in a sustainable way
4. Analyze the current status of capacity development of farmers, institutions and enabling environment in livestock sector and suggest intervention strategy for improvement and way forward.
5. Support implementation of Matching Grant Scheme to encourage entrepreneurs to start new livestock business or strengthen the existing ones at private level to contribute to livestock development
6. Assess the existing partnership models in livestock sector and suggest on innovative approaches to implement suitable models under the current content of livestock development paradigm.

1.1 Country context

Bangladesh is expected to attain a status of lower middle-income country by 2026 from least developed country (LDC)¹. The Bangladesh's Vision 2041 provides perspective plan with a target of 9% annual growth of gross domestic product (GDP) until 2031 and 9.9% annual growth of GDP to become a High-Income Country by 2041². This implies that the livestock and dairy sector has to grow three times to maintain its current position in GDP.

In Bangladesh livestock sub-sector is a key socio-economic component of the agriculture sector, particularly for the most vulnerable and landless farmers. Over 70 percent of rural households are involved both directly and indirectly with livestock production. This sub-sector also employs an estimated 14 percent of the total labour force or one-third of total agricultural employment. Besides, livestock has a key role in ensuring national as well as household food security and nutritional improvement, rural women empowerment and in reducing gender and social disparity. Rapid growth in education, income and urbanisation in Bangladesh lead to changes in tastes and food preferences. Thus, consumers are increasingly demanding food from animal origin particularly meat, egg, milk and its products. Even, they are willing to pay higher prices for quality and certified foods. Thus, modern food supply chains create both challenges and opportunities particularly for competitiveness of local smallholder farmers.

¹ <https://www.worldbank.org/en/country/bangladesh/overview>

² <http://oldweb.lged.gov.bd/uploadeddocument/unitpublication/1/1049/vision%202021-2041.pdf>

Figure 1 presents the trend in livestock composition in terms of livestock units as per FAO norm.

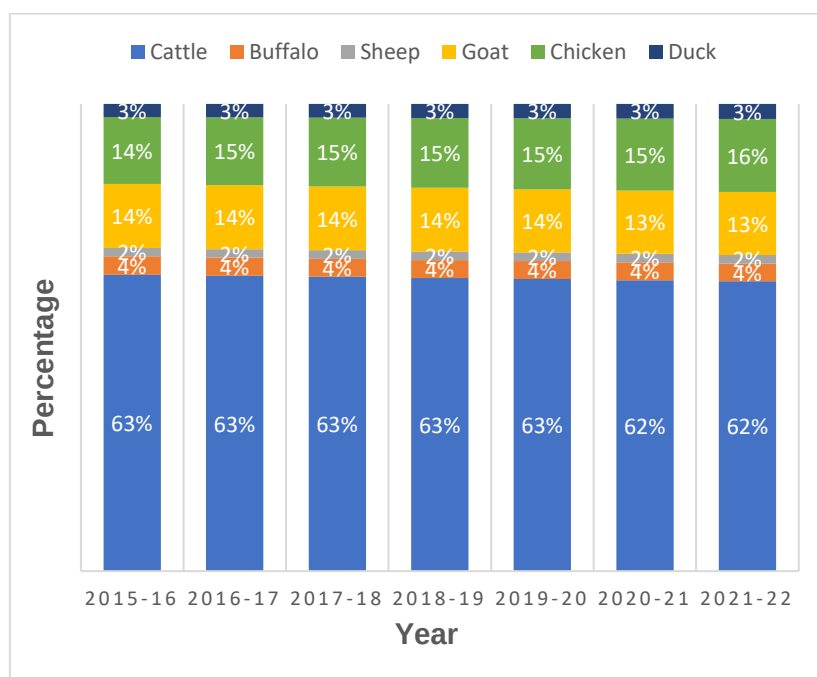


Figure 1: Livestock composition in Bangladesh (2015-2022)³

The livestock population and its by-products such as meat, milk and eggs have rapidly increased in over the last decade. Figure 2 provides trend of total production and demand of livestock products from 2016-2022⁴.

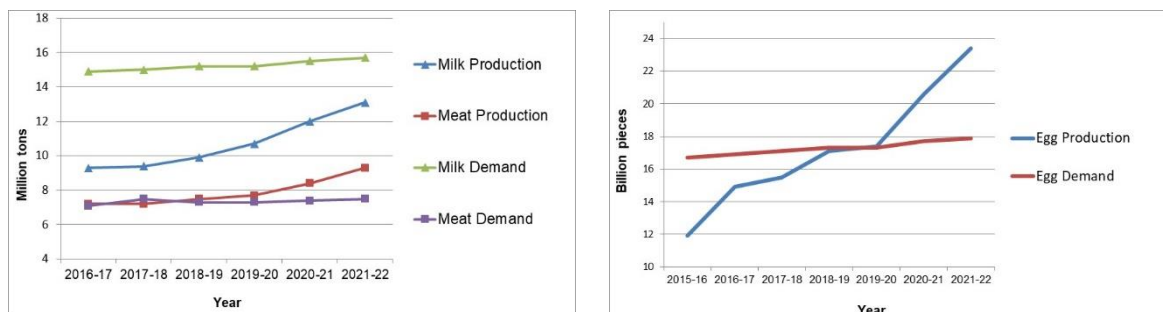


Figure 2: Production and requirement of livestock products

According to DLS report Bangladesh has reached self-sufficiency in meat and eggs. Milk production has increased from 7.3 million tons in 2015-16 to 13.1 million tons (79.45%) in 2021-22 whereas the demand has increased by only around 6% for the same period. Similarly, the production of eggs has increased by around 49% between 2015 and 2022 but the demand for eggs has increased only by around 7% in the same period. However, animal productivity (kg/LSU) measured as total meat production (kg) divided by the number of livestock units (LSU) has remained static in the last decade. Compared to many developed countries, per capita meat availability is lower in Bangladesh. Per capita meat consumption in Bangladesh rose rapidly between 2002 and 2009, and since then it has stagnated at around 4.23

³http://dls.portal.gov.bd/sites/default/files/files/dls.portal.gov.bd/page/ee5f4621_fa3a_40ac_8bd9_898fb8ee4700/2022-07-18-03-43-37d18965a6458cda3c542ab146480962.pdf

⁴ <http://www.dls.gov.bd/site/page/22b1143b-9323-44f8-bfd8-647087828c9b/->

kg/capita/year. Per capita meat consumption of Bangladesh and other selected countries is given in Figure 3⁵.

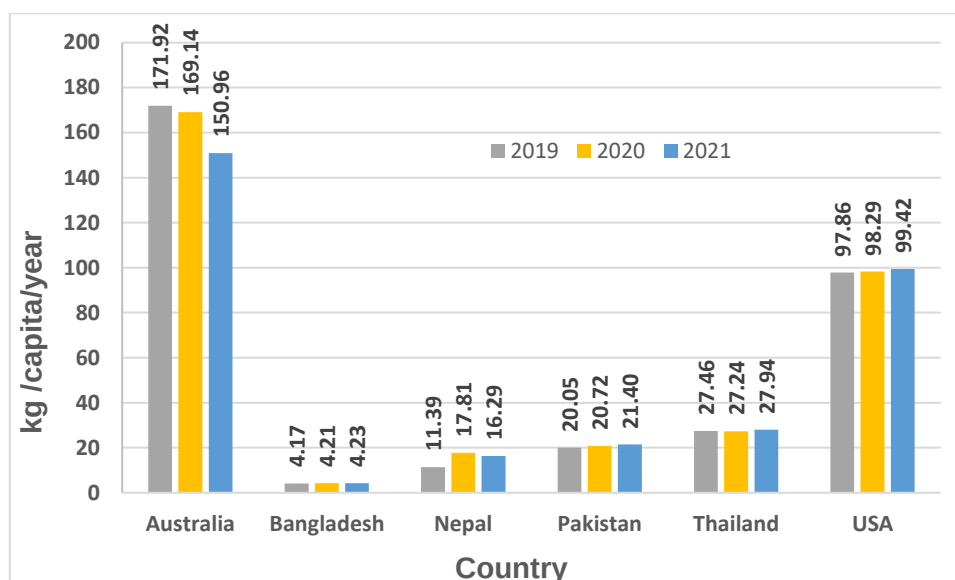


Figure 3: Per capita meat consumption in selected countries

Bangladesh's current per capita milk consumption is well below Nepal (a low-income country), but higher than Thailand (upper middle-income country) and much lower than Australia, and USA (developed countries) which can be clearly seen in figure 4⁶.

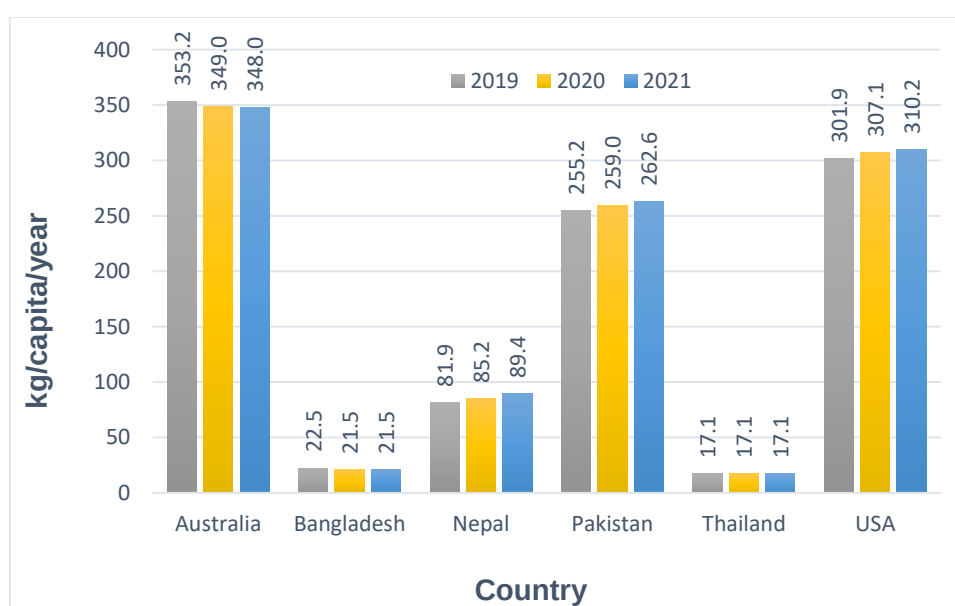


Figure 4: Per capita milk consumption in selected countries

Rapid growth in income and urbanization have increased the demand for meat and milk-based products in Bangladesh. However, the level of demands was not as has been expected during the period might have been due to lack of awareness of the rural low-income category of

⁵ <https://www.fao.org/faostat/en/#data/OA>; <https://www.fao.org/faostat/en/#data/QCL>

⁶ <https://www.fao.org/faostat/en/#data/OA>; <https://www.fao.org/faostat/en/#data/QCL>

people of the country. Thus, modern food supply chains create both challenges and opportunities, particularly for the competitiveness of local smallholder farms.

Key constraints in the livestock sector include poor animal husbandry practices, problems with low genetic potentials, shortage and high price of quality fodder and feeds, high incidence of diseases, poor infrastructure, low level of technical competencies of the farmers, limited access to financial assistance, unorganised marketing channels, and lack of producer organisations. Despite these constraints, the weak regulatory framework and enforcement of laws have a strong influence on livestock productivity which results in insufficient investment in the livestock activities, particularly by the private sector.

The role of DLS under the Ministry of Fisheries and Livestock (MoFL) is to provide veterinary services and development & extension services to meet nutritional requirements as well as create employment opportunities through rearing livestock and poultry, and the marketing and processing of their products. The activities of the DLS are overseen by a Director General supported by a group of professionals and supporting staff (about 8,500 at present). It has offices in every district and Upazilas in the country. Emphasizing the importance of socio-economic contribution of livestock sector to the national economy of Bangladesh, LDDP project has been undertaken by the DLS with the following four components:

- A. Productivity improvement
- B. Market linkage and value chain development
- C. Improving risk management and climate resilient livestock production
- D. Project Management, Monitoring and Evaluation

In view of this, the agribusiness consortium was assigned to provide implementation support to LDDP. The LDDP is providing sub-grant and matching grant assistance against different activities under the five selected sub-components⁷ out of ten sub-components as mentioned in the Grant Manual.

1.2 Methodology

The agribusiness consortium has produced eight deliverables (including this). A variety of methodological approaches have been used to collect data and insights for the preparation of these deliverables. Such approaches included:

- Brainstorming within the consultant team and with other stakeholders,
- Literature review: Related technical journals, technical reports, books, technical notes, newspaper articles were reviewed.
- Organization of Focus Group Discussion (FGD) – Consultant team members organized meeting with related stakeholders like livestock farmers and entrepreneurs in the field with a prepared questions for a specific purpose which was discussed and conclusion was drawn.
- Key Informant Interviews (KII): KIIs were used with wide range of people like producer, entrepreneur, government officials, NGOs etc. to get the first-hand information.
- Questionnaire based surveys: A detail questionnaire was developed and finalized after discussing with consulting team before taking it to the field.
- Field visits: Field visits were made for getting the firsthand information from the field. Consultant team met livestock farmers, entrepreneurs, NGOs and government officials in the field. Field visits were done in the districts/Upazillas of all 8 Divisions of the country.

⁷ As per Grant Funding under LDDP: A2-Support To Improving Production Practices, B1-Market Linkage Through Productive Partnerships, B2-Critical Public Infrastructure For Livestock Development, B3-Consumer Awareness And Nutrition and C3-Livestock Risk Mitigation

The summary of the same is provided in table 2 below.

Table 2: Methodological approaches followed

No.	Deliverable	Brainstorming	Literature review	Focus group discussions (FGDs)	Key Informant Interviews (KIIs)	Questionnaire based surveys	Field visits
1	D#1 Inception Report	✓	✓	-	-	-	✓
2	D#2 Slaughtering Facilities Report	✓	✓	-	-	-	✓
3	D#3 Value Chain Analysis Report	✓	✓	✓	✓	✓	✓
4	D#4 Livestock and Dairy Business Structure Analysis Report	✓	✓	✓	✓	-	✓
5	D#5 Farmers' Capacity Development Report	✓	✓	✓	✓	-	✓
6	D#6 Critical Structure and Grant Modality Report	✓	✓	✓	✓	-	✓
7	D#7 Partnership Development Report	✓	✓	-	✓	✓	✓
8	D#8 Draft Final Report	✓	-	-	-	-	✓

The brainstorming session was followed to gather data and literature references from subject matter experts and the team members. For the preparation of the deliverables, papers published in reputed journals, books, technical reports, newspaper articles, and specialized internet sources were reviewed. Table 3 summarizes different types of documents reviewed, totalling around 170 documents/references.

Table 3: Literature review sources

No.	Deliverable	Journals	Books/ Reports/ Monographs / Conference proceedings	Newspapers	Others	Total
1	D#1 Inception Report	11	8	2	1	22
2	D#2 Slaughtering facilities Report	4	10	-	-	14
3	D#3 Value Chain Analysis Report	32	36	1	3	72
4	D#4 Livestock and Dairy Business Structure Analysis Report	-	5	-	4	9
5	D#5 Farmers' Capacity Development Report	12	14	-	2	28
6	D#6 Critical Structure and Grant Modality Report	-	3	-	-	3
7	D#7 Partnership Development Report	7	15	-	-	22
8	D#8 Draft Final Report	-	-	-	-	-

During all the field visits, the consortium team interacted with the community members either in DLS offices or in the field villages with the support of the District Livestock Office. The field visits were closely tied with the preparation of deliverables at hand, collection of data, and interaction with a cross-section of smallholders, traders, and field officials. Overall, the expert team spent 478 person days on the field between December 2021 and December 2023 (refer Table 4). The survey questionnaire used are given in Annexure 2 and 3.

Table 4: Number of person-days spent on field visits

No.	Deliverables	Barishal	Chatto gram	Dhaka	Khulna	Rajshahi	Rangpur	Mymen singh	Sylhet
1	D#1 Inception Report	-	-	11	-	-	11	-	-
2	D#2 Slaughtering Facilities Report	-	-	36	12	21	-	-	-
3	D#3 Value Chain Analysis Report	12	21	23	48	28	23	26	8
4	D#4 Livestock and Dairy Business Structure Analysis Report	-	20	23	-	-	12	-	-
5	D#5 Farmers' Capacity Development Report	-	-	25	-	35	10	20	18
6	D#6 Critical Structure and Grant Modality Report	-	-	-	-	-	-	-	8
7	D#7 Partnership Development Report	-	-	27	-	-	-	-	-
8	D#8 Draft Final Report	-	-	-	-	6	12	-	-
Total		12	41	145	60	84	56	46	34

Questionnaires-based surveys were done and for the value chain report, questionnaires were administered to 832 small holders, and 284 traders. Key informant interviews (KIIs) were extensively used to collect information from a wide range of people, including producer group leaders, professionals, or government officials who have first-hand knowledge about the

livestock and dairy sector. Focus group discussions (FGD) and surveys were also conducted. Data analysis and representation techniques that were used for various deliverables include, but not limited to, flowcharts, affinity diagrams, matrix tables, etc. Some of the key institutes/organizations visited are RDA, Bhogura, BAPARD, Gopalgonj, ILST, Nethrokona, BTI, Alamdanga, IUBAT, Dhaka, etc. Table 5 shows the number of respondents reached through surveys, KIIs and FGDs.

Table 5: Number of respondents

No.	Deliverable	Surveys	KII	FGD	Total
1	D#1 Inception Report	-	-	-	-
2	D#2 Slaughtering Facilities Report	-	-	-	-
3	D#3 Value Chain Analysis Report	1,116	15	106	1,237
4	D#4 Livestock and Dairy Business Structure Analysis Report	-	-	40	40
5	D#5 Capacity Development Report	-	16	44	60
6	D#6 Critical Structure and Grant Modality Report	-	-	-	-
7	D#7 Partnership Development Report	-	37	-	37
8	D#8 Draft Final Report	-	-	30	30
Total		1,116	58	220	1,394

1.3 Support to Matching Grant Scheme

As per the Grant Manual (2020) approved by PMU LDDP, the matching grant under the sub-Component B1: Market linkages and Investments, the matching grants (MGs) to agro-businesses was envisaged with 9 packages with an allocation of USD 30.43 million and a target of 2,365 beneficiaries. In subsequent internal revisions, PMU has modified the matching grant packages as provided in Annexure 4 where it was shown 9 packages. The matching grant ratio between the applicant and LDDP is set as 60:40 for all packages. The target applicants are agro-businesses, producer organizations, farmer organizations, individual entrepreneurs and private enterprises (cottage, micro, small and medium) operating in livestock systems or livestock value and supply chains in Bangladesh.

Agribusiness consortium support to matching grant initiatives PMU falls into three main organizational processes, namely initiating, planning, and executing. The three groups are connected to each other by their inputs and outputs, where the result of one business process represents the beginning of the other. The support was largely provided by Dhaka-based national experts, occasionally guided by international experts. Further information on initiation, planning and execution process is provided in Annexure 4.

1.4 Organization of Work

The agribusiness consortium assembled a team of international and national experts with excellent professional experience from the fields of agribusiness, agro-economics and finance, animal feed, animal husbandry, renewable energy, communication, and monitoring and evaluation (M&E). Currently, the list of international and national experts on board is included in Annexure 1. There are 5 support staff helping the smooth conduct of back-office operations.

The agribusiness consortium operates from the project office located at House #316 (5th Floor), Road 21, New DOHS, Mohakhali, Dhaka, Bangladesh. The office has a meeting room facility, kitchen, safety equipment including fire extinguisher, first aid kit, emergency services, etc. Essential information like team member contact list, evacuation protocols, etc., are kept displayed to support emergency situations. Safety check on electrical wiring is done periodically. Actions are being taken to install removable grilles for the windows and also evacuation rope. The office has two regular vehicles for travel to meetings and project sites. Kick-off meeting was arranged on 01/12/2021 in the newly established office which was attended by the experts and office staff members. They were self-introduced and took part in free and fair discussion, essential to maintain a congenial working environment. The team members work in a free and fair environment under the guidance of the acting team leader. Every expert follows his/her own Terms of Reference (ToR) and work plan prepared and subsequently cleared/aligned in a joint meeting. In case of any concerns, the acting team leader helps in finding the appropriate solution.

The members initially met every week for online team meetings and thereafter since 24/10/2022 the meetings took place on a fortnightly basis to share update on the activities performed and to plan for future work and to discuss on the emerging issues to resolve. There were 50 team meetings held so far and in addition, there were 11 special/emergency team meetings held to discuss a topical issue of importance. Details of meeting conducted and organizational arrangement with the PMU, LDDP is included in Annexure 1.

2. Overview of previous reports

2.1 Inception report (D#1)

The agribusiness consortium team is composed of 6 international and 7 national experts and is headed by a Team Leader. Six deliverables are identified to meet the objective of the project. Approach, methodologies and work priorities for the deliverables are developed to guide the preparation of the deliverables. All the national and international experts were recruited and terms of reference for these experts were finalized. Work schedules for all the deliverables covering the tenure are prepared and presented in the report. The Inception Report (IR) was presented on 21/12/2021 at Hotel Pan Pacific Sonargaon, Bangladesh in a formal manner in presence of the Minister, Ministry of Fisheries and Livestock (MoFL) as the Chief Guest, Secretary, MoFL as the Special Guest and with the participation of representatives of all categories of stakeholders related to livestock production throughout the country. The presentation of the report was followed by discussions and clarifications about the implementation of LDDP. The Minister and Secretary of MoFL and senior officials of DLS addressed the function.

IR was prepared based on the proposal made by the AFC/SSIL and subsequently approved by the appropriate authority. It identified the major constraints in the livestock sector in Bangladesh. These constraints include loss of arable land, climate changes, shortage of feed and fodder, credit constraints, inadequate animal husbandry practices, poor quality of products, etc. To achieve the project objectives, an integrated approach was proposed. The approach aims to mainstream the support to the micro, small and medium enterprises (MSMEs), farmer organizations/producer organizations and smallholders, infrastructure development, improvement in wet markets, slaughterhouses, cold chain facilities, the establishment of Village Milk Collection Centres (VMCC), training facilities, etc. IR set the understanding of the responsibilities/assignment and has put forward a work plan from December 2021 to December 2023. It included the key tasks and key deliverable dates to the end of the project. For more details, refer to deliverable D#1 inception report.

2.2 Slaughtering facilities report (D#2)

2.2.1 Background & objective:

The slaughtering practice in Bangladesh is traditionally dependent on the wet market as the customers prefer fresh meat. Slaughtering on the roadsides is quite common and has a negative effect on the growth and development of scientific and modern slaughtering facilities. Furthermore, the weak enforcement of legislative and regulatory requirements makes the slaughtering facilities to function poorly. This practice needs to be improved to attract the private sector in the meat industry. Thus, the objective of the report is to increase producers' linkage with the profitable markets, improve the volume, quality and safety of meat products and decrease transaction costs along the value chains.

2.2.2 Approach and methodology:

Approaches followed are mainly,

- Understand the current slaughtering practices
- Prepare business plans for different types of facilities
- Prepare long-term roadmap for capacity development in the meat business
- Develop a monitoring framework

Methodologies adopted are literature review, stakeholder consultation, site visits to slaughtering facilities, assessment of training needs, gender involvement in slaughtering business and analysis of information/data collected.

2.2.3 Landscape of slaughtering facilities

Cattle, goats and chicken are the main sources of meat in Bangladesh and are self-sufficient to meet the demand. However, the slaughtering in Bangladesh is unplanned, unhygienic and unorganized. It is more reflected during major festivals like Eid-ul-Adha. Per capita requirement of meat is 120 gram/day and the availability is 137.38 gram (2022-23)⁸. Bengal Meat Processing Industries Ltd. is processing hygienic meat and exporting halal meat to Middle East countries and also supplies quality meat to domestic customers. The DLS, city corporations, municipalities and executive magistrates in the Upazilas are the responsible organizations for implementing the regulatory functions.

At the end of the slaughtering facilities report, sample of business proposal models were also prepared and attached for benefit of the enterprises.

Detailed observations are provided in section 3.1 of this report. For more details, refer to deliverable D#2 slaughtering facilities report.

2.3 Value chain analysis report (D#3)

2.3.1 Background & objective:

Livestock production is largely carried out through subsistence farming with limited linkage to product markets. This report looks for ways to increase producers' linkage to profitable markets, improve the volume, quality and safety of livestock products being marketed, and reduce transaction cost along the value chain.

2.3.2 Approach and methodology

The analytical framework adopted in this report is influenced by Vision 2041 of Bangladesh, its 8th Five Year Plan (2021-2025), the need for building robust global value chains as espoused in World Bank report 2020 (a), and ILO manual 'Value Chain Development for Decent Work – A Guide for Development Practitioners, Government and Private Sector Initiatives' (2009). Both Vision 2041 and the 8th Five Year Plan would require the dairy and livestock sector to raise its growth rate from a current 3.4% to over 8% and become an export-oriented item in the globally competitive market.

2.3.3 Sectoral regulations and policy framework

The key ministries involved in livestock and dairy development in Bangladesh are MoFL, Ministry of Agriculture (MoA), and Ministry of Food (MoF). The legal and regulatory regime for livestock management, food and food safety, and pollution control is governed by several enactments and government administrations. In Bangladesh, a slaughter act has been in effect since 2011, which defines rules, regulations, and restrictions for slaughter. Animal Feed Act, 2011, and the associated rules of 2013, provide an important legal framework to control the formulation, distribution and marketing of animal feed. The Bangladesh National Parliament enacted the Food Safety Act, 2013, to counter threats related to food safety. The 'Animal Disease Rules' Act and the 'Bangladesh Avian Influenza Compensation Strategy and Guidelines' exist to combat avian diseases and compensate farmers in case of a disease

⁸ <http://www.dls.gov.bd/site/page/22b1143b-9323-44f8-bfd8-647087828c9b/Livestock-Economy>

outbreak. The Bangladesh Environmental Conservation Act, 1995, and the Environmental Court Act, 2000, are important regulatory instruments for pollution control and environmental conservation. To increase productivity, the National Breeding Policy, 2019, advocates artificial insemination of native dairy breeds with Holstein Friesian semen.

2.3.4 Stakeholders involved in the livestock and dairy sector

Farmers are the main stakeholders in milk and meat production. Others include commercial feed manufacturers, feed supplement shops, forage seed/seedlings producers, veterinary medicine suppliers, service providers such as veterinarians, Artificial Inseminators (AI), AI Centers of DLS, non-governmental organizations (NGOs), private veterinarians, insurance agencies, breeder farmers, training institutes/organizations, etc. There are milk collection centers, chilling centers and dairy plants who are involved in collecting, processing, and marketing of milk. Annexure 5 is added discussing the key stakeholders across the value chain.

2.3.5 Selected value chains

Four value chains were selected by PMU of LDDP for further elaboration. The rationale behind the selection of (a) dairy, (b) beef fattening, (c) small ruminants and (d) backyard poultry value chains are that small and unorganized farmers dominate this segment of the livestock economy, i.e., 13 million out of the 15 million farm holdings are small farms⁹. The Bangladesh dairy value chain can be categorized into two models: the informal sector, and the formal organized sector. Division wise economic analysis for milk, beef, small ruminant and backyard poultry is done.

Box 1 presents a brief about the dairy buffalo rearing in the country. Detailed observations are provided in section 3.2 of this report. For more details, refer to deliverable D#3 value chain analysis report.

Box 1: Buffalo, the Black Gold

Buffalo is known as Black Gold for its multiple contribution in milk, meat and draft power. Buffalo population in Bangladesh is about 1.5 million which are mainly concentrated in the southern part of the country. In the last 10 years, buffalo population has increased by 3.95%. Share of buffalo in the total milk and meat production is 3-4% and about 6 % respectively. Buffalo milk contains almost twice the amount of fat than that of exotic breeds of dairy cattle. Buffalo is a hardy animal which can be raised even in relatively poor feed base. Government has established a Buffalo Development Farm in Bagerhat in 1960s. Now government is going to import 150 Murrah buffalo heifers from India for strengthening the Buffalo Development Farm in Bagerhat. Besides that buffalo bulls for semen collection are also in the process of importing from India.

Buffalo is an important animal for milk and meat production in other The South Asian Association for Regional Cooperation (SAARC) countries like Nepal, India and Pakistan where more than 50% of the milk is produced from buffalo.

⁹ <https://bbs.gov.bd/site/page/3e838eb6-30a2-4709-be85-40484b0c16c6/->

2.4 Livestock and Dairy business structure analysis report (D#4)

2.4.1 Background & objective:

The livestock sector contributes in income, employment and household nutrition. More than 20% of total population of the country are directly employed and 50% are indirectly dependent for their livelihood on livestock rearing¹⁰. This report studies the structure of service delivery to the farmers, analyze the competitiveness of the livestock and dairy sector, both domestically and internationally and make recommendations for the future development of livestock and dairy business in a sustainable way.

2.4.2 Approach and methodology

Extensive literature review followed by field visits to different parts of the country, meeting with related stakeholders, interaction with the livestock and dairy farmers, private sector entrepreneurs and service providers. Consultations was done with the livestock industrialists, dairy professionals, government officials, scientists, private sector organization farmers, marketers, milk/meat processors, etc.

2.4.3 Institutional development in livestock sector

There are four major structures with distinct features, drivers and strengths that are operating within the country's livestock sector, they are led by: (1) government, (2) private businesses, (3) producer organizations, and (4) public-private-producer partnerships. There are 18 policies, acts, regulations and ordinance in the livestock sector. Some of them had been formulated and enacted long before the birth of the country.

Detailed observations are provided in section 3.3 of this report. For more details, refer to deliverable D#4 Livestock and dairy business structure analysis report.

2.5 Farmers' capacity development report (D#5)

2.5.1 Background & objective:

There are number of ongoing initiatives on capacity building through different training institutions, DLS, NGOs, development agencies and private sector. The study was aimed to analyze current status of capacity development of livestock sector for (i) identification of opportunities, gaps and needs (ii) suggesting intervention strategy and creating business opportunities for entrepreneurs (iii) strengthening institutional facilities and (iv) present the overall recommendations.

2.5.2 Approach and methodology

The whole work for assessment of existing capacity development was carried out at three aspects – (i) finding gaps and needs, (ii) identify interventions for strengthening capacity development at organizational level and (iii) frameworks needed for enabling market environment. Literature review was done by studying the documents of GOB and the leading NGOs working in the field of capacity development of farmers. The relevant literatures on other developing countries were also collected and reviewed. Secondary data and information were collected from the DLS and relevant offices. Primary data were collected through 44 Focus Group Discussion (FGD) and 16 Key Informant Interviews (KII). Current status of capacity development program of DLS training organizations and private sector was assessed. Information was collected from different sources and analysed. Opportunities and gaps were identified.

¹⁰ <http://www.dls.gov.bd/site/page/3dd01de1-e39e-46b6-acad-b997330af39e/->

2.5.3 Capacity building scenario in livestock sector

Capacity development of livestock farmers and field officers are addressed but having gaps and faults. The capacity development at organizational level is addressed but not effectively and that of enabling environment level are seldom addressed. Only training is considered as the prime means for capacity development of farmers, extension personnel and service providers. Other tools that have been implemented in the comparatively recently especially for the farmers are: Uthan baithak, which is being practiced regularly, some exposure visits, discussion meetings and workshops for extension workers. However, because of the big gap in addressing the enabling environment the level of capacity building of the farmers and other stakeholders are not sustained due to unfavourable and sometimes antagonistic environment.

The department has a good set of training institutions for capacity building of farmers and other stakeholders. It runs BCS Livestock Academy, number of training institutions such as 4 Institutes of Livestock Science and Technology (ILSTs), 2 Veterinary Training Institutes (VTIs), 2 veterinary colleges, chicken, duck, buffalo, and cow breeding and improvement centres, and a chain of diagnostic laboratories. However, because of the insufficient budget, manpower and lack of appropriate planning system the training institutions are not effectively working.

The limitations of current capacity building programs are narrated under the section 3.4 of this report. For more details, may be referred to the deliverable # 5, which is Farmers Capacity Development Report.

2.6 Critical structures and grant modality report (D#6)

2.6.1 Background & objective:

Under the project subcomponent B1 Market linkage and investments in the value chain of LDDP project, a Matching Grant Scheme (MGS) is managed by the Fund Management Unit (FMgtU). Matching Grants amounting to USD 30 million are awarded by the Grant Review Committee (GRC) of LDDP once the qualification and sustainability of the submitted proposal under the scheme has been assured. The purpose of this report is to facilitate the operationalization of the MGS.

2.6.2 Operational process of matching grants

Matching grants are offered in a series of bidding rounds through the implementation of a two-stage process, comprising expression of interests (EOIs) at the first stage, and a business plan (BP) at the second stage. Before submission of BP the successful EOIs are called for orientation on how to prepare BP. Typical activities for the promotion of MGS facility include: Organizing awareness workshops one at the national level and one in each of the all eight Divisions¹¹, public announcement of EOI on national print dailies, posting information about MGS on LDDP website, Facebook, and other social media sites, encourage TV channels to highlight MGS and involve field level livestock extension officers (DEO) to encourage eligible person/organizations to apply for the grant. The PMU/PIU shortlist all successful EOIs and business plan applicants and notify them of their award with conditions laid there in the advertisement.

Selection criteria for matching grants are,

- a) The applicant must be a Bangladeshi adult citizen and where applicable have valid trade license and TIN Certificate.
- b) The applicant's manufacturing facility must be located in the project area.
- c) The applicants shall have at least one to three years' experience in the area of production and marketing as when required.
- d) The applicant is willing to contribute his/her share of 40-60% the total project cost.
- e) Public limited companies and companies listed with the stock exchanges and Government controlled entities are not eligible to apply.
- f) The applicant's business must be connected to livestock and dairy product of Bangladesh.
- g) Women and youth entrepreneurs are encouraged to submit EOI.

Annexure 4 shows the support provided for operationalization of matching grant scheme and Annexure 6 presents the monitoring mechanism for sustainable use of matching grants.

2.6.3 Recommendations

- MG share be increased from 40% to 60% or higher. If possible, MG amount may also be suitably increased in some of the packages depending on the necessity.
- DLS staff at District/Upazila level, business associations, and NGO associations are mobilised, sensitised, and encouraged to promote MG outreach.
- MG procedures be further simplified to make them easy for the applicants/rural farmers women and small enterprises. This will attract more farmers/small entrepreneurs to apply for the grant.
- EOIs be well circulated through the DLS Upazila field officers/staffs for encouraging more applicant.
- Start-ups to be encouraged and benefitted from handholding, coaching and mentoring through enterprise incubation centres.

¹¹ The administrative structure of Bangladesh currently comprises eight divisions (Bengali: bibhag) at first order administrative level (ADM1): Barishal, Chattogram, Dhaka, Khulna, Rajshahi, Rangpur, Mymensingh and Sylhet.

For more details, refer to deliverable D#6 Critical structures and grant modalities report.

2.7 Partnership development report (D#7)

2.7.1 Background & objective:

The examples of successful partnership in Bangladesh are limited. Though partnership approach has shown promising results in value chain programs funded by international donors, yet there are significant challenges in design, and execution. The objective of the partnership development report is to understand the existing partnership models in the country that are supporting the development of the livestock and dairy sub-sector and suggest on innovative approaches which are possible to implement under the current context of livestock development paradigm.

2.7.2 Methodology

The report preparation applied following methods:

Literature review: All relevant and important literatures (national & international) on partnerships were reviewed.

Key Informants' Interview (KII): A detailed interview was conducted with the 37 key informants from public and private sector players engaged in the subsector.

Field visit: Field visits to a dozen of enterprises in Bangladesh was undertaken. Different caselets were also developed from Bangladesh and other countries to understand various issues in connection with the partnership development process.

2.7.3 Partnerships scenario in Bangladesh

In general, three main types of partnership models are currently active in Bangladesh: (a) Partnership between two parties (2P model), (b) Public-Private partnership (3P model), and (c) Cooperative model of partnership (Coop model). The Public-Private Partnership Authority (PPPA) under the Prime Minister's Office is a catalyst to proactively realize PPP projects in Bangladesh. These are mostly for the sectors other than livestock sector e.g. constructions, roads and high ways, etc. However, women centric partnership fund was established in Bangladesh by the intergovernmental agencies, national government and private sector is a classic example of partnership development which may be designed in livestock sector to provide support particularly to the women farmers. The 4P system of partnership (Public-Private-Producer Partnership) suggested by IFAD can be more effective since it has provision for raising voice for the benefits of the producers as they are one of the partners. This may be applied in the livestock sector also.

Annexure 7 discusses the Milk Vita co-operative model and the annexure 8 presents the PPP model in the livestock sector of Bangladesh. Detailed observations are provided in section 3.5 of this report. For more details, refer to deliverable D#7 Partnerships development report.

The links to all the deliverables and field visit reports, orientation program reports are provided in Annexure 9. Annexure 10 presents the summary of field visits carried out and annexure 11 lists the selected details of officials or other stakeholders contacted for the purpose of this project. Selected site visit photos are given in Annexure 12.

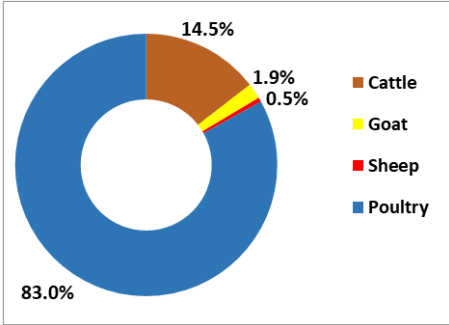
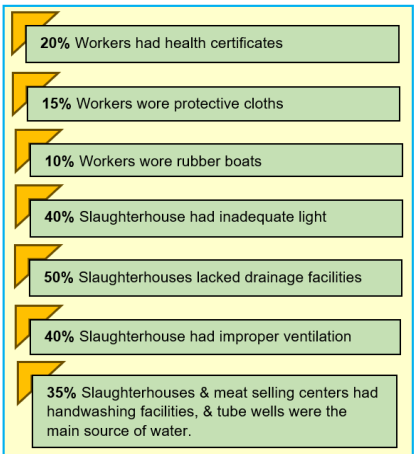
3. Observations on livestock sector

Under the LDDP project, the agribusiness consortium has made number of observations (under its deliverables discussed in previous chapters) that capture the current practices, socio-economic conditions and market structures. These observations offer valuable feedback to the GOB, the DLS and other stakeholders on the opportunities, challenges and bottlenecks to be addressed to enable rapid market growth. For ease of presentation, the observations from each deliverable are covered under general and specific observations in this chapter. The general observations cover the overall trends with respect to market context, breeding, etc., and the specific observations are categorized under five aspects:

- Livestock productivity
- Product marketing
- Capacity building
- Financial services and investment opportunities
- Climate-smart technologies

3.1 Slaughtering facilities report (D#2)

3.1.1 General observations

a. Statistics show that the availability of meat per person is 137.38 grams per day based on production versus population¹². However, it is observed from the field that the actual consumption per capita could be less due to challenges in the market supply chain. b. The share of livestock slaughtered per day in Dhaka is provided in figure 5. Key statistics on slaughtering practices followed are provided in figure 6 c. Though the overall meat consumption is growing, the infrastructure for slaughtering facilities is less developed. There are two to three slaughterhouses in big cities, although they are typically underutilized and dilapidated. d. Almost 90%¹³ of the beef market is distributed through informal marketing channels, yet slaughtering is unorganized, unscheduled, and less hygienic. e. The only organized, contemporary, integrated abattoir and meat processing facility in Bangladesh is Bengal Meat PVT Ltd. f. Five modern slaughterhouse facilities are undergoing refurbishment in Dhaka.	 Figure 5. Share of livestock slaughtered per day in Dhaka (weight basis)¹⁴  Figure 6. Key statistics on slaughtering practices¹⁵
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¹² <http://www.dls.gov.bd/site/page/22b1143b-9323-44f8-bfd8-647087828c9b/Livestock-Economy>

¹³ FAO-UNIDO. (2019). The dairy and beef value chain in Bangladesh: Diagnostics, investment models and action plan for development and innovation. Available at <https://www.unido.org/sites/default/files/files/2019-05/Bangladesh%20dairy%20and%20beef%20vc%20report%20%28Wei%27s%20final%20version%29%20.pdf>

¹⁴ DNCC and DSCC (information received from the conversation with the officials)

¹⁵ [http://www.pertanika.upm.edu.my/resources/files/Pertanika%20PAPERS/JSSH%20Vol.%2028%20\(2\)%20Jun.%202020/09%20JSSH-4191-2018.pdf](http://www.pertanika.upm.edu.my/resources/files/Pertanika%20PAPERS/JSSH%20Vol.%2028%20(2)%20Jun.%202020/09%20JSSH-4191-2018.pdf)

3.1.2 Specific observations

Livestock productivity 
a. About 70% of the rural households (smallholder and landless farmers) are directly or indirectly engaged in livestock production¹⁶. b. A wide yield gap exists between traditional, intensive and semi-intensive farming¹⁷. There is a lack of space and physical security for animal resources.
Product marketing 
a. Strong backward (with the producers of the animals) and forward (market and consumers) links must be established through the modern slaughterhouse (including upgraded wet markets). b. Reducing production costs is the biggest challenge for industrial processing (current average wet market beef price – BDT 500-520 per kg¹⁸) while high customs fees and energy prices lead to increased overheads.
Capacity building 
a. The butchers (around 5,000 licensed¹⁹) and slaughters are not aware of any legal necessity to carry out animal slaughter in a location that has been authorized by the government. b. There is a lack of resources, butcher training and lab facilities at the municipal or city corporation level. New challenges caused by globalization, trade liberalization and WTO regulations require policy and institutional reforms of the DLS and its functional arms.
Financial services and investment opportunities 
a. Low investment in livestock research and poor management of available resources are matters of major concern. b. Producers, traders, slaughtering units and meat processing facilities lack access to credit.
Climate-smart technologies 
a. Animal disease is the cause of nearly 50% of mortality and there is a lack of technological know-how in adaptation and mitigation against climate risks²⁰. b. There is a lack of refrigeration facilities and cold chain services to increase the shelf-life of meat and reduce losses.

¹⁶ Barua, P., Rahman, S.H. and Barua, M. (2021). "Sustainable value chain approach for livestock-based livelihood strategies for communities of the southeastern coast of Bangladesh", Modern Supply Chain Research and Applications, Vol. 3 No. 3, pp. 191-225. <https://doi.org/10.1108/MSRA-08-2020-0021>

¹⁷ BBS (2020) does not define farm categories. However, Zaman et al (2010) defines landless holding <0.2 ha; Marginal 0.2-0.5 ha; Small 0.5 – 1.00 ha; Medium 1.01 – 2.00 ha; Large > 2.0 ha; pg. 40.

¹⁸ source: Field survey and personal interviews, 2022

¹⁹ Estimated figure

²⁰ Based on the study made by Bangladesh Institute of Development Studies

3.2 Value chain analysis report (D#3)

3.2.1 General observations

- Livestock provides direct employment for 20% and indirect employment for another 50% of the population²¹.
- As per estimates of Bangladesh Bureau of Statistics (BBS) 2020, there are about 2.6 million cattle farms with an average herd size of 1–3 cows. Cattle density of 282 large ruminants/km² puts pressure on the country's already limited feed supplies. Crossbreeds are getting popularity because of higher milk yield²².
- The preference ranking of livestock by producer with respect to profitability, convenience, cash flow is provided in figure 7.
- Key statistics on households with livestock is provided in figure 8.
- Bangladesh gained self-sufficiency in the production of eggs and meat during the seventh five-year plan period from 2016 to 2020 (DLS, 2021).
- The gap between demand and production of milk is narrowing while the current gap is managed by import milk and dairy products.

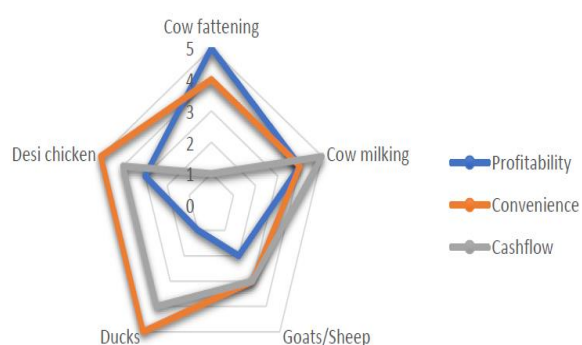


Figure 7. Preference ranking by producers

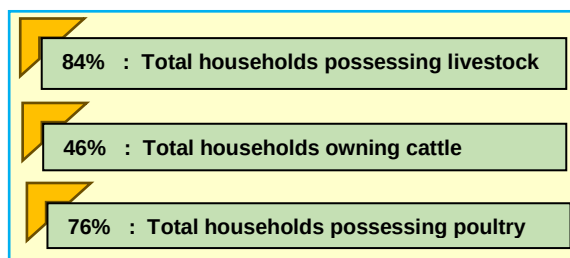


Figure 8. Key statistics on households with livestock²³

3.2.2 Specific observations

Livestock productivity 🐮

- The average milk output of indigenous cow is around 1.9 liters per day and that of crossbred cows is around 6.48 liters per cow per day. Local cattle typically weigh between 125 and 150 kg for cows and between 250 and 400 kg for bulls.
- Cattle breeding programs have greatly improved through the usage of deep-frozen semen used for artificial insemination. Commercial-scale cattle fattening for the production of beef is done, especially in Gazipur, Mymensingh, Sirajganj, Rajshahi, and Pabna.
- Goats also provide meat, milk, and skin in Bangladesh.

Product marketing ⚙️

- There are currently more than 20 significant dairy companies. The dairy industries have built a network of milk hubs in the country. Currently, 300 cooling units with a combined capacity

²¹ <http://www.dls.gov.bd/site/page/3dd01de1-e39e-46b6-acad-b997330af39e/->

²² BBS (2020) does not define farm categories. However, Zaman et al (2010) defines landless holding <0.2 ha; Marginal 0.2-0.5 ha; Small 0.5 – 1.00 ha; Medium 1.01 – 2.00 ha; Large > 2.0 ha; pg. 40.

²³ [Livestock - Banglapedia](#)

of 1,057,026 liters/day (LPD) are held by Milk Vita, PRAN, Aarong, EON, and Akij. Chilling units are mainly located at Rajshahi and Dhaka areas²⁴. b. Low purchase prices (BDT 40 against production cost of BDT 43) act to discourage farmers to supply good quality milk for industrial processors. c. In 2018-19, 150 lakh tons of milk powder (worth BDT 2,800 crore) were imported and 99 lakh tons of the dried dairy product were produced locally (BBS). d. The major mode of trading livestock by the producers are through contracted customers, walk-in customer at the farm gate, village 'haats' (market) and local/village traders.	
Capacity building	
a. Insecure livestock ownership, lack of access to inputs/information, and lack of extension services/credits are just a few of the challenges women encounter while trying to participate in the market. Appropriate interventions can influence the livelihoods of women livestock keepers and their families by (i) securing current and future assets, (ii) sustaining and improving the productivity of agricultural systems, and (iii) facilitating greater market access.	
Financial services and investment opportunities	
a. Major banks provide short-term loans for beef fattening. Majority of the producers (56%) use their own capital, 24% take loans from banks and the remaining lent from other sources²⁵. b. Innovative approaches to financing are lacking in the market as the bank considers the livestock sector risky. There is a large potential for climate finance for livestock which is untapped in Bangladesh.	
Climate-smart technologies	
a. Bangladesh is the 33rd most vulnerable country and the 25th least prepared country, indicating that despite its high vulnerability, it is not equipped to avert or mitigate the effects of climate change (MoFA, 2018)²⁶. b. There are proven mitigation options available, such as supplying better quality animal feed to lower methane emissions or effective land management to promote carbon absorption, including soil restoration, better waste management practice, energy efficiency, renewable energy production.	

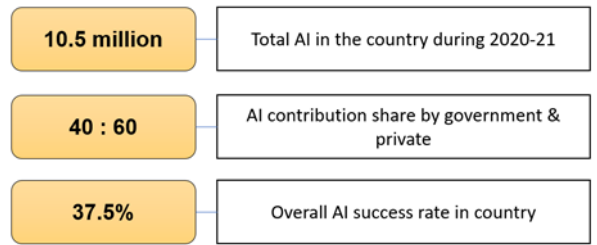
²⁴ From response of companies.

²⁵ Rahman, Zaina & Hossain, Mohammad & Hashem, Md Abul & Azad, MAK & Khatun, Hafiza. (2013). Factors Related to Small Scale Beef Fattening Programs in Dinajpur District of Bangladesh. Progressive Agriculture. 23. 10.3329/pa.v23i1-2.16563.

²⁶ MoFA (2018). Climate Change Profile: Bangladesh. Ministry of Foreign Affairs of the Netherlands P.O. Box 20061 | 2500 EB The Hague | The Netherlands www.government.nl/foreign-policy-evaluations

3.3 Livestock and dairy business structure analysis report (D#4)

3.3.1 General observations

a. About 100% foreign investment is allowed in the dairy sector, and repatriation of profit and capital is allowed. b. The details of artificial insemination infrastructure are provided in figure 9 and key statistics of artificial insemination is provided in figure 10. c. Shortage of fodder and high price of concentrate/compound feeds are the major constraints. Around 290 registered feed mills with a capacity of 8-12 tons compound feed per hour is operating in the country²⁷. d. Green grasses, silage, and Total Mixed Ration (TMR) are the emerging micro level business in the rural and peri-urban areas. e. Inadequate health care and veterinary services are serious constraints to sustainable livestock development in the country. f. Inefficient business and market structure is one of the reasons for uncompetitive prices of milk and meat in the country.	 Figure 9. Artificial insemination infrastructure  Figure 10. Key statistics on artificial insemination²⁸
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3.3.2 Specific Observations

Livestock productivity 	
a. Few private farms use modern facilities and technologies along with pure breed mainly HF which yields 3,500 to 4,000 liter/lactation period. Number of bigger commercial dairy farms and beef fattening farms are emerging with increased herd size and improved level of mechanization.	
Product marketing 	
a. Most of the producers engaged in the livestock and dairy sector are individual unregistered sole proprietors. Around 538,000 liters of milk is procured by 18 dairy companies through middlemen²⁹. b. Bangladesh Milk Producers Co-operative Union Limited (BMPCUL) is the central union of 345 Primary Milk Producer's Co-operative Societies with a collective membership of about 40,000 milk-producing farmer-members. BMPCUL markets milk & milk products under the brand name Milk Vita.	

²⁷ DLS (2022). Department of Livestock Services, Ministry of Livestock and Fisheries, Bangladesh.

²⁸ DLS (2021). Department of Livestock Services, Ministry of Livestock and Fisheries, Bangladesh.

²⁹ Annual reports of different dairy processing companies

- c. Bangladesh's milk and meat products are not competitive in South Asia or the global market. Buffalo milk is marketed in limited areas whereas goat milk does not enter the market and is utilized by the farmer itself.
- d. Increase in concentrate feed price (30 to 40%) in recent months has increased the milk production cost (BDT 60-65 per liter) whereas the sales price is low (BDT 55-60 per liter).

Capacity building



- a. In upazila level, for almost 0.7 million animals of 200 villages there are only 1-2 qualified veterinarian(s) along with 2-3 para veterinarians of DLS. Further, the veterinary service is hospital based and is inconvenient to farmers (LDDP, 2022).
- b. The government has prioritized goat farming and established 5 farms to provide farmers with pure breed of black Bengal at subsidized price. However, sheep production is neglected in the development activities.

Financial services and investment opportunities



- a. Cooperatives are suitable for businesses where external equity requirement can be met by share subscription of members, or donations by government, bilateral and multilateral agencies and philanthropic organisations.
- b. There is an escalation in cattle feed cost (50%), veterinary medicine cost (25%), labour cost (100%) and utility bill cost (200%) in last five years³⁰.

Climate-smart technologies



- a. Livestock disease and its outbreaks is the major issues in livestock production. High incidence of endemic Mastitis in dairy herds is key reason for poor milk quality.
- b. Raw materials produced for concentrate feed are insufficient in the country and most of the protein source and some corns are imported.

3.4 Farmers capacity development report (D#5)

3.4.1 General observations

a. Government initiatives in capacity building of staff and livestock farmers resulted in making the country self-sufficient in meat and eggs. Further, the initiatives also helped to boost milk production. However, due to the unfavourable and occasionally hostile environment, the farmers' and other stakeholders' capacity growth is not sustained. b. Location of available training centers and other capacity development institutions in the country are provided in Figure 11.	
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³⁰ <https://www.dhakatribune.com/commerce/2022/05/11/why-is-beef-so-expensive-in-bangladesh>

- c. The training centres are not able to function because of budget, quality trainers and lack of standard.
- d. Due to lack of technical capacity, specific challenges related to animal genetic resources, value chain analysis and development of entrepreneurship and institutional leadership at community, producer, and market organization levels persist.
- e. Farmers field school (FFS) also called as “school without walls” was introduced by LDDP and around 4,500 livestock Producer Group (PG) were trained and still running smoothly.

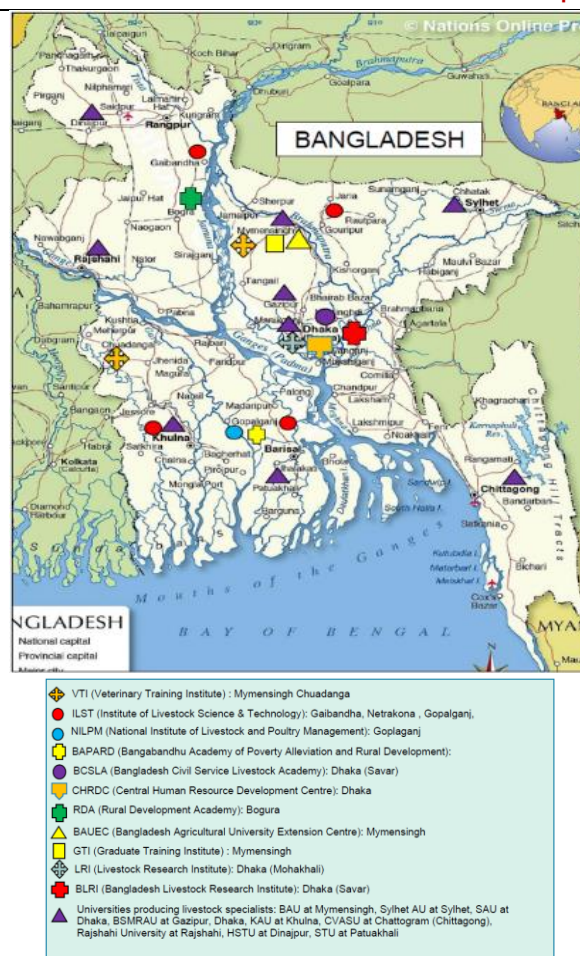


Figure 11. Training centers & other capacity development institutions

Table 6: Capacity of DLS at a glance

No.	Location	Cadre	Non-Cadre	Total
1	Division level Office in 8 divisions	46	54	100
2	DLO office in 64 districts	502	333	835
3	ULO cum Veterinary Hospital in 492 upazila	4,880	421	5,301
4	Union Livestock Service Centre in 4554 unions	0	2,017	2,017
Total		5,428	2,825	8,253

3.4.2 Specific observations

Livestock productivity 
a. Since the late 1970s, the youth training centers (YTC) have been useful tools in helping young people in the livestock production by developing their ability in self-employment, entrepreneurship, and other associated jobs. b. One of the barriers identified is the poor technical knowledge of feeding, breeding, management and disease control.
Product marketing 
a. The gaps in capacity on different levels have led to • high price of concentrate feeds and scarcity of forage • lack of/weak livestock monitoring system, prolonged postpartum anoestrus³¹ and repeat breeding • high incidence of diseases • lack of organized marketing system making credits offering risky • lack of enabling policies for sustained growth
Capacity building 
a. 3 days in-country training to 39,000 livestock farmers and 7 days abroad training to 480 livestock officials were provided under National Agricultural Transformation Programme (NATP) between 2010 to 2022. b. Under the Integrated Agricultural Productivity Project (IAPP), DLS trained a significant number of women in livestock rearing giving emphasis on goat rearing technology during 2011 to 2016. c. There is a total gap of training to the milk/meat/ sweat meat marketers on business plan and financial management.
Financial services and investment opportunities 
a. Performance, motivation and capacity of the extension workers at the union level are limited by lack of resource availability (i.e., fund, insufficient transport, communications, and office). b. Physical condition of DLS institutes is not good and needs maintenance to continue service. Resources like land are not used due to shortage of fund. However, large new establishment (NIPM) is underutilized due to lack of adequate programmes, funds and manpower.
Climate-smart technologies 
a. Some key areas of livestock sector such as climate smart livestock production, better livestock waste management, fodder conservation and marketing lack practical training. b. There is lack of hygienic milk handling, milk cooling, cold chain maintenance in milk handling and milk marketing. There is limited access to information and communication technology resources to link farmers with technical needs and market information.

³¹ After giving birth, all females go through a period in which they do not experience estrous cycles; this is known as postpartum anoestrus.

3.5 Critical structure and grant modality report (D#4)

3.5.1 General observations

- a. Matching grants have been used by the LDDP as an instrument aimed to stimulate private investment in livestock development. The beneficiary makes the upfront expenditure, a part of which is reimbursed as grant by the LDDP.
- b. It is observed that there has been an enormous response from the private sector (large and medium) to invest for the livestock business establishment/development.
- c. The process of circulation of EoI, evaluation of application and business proposals were systematic and methodical.

3.5.2 Specific observations

- a) LDDP has an outlay of USD 29.84 million for distribution to 2,413 beneficiaries across the country except three hill districts. There are 9 packages of matching grant for which the applications were invited: 4 on feeds, fodders, TMR and feed mills, 4 on milking, milk collection and processing, and 1 on climate resilient manure enterprise³².
- b) In each package it was mandatory to spend at least 60% by the applicant (beneficiary) and matching grant contribution of the government is 40% for small and medium scale beneficiaries and 50:50 for large scale entrepreneur's.
- c) Request for expression of interest for all packages were placed in local newspapers in different lots. The submitted applications were evaluated and the shortlisted candidates were called for orientation on business plan. A total of 527 prospective matching grant applicants under different packages were provided 4 hour orientation package by package.
- d) The business plan submitted by the shortlisted applicants were evaluated by the experts and thereafter finalized by the Grant review committee (GRC) and offering letter were issued by LDDP. Final selections were made through physical verification of the equipment and other business activities at the individual business site by the DLS officers.

3.6 Partnership development report (D#7)

3.6.1 General observations

- a. In Bangladesh, there are well-established partnerships in sectors other than livestock, which need standardisation and maybe modification (if necessary) to use in livestock sector. Some of the ongoing partnership models are working well in some locations but is not significantly benefiting the smallholder producers at the ground level.
- b. The goal of transiting to a developed country status by 2041 will require investments in infrastructure, larger provisioning of livestock and extension services and access to finance for working capital and asset creation.
- c. The PPP approach till now proved to be one of the most efficient instruments to blend the technology and enabling policy to transform the rural economy in the country. In the livestock sector, PPP type of partnership is rare. Most of them are contracts growing between a private company and the producers, or between two companies. Therefore, it

³² Source: Communication from PMU, LDDP.

has become imperative to introduce broad types of partnerships in the livestock and dairy sector that can boost the productivity and profitability of the livestock business.

- d. The private sector often perceives working directly with smallholder producers as non-remunerative, costly and wasteful. While smallholders often accuse private companies for offering low prices and stiff conditions they cannot cope with.
- e. The 4P approach, popularized by the International Fund for Agriculture and Development (IFAD) is a locally implemented approach through national governments stresses strong inclusion of local (sub-national) governments, private companies and producer organizations as equal partners.

3.6.2 Specific observations

Livestock productivity

- a) The analysis of the current initiatives of the national government for the livestock and dairy sector shows that the government support to private investments and promote producer groups of small farmers has started yielding good results and fostering growth in the sector to some extent but still there are gaps in terms of maximizing the value involved in the entire value chain.

Product marketing

- a. Producer ownership to many 4P initiatives have plagued their after-project sustainability. Due to elite capture and corruption, many 4Ps loose transparency, and remain unaccountable to the partners.
- b. Milk Vita has organized 345 primary cooperative societies of dairy farmers. This has been hailed as a successful model which has ensured the livelihood of numerous smallholders along with a large increase in milk production in the country.
- c. The women milk cooperative of Panjor Bhanga in Northern Bangladesh is a positive example of partnership among the stakeholders.

Capacity building

- a. In pursuit of Bangladesh Vision 2041 and national sectoral goals, the government of Bangladesh is supporting collaborations among, public, private and civil society organizations to establish an enabling atmosphere through liberalizing its present policies so that the benefits of the development percolate to the small producers and entrepreneurs in the livestock and dairy sector.
- b. In recent years, emphasis has been shifted over to decentralizing veterinary and extension services, cost recovery, and introduction of contractual services.

Financial services and investment opportunities

- a. The PPP frameworks provide important instruments for attracting investments. Potentially, it is a viable means to effectively address constraints of financing, managing and maintaining public goods and services.
- b. It was observed that the Public-Private Partnership Authority (PPPA) under the Prime Minister's Office is a catalyst to proactively realize PPP projects in Bangladesh.
- c. Large size partnership funds are available to support PPP projects such as a) PPT Technical Assistance Fund (PPTAF), b) Viability Gap Fund (VGF) and c) Bangladesh Infrastructure Finance Fund Ltd. (BIFFL).
- d. The Inclusive and Equitable Local Development Programme (IELD) is a joint global initiative of UNCDF, UNDP and UN Women.

Climate-smart technologies

- a. It was recognised by the policy makers that large ticket investments is needed in developing climate smart infrastructures in the areas of mass production of vaccines, animal feeds, breeding, processing, marketing, and exporting quality livestock products.

4. Learning from Bangladesh and international experience

This chapter discusses the summary of best practices in the key areas of the livestock sector for its desired level of development. It has been based on the current successful practices ongoing in Bangladesh as well as the lessons learned from the practices that are available abroad but might be suitable (even after modification) under Bangladesh conditions. The key focus areas are: Productivity improvement, Product marketing, Capacity development, Finance and investment and Climate resilient livestock production.

4.1 Productivity Improvement

Low productivity of the native animals, shortage of feed and fodder, high incidence of diseases, inadequate extension coverage, lack of technical skills and finance, poor hygiene of milk and meat and climate change effects are the major constraints in the improvement of livestock productivity in Bangladesh. To increase the production efficiency of livestock and dairy, some of the existing practices in livestock management need to be refined, changed, and improved. Annexure 13 presents the best practices for livestock productivity in the country and annexure 14 discusses the key biosecurity and biosafety risks and mitigation measures.

4.1.1 Current situation

The government's livestock department (DLS) and private sector including NGOs have taken various initiatives with the funding of government as well as international development partners during the last two decades. Under those initiatives there have been improvement in provision of technical training, increased AI service for breed improvement, fodder production and feeding, better veterinary services, and access to modern technology to the farmers. Additionally, the government has increased its investment in livestock research, development, and extension services to enhance productivity and efficiency in the sector. As a consequence, the country has achieved good progress in all subsectors of livestock. The poultry sector has seen a revolutionary development during the past decades due mainly to the initiatives from the private sector entrepreneurs along with the government contributions. Milk production has increased by three folds during the last two decades because of the government as well as private sector initiatives. Progress has also been made in meat and egg production during this period.

Despite the above development progress, the productivity of the livestock sector in Bangladesh is still lagging behind due to several challenges, such as poor management practices, inadequate infrastructure, lack of skilled manpower, and limited access to quality inputs and services. The livestock products cannot fulfil the demand of the growing population. Milk production is yet 35% deficient compared to demand. Although considerable improvement has been achieved in meat and egg production, practically these products are out of reach of the rural smallholder people. There has been considerable progress in AI activities in the country, still the percentage of cross-breed animals in the country is only 30-35%. There is feed shortage in quantity and quality, marketing systems need to improve, bank loan is cumbersome for the farmers and entrepreneurs. There climate borne disasters are hindering production improvement and so on.

4.1.2 Gap in productivity improvement

- **Inadequate advanced knowledge and technology:** The livestock sector of Bangladesh still largely depends on traditional methods and practices. There is a lack of modern technology adoption and advanced knowledge about efficient livestock management and production systems, which limits the scope for productivity improvement.
- **Insufficient infrastructure:** The livestock sector lacks proper infrastructure, such as processing plants, storage facilities, and transportation networks. This hinders the ability to move livestock products to different locations and limits the shelf life of animal products.
- **Inadequate research and development:** The research and development in the livestock sector of Bangladesh is limited to a few public and private organizations. There is a need for more research and development in areas such as breeding, nutrition, health, and disease management to enhance productivity.
- **Poor access to credit and finance:** Access to credit and finance is challenging for many livestock farmers, especially smallholders. The high cost of feed, vaccines, and other inputs, coupled with limited access to finance, reduces the capacity for investment in livestock production.
- **Lack of quality training and extension services:** Livestock farmers in Bangladesh are often not trained or provided with extension services. This limits their knowledge and skills about efficient animal husbandry, which can influence the productivity of their livestock.
- **Climate change and natural disasters:** Climate change and natural disasters like flooding and drought can severely impact livestock productivity in Bangladesh. These events reduce the availability of feed and water, increase the incidence of disease, and affect the health of breeding animals, leading to a decrease in productivity.

4.1.3 Suggested improvement

- **Strengthen and expand extension services:** The existing extension services is very weak as the husbandry experts are very few in the field, so more experts and workers should be employed. The services should be expanded to reach more farmers, particularly in remote rural areas. DLS and NGOs should do this job. Strengthened extension services for the livestock sector can provide information/techniques on best practice in animal husbandry, disease prevention, market analysis, livestock production practices, and connections to technical knowledge.
- **Improve access to training and knowledge:** Quality of training must be good and be access to all farmers as many farmers need but lack formal training in animal husbandry. Providing opportunities to farmers for training and education in areas such as animal breeding, nutrition and health, and marketing can enhance their knowledge and skills and improve the productivity of their livestock.
- **Improve access to credit and finance:** Providing farmers with easy access to financial resources such as loans, grants, and subsidies can help to better feeding to

livestock, buy better genetics, and improved management system, enhance productivity of their livestock, and improve the overall quality of their livestock products.

- **Invest more in research and innovation:** Research and technology development are critical for improving the productivity, profitability, and sustainability of the livestock production. The government and private sectors should invest more in research that addresses key challenges in the sector, such as breed improvement, feed and feeding techniques, disease prevention, and value chain development. Research partnerships between government, academia, and industry can help to produce more impactful and relevant research.
- **Encourage and facilitate private sector services:** The private sector has proved remarkable contribution in the development of poultry and dairy subsectors in the country. Also private sector and NGOs are contributing a lot in expanding AI for breed improvement. Therefore, the government should support the development of private sector services to enhance their reach and quality, and to incentivize private sector investment for sustainable productivity of livestock. They should be encouraged and given facilities in the areas such as breed improvement through AI, feed and vaccine suppliers, health service providers, and market intermediaries.

4.2 Product Marketing

4.2.1 Current status

The national government is currently focusing on improving the efficiency in production of livestock and dairy animals through intervention in production technologies and linkages (backward and forward). However, these intervention lacks product marketing support and value chain development through improved business development services (BDS) which resulted in low access to formal market by the rural producers. However, the dairy and poultry sub-sectors in Bangladesh has shown better results in terms of marketing of their products and linking the producers with the value chains actor mainly due to the investments made by the private sector. But in cases other than private sector, marketing system is highly unorganised particularly for milk, the farmers are selling milk at very low price at the farm gate but the consumers are buying at high price because of the influence of middlemen. In Bangladesh, several agro-farms like Kazi Farms, Paragon, Purnava, and Omega have sprung up in the past few years and they are selling branded eggs on the domestic market. But Bangladesh has only one branded meat processing industry called Bengal meat. However, there are some super shops like Protein Market, Royal Meat, Shwapno, Agora, and Unimart, that sell prepared poultry and meat through their physical stores and online shops. Apart from these, agro-businesses like CP and Kazi Firms are also selling ready-to-eat and ready-to-cook meat. This is however not the case with other animal products where the value chain has not been developed due to lack of policy and investment support.

4.2.2 Gaps in product marketing:

The livestock and dairy sector in Bangladesh have demonstrated its strong presence with a fast-growing market for meat and dairy products. The government of Bangladesh through the department of livestock services (DLS) has deployed great efforts in bringing this subsector into the centre stage through various interventions. According to the DLS, Bangladesh is

currently self-sufficient in livestock production³³. Despite the increase in production, the livestock and dairy industry has not been able to fulfil the domestic requirement yet. For example, currently, the per capita availability of milk stands at 175.63 ml/day whereas the minimum recommended daily intake is 250 ml. This shortfall implies that self-sufficiency in the dairy sector is still outlying and a testimony that the value chain is not inclusive as there are reports of postharvest loss³⁴ and the small farmers in accessing the national level markets. There is a huge gap in provisioning inclusive marketplace for the small producers which needs immediate attention.

In Bangladesh, there is a significant seasonal effect on milk production and price. In the lean season, particularly when good quality green fodders are scarce, the milk production decreases comparing to flush season when the fodders are available. Production is also affected by concentrate feed availability and its price. Not only production, seasonal variation also affects fat content, SNF (Solids-not-fat), TS (Total Solids), specific gravity and other qualitative parameters of milk. Variation of milk yield and quality also are affected by different agro-topographic zones of the country which again varies with the rainfall, weather/climate and feed availability. As per research findings, it was observed that highest milk production is in the month of February (10.01%) and lowest in September (6.46%) and milk production gradually increases from the month of September to February³⁵. Variation in raw milk production may also be affected by breeding season, stage of lactation, feeding management, seasonal flood and so on. Milk wastage in Bangladesh happens due to inadequate milk sales network, lack of required short term preservation technology, lack of awareness of hygienic milk production & collection and above all inconsistency of market volume and milk price in the flush season. Market price of milk is determined by the formal sector of milk processors and depends on fat content and specific gravity of milk. As the season has effect on milk quality (e.g., milk fat content), it also has effect on price. On the other hand, in the informal market no standard milk pricing is adapted. The milk processing companies in Bangladesh procure raw milk from their enlisted dairy farmers from BDT: 50 to 75 (+/-) depending on the fat content and other qualitative parameter.

4.2.3 Best practices

- Attract young entrepreneurs:** The government of Bangladesh through its various schemes attracting educated unemployed youth in Bangladesh in raising poultry and cattle rather than looking for employment. According to available information, there are about 5000 modern cattle farms in and around Dhaka which are run by young entrepreneurs. According to the data published by the DLS, there were 377,000 cattle farm owners in 2017 which increased to 577,416 in 2019. Only 57,000 of the farms are registered with the government so far. Around one million young people are associated with cattle farms in the country. The government should attract and facilitate these youngsters so that more become interested in this business.

³³ The production of meat, milk, and eggs in the country has increased continuously every year for the past decade. In FY 2021-22, about 131 (130.74) lakh metric tons of milk, about 93 (92.65) lakh metric tons of meat, and more than 2335 million eggs were produced in Bangladesh.

³⁴ The postharvest loss meaning hereby is wastage of the milk and other animal products after they were produced at the farmer household and no market to sell.

³⁵ Azad, M.A.K., 2001. MS research thesis entitled "Milk production trend of Bangladesh Milk Producers' Co-operative Union Ltd. (Milk Vita) throughout the year".

- **Use of Mobile Vans:** The mobile vans/cool vans are being used in many countries to sell livestock and dairy products. The DLS, in collaboration with the city corporations of Dhaka, Khulna and major cities of the country started to use mobile vans to facilitate supply/deliver the livestock products at the doorstep of the citizens during the COVID-19 pandemic situation. This is an example of best practices in marketing the products of the small farmers during an emergency/disaster situation as the smallholders are not able to access the markets due to lockdown in many parts of the country.
- **Digital marketing and e-commerce:** The rapid growth of the digital platforms and the e-commerce market in developing countries such as India, Indonesia, and Malaysia offer strong opportunities for online sales of animal product with special reference to meat in the Asia-Pacific region. Some of the good practices of these countries can also be scaled up in Bangladesh. The rural producers will get access to the urban markets where the consumers are increasingly prioritizing services that offer convenience and time savings. Online meat start-ups have adopted the '*farm to fork*' model, through which stock is procured directly from the farmers to ensure that consumers receive fresh meat grown sustainably and without the use of antibiotics or growth hormones.
- **Improvising the market:** The private sector companies in Bangladesh are using fictional characters, celebrities, or experts (such as doctors) to sell animal/dairy based products, while some others use specific statements or "health claims" through "fortification process" to improved nutritional value that of using a particular product. Currently, about one-fourth of all television commercials are related to food, and approximately one-half of these are selling snacks and other foods low in nutritional value. This system of improving marketing livestock products should be further strengthened and improvised.
- **Expand product range:** Future interventions in the livestock and dairy sector should consequently be market or demand driven and thus promote general economic development. This needs to be supported by expanding the product variants to attract a range of consumers. For example, the primary product in dairy industry in Bangladesh is liquid milk, however, the most important players in the market (Milk Vita, Aarong etc.) came out with various milk value added products such as cheese, powder milk, Ghee, butter, ice cream, yogurt, etc. to attract market demand.

4.3 Capacity Building

4.3.1 Current status

Capacity development initiatives are implemented by DLS and private sector including NGOs. The DLS runs BCS Livestock Academy, Officers Training Institute, 4 Institutes of Livestock Science and Technology (ILSTs), 2 Veterinary Training Institutes (VTIs), 2 veterinary colleges, one NILPM, and a chain of diagnostic laboratories. Under these training institutes the officers, farmers, extension workers, LSPs are getting training as and when necessary. Other collaborating institutes are: Youth Training Centres in Gopalganj, Mymensingh, Bogura, Rajshahi, and Sylhet; Bangabandhu Academy for Poverty Alleviation and Rural Development (BAPARD), Gopalganj; Rural Development Academy (RDA), Bogura; and Bangladesh Academy for Rural Development (BARD), Cumilla.

Extension package of DLS officials under the National Agricultural Transformation Programme (NATP) initiated in 2010 and completed in 2022, trained 39,000 livestock farmers for a period of 3 days and 480 livestock officials got training abroad. Another capacity building program of DLS under Technical Assistance (TA) component of Integrated Agricultural Productivity Project (IAPP), significant number women were trained in goat rearing technology in the year 2011 to 2016. The LDDP has utilized the services of other collaborating institutions for delivering 21day induction training of LSPs. In the recent past LDDP has introduced Farmers Field School (FFS), is a participatory method for technology development and dissemination. The FFS gave training of 25–30 farmers, both male and female, on theoretical knowledge and hands-on activities on livestock production system. Under the leadership of LDDP a comprehensive training of farmers (4500 livestock producer group) is running smoothly.

4.3.2 The limitations in capacity development

Despite some progress achieved in capacity development, livestock sector still faces various challenges. Capacity development of livestock farmers and related stakeholders is not addressed in a systematic manner. Capacity building at organizational level is addressed but not effectively and that of enabling environment level are seldom addressed. Only training is considered as the prime means for capacity development. Other tools that have been implemented for the farmers are: Uthan *baithak*, which is being practiced regularly, some exposure visits, discussion meetings and workshops for extension workers.

The limitations in the capacity development in livestock sector are listed below:

- Current trainings are unable to meet the required quality standard in terms of lack of practical demonstration, effective evaluation system, effective resource persons etc.
- Less emphasis on training need assessment (TNA) and analysis before training for skill development.
- Most of the training programs are not need-oriented and market driven, for example, entrepreneurship development, business plan development, small-scale business techniques, climate change resilience etc. are absent.
- No follow-ups for performance appraisal after providing skill development trainings.
- Poor coordination between government and private/NGO training organizations and lack of collaboration/partnerships development.
- Revenue budget is scanty (e.g., BDT 30,000 per year in district DLO office) and heavily dependent on project funding for which no regularity in the training programme, no calendar of training maintained.
- Poor data-base for skill development in different areas/aspects, resulting in repetitions, incoordination, poor follow-ups, poor quality etc.
- Capacity building at the organizational level is not given enough importance and at enabling environment is ignored.
- The HRD section of DLS has no power of supervision, monitoring or evaluation of training, responsibilities of management, and performance appraisal.

4.3.3 Improvement suggested

Establish quality training system: Capacity building efforts should aim to transfer knowledge and skills to livestock farmers and other stakeholders through various training programs, workshops, and seminars. For effective training for capacity building the following should be ensured:

- a) The titles of training must be need-based and demanding
- b) The trainees should be properly evaluated for skill development
- c) Learning topics should be taught through practical demonstration
- d) The trainers should be well experienced and efficient
- e) Provision for sufficient budget allocation
- f) Training institutes that needs refurbishments should be done on urgent basis.

g) NILMP be given attention for manpower, budget and programmes.

RDA has been offering quality training for capacity building of various stakeholders in livestock sector.

A detailed feasibility study has been provided in the Slaughtering facilities report (Report #2; pages 52 - 64). Annexure 15, 16 and 17 presents the business model for slaughterhouses. These annexures are addition to the mentioned feasibility report here.

A detailed analysis of dairy milk, beef fattening, small ruminants, backyard poultry have been furnished in section 6.0, Analysis of selected Value chains of Value Chain Analysis report (Report #3, pages 9-32). Annexure 18 presents the model analysis for VMCC.

Title of practice: Training for capacity development

Country: Bangladesh

Organisation: Rural Development Academy (RDA), Bogura

Facilities available and activities: The RDA is located in 20 km north of Bogura town and established in 46.5 hectares of land in the year 1974. Out the total area, 29.50 hectares is earmarked for demonstration for undertaking field research in paddy cultivation, horticulture, floriculture, poultry, dairy, pisciculture, and solar energy. They have dairy farm, poultry farm, AI laboratory, biogas plant, fodder field and all modern facilities for training. Since 1974, RDA is providing very good technical training for both officials and non-official members of the government, private sector and civil society. The faculty of the Academy consists of multiple academic disciplines. The Academy has a strength of 304 personnel - 61 Faculty Members and 203 support staff. The quality of training is excellent following all the requisites of an ideal training, having experienced and knowledgeable trainers. They also conduct need-based research on livestock production and health including all disciplines of agriculture. The RDA hosts the training of internee students of the animal husbandry and veterinary disciplines of agricultural universities as and when spaces are available.



- **Develop community-based livestock development organisation:** Kenya has formed community-based livestock development organisation called Kenya Livestock Marketing Council (KLMC) which is working to enhance capacity of local livestock keepers through education and training. This approach can be adopted in Bangladesh.

Title of practice: Community-based capacity development

Country: Kenya

Organisation: Kenya Livestock Marketing Council (KLMC)

Mechanism: The KLMC is an umbrella organization of livestock producers and traders in arid and semi-arid areas of Kenya. It was established in 2000 as a non-profit making services organization to counter the challenges the livestock farmers are facing. KLMC recognizes the fundamental challenge facing the pastoralists is their inability to access better market for their livestock and livestock products. In order to overcome this challenge, KLMC is working closely with other development partners and stakeholders to source for better market for livestock and livestock products and disseminate market information to producers and traders on timely basis within the country, regionally and internationally.



- **Ensure easy access to finance and credit:** The smallholder farmers and entrepreneurs should be provided with easy loans, grants, and other financial resources that will enable them to invest business and improve production and marketing capabilities.
- **Build strong networking and collaboration:** Farmers, livestock extension personnel, private sectors including NGOs, researchers, and policymakers should be brought under one umbrella to share knowledge and resources that will enhance capacity building in all areas of livestock sector.
- **Focus on building capacity at policy level:** Designing and implementing policies can support the development of livestock sector. Therefore, capacity building should involve training in policy analysis, formulation, and evaluation.

4.4 Finance and Investment

4.4.1 Current Status

According to Bank of Bangladesh 54.3 billion BDT (495 USD million) credit was disbursed for livestock in FY 2022. The actual disbursement to livestock sub- sector in FY22 was 44 percent higher than the actual disbursement of BDT 35.3 billion in FY21. Short-term loans accounted for approximately 82.84 percent of the total disbursement while long-term loans for irrigation livestock, and other purposes accounted for the remaining 17.16 percent.

The main sources of finance in livestock are still the state owned banks. The specialized banks viz. Bangladesh Krishi Bank (BKB) and Rajshahi Krishi Unnayan Bank (RAKUB) and six state-owned commercial banks³⁶ are dominant players in the area of livestock and agricultural credit. BKB had the largest share like previous years in annual disbursement mostly due to their vast network of branches in countryside locations.

Microfinance institutions are major source of credit for smallholders. Palli Karma Sahayak Foundation (PKSF), a bulk lender, provided BDT 56.58 billion (523 million) loans to 279 partner organizations (Pos) in FY22, which was BDT 48.32 billion (447 USD million) in FY21. 10% of these loans are utilized for dairy and livestock small business. Another source of microcredit are Grameen Bank and the top five MFIs namely BRAC, ASA, Proshika, TMSS and BURO Bangladesh. In 2022, these six organisations disbursed a total of BDT 1203.04 billion and their recovery stood at BDT 1085.34 billion (10,056 USD million) in FY22. Total overdue loans as a percentage of total outstanding loans of these large MFIs fell to 2.22 percent in FY22 from 4.69 percent in FY21, owing primarily to the pandemic situation of COVID-19.

4.4.2 Gap in Finance and investment

Inclusive, affordable, accessible, gender-friendly finance is one of the most prominent elements for poverty alleviation strategies. Without finance, small holders may not be able to buy good animals, invest in equipment, animal housing, afford veterinary care. For traders, a

³⁶ These banks are Agrani Bank Limited, Bangladesh Development Bank, BASIC Bank Limited, Janata Bank PLC, Sonali Bank and Rupali Bank.

lack of finance may mean that they cannot pay cash when they take delivery of the animals so the smallholder may end up borrowing elsewhere. For small-scale processors, lack of finance may mean they cannot expand their value addition activities. The main gaps observed in Bangladesh are:

- Less than 5% of the livestock farmers receive any institutional credit.
- The ticket size of micro-loans are small and the duration are most of short-term in nature.
- Small and medium enterprises and large livestock farmers with 50+ animals have limited avenues for concessionary finance to expand their business and meet critical viability gap funding for acquisition of technology and product development.
- The financial products are poorly designed requiring high financial literacy, substantial collateral and extensive paper work.
- Only livestock finance, like poultry contract farming and loans to commercial farmers are successful. But this generalised negative perception has reduced interest in livestock opportunities, even though there is still a residual interest to address livestock needs.
- Natural and man-made calamities are under financed. This is a big gap given that climate change induced calamities are on the increase.

4.4.3 Improvements suggested

- a) **Follow cluster approach in promoting microenterprises.** PKSF of Bangladesh has adopted a geographical cluster approach to promote specialisation, economic complementariness, and scaling up along the agri-value chain.

Name of practice: Cluster approach in microenterprise development.

Country: Bangladesh

Financial service provider: PKSF, Bangladesh.

Mechanism: With the help of experts, own staff, farmers, government functionaries and private sector players, PKSF and its partner organisations identify value chains and commodities and services there in. For instance, in Sirajganj, a prominent beef producing area, it identified the need for financing beef fattening before Eid festivities, and setting up veterinary medicine and vaccine hubs. It financed the purchase of quality animals, feed and fodder, and inventory for retail medicine shops. Further, it made arrangements with the Department of Livestock Services for supply of vaccine and private companies for supplying veterinary medicine and accessories. PKSF trained unemployed youth on how to manage veterinary shops.

What made it best practice:

1. Strategic thinking and partnership (government line department, private medicine distributors, local youth to tie up different nodes of the value chains).
2. Identification of commercially viable services while reducing business risk.
3. Technical Assistance (TA) in training retail shop keepers.

Source: PKSF Annual Reports



- b) **Engage the private sector in livestock value chains:** Many banks in Bangladesh in silo. Where lending is integrated in supply chain partnerships, the risks of the lender is reduced. As shown by the example from Equity Bank, Kenya, a loan giving system called Kilimo Biashara (Direct Smallholder Lending). It's working mechanism is that the smallholder lending is integrated into a larger supply chain partnership and

supported by a first loss Guarantee provided by donors. Its features are: strategic partnership (FSP, donors; local agro-dealers, & off-taker) to reduce repayment risk; collateral through group lending, capping loan exposure, and 10% first loss account; vetting of client SHFs is based on local knowledge i.e. by local agro-dealers and Technical Assistance (TA) in financial education and extension services to smallholders to increase financial capabilities & productivity.

- c) **Use of credit guarantees may facilitate bank lending:** Banks in India, much like Bangladesh, feel more comfortable if their loans are backed by recovery guarantees. In July 2023, Government of India rolled out a credit scheme for livestock sector which guarantees coverage of 25% of the loan amount. It is too early to judge performance of the scheme, but it incentivises the banks to lend more.

Name of practice: Credit Guarantee Scheme for Livestock Sector

Country: India

Financial service provider (FSP): Commercial Banks.

Mechanism: Interest subvention of 3%, loan up to 90% of total project cost from any scheduled Bank and National Cooperative Development Corporation.

What made it best practice:

1. Department of Animal Husbandry & Dairying established a Credit guarantee Fund Trust of USD 91 million, which will provide credit guarantee coverage up to 25% of the credit facilities to the MSMEs by eligible lending institutions.
2. The following projects are eligible for the incentive:
 - a) Dairy and meat processing and value addition infrastructure,
 - b) Animal Feed Plant and breed improvement and multiplication farm,
 - c) Animal Waste to Wealth Management,
 - d) Setting up of Veterinary Vaccine and Drugs Manufacturing facilities,
 - e) Individual entrepreneurs, private companies, MSMEs, Farmers Producers Organizations.

Source: Press Information Bureau, 20 July 2023



- d) **Fund not on the strength of balance sheet but reliable fund flows.** Traditional bankers in Bangladesh demand tangible collateral before sanctioning loans. Experience suggests that when lenders attempt to recover their money from the mortgage kept against loans, they find that the security asset is overvalued. These problems are compounded by lengthy judicial process, high litigation costs, and poor enforcement of settlement orders. Property mortgages is unsuitable for small holders. They simply do not have bankable assets to satisfy traditional lending norms. Zambia is showing way to fund livestock keepers on the basis of their cash flows not fixed assets.

4.5 Climate change resilience

4.5.1 Current Status

Three regions of Bangladesh are severely affected by climatic changes: Coastal region in Southern part, Drought hit area in North-Western part and Flood hit area in its middle part. Climate change effects in coastal area are mainly cyclone, storm/tidal surge, salinity intrusion, increased temperature etc. Climate change impacts on livestock is severe as they are killed

directly by cyclone, tornados, heat stress and indirectly affected through reduced feed intake, inadequate feed supply, destruction of houses and most seriously affected by salinity through reduction of land for fodder cultivation. Loss of livestock were: cattle 37,391; goat 59,804 and hen 2,219,328 due to Cyclone Sidr in 2007.

Livestock also contribute to GHG emission. In 2018, the scientists of BLRI reported that GHG emission from livestock was 67 million tCO₂/year and expected to rise to from 70 million tCO₂/year in 2020 to 113 million tCO₂/year in 2050. Furthermore, pollution from slaughterhouse effluents affects water bodies and is a vital environmental concern. Bangladesh is committed to implementing various interventions. National Adaptation Program of Action (2009), Technology Needs Assessment and Technology Action Plans for climate change adaptation (2012), nationally determined contribution to Paris climate agreement (2016), National plan for disaster management 2016–2020 (2017), Bangladesh Delta Plan 2100 (2018), National communications to the UNFCCC (2018), Mujib climate prosperity plan (2021) are key government policies, national adaptation policies, and strategies that are focused on mitigating climate change effects. Not much research has been done in livestock sector on mitigation and adaptation measures against climate change effects. In the recent past development of decision support system (DSS) to provide weather/climate forecasting and automated advisories for livestock farmers has been recommended under the World Bank funded project “Climate Adaptation and Resilience for South Asia (CARE).” The Regional Integrated Multi-hazard Early warning System (RIMES) was implementing the project. However, the GHG mitigation initiatives in the livestock sector were focused on waste management, fertilizer abatement and renewable energy interventions. National Integrated Livestock Manure Management Policy (2018) outlines the emission reduction potential and presents various linkages with other ongoing action plans. IDCOL and LGED are the notable government entities intervening in the livestock sector waste management. Annexure 19 discusses the key environmental issues related to livestock sector and Annexure 20 presents the set of climate-smart technologies for livestock sector.

4.5.2 Gaps in climate change resilience

Climate change and its impact on livestock and contribution by the livestock has not been given importance in the past. Only in the last 2 decades it is being given emphasis due mainly to the demand and conditions imposed by international donor agencies. Sporadic research has been conducted on the impact of climate change on livestock in coastal areas to solve the problems of livestock feeding and shelter and some were done on reduction of enteric methane emission from ruminants and livestock waste management. The important gaps in the sector are mentioned below:

- Inadequate research and innovation on impact of climate change on livestock
- Lack of proper knowledge & education in impact of climate change on and from livestock
- Insufficient mitigation and adaptation technologies for livestock against climatic disasters
- No package form of climate smart livestock farming (CSLF) system/technologies have been developed nor implemented
- Bio-gas technology has not yet been adopted in large scale
- Improper waste management in animal farms and slaughterhouses.
- Total absence of hygiene and standard in the slaughterhouse and wet markets
- Lack of training of butchers and helpers and ignorance of rules of slaughterhouse
- No enforcement of slaughterhouse acts and rules

- Wet markets and slaughterhouses need cooling options for storing frozen meat to reduce wastage and to improve the supply chain quality. Hot water is required for proper hygiene maintenance.
- The milk produced by small-scale dairy farmers is often collected and transported without cooling options. Insufficient cleaning procedures and lack of hygiene cause bacterial growth during storage and transportation at VMCC.

4.5.3 Identified best practices

- **Build Knowledge and awareness about climate change effects:** Majority of the livestock farmers are not well aware of the impact of climate change on livestock, and the contribution of livestock to environmental pollution through GHG emission. Even livestock extension workers are not fully aware of the issues. Therefore, intensive training should be organized for building the knowledge bank of the farmers and other stakeholders working with them on climate resilient livestock management practices including mitigation and adaptation techniques.
- **Encourage to develop community-based approach:** Development of community-based organizations and cooperatives should be encouraged so that farmers can work together in adopting climate resilient livestock production practices and accessing resources. **Ethiopia** has good example of the system. In **Ethiopia** various community-based projects and approaches have been implemented to address the challenges posed by climate change on livestock farming such as: Community breeding program; Training and capacity building; Micro-credit and financial support; Feed and water management during drought; Research and innovation etc.
- **Develop early warning system on weather/climate change:** Improve access to weather forecasting and climate information such as early warning system on weather/climate change so that the farmers can take precautionary measures. The advisory on weather/climate change for the livestock farmers should be developed and distributed well ahead of the incidence of hazard. This would help them make decisions such as moving animals to safer places during flood etc.
- **Invest in research and innovation:** More research and technology development must be encouraged and facilitated to develop climate resistant breeds of livestock and saline-tolerant fodders for adapting with the climate-changed environment. Research should also be conducted on reduction of enteric methane emission from ruminants and better livestock and slaughterhouse waste management. Bio-gas production must be made popular through research for efficient management of waste.



Biogas facility at **Keekonyokie slaughterhouse**

Location: Kiserian, Kenya

150 cattle in a day (average)

10 Mt Waste generated

450 m³ biogas plant capacity

Generate electrical power for the meat cold room, meat processing equipment and hot water for sterilizing and washing the abattoir

- **Renewable energy usage:** Renewable energy usage with backup for milk storage at farms and milk collection centres will prevent spoilage of milk and increase profit & no GHGs.

5. Recommendations

The reports highlighted various aspects in the livestock and dairy development process in Bangladesh. It is clearly observed that there are certain limitations across all activities being faced by the stakeholders. The key limiting factors are (a) disposable resources (economic, social and empowered human), (b) coordination among the partners in development (especially by local government authorities and the private sector), (c) absence of clear vision on implementing the “theory of change” to achieve the desired results, (d) low prioritization of livestock and dairying in some districts due to under-appreciation of its potential for improving livelihoods, (e) lack of systematic feedback cycle on the intervention from the stakeholders, and (f) rationalization of the budgetary allocations to underserved areas which resulted in underinvestment and an overall low contribution of this sub-sector to the real economy.

5.1 General recommendations

Addressing the challenges and barriers identified by the LDDP will contribute to achievement of the Sustainable Development Goals (SDGs) by 2030 and Bangladesh’s Vision 2041. The “theory of change” (ToC) has been a candidate for a more satisfactory approach in this endeavour. Figure 12 provides an indicative ToC recommended to achieve SDGs & Vision 2041 targets.

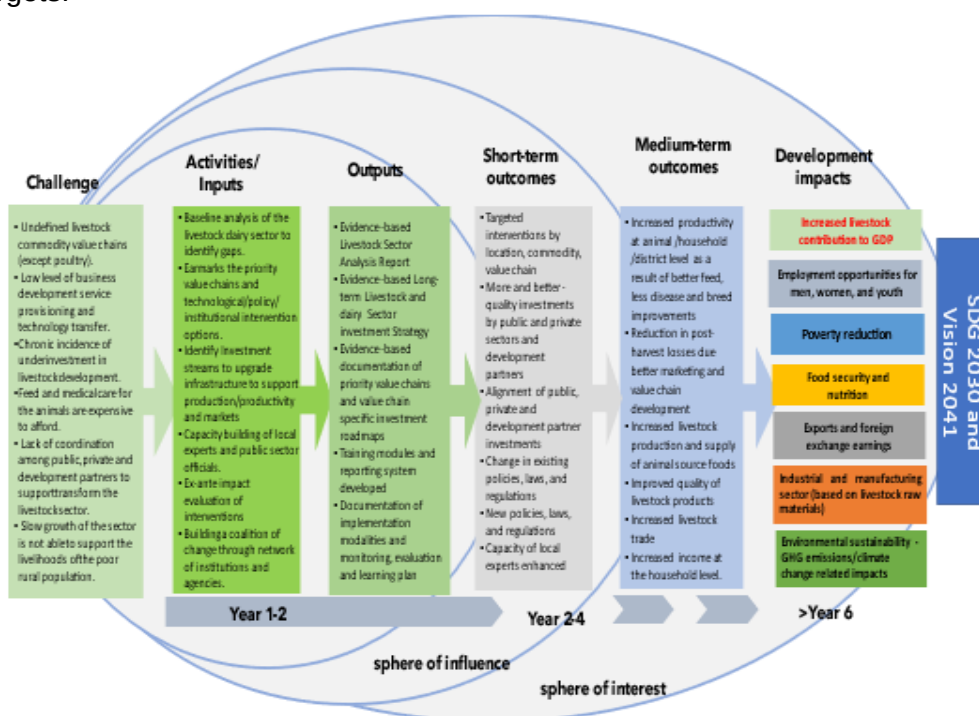


Figure 12: Theory of change to achieve SDGs and Vision 2041

It has key elements of the outcome-based approaches, such as a focus on influencing coordination, institutions, and policies, but is considered more flexible. The ToC is the outcome of the need to provide a robust framework for channelling resources to address persistent challenges in smallholder livestock and dairy systems in Bangladesh in a sustainable manner. The recommended ToC embraces the complexity and interlinked issues related to social change and proposes a model of change that will be tested and improved over time. This requires regular critical reflection and adaptation of the model as contexts change,

assumptions are tested, and progress toward desired change is assessed through a systematic process of analysing the feasibility and plausibility of planned pathways to change.

5.2 Specific recommendations

The policy makers and the civil society are of the view that there is no silver bullet solution to the challenges which has been noted during the studies conducted in the field. However, a combination of strategies may be extremely helpful to achieve the SDG 2030 and the Vision 2041. Keeping these in view, we propose the following five pillar strategies to be adopted in next 3-5 years' timeline to achieve the objectives of competitiveness in developing the livestock and dairy sector in Bangladesh:

Pillar 1: Strategies for improving livestock productivity

❖ **Rationale for action:**

In Bangladesh, livestock productivity is low due to occurring and reoccurring, poor animal husbandry practices, low penetration of high-yielding breeds and shortage of feed and fodder. The yield rates of different livestock products have remained stagnant over the last 3 decades. The productivity of large ruminants, small ruminants and poultry in Bangladesh is notably lower than those of neighbouring countries such as Bhutan, India, Nepal and Pakistan (FAOSTAT, 2020). As noted by the Planning Commission (2020, pp. 308), the average weight of local cattle in Bangladesh ranges from 125 to 150 kg for cows and from 200 to 250 kg for bulls is lower by 25–35% of the average weight of all-purpose cattle in India. Milk yields in Bangladesh are low: 200-250 litres during a 10-month lactation period compared to 800 litres for Pakistan, and 500 litres for India (Bangladesh Planning Commission, 2020, pp. 305).

❖ **Recommended activities:**

- **Transfer knowledge of breeding and fertility management:** Increasing the productivity of animals is a blend of genetic improvement and fertility management. Farmers have little understanding of breed improvement. In many cases artificial insemination fails due to faulty heat detection and insemination at improper time, quality of semen, efficiency of inseminator and management of inseminated cow (fertility management) including nutrition. In order to maximise production and productivity, farmers have to be schooled about modern ways to improve breeds and fertility management.
- **Address nutritional management:** Nutritional deficiencies are common in livestock and poultry birds due to shortage of quality feeds and fodder and also due to poor technical knowledge of farmers in formulating balanced ration and feeding. Deficiency of quality protein and micronutrients (essential minerals & vitamins) is frequently seen in livestock and poultry especially in pregnant, lactating and laying animals. Care must be taken for poultry birds in terms of essential amino acids and micronutrients particularly during laying periods. Because of the high price of concentrate feeds, particularly soybean and fish meal the farmers should be encouraged to grow soybean as poultry feed and fishmeal should be produced in-country using fish wastes at the port city of Chittagong and Cox's Bazar.
- **Control morbidity and mortality:** Morbidity and mortality is a major problem for livestock profitability. An estimated 15% of the ruminants (large and small) and 20% of poultry die from different diseases which affects the farmers/smallholders adversely³⁷. The DLS is making its efforts to reduce the incidence which however need more concerted efforts and collaboration with private sector, research institutes and civil society.

³⁷ Diseases like anthrax, mastitis, pneumonia, Haemorrhagic Septicaemia (HS), lumpy skin disease (LSD), Foot and Mouth Disease (FMD), retained placenta, prolapsed uterus are predominant in cattle, whereas Peste de Petits Ruminants (PPR) and Goat Pox are common in goats, New Castle Disease (ND), Infectious Bronchitis (IBD) and Gumboro in chicken and Duck plague and Duck Virus Hepatitis in ducks are some of the major animal diseases in Bangladesh. The animals also suffer from protozoan disease including anaplasmosis, babesiosis, leishmaniasis, toxoplasmosis, amebiasis, giardiasis, and cryptosporidiosis.

- **Increase artificial insemination coverage:** There are about 26.2 million cattle in Bangladesh, of which 60-65% are local breeds and 35-40% are crossbreeds (DLS, 2021). The yield of local breed cattle is only about 200–250 litre milk per annum as compared to 1,500–1,800 litre per year in crossbreeds. The beef fattening business is also affected as the feed conversion ratio of the local breeds are less than the crossbreeds. The artificial insemination (AI) process is the most cost effective and reliable option in breed improvement. Currently, the AI service providers are DLS, Milk Vita, and 5 private sector stakeholders (BRAC, Lal Teer, ACI, Ejab and ADL). Keeping in view the low success rate, the number and AI doses (which is around 10.5 million presently) need to be increased.
- **Updating of farmer knowledge of practical feeding systems,** nutritional requirements & feed commodity options for dairy, beef, buffalo, goats, sheep & poultry. This would include the role of advanced feed additives such as **enzymes** to improve the digestibility of high lignin fodders (such as rice straw); **rumen modifiers** (ionophores); **rumen protected proteins & fats**; synthetic **amino acids**; **mycotoxin binders & deactivators**; **mould inhibitors**; **antioxidants**; **Organic Acids**; **anionic salts**; Vitamin & Trace Element Premixes, plus additives such as ‘Bovaer’, to help reduce enteric **methane emissions** from ruminants. This would also include best practice **milage making**, **hay making**, and the use of low cost **urea-based protein & mineral blocks and loose mixes** for improving the value of low nutritional value pastures during times of drought.

❖ *Problem/urgency/impact/responsibility matrix*

No.	Issues and challenges	Urgency level	Impact	Responsible agencies
1	Breeding & fertility Knowledge transfer	Medium	High	DLS, training institutions, Mobile companies
2	Control of mortality and morbidity	High	High	DLS, Private sectors
3	Address nutritional management	Medium	High	DLS, Private service providers, NGOs
4	Increase coverage of artificial insemination	High	High	DLS, Milk Vita, NGOs, Private service providers
5	Updating of farmer knowledge of practical feeding systems	Medium	Medium	DLS, NGOs

Pillar 2: Strategies for improving efficiency of livestock commodity value chains

❖ *Rationale for action:*

Most smallholder livestock growers and downstream business entities operate in small, stable local markets; only a few cater to national/international markets. Given the high perishability of livestock products, the focus is village markets in the neighbourhood and domestic markets within 100 kms radius. A strong base of domestic supply chains is robust enough to withstand external shocks and global pandemic like Corona. However, from a long-term perspective, strengthening competitiveness and promoting participation in global value chains would help the GOB achieve its goals for inclusive, export-led growth.

❖ **Recommended activities:**

- **Product and process upgrading** aims at “doing things better and/or bigger” and includes enhancing the efficiency of production processes and the quality of products to comply with buyers’ requirements. For example, a dairy farmer can avoid adulteration practices or can chill milk immediately after milking to produce a higher-grade product. These interventions focus on the production stage.
- **Functional upgrading** involves producing new goods or services either upstream or downstream in the value chain (VC). Examples of upstream interventions include livestock keepers producing high-quality fodder for their animals or for sale. Downstream, farmers/farmer groups may make yogurt, and sweets from the raw milk. Another form of functional upgrading occurs when farmers involved in a VC enter another closely related one, such as when milk producers expand their activities to cattle fattening.
- **Upgrading of coordination and business models** often implies helping to formalize and make more transparent (through contracts) both the horizontal relationships among livestock farmers in the same VC segment, such as among the different producer groups of dairy farmers who sell to a single chilling unit (Upazila level), and the vertical relationships between actors in different VC segments, such as between dairy farmers and milk processors like Milk Vita, Aarong Dairy, etc.

Various product diversification option has been provided in Table 6. Annexure 21 offers strategy discussions on linking producer groups with the dairy hubs.

Table 7: Recommendation for livestock product development

No.	Activity/ Input	Type of activities	Rationale	Remark
1	Processing/ Transforming of milk and egg-based food like yogurt, cheese, cake, pudding, varieties of sweetmeats etc.	Diversification	Value Chain Development through transforming raw milk and egg into value added products	Training/ Orientation can be organized for new entrepreneurs taking assistance from matching grant awarded to entrepreneurs.
2	Transforming egg into powder	Diversification	Make easier for using egg in bakery products and easy transportation and also for long time storing.	May require study tour to egg powder making industry.
3	Solar power refrigerator for remote area specially in char land	Technology based Product Development	Storage of vaccines in the remote area where there is no electricity	Need to promote business plans and demonstration projects using solar power
4	Hydroponic Fodder/ Vertical fodder production	Diversification	Good quality fodder production without using cultivable land which can be used	Private sector entrepreneur development for

No.	Activity/ Input	Type of activities	Rationale	Remark
			for food crop production.	Hydroponic Fodder cultivation.
5	Use of Ultrasonography (USG) for disease and pregnancy diagnosis	Technology based Product Development	For pregnancy diagnosis and observing changes of internal organ specially in pelvic cavity animal health professional can be educated on diagnosis through UGS method.	May require assistance from department of Health for USG operation training program
6	Introduction of some analysing equipment like (Blood, Biochemistry, USG, Electrolyte, Feed Analyzer) for routine health check-up, disease diagnosis, quality inspection of feed.	Technology based Product Development	Clinical diagnosis cannot provide changes in blood which denote the disease condition. Through Blood Analyzer, changes in the blood can direct a livestock health professional for confirmatory diagnosis of a disease	At least District level Vet Hospital may have analysers and private sector entrepreneur development through establishing clinics cum diagnostic laboratory
7	Livestock Insurance	Financial Product	Require for risk coverage of a farmer on animal loss due to death	Develop instruments for insurance through development finance
8	Credit support for procurement of accessories like water pump for irrigation, harvester cum baler, milking machine etc.	Financial Product	To purchase required equipment for saving money and economic expenditure.	Requires developing linkage of farmers with the money lender like MFI, Bank
9	Waste management through biogas plant and power generation.	Diversification	Recycling and better use of farm wastes making the farm premises clean and gas used for energy supply	Government support will be required for the farmers intend to replicate the activity (modern manure disposal and utilization)

❖ **Problem/urgency/impact/responsibility matrix**

No.	Issues and challenges	Urgency level	Impact	Responsible agencies
1	Product and process upgrading	High	High	DLS, Government line departments (trade, marketing etc,) NGOs, Private sector
2	Functional upgrading in both upstream and downstream activities	High	High	Trade and marketing departments, Private sector
3	Upgrading of coordination and business models	Medium	Low	Local governments and private sectors

Pillar 3: Strategies for enhancing capacity building

❖ **Rationale for action:**

There is insufficient manpower both at DLS offices and training institutions. Training budget at District offices of DLS are BDT 30,000 which is barely enough to conduct one or two one day events and therefore needs enhance for sustainable capacity building. The main training tools used are *uthan-baithak*, Farmer Field Schools, extension services, demonstration farms, training workshops, and printed materials. However, for various reasons, the main pedagogical tool for training used is classroom lectures, while participants clamour for hands-on practical sessions. Quality and standard of training is low and no evaluation of trainees. Many of the faculty members have little or limited exposure to field realities because of lack of prior experience of practical problem solving. The producer groups are in its infancy and are in inception stage who need focussed training which is currently absent. The number of female farmers in training participation is comparatively low. Annexure 22 presents the matrix on policy implementation for institutional capacity.

❖ **Recommended activity:**

- **Training need assessment (TNA):** The TNA for the livestock farmers, producer groups (PGs), VMCCs/dairy hub, dairy and meat entrepreneurs, sweet meat producers and traders, Milk marketers, live animal marketers and unemployed youths need to be undertaken to understand the current level of technical knowledge.
- **Improved infrastructures of training establishments:** The training is being imparted mainly through DLS run institutions and some other institutions under various other line departments. Some of the institutions do have large infrastructures which need immediate maintenance to continue their services. On the other hand, few of the establishments (for example, NIPM at Gopalganj) remained underutilized due to lack of adequate programs and funds. In some cases, the resources like land are not in use due to shortage of funds.
- **Organisation of on-site training:** Major advantage of farmer field schools and *uthan-baithaks* are that farmers animal shed/barn, animals/birds, fodder farms can be used for practical demonstration and training.
- **IT based capacity development tool:** Digital technology-based capacity development tool will prove to be more efficient to reach out to last mile livestock farmers and other upstream actors. The Application (APP) based training and capacity development initiative is completely absent which need to be established through digital platforms

which could be an effective approach in delivering benefits and effective dissemination of information on technological advancements.

❖ **Problem/urgency/impact/responsibility matrix**

No.	Issues and challenges	Urgency level	Impact	Responsible agencies
1	Training Need Assessment	High	High	DLS, Training establishments (Government and Private)
2	Improved Infrastructure of Training establishments	High	High	DLS, Line ministries like finance, human resources etc.
3	IT enabled capacity development	Medium	Low	DLS, Line ministries (IT, Human Resources etc.), Private sector

Pillar 4. Strategies for improving financial services and investment opportunities

❖ **Rationale for action:**

Access to finance is a major challenge to the growth of livestock and dairy sector enterprises (classified as agriculture and MSME sector). The Bangladesh Bank (Central Bank of Bangladesh) is setting lending targets, commercial bank credit to agriculture and MSMEs has been steadily rising at a significant rate. However, there are two institutional biases at work against the rural enterprises: firstly, 80% of the credit goes to urban establishments and secondly, within the rural segment it is skewed to organised poultry establishment³⁸. The smallholder livestock farmers rely on microfinance institutions (MFIs) to meet their credit needs for dairy animals and beef fattening³⁹. The survey conducted by AFC/SSIL with 1,116 livestock producers, observed that only 3% of the farmers access loans from microcredit organisations. Collateral is the main barrier for small producers for accessing credit from the banks and other institutional credit. The livestock producers and enterprises must pay interest of 14.44 % (annually compounded) on institutional credit and 31.22% (annually compounded) on non-institution credit. The credit need and supply gap are considerably high which deters the growth of the sector.

Despite remarkable livestock product growth of 10% (dominated by the poultry sector) and a stable GDP contribution of 2.9-3.1% during 2012-13 to 2021-22, budget allocations remained <1% of total outlay during the 8th plan period (2020-2025). If Bangladesh has planned to increase its livestock productivity rapidly, extend coverage of veterinary services, build climate resilient green infrastructure, and achieve value addition in meat and milk processing, it will require considerable investment. This can come only from the private sector, external donors, and foreign investors.

❖ **Recommended activities:**

- **Establish autonomous agency:** One of the key reforms needed is to improve the investment climate for transformation. For this purpose, it is suggested that the government may establish a dedicated and autonomous agency as *Prani Sampad Bikash*

³⁸ According to a Bangladesh Poultry Industries Central Council (BPICC) investment in poultry has now reached USD 322 million (BDT 35,000 crore).

³⁹ The Palli Karma-Sahayak Foundation (PKSF), a wholesale lending institution, and its 170 NGO partners offers microenterprise loans in rural areas, including livestock activities

Foundation (PSBF) as a government company under the Companies (Bangladesh) Act, 1994. The PSBF will create an ecosystem which is friendly for the growth of livestock related SMEs and producer organisations.

- **Create suitable financial products for the customer segments in livestock and dairy sector:** The Mission of PSBF is to implement policies and action programme focussed on commercially viable entities that promotes socio-economic development of producers and environmental protection. Its objectives are: (a) Function as an investment vehicle or fund which invests or co-invests in enterprises, providing the catalytic energy to unleash new dynamism in the livestock and dairy sector (b) Serve as a capacity building organization that facilitates financial, human, and other resources to help entrepreneurs learn and develop and (c) Create platforms where investors, entrepreneurs, and other stakeholders in the ecosystem opt to transact business.
- **Raise capital to establish and run the autonomous agency (PSBF):** It is proposed that the PSBF may be provided with an initial corpus of USD 300 million contributed by LDDP, multilateral and bilateral donors, development finance institutions (Asian Development Bank, World Bank etc.). The PSBF may also approach the investors for equity and debt (both junior and senior) funds and may try to source funds as donations from the philanthropic foundations/charities. At the request of the Project Director, LDDP, PMU, the concept of PBSF has been further elaborated in Annexure 23.

❖ *Problem/urgency/impact/responsibility matrix*

No.	Issues and challenges	Urgency level	Impact	Responsible agencies
1	Lack of affordable and adequate credit for livestock sector.	High	High	PSBF, Banks (Public and Private)
2	Supply of long-term financing for building infrastructure, purchase of equipment, and working capital is very limited.	High	High	PSBF, Banks (Public and Private)
3	Credit to beef fattening activities	Medium	Low	PSBF, Banks (Public and Private)

Pillar 5. Strategies for promoting climate-smart infrastructure and technologies

❖ *Rationale for action:*

Bangladesh is one of the most vulnerable countries due to extreme weather events. 85 million people (53% of the population) live in areas with subject to “very high” exposure (USAID 2018). Large number of inland communities practicing livestock farming have already started migrating to urban areas for safety, and new occupations. The lack of animal shelter and warehouse for fodder exacerbates morbidity and mortality of both livestock and human populations during extreme weather events. The livestock sector is simply not geared to deal with the extra climate-induced stress on production and health services. In recent years global attention has highlighted the large amount of methane emission from the livestock population. According to the calculation made by Das et. al. (2020), the dairy cattle sector in Bangladesh is responsible for about 66,586 GgCO₂ equivalent (CO₂e) in 2018. Most of this (79%) is methane. The national research and development capacity to cope with climate change issues is alarmingly low and there is a huge shortage of climate data on livestock origin affecting the choice of implementing adaptation and mitigation measures for livestock in vulnerable areas. Therefore, the technology received by the livestock institutes and farmers are inadequate.

With this background, it is clear that the choice of adaptation and mitigation options in the livestock sector should be considered as one of the top priorities of the policymakers of Bangladesh.

❖ **Recommended activity:**

- R&D to develop technologies for reduction of methane emission in livestock and to create sufficient data and information for recommending early warning and mitigation measures against climate disasters.
- Build adequate number of animal disaster shelter homes and fodder depots co-located with the livestock service centres.
- Rehabilitate and upgrade hospitals and livestock centres while incorporating green building features.

❖ **Problem/urgency/impact/responsibility matrix**

No.	Issues and challenges	Urgency level	Impact	Responsible agencies
1	R&D for methane emission reduction and technology for mitigation of climate hazards	High	High	Bangladesh Livestock Research Institute (BLRI), Universities and relevant institutions
2	Build animal disaster shelters	Medium	Medium	Local government Engineering Department (LGED)
3	Rehabilitate and upgrade livestock service centres	Medium	Low	DLS/LGED

6. Next steps

Livestock and dairy farming is a livelihood activity and is critically important for the food and nutritional security of the majority of the population in Bangladesh. Nevertheless, livestock farming operates far below the optimum production potential, mainly due to demographic, biophysical, economic, environmental, and sociopolitical challenges. To address these issues, the LDDP project was launched with the overall objective of characterizing different livestock farming systems and identifying challenges and opportunities to improve livestock production in the country through broader perspectives.

6.1 New perspectives

The tasks of ensuring livestock development, production and health coverage, and extension services to meet nutrition requirements as well as to create employment opportunities through rearing livestock and poultry, and the marketing and processing of their products have largely fallen on the DLS and the GOB. The growth of private sector and civil society organizations in Bangladesh presents a new opportunity for opening the doors for investment in the sector, tap into their expertise, and deepening the outreach among all sections of the population. Livestock sector development does require an infusion of large amounts of capital, technology, and capacity building of people and their institutions, however, these alone are not sufficient. A paradigm shift (figure 13) towards a more collaborative, pluralistic ecosystem is required which treats private sector and civil society as equal partner to the government.

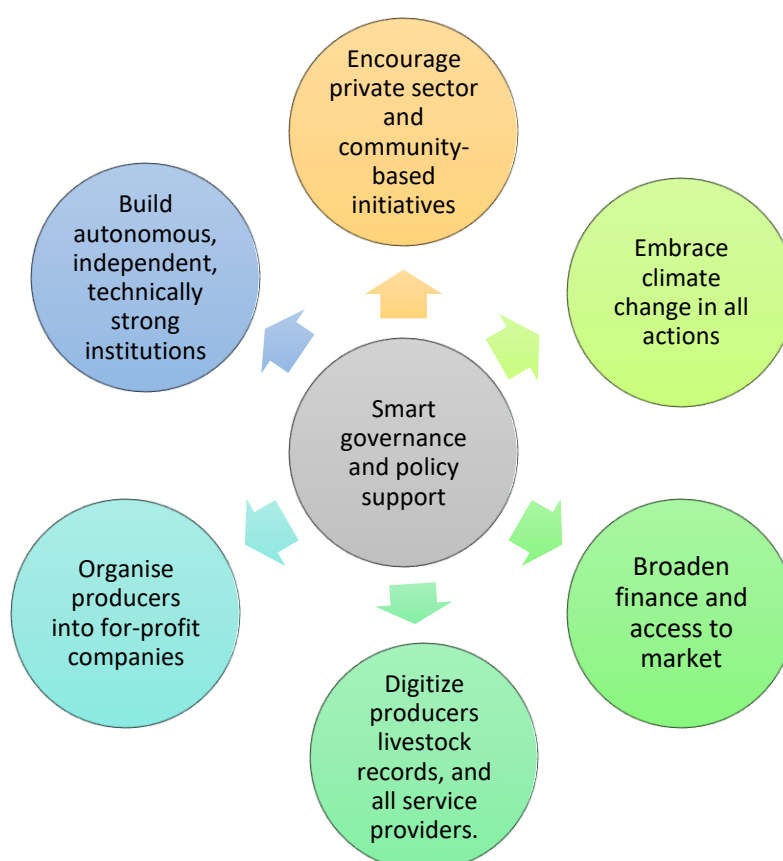


Figure 13: Paradigm shift to be made by the GOB

The new perspective is based on seven inter-related premises:

- a) **Minimal interference, smart governance:** Within the livestock and dairy sector, the GOB should focus on matters of importance to public health, enhance productivity through research and development; develop good quality breed; ensure better nutrition and provide adequate animal production and health services in collaboration with private and community-based initiatives.
- b) **Encourage private sector and community-based initiatives:** The GoB need to discontinue all activities where competitive markets have come of age and economic potential of such entities may be better discovered in the hands of investor due to various factors such as infusion of capital, technological upgrade, and efficient management practices. The strategic disengagement or privatisation must be carried out through an open, transparent, and competitive bidding process.
- c) **Factor climate change in every action:** Climate change is a real and growing threat to Bangladesh, particularly in southern coastal zone, central and north-western zones for cyclone, tidal surge, salinity, flood and drought, respectively. Therefore, adaptation and mitigation measures to cope with climate change induced hazards and reduction of methane emission in livestock sector should be a high priority.
- d) **Broaden finance and access to market for small holders:** Access to finance and market is hindering the growth of cottage, micro, small and medium enterprises in livestock sector. Impact funds and catalytic philanthropy are emerging tools that can bridge the credit gap in the livestock sector.
- e) **Organise producers in a big way:** Livestock and dairy producers are not that organised what it should be, hence, they are not able to influence pricing of their produce in the market. Producers should be organised in a three-tier structure: semi-formal producer groups at the village level, livestock companies at upazila level, and Division level. The ownership of upazila livestock company will be held by individual producer shareholders, and divisional level companies by upazila companies.
- f) **Digitize producers and farm records:** Digitization of farm transactions, and animal health records will facilitate collaboration across the value chain. Further, publicly available data on value chain actors, particularly business development service providers will foster prompt on-time service delivery.
- g) **Build autonomous, independent, technically strong institutions:** These institutions are responsible for improvement of public and private infrastructure of research, production, finance, market and training.

Further, the efforts shall not be limited to the above mentioned interrelated premises and shall also be extended towards incorporating climate smart practices in energy efficiency and renewable energy initiatives such as efficient lighting, energy efficient appliances, Solar photovoltaic power generation, solar water heating and waste to energy as well as adaptation measures in reducing climate risks.

6.2 Strengthening existing policy, system and infrastructure

In Bangladesh, GOB has outlined several rules, regulations and acts for the development of livestock industry and supply safe food to the nation. The slaughterhouse act 2011, Animal Feed Act 2011 and the Food Safety Act 2013 are the vital acts which regulate the related activities. However, these acts are not being practiced properly resulting in unhygienic

slaughter of animals, slaughtering of diseased animals, frequent increase of feed prices by the millers, and adulteration of different foods.

Animal Feed Act 2011 and associated rules 2013, provide an important legal framework to control the formulation, distribution and marketing of animal feed. But the companies active in the livestock sector are neither adequately aware of these acts, nor is there strong enforcement by the GOB. Similar is the situation with other acts.

To achieve the goals of the development of livestock sector by 2041, a massive restructuring of the existing implementation sector of the government and other organizations should be undertaken with utmost importance. Table 7 presents developmental plan for existing infrastructure of livestock sector.

Table 8: Existing infrastructure and developmental plan for livestock sector

Existing system, policy and infrastructure	Improvement suggested	Responsible Organizations
1. Slaughtering practices: Slaughtering practices are done without any hygienic and environmental consideration. Slaughterhouse wastages are carried out by the city corporation/ municipal authority and dumped in roadside, creating serious environment pollution. No hygienic transportation is used for carrying the carcass to the marketplace / meat traders. Conventional slaughterhouses do not possess refrigerator /cooling facility and there is no suitable system for the utilization of these large volume of by-products.	Modern slaughtering system should be implemented in the slaughterhouse without any delay. The proposed and ongoing modern slaughterhouse in the city corporation must be constructed immediately. Proper water supply, electricity, boundary wall with roof, semi permeable material in the slabs must be ensured. Special emphasis should be given to the protective and hygienic uniform of the butchers (PPE, Gloves, Gum boot, sanitization material). Immediate attempt should be taken for converting the slaughterhouse wastages (traditional and modern slaughterhouse) in to biogas and converting the product (biogas) into renewable energy. Modern supply chain should be established to save these perishable products. Cooling van should be introduced for the transportation and proper hygienic measure should be taken for the labour and other who are involved with these activities. Attempts should be taken to use by-products like bone, blood and hide (Skin) for industrial purpose and export market and the by-products like liver, kidney, spleen is used for human consumption.	Department of livestock services (DLS)/City corporations /Municipalities/ Large dairy, beef and poultry farms/ Meat processing industries

Existing system, policy and infrastructure	Improvement suggested	Responsible Organizations
2. Slaughtering regulation: Slaughtering are done without following rules and regulation. There is Slaughtering Act but no enforcement of it for practice. Having no provision/ facilities of training for butchers or slaughterers from municipality/ city corporation. There is no baseline survey regarding daily animal slaughtering and meat production based on market demand. There is no permanent monitoring authority in case of mal practices, fraud performed related to animal slaughtering and meat marketing. Moreover, an acute shortage of trained human resources as per standard requirements. City corporation/ municipality does not have own testing laboratory.	Slaughtering Act must be enforced to comply by the slaughterers and related bodies. Government departments (DLS and other responsible departments) or the local authorities (city corporation / municipality) may take initiatives to arrange training course on personal hygiene, meat hygiene for persons related to slaughtering and meat business. All the slaughterhouses should be equipped with modern facilities and trained manpower to be recognized by international marketing system. The divisional slaughterhouse should have their own laboratory. City corporation should take initiatives for establishing testing laboratory. There should be regular monitoring to slaughterhouse and butcher/ meat shops from DLS and also from local government.	Department of livestock services (DLS), City Corporation and Municipalities Executive Magistrate in the respective Zila/Upazila
3. Product diversification: There is a great scope of producing a large number of value-added products from milk and meat. But only some common products are available in the market and most of them are traditional sweetmeats and ice cream and a few meat balls and fermented milk.	More entrepreneurs should be encouraged to go for value addition in milk and meat. The financial support through MG by LDDP to sweetmeat producers and other entrepreneurs for the production of value-added products will imply positive role in this regard. More financial support from govt. and NGOs will help to flourish this sector.	MOC, DLS, Dairy entrepreneurs, Meat Industry, Food Industry, Financial Institutes
4. Support structure and services: There is no systematic information to the government departments on supply availability, consumption, import, export, financial support system, human resource development system etc., which hinders the overall business environment of livestock sector.	Government departments should facilitate the producers, entrepreneurs, business professionals, the importers and exporters with necessary information and technical support. Training of farmers and improve access to business development services must be ensured.	DLS, MoFL, Financial Organizations, PKSF, Bureau of export-import, BLRI, NGOs.

Existing system, policy and infrastructure	Improvement suggested	Responsible Organizations
5. Monitoring and evaluation: In existing system, there is no permanent authority for monitoring the production system, products and marketing.	A tool for monitoring and to evaluation both the underlying and business performances for potential scaling up across the country should be introduced. Guideline should be chalked out to establish linkage/ partnerships with the private and other on-going initiatives to expand the market of value-added animal products.	MoFL, DLS, Private meat processing industries, Food Safety Authority
6. Partnership development: Public-private-partnership (PPP) is a concept for the easy and effective investment of private money for development activities (projects) of the country, which is badly absent in livestock sector.	A wide scope of development of livestock sector in the country can be attained through the participation of private individual/farm with government /producer/producer group in the frame of 2P /3P /4P. The most successful partnership performance in dairy is MILK VITA and in poultry sector is contract growers' system. Currently, there is no dedicated fund for investment in livestock and dairy business in Bangladesh. A dedicated partnership development fund (PDF) should be established with the support from financial organizations and soft loan from international financial organizations like Asian Development Bank.	Government and non-govt. financial organizations, international donor organizations, Private individual, Entrepreneurs, Producer/Producer groups.
7. Commercial feed market: Feed markets of the country are regulated by a number of feed exporters and feed millers, who import, manufacture and supply compound feeds to the farmers through dealers. Presently no infrastructure is available for commercial marketing of feeds & animal by products, which are utmost important for uniform distribution and maintaining similar price throughout the country.	Appropriate steps to be taken by the govt. to ensure adequate supply and distribution of quality feed throughout the country, especially in fodder available areas to unavailable areas of the country. Necessary support would be provided to the private entrepreneurs by creating contact farming among fodder processors by leasing the land of small producers to larger producers. Encourage small to medium entrepreneurs for commercial silage making and establishment of community-based fodder banks or cooperatives to ensure a consistent supply of quality fodder during periods of scarcity.	MoFL, DLS, BLRI, BAU, BRAC, NGOs, Feed Miller, Feed Importer, Entrepreneurs.
8. Capacity building: In Bangladesh, capacity development of livestock farmers and related stakeholders is not	Adequate budget allocation, employment of more manpower, practical demonstration to the trainees, evaluation of training outputs, coordination between different training offering organizations with DLS must be ensured to improve the	MoF, DLS, BLRI, PKSF, BRAC, Universities Large entrepreneurs

Existing system, policy and infrastructure	Improvement suggested	Responsible Organizations
addressed in a systematic manner. The capacity development at organizational level is addressed but not effectively and that of enabling environment level are seldom addressed. There is no trained manpower for slaughtering and processing the carcass. All these activities are performed by the butcher who do not have any idea about the slaughtering system and hygiene. There is also an acute shortage of trained manpower in feed manufacture, processing and in formulation.	capacity development activity of DLS. Hazard Analysis and Critical Control Point (HAACP) compliance for slaughtering facilities should also be established. This will help the reviewing and monitoring authorities in Bangladesh for renewal of registration and financial institutions in assessments of risk in lending. Coordination between key players in capacity development viz. DLS, BLRI, PKSF, BRAC, Universities and other NGOs should be established and any gap identified needs to be minimized. New capacity development policy of the govt. should be based on the following strategy: a) capacity need assessment and intervention strategy design; b) innovative learning materials and approaches; c) partnering capacities of the government and non-government training centers; d) future training leaders through training of trainers (TOT) packages; e) gender sensitive approaches f) strengthening livestock institutions engaged in policy work; and g) a temperament to experiment, research and innovation	and other NGOs
9. Livestock breeding: Lack of breeding policy in the country resulted in haphazard way of breeding animals particularly in the rural areas and also shortage of quality meat type breeds of cattle and poultry.	GOB should formulate a breeding policy in consultation with GO-NGO experts, Research Institutes and Universities. This should be done immediately with due consideration of expert opinions. This policy should be formulated with the national requirement as well as export target of meat and meat products in 2041.	MoFL, MOC, DLS, NGO's, Private entrepreneurs, BLRI and Agricultural Universities
10. Inadequate technical knowledge of farmers: Most of the farmers are poor in technical knowledge particularly HYV fodder cultivation, preparation of balanced ration, feeding, housing and management of their animals.	DLS should organize practical hands-on intensive farmers training programme throughout the country. This could be done in govt. training centers as well as other institutes operated by NGO/private. Cultivation of annual forage legume <i>berseem</i> (<i>Trifolium alexandrium</i>) has good potential.	MoFL, MOC, DLS, NGO's, Private entrepreneurs, BLRI and Agricultural Universities.
11. Feed price and quality: Feed cost alone comprises almost 70 – 80% of the rearing cost. Due to recent Ukraine war, the prices of grain have	Marketing of quality feed must be ensured through recruitment of Animal Nutritionist in every district, they will not only ensure the quality of feeds by implementing Feed act & BSTI standards but also suggest	MoFL, MoIC, DLS, NGO's, Private entrepreneurs, BLRI and

Existing system, policy and infrastructure	Improvement suggested	Responsible Organizations
been increased several folds (from 11.9 to 31.2% between 2018 to 2023).	intervention in the daily rations for reducing the daily feed cost. The imported feeds such as soybean and fish meal should be produced in the home country by encouraging cultivation of soybean and production of fishmeal in the coastal fishing areas with fish wastes and small fish. Other way of reducing production cost of by supplementing good quality fodder, hay and silage. Establishment of fodder germplasm center at divisional and district level is utmost importance.	Agricultural Universities, Food Safety Authority
12. Market linkage development: Poor transport linkage and lack of coordination are the everyday scenario in livestock products and by-products transportation system.	A time demanded transportation should be developed for the easy and quick transportation of agricultural products and by-products throughout the country should be established.	MoFL, MoLG, DLS, Bangladesh Railway, In land water Transport Authority, NGO's, Private entrepreneurs
13. Financial support and incentives: Directorate of Livestock Services (DLO) do not possess any fund for financial support to farmers / producers/ entrepreneurs except some project funding	Proper initiative should be taken to provide financial incentives, subsidies, and credit facilities to farmers, producers, processors, cooperatives, and feed manufacturers to promote investment in breed development, value added product development, feed production, processing, and storage infrastructure. Sustainable insurance facilities should be developed for fodder producers, silage producers and distributors.	MoFL, DLS, BLRI, PKSF, BRAC, Universities, Large entrepreneurs, other NGOs and Govt. & Non-Govt. commercial Institutes.
14. Research and development: Although there is a wing of R&D in the directorate, but this wing is very weak. There is no appropriate manpower and infrastructure for this section.	It is necessary to promote research on breed development, livestock nutrition, feed formulation, fodder production and processing techniques and value-added product development from milk, meat and eggs. Collaboration between research institutions, universities, extension department, and the livestock industry to be encouraged to develop innovative and cost-effective technologies for livestock development.	MoFL, DLS, BLRI, PKSF, BRAC, Universities, Large entrepreneurs and other NGOs

Existing system, policy and infrastructure	Improvement suggested	Responsible Organizations
15. Strengthening extension services: DLS has root level infrastructure with trained technical and sub-technical staffs e.g., Livestock Extension Officer (LEO) and Livestock Service Provider (LSP) throughout the country.	These technical staffs could effectively be used in extension of livestock rearing, feeds and fodder seeds, demonstrating HYV fodder in the Upazila level and training of the farmers on fodder production and feeding systems.	MoFL, DLS, BLRI, PKSF, BRAC, Universities, Large entrepreneurs, and other NGOs
16. Addressing climate change hazards: Cyclone, tidal surge, saline intrusion and flood are common every year but no mitigation or adaptation measures are seen. Livestock in those areas suffer from serious shortage of feeds and shelter. On the other hand, ruminant livestock are the cause of methane, nitrous and nitrite oxides production.	Mitigation and adaptation measures should be developed for livestock in disaster affected areas. Saline tolerant fodders must be developed. Shelters must be built for sheltering livestock during disaster periods. Methane emission from ruminant livestock should be minimised through feeding them with better quality feeds and fodder and nitric and nitrous oxide gases should be minimised through better management practice of livestock wastes and production of bio-gas.	BLRI, Universities, and other research institutes, private companies and NGOs
17. Mobilising new resources for addressing climate change	Bangladesh should make efforts to tap climate finance in a big way, particularly Loss and Damage fund, and catalytic grant funding to deliver on the goal to cut methane at least 30 percent by 2030 ⁴⁰ . Different financial instruments such as grants and donations, green bonds, equities, debt swaps, guarantees, and concessional loans can be used for climate change mitigation, adaptation, and resilience-building.	Ministry of Environment, Forest and Climate Change of Bangladesh; PPP Authority, Ministry of Finance, MoF.

6.3 Introducing new and innovative systems

6.3.1 Policy support and institutional capacity:

Strengthening the livestock policy and regulatory framework, planning, and monitoring at the national and district levels and improving the capability of key institutions in the livestock innovation system to deliver public goods and services essential for improving sector productivity, increasing the resilience of the livelihoods anchored in the sector (including livelihoods in *char* lands), reducing competition for natural resources, and reducing the methane emission from bovine animals. Some of the areas that may be considered are:

⁴⁰ Bangladesh is a signatory to Global Methane Pledge.

- Development of Livestock Master Plan for selected divisions: The Master Plan⁴¹ will address the spectrum of ruminant production systems (char lands, mixed, intensive) and their trade-offs in terms of economic, social, environmental, and public health risks and opportunities in the context of a changing climate.
- Develop policies related to feeding, breeding, dairy production, and animal health, import of semen and live animals.
- Approval of the national parliament of the Dairy Development Board Bill 2023 as an act.
- Final approval of draft National Livestock Extension Policy, 2013; National Breeding Policy, 2019; and National Dairy Development Policy, 2019.

The legal liability for dairy plants and business are discussed in box 2.

Box 2: Legal and liabilities issue in dairy business

There are several approved Policies and Acts in the livestock and food safety sector. Some of the policies like National Dairy Development Policy 2019, National Breeding Act 2019 and National Livestock Extension Policy 2013 are still waiting for government approval. Food Safety Act 2013 is approved by the government. Poor milk quality and low conception rate of Artificial Insemination (AI) are some of the issues now. Due to poor quality of locally produced milk, dairy industry is importing milk powder and farmer's income is affected by low conception rate of AI. Some institutions should be liable for this. As a remedy of avoiding such liabilities, government should enforce the existing Policies and Acts seriously. Further to this, Bangladesh Dairy Development Board is expected to develop important policies specifically related to dairy sector such as the welfare of the dairy farmers, insurance of dairy cattle, farmers, safety of dairy workers, marketing and improvement in the quality of the dairy products.

6.3.2 Increased access to finance through institutional mechanism:

An investment and partnership ecosystem for livestock is needed to support SMEs, start-ups, incubate them, and share risks and knowledge. Currently, livestock entities are in functioning out of their silos and lack in visualizing the big picture. As observed by the policy makers and the private sector operators in Bangladeshi livestock sector, one of the key reforms needed is to improve the investment climate for transformation. For this purpose, it is suggested that the government may establish a dedicated agency as *Prani Sampad Bikash Foundation* (PSBF) as a government company under the Companies (Bangladesh) Act, 1994. The PSBF will create an ecosystem which is friendly for the growth of SMEs and producer organisation.

The Mission of PSBF is to implement policies and action programme focussed on commercially viable entities that promotes socio-economic development of producers and environmental protection. Its objectives are: (a) Function as an investment vehicle or fund which invests or co-invests in enterprises, providing the catalytical energy to unleash new dynamism in the livestock and dairy sector. (b) Serve as a capacity building organization that facilitates financial, human, and other resources to help entrepreneurs learn and develop. (c) Create platforms where investors, entrepreneurs, and other stakeholders in the ecosystem opt to transact business.

It is proposed that the PSBF may be provided with an initial corpus of USD 300 million contributed by LDDP, multilateral and bilateral donors, development finance institutions (Asian

⁴¹ Livestock Master Plans are developed through a systematic process using global reference tools available in the Livestock Sector Investment and Policy Toolkit (LSIPT). See <https://www.ilri.org/livestock-master-plans>.

Development Bank, World Bank etc.). The PSBF may also approach the investors for equity and debt (both junior and senior) funds and may try to source funds as donations from the philanthropic foundations/charities.

PSBF will create two specialised funds (a) Special purpose vehicles (SPVs) to invest in livestock and dairy development initiatives by the partners; (b) Livestock sector partnership fund (LSPF) which will support with seed funding, subsidies in developing climate resilient green infrastructures, building capacities of the partners involved in livestock and dairy development projects (Figure 14). Annexure 23 presents the overview of the proposed Prani Sampad Bikas Foundation (PSBF).

Eligible investees and end-borrowers will be micro, small and medium-sized agribusiness companies and producers (including producer cooperatives), primarily in the beef, dairy, sheep, goats, and poultry value chains—in other words, value chain actors such as off-takers, processors, transporters, and input suppliers. The investors and borrowers will present financially viable expansion plans involving linkages to smaller businesses and producers in their value chains that meet the eligibility criteria for CGMSME as defined by the Bangladesh Bank's revised definition of Cottage, Micro, Small & Medium Industry & Determination of Credit Limit (SMESPD Circular No.2 dated. 29.06.17).

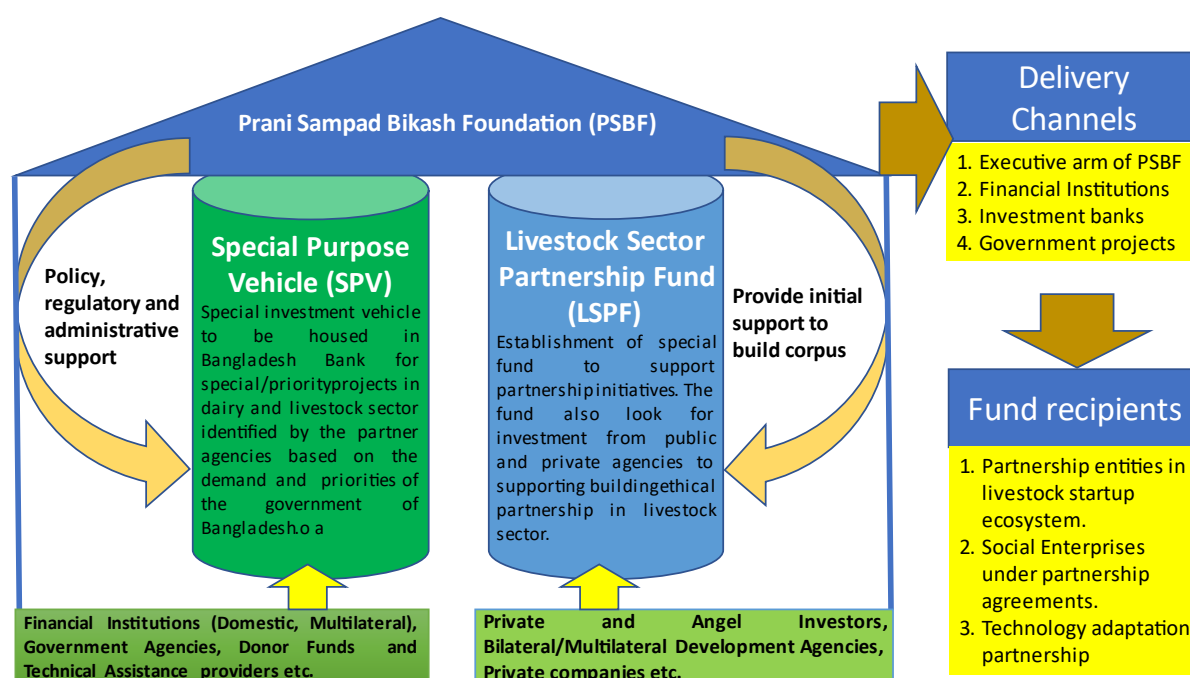


Figure 14. Funding ecosystem of PSBF

PSBF will provide loan, equity and credit guarantees to the investees. Financial assistance from PSBF will enable viable and bankable firms and producer organisations across the livestock value chain to boost the value chain's productivity, enhance its resilience, reduce its emissions footprint, and upgrade its performance through access to long-term debt. This type of financing will facilitate long-term investments, particularly in fixed assets, advanced technology, or equipment that can also serve as security for the financing. PSBF will earn its keep from interest, dividend on equity, sale of equity stake, and guarantee fees. It will provide technical assistance to the investees against a professional fee.

Technical assistance for borrowers and investees. Both the credit line and risk-sharing facility will be complemented by technical assistance for investees to: (i) develop the capacity

to implement the credit line and risk-sharing facility effectively; (ii) acquire an understanding of climate risks, resilience planning, and climate-smart livestock production systems; (iii) identify new business opportunities, marketing strategy, and risk mitigation; and (iv) improve business efficiencies through the application of IT and other productivity tools.

Activities

- Establish PSBF as a legal entity after due consultation and approval of the Government.
- Appoint the Board of Directors of PSBF for its self-governance.
- The Board will appoint CEO and other key staff.
- Corpus fund of US\$ 100 million to PSBF. PSBF will raise the balance US\$200 million from other donors.
- Facilitate leverage by investees of 2x capital from other financial institutions and private entrepreneurs.

Output

- US\$900 million of investment in livestock and dairy sector
- Hundreds of enterprises made commercially viable
- Major boost to entrepreneurship in the country
- Standard operating procedures (SOP) and other policies to guide PSBF operations.
- Training to over 500 individuals and 200 enterprise every year.

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Annexure 1. Agribusiness consortium team

The agribusiness team is composed of both national and international experts of different disciplines as has been decided in the LDDP. In total 13 experts are working in the team. They have been appointed by AFC/SSIL having office based at House # 316, Road #21, DOHS Mohakhali, Dhaka.

A. Name and designation of the team members:

International experts

1. Prof. Dr. Md. Ali Akbar - Animal Husbandry Expert
2. Dr. Dala Ram Pradhan - Agribusiness Development Expert
3. Dr. Prasun K. Das, Agro-economist & Financial Expert
4. Dr. Manab Chakraborty, Agro-economist & Financial Expert
5. Dr. Balasankari P. Krishnan, Renewable Energy Expert
6. Mr. Gregory Lawrence Willis – Agribusiness Development Expert

National experts

1. Dr. Md. Jasimuddin Khan, Animal Feed Expert
2. Md. Abul Kalam Azad, Dairy and Village Milk Collection Centre Expert
3. Md. Mostafa Kamal, Grant Scheme Expert
4. Md. Mirza Altaf Hossain, Value Chain Expert
5. Md. Mudasser Billah, Monitoring & Evaluation Expert
6. S.M.A. Samad, Training & Communication Expert
7. Dr. Md. Rezaul Karim, Livestock Product Development Expert

B. Communication and liaison of Team with the PMU, LDDP

Regular communication has been maintained by Md Farid Uddin Managing Director, SSIL with Md Abdur Rahim (Project Director & Joint Secretary) and Dr. Md. Golam Rabbani (Chief Technical Coordinator) as the PMU, LDDP. Md Farid Uddin is the Focal Person of contact for AFC/SSIL. He is responsible for coordinating efforts between stakeholders, transmitting instructions from PMU to agribusiness consortium, submitting deliverables on time, and communicating updates to key players. In addition, Mr. Johannes Geisen, Project Manager, AFC, Germany has periodic communication with Md Abdur Rahim, Project Director on contractual and other high-level matters.

Prof. Dr. Md. Ali Akbar, Animal Husbandry Expert maintains close rapport with Dr. Md. Golam Rabbani on technical matters. Md. Mostafa Kamal, Agri-business Expert (Grant Scheme) and Mr. S.M.A. Samad, Agribusiness Expert (Training & Communication) maintain close liaison with Dr. Rabbani and PMU officers concerned with the delivery of matching grants scheme. From time to time, agribusiness consortium presented its works to the LDDP. The team presented the Inception Report on 25th January 2022 at Hotel Sonargaon, Dhaka. Dr. Manab Chakraborty presented the inception report on behalf of the team. The workshop was graced by Mr. S.M. Rezawul Karim, M.P., Honourable Minister, MOFL; Dr. Md Yamin Chowdhury, Secretary, MOFL; Dr. Manzoor Md. Shahzada, DG, DLS; Md. Abdur Rahim, PD and Joint Secretary, Dr. Golam Rabbani, Chief Technical Coordinator and Md Farid Uddin, Managing Director, SSIL. All national and international experts from the consortium were present.

On 17th February, 2022, the agribusiness consortium team had a meeting with PMU, LDDP and discussed about the plan of work and administrative and technical directives from the PMU to the team.

On 6th March 2022, the agribusiness consortium team had a meeting with the CTC and his deputies on future deliverables.

The agribusiness consortium presented its work to the World Bank missions on 22 March 2022 and 11 January 2023.

The details of meeting held is given in table A4.1.

Table 9: Team Meetings Held

Meeting Type	No. of meetings held	Minutes available	Zoom recordings available
Team meetings – weekly (03.01.2021 to 10.10.2022)	36	36	26
Team meetings – fortnightly since 24.10.2022	14	14	14
Special meetings	11	1	9

Annexure 2. Slaughtering facilities – Survey questionnaire

The objective of the subgrant (100% grant) for developing slaughtering facilities and meat processing was focused on hygiene and technological improvement with special reference to cold chains. As the allocations were mainly for (a) Improvement of 200 wet markets, (b) Establish 20 medium sized slaughtering facilities at District level and (c) Modernizing 3 existing slaughtering facilities at the metropolitan areas.

Keeping in view the foregoing, the questions essentially need to be asked at 3 levels:

1. Butchers/Abattoirs at the wet markets on their proposed relocation.
2. District level officials on their understanding on the proposed public-private partnerships (PPP) model for establishing medium sized slaughtering facilities.
3. Municipality level on upgradation of the existing facilities/establishment of new facilities.

Part 1: Wet markets

- a) Operating time of the shop/wet market
- b) Check the location of the wet markets (distance from the nearest city centres):
 - Attached with the existing market
 - Located outside
 - If located outside, what is the average distance?
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 -
 -
- c) Suitability for redesign of the markets with clear separation of dirty (slaughtering, dressing) and clean areas for sales of final produce (fruits and vegetables, meat, fish, general groceries).
 - Yes, suitable
 - No, not suitable
 - If not, what are the requirements to make it suitable
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d) Do the wet markets have additional land to allocate for the new slaughtering facilities? Preferably all live animals and slaughtering/dressing outside market.

-Yes

-No,

-If No, how the problem will be solved?

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e) What are the options for installing cooling/freezing facilities?

- Within the market yards,

- Outside the market yards

- If outside, how the meat will be carried to the location?

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- In case colling facilities are available with private sector, what is the cost for keeping the meat with them and how safe it is?

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f) Quantity of waste generated/day

- Solid waste

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- Liquid waste

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g) What are the options for installation of waste water collection and waste water treatment facilities?

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h) Check the options for waste collection and disposal (dumping site,

composting, rendering of meat offal).

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i) Average number of butchers operating at the wet markets and their monthly average number of slaughtering, Average current rent and other expenses and sales?

- Number of butchers cum meat shops
- Out of which how many are women
- Average number of slaughtering/ month (Cattle/buffalo, Goats/lambs, chicken/duck)
- Water consumption (per day)
- Hot Water Requirement (if used) (per day)
- Fuel consumption (Type of fuel & Consumption)
- Current rent (per month)
- Average Monthly Electricity consumption
- Average Monthly Electricity charge
- Average other expenses
- Average income from selling meats (per month)
 - (a) Beef
 - (b) Mutton/Lamb
 - (c) Chicken/duck
- Average income from selling hides (per month)
- Average other incomes (per month)
- Whether the butchers/meat shop took the space on long term basis/annual rent basis?

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j) Training requirement of the butchers: what type, what level etc.

- Years of Experience in butchering
- View on Health and Hygiene at Wet market
- View on unorganized slaughtering
- Knowledge on Health risks from unorganized slaughtering
- View on Frozen meat
- View on LDDP project

- Do they need training? (if yes, then)
 - (a) Hygiene & bio safety
 - (b) Financial management
 - (c) Packaging & marketing
 - (d) Waste management
- What level of training they need?
 - (a) To run their business independently?
 - (b) Cooperative basis?
 - (c) Formal training on evaluating the quality of meat etc.?

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k) How the butchers/meat shops are being financed?

- Self-Financed
- Finance from Banks/MFIs
- Finance from money lenders
- Finance from other actors in the value chains

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l) Listing of other important issues and challenges:

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Part 2: Information from Districts and city corporations/ municipalities

a) Number and details of Slaughterhouses in the zone:

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b) Number and details of Wet markets in the zone:

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c) View on LDDP project

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d) Willingness of municipalities to work with the private operators to run the slaughter houses build under the LDDP?

- Yes/No
- If Yes, what will be the operating model and how the contract and financial dealings will be done?
- Willingness of municipalities to outsource the operations and maintenance to a private sector operator for a minimum period of 5 years.

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e) Willingness of municipalities to forbid open-air and informal slaughtering, once a new facility will be constructed;

- Yes/No,
- If yes, what are the proposed modus operandi

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f) Frequency of food safety inspection:

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g) Financial plan including, investment and operating cost, as well as cost coverage through increasing stall rents and contribution from Municipality budgets

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h) Income/Expenditure of Municipalities/City Corporation from/to maintain slaughterhouses.

- Income from Rent (per month)
- Income from other activities (per month)
- Operational expenditure (per month)
- Fixed expenditure (per month)

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i) Current waste management practices by the slaughterhouses/wet markets.

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j) Difficulties/Problems/Challenges in Waste disposal of Slaughterhouse/Wet market waste

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k) Environmental Regulations/Norms of Slaughterhouse waste disposal

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Part 3: Information from Metro/Upazila level Slaughterhouses

No.	Type of information	Number/ Qty.	Remark
1	Operating pattern of the slaughterhouse -No. of days in a week -No. of days in a month -No. of months in a year		
2	Operating Time of the Slaughterhouse		
3	Avg daily capacity of animal slaughtering	Cattle/ Buffalo ---- Goat/ Sheep ---- Poultry ----	
4	No. of animals maintained in the slaughterhouse	Cattle/ Buffalo ---- Goat/ Sheep ---- Poultry ----	
5	Quantity of waste generated from each slaughter of	Cattle/ Buffalo ---- Goat/ Sheep ---- Poultry ----	
6	Waste generation in slaughterhouse	Solid waste---- Liquid waste----	
7	Any periodic fluctuations / seasonal variation in waste generation		
8	Current waste management practice		
9	Cost involved in disposal of slaughterhouse waste		
10	Issues faced in current waste management practice		
11(a)	Biogas Facility -Yes -No		
11(b)	Type of Reactor used		
11(c)	Retention time		
11(d)	Waste handling Capacity of the Biogas Plant(per day)		
11(e)	Biogas generation(per day)		
11(f)	Utilisation/Application of biogas generated		
11(g)	Installed on (month/year)		
11(h)	Operational Status -Yes -No		

No.	Type of information	Number/ Qty.	Remark
	-(if no duration of operation and reasons for failure)		
11(i)	Bio slurry generation		
11(j)	Economic value of Bio slurry		
11(k)	Bio slurry sold to		
12	Quantity of electricity used by the slaughterhouse - kWh per day -kWh per week -kWh per month -Previous year 12 months data on electricity consumption		
13	Cold storage (Yes/No) If Yes -dimensions -electricity requirements -operating temperature -technical specifications		
14	Standards followed -Environmental regulations for waste disposal? -Meat quality standards? -food inspection? -Any other?		

Annexure 3. Value chain analysis – model questionnaires

A) Backyard poultry

A. Producers:		
Divisions		
Districts		
Purchase price of DOC (BDT)		
Rearing time for each batch (in week)		
Eggs produced in 52 weeks		
Selling price of egg (BDT)		
Value of self consumed eggs- 20% of production (in BDT)		
Earnings from eggs sale (25% of prodn.) (BDT)		
No. of chicks brooded (55% of eggs, 35% mortality)		
Weight of 13 week chicken (in kg)		
Sale price of 13 week chicken (BDT)		
Earning from each 13 week chicken (BDT)		
Medicine cost (Tk)		
Gross profit from eggs and chicken (BDT)	-	-
Gross profit as % sales		
No. of respondents	-	-
B. Traders		
Divisions		
Districts		
Value of eggs purchased (BDT)	-	-
Purchase of chicken (BDT)	-	-
Marketing cost (BDT)	-	-
Sale price of egg (BDT)	-	-
Sale price of chicken (BDT)	-	-
Earning from sale of eggs (BDT)	-	-
Earning from sale of chicken (BDT)	-	-
Gross profit from sale of eggs and chicken (BDT)	-	-
Gross profit as % sales		
No. of respondents		

Annexure 4. Support provided for operationalization of matching grant scheme

Out of the nine major activities (deliverables) assigned to the agribusiness consortium, the support to PMU LDDP for sound implementation of Matching Grant Scheme (MGS) has been considered by LDDP as the vital task. The agribusiness team, both national and international experts, provided assistance in some aspects (as mentioned below) in this task. Taking account of the timeline needed for the roll out of MGS and on request from the PMU LDDP, the team prepared and submitted a report on 'Guidance on Operationalization of Matching Grant Scheme' in March 2022 (which was originally scheduled to be delivered in July 2023). This report on MGS was prepared as per guidance spelled out in the Grant Manual of LDDP.

1 Matching Grants Packages

Under the sub-Component B 1: Market linkages and Investments, matching grants to agro-businesses is being offered under the following packages (Table 1). The target applicants are private enterprises (cottage, micro, small and medium) operating in livestock and dairy value chain in Bangladesh. LDDP's contribution is set not to exceed 40% of the total proposed project cost.

Table 1: Matching Grant Packages

No.	Name of Activity	Unit	Number of grant (in total project period)	Per unit MG Amount (BDT) maximum 40% of total cost
1	Demonstration for feeds for fodder storage option	Roughage baler	16	3,65,000
2	Feeds - support to small scale feed mills to improve processing technology and quality	Feed mill	100	20,75,000
3	Feeds – Assistance in TMR including roughage, silage, concentrate, minerals/vitamins	Feed production centre	760	4,15,000
4	Dairy cattle – support to market-oriented feed and fodder production	Farm	32	20,75,000
5	Milk collection – Dairy Hubs, collecting from VMCC (including the VMCC)	Dairy Hub	20	2,61,00,000
6	Milk processing – small scale milk processing technology at the premises of large dairy farmers and Hubs/POs and sweet meat shops	Mini processing unit	465	24,95,000
7	Milk processing – large processors to adopt technologies for product diversification (cheese,	Processor	10	83,00,000

No.	Name of Activity	Unit	Number of grant (in total project period)	Per unit MG Amount (BDT) maximum 40% of total cost
	yogurts, etc.)			
8	Milk processing – mobile milking machine for leasing by processors to farms	Milking Machine	1,000	83,000
9	Climate resilience - manure enterprise development	3-20 tons/day Digester	10	1,55,00,000
Total			2,413	

Table 2 Matching Grants Packages Revised as of May 2022

No.	Particulars	Unit	Number	Individual Amount	Total MG Amount
				in USD	in million USD
1	Demonstration for feeds and fodder storage options	Roughage baler	16	4,195	0.067
2*	Feeds - support to small scale feed mills to improve processing technology and quality	Feed mill	100	23,848	2.38
3*	Feeds – Assistance in TMR including roughage, silage, concentrate, minerals/vitamins	Feed production centres	760	4,770	3.62
4	Dairy cattle – support to market-oriented feed and fodder production	Farm	32	23,848	0.76
5	Milk collection – Dairy Hubs, collecting from VMCC (including the VMCC)	Dairy hub	20	299,966	6.00
6	Milk processing -small scale milk processing technology at the premises of large dairy farmers and Hubs/POs and sweet meat shops	Mini processing unit	465	28,617	13.31

No.	Particulars	Unit	Number	Individual Amount	Total MG Amount
				in USD	in million USD
7*	Milk processing -large processors to adopt technologies for product diversification (cheese, yogurts, etc.)	Processor	10	95,391	0.95
8	Milk processing – mobile milking machine for leasing by processors to farms	Milking machine	1,000	954	0.95
9*	Climate resilience - manure enterprise development	3-20 T/day Digester	10	178,140	1.78
Total			2,413		29.84
Exchange rates as on 4/10/2022 USD 1 = BDT 87.01					
*These activities are geared towards enterprises					

2. Operational Process

As per request of the LDDP PMU the agribusiness team considered to help implementing MGS by LDDP as of prime importance. Accordingly, the national expert (Matching Grant) together with two other national experts (Value Chain and Animal Feed) and an international agro-economist and financial expert, initiated works on the MGS. The team worked on development of templates and evaluation sheet on EOI and business proposal (BP), bidding documents and translating those documents in Bangla. Later, all experts of the agribusiness consortium were involved with the matching grant implementing process and prepared and submitted a report on 'Guidance on Operationalization of Matching Grant Scheme' in March 2021 as has been mentioned above.

LDDP Matching Grant is to go through a complex process with the involvement of donor, ministry, Economic Relations Division (ERD), DLS, LDDP PMU and Agribusiness consortium. Although Agribusiness consortium has been given responsibility to evaluate EOIs and Business Plans, it was requested (official letter) to be involved in other necessary activities for the MG.

Matching Grants are offered in a series of bidding rounds through the implementation of a two-stage process, comprising EOIs at the first stage, and a business proposal at the second stage. PMU invited bidding of EOI for different packages using advertisements published in newspapers and LDDP website. A number of entrepreneurs, farms and organizations participated in the bid and submitted their EOIs. The received EOIs through PMU were sent to Agribusiness consortium for evaluation along with official letter from LDDP. All national experts from the team participated in EOI evaluation. After completion of evaluation of package, all documents including evaluation sheet were sent to LDDP PMU.

As a next step to the EOI evaluation, Agribusiness consortium assisted PMU in executing

business proposal orientation training to the applicants. After BP orientation, the applicants submitted their business proposal. Agribusiness consortium evaluated the submitted BPs (official letter) and evaluation package was submitted to PMU. Then the applicants were finally selected by the Grant Review Committee (GRC). Thereafter the team assisted in the preparation of deed agreement to be signed by the successful applicants and the Project Director.

The details of assistance provided by the Agribusiness consortium at different stages of the project are summarized below.

Initiation Process (January - June 2022)

The support provided under this process were:

- A detailed background report on how MGS can be operationalised (March 2022). Technical notes on all the 9 packages (April-May 2022)
- Developing grant application form, scoring tools for evaluating applications; format for business plan, and scoring tools for evaluating business plans.

Planning Process (July – December 2022)

The support provided under this process were:

- Preparation of advertisements in Bengali and English for expression of interest (EoI) from prospective beneficiaries.
- Preparation of training materials for and delivering 8 orientation workshops on various MGS packages held in Dhaka (Table 3). The half-a-day workshops were conducted by Mr. S.M.A. Samad, Expert (Training & Communication) from the consortium.

Table 3 Orientation programs held

No.	Date	Topic	No. of participants
1	29-Nov-22	Roughage Baling	10
2	30-Nov-22	Market Oriented Feed and Fodder Production	37
3	01-Dec-22	Small Scale Feed Millers	51
4	10-Jan-23	Total Mixed Ration (TMR)	138
5	19-Feb-23	Climate Resilient Manure Entrepreneurs (CRME)	21
6	03-Jun-23	Dairy Hubs & Village Milk Collection Centres (VMCC)	51
7	10-Jun-23	Small Scale Milk Processing	203
8	10-Jun-23	Large Scale Milk Processing	16
Total			527

Executing Process (January -December 2023)

The support provided under this process were:

- Assisted with wording of advertisement for all packages.
- The EOI advertisement i) Roughage Baling ii) Small Scale Feed Mill iii) Market Oriented Feeds & Fodder production and iv) Small scale milk processing was repeated,
- Evaluating and scoring all applications received.
- All evaluation and scoring sheets were signed by the Acting Team Leader and at least one more person representing the agribusiness consortium.
- Draft grant agreement letters for signature by the LDDP Project Director.
- As per request of LDDP, Agribusiness team conducted rapid price assessment of equipment those were demanded by the applicants through business plan and submitted vouchers.

PMU, LDDP provided access to files of all applicants. These files were kept under supervision of Md. Mostafa Kamal, Expert (Grant Scheme) and he is the key person supporting the Matching Grant Scheme.

Annexure 5. Key Actors in Livestock and Dairy Value Chain

a) Milk Value Chain

Farmer or producer, feed mills, and feeds sellers are the production end actors of the dairy value chain. Small holders account for the overwhelming majority of milk producers. On the processing side, Milk Vita/Aarong/PRAN and other dairy companies account for more than 96% of the organized trade. These companies collect milk from farmers and middlemen, value add in their factories, and distribute milk and milk products through distributors, and retailers. Producers also directly sell their produce to neighbours, village traders, and sweet meat shops. The milk value chain found in various districts during the research of the agribiz consortium is represented below:

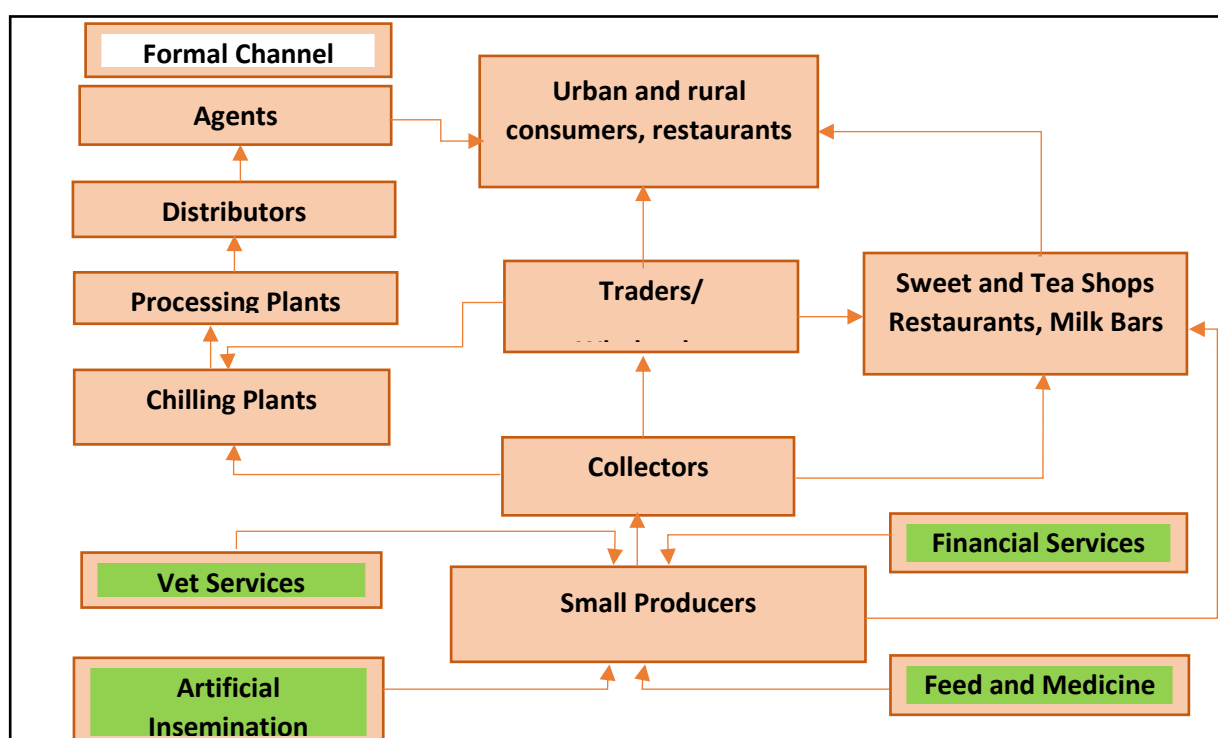


Figure. Dairy Value Chain

As per agribiz consortium's field observation, average gross profit on sale of a liter of milk is 6% both for producers and traders. Feed cost including concentrate and fodder accounts for 90% of all expenses.

b) Beef Value Chain

Farmer or producer, feed mills, and feeds sellers are the production end actors of the dairy value chain. The farmers sell their animals to village trader ('faaria') who sell to larger traders along the value chain. A small amount of animal meat is processed in integrated meat plants. The beef fattening value chain is represented in the figure below. As per agribiz consortium's field observation, producers in beef fattening trade sold their products mainly to forward contracted customers (20%), walk in customers at the farmgate (20 percent), 20% in village 'haats', and balance 20% to local/village traders.

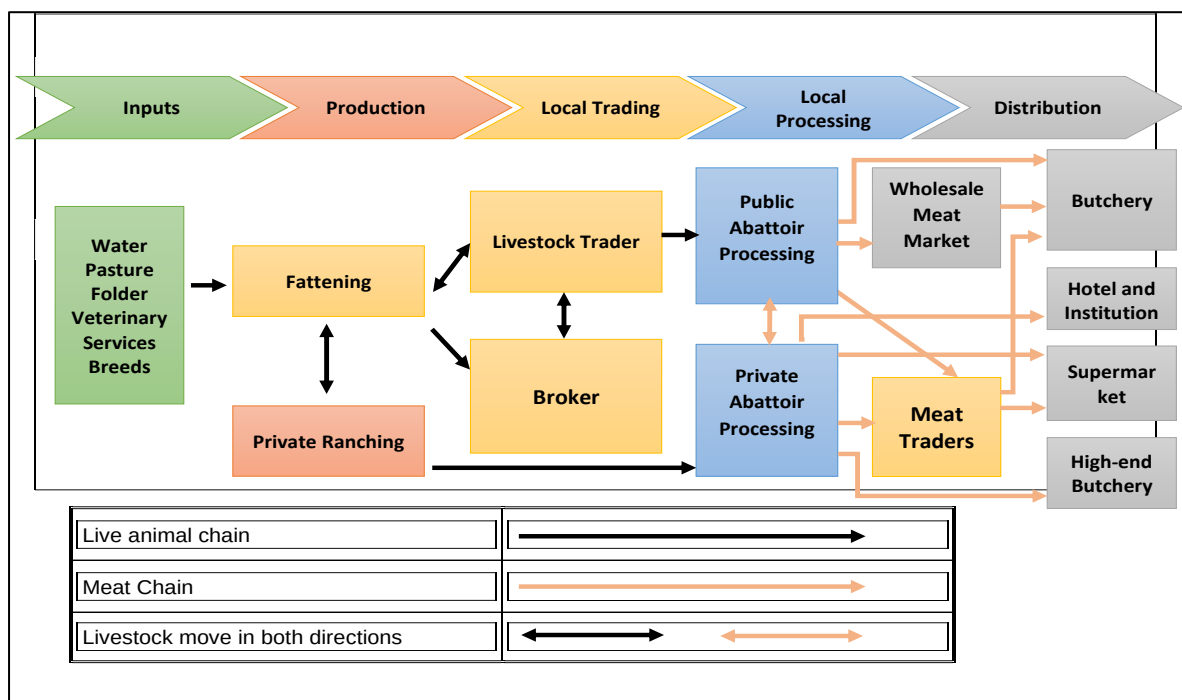


Figure. Beef fattening Value Chain

b) Goat and Sheep Value Chain

The value chain map below illustrates the way in which live goat and sheep flow from farm gate to end markets and how the overall small ruminant segment operates. It is a visual representation of the structure of the value chain. As per our field observation, producers in goat trade sell their products mainly to village traders (50%), 30% in village 'haats', and balance 20% to walk in customers at the farmgate.

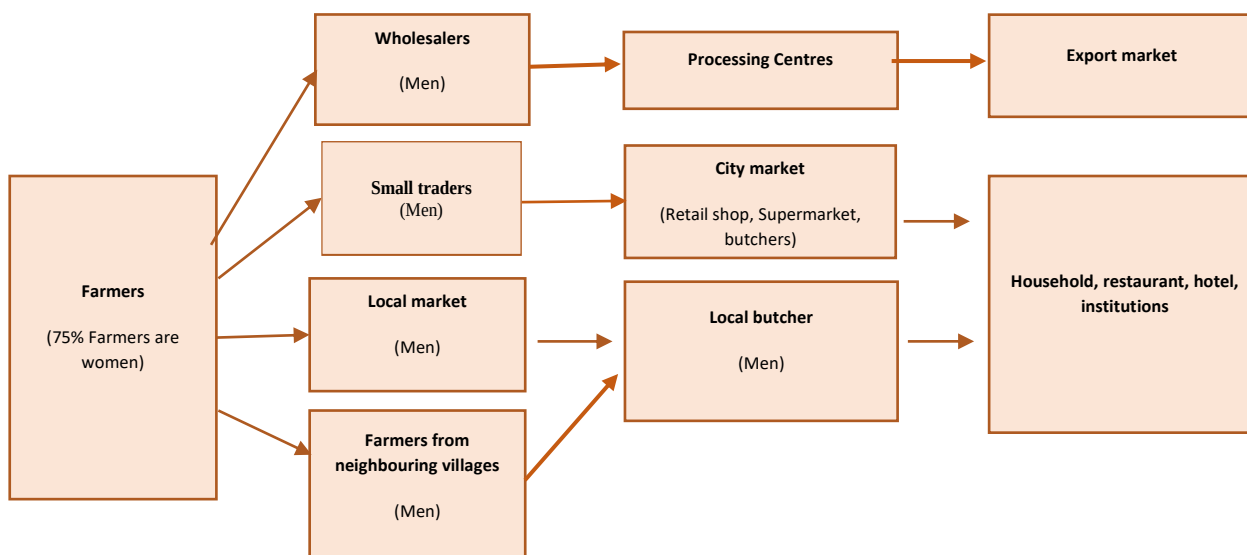


Figure. Small Ruminants Value Chain

Annexure 6. Monitoring of Grant and Investment Sub-Projects

The monitoring of outcomes/results will be based on the results framework and monitoring arrangements that are described in detail in Table below. For the monitoring of the project processes and results using indicators from the results framework, the project M&E function will adopt an Information and Communication Technology (ICT)-based project Management Information System (MIS) that caters to the project level information. The project M&E will also use Participatory Community Monitoring and Accountability approaches such as for local level monitoring, performance evaluation of services, and citizen feedback. In addition, the project M&E function will undertake periodic beneficiary assessments through sample surveys to track the project's progresses towards its goal.

Table. MGS Monitoring Plan

No	Indicator	Frequency	Data source	Responsibility for data collection
1	MGS amount and number approved, disbursed	Annually	MIS and Progress report	PMU/PIU
2	Amount of Matching Grant amount invested by applicants	Annually	do	PMU/PIU
3	POs and enterprises have received business development skills training, marketing support, and financial services (number)	Annually	do	PMU/PIU
4	Systems and devices for renewable energy production and energy gains established (number)	Annually	do	PMU/PIU

A team need to be constituted comprising the District Livestock Officer of the concern district and Deputy Secretary for monitoring the MGS activities. The team will physically visit the MGS's progress reports including financial statements indicating grant expenditure and Beneficiary contribution expenditure to date, forecast expenditures for the next period, progress to date against work plans, agreed performance targets, and indicators, workplan for the next period with any revisions proposed and revised budget where appropriate. The team will also monitor the actual achievements of the sub-project in terms of objectives, overall outcomes that were expected to be achieved and lesson learnt regarding sustainability of the sub-project and report to the PD of the project and Secretary of MOFL. Another team comprising Upazila Livestock Officer and concern VFA will visit the achievement against the agreement of MGS and report to the DLO and PD fortnightly. PMU will coordinate the monitoring programs and will take necessary action. Moreover, PMU need to organize periodic/monthly/annual monitoring of the MGS, suggestions, find the best practices and replicate among the others through training and exposure visit program.

Annexure 7. Milk Vita Cooperative Model

In the context of Bangladesh, there are only 15 milk processing organizations are in existence who are producing, collecting, processing and marketing of milk and milk products. Among them, Milk Vita is the largest organization and having the highest milk market share and is the only example of cooperative business model running successfully in the country like AMUL in India.

Milk Vita, the largest milk processing organization operating since 1974. The milk chilling centres of Milk Vita are initially placed in the Northern and Southern part of Bangladesh and afterwards the coverage has been extended to cover almost nationwide. On the other hand, others milk processors are mainly established under umbrella of Milk Vita at their initial stage. However, now they are expanding their milk collection centres/points to different districts of the country. Undoubtedly, it's a positive signal for dairy development in Bangladesh. Generally, for establishing a VMCC or milk collection centre in the rural areas requires BDT 15,00,000 to 18,00,000.

Milk Vita Cooperative Model: The Milk Vita Cooperative model was adopted from the world-renowned ANAND Model in India. It was modestly started in the mid-seventies by providing 4300 very poor, often landless, households in the remote rural areas with a complete package of milk production enhancing technologies, organizational skills and a milk processing and marketing system. It has since grown into a successful commercial enterprise in Bangladesh covering about 2,50,000 smallholder milk producer members. The raw milk is collected with fair price-based quality which is then processed in different types of dairy products and marketed nationwide. The Milk Vita cooperative model has been shown below.

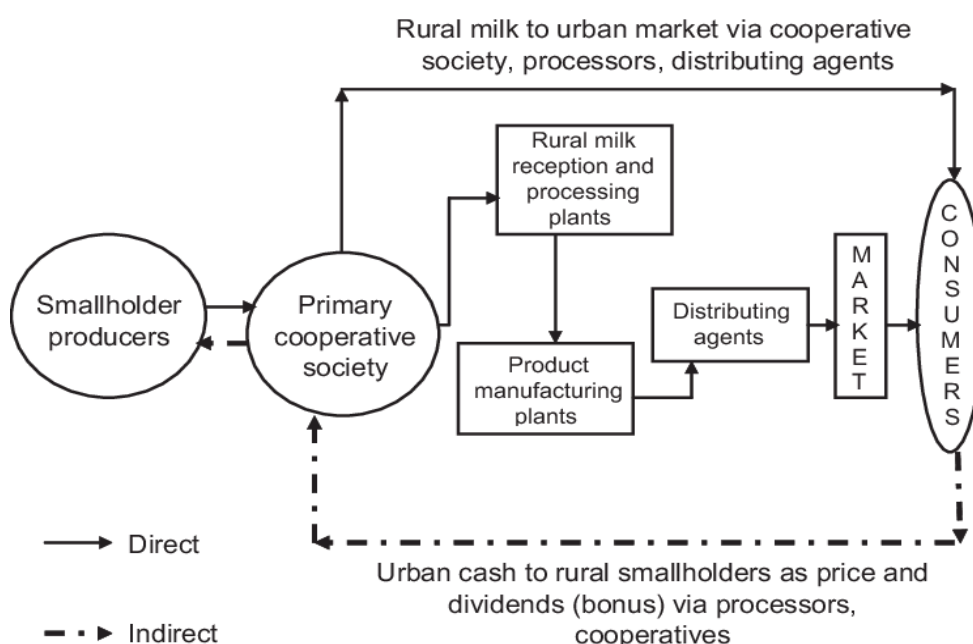


Figure. Milk Vita Cooperative Model

Annexure 8. PPP model in livestock sector in Bangladesh

The PPP model in livestock sector in Bangladesh is under-explored. Some of the potential areas that emerged during the study is illustrated below.

Table. Potential Areas of PPP within Livestock Sector in Bangladesh

Broad category	Main variants	Ownership of capital assets	Potential private partners	Approximate duration of contract (years)
Milk hub	Lease-transfer	Public	Dairy companies/ NGOs	10 years
Slaughterhouse (metro)	Build-own-lease	Public	Private meat companies/ wholesalers/ Exporters	10 years
Slaughterhouse (district)	Build-own-lease-transfer	Public	Well established retailers/ meat companies/ exporters	10 years
Slaughterhouse (upazila)	Lease-transfer	Public/private	Progressive butchers/NGOs	20 years
Wet market	Build-Own-Franchise	Public	Wet market association/ Private enterprise	10 years
Vaccine production	Joint ventures with foreign companies	Public/private (FDI)	Foreign multinationals / national vaccine manufacturers	20 years
Feeds production	Joint ventures with foreign companies	Public/private (FDI)	Foreign multinationals / national feed producers	10 years
Refrigerated vans/ cold chains	Concessions	Public	Unemployed youth/ traders/ transport operators/ NGOs	5 years

Annexure 9. Link of all reports

1. [Link of Submitted copies of all deliverables](#)
2. [Link of Meeting minutes](#)
3. [Link of Field visit reports](#)
4. [Link of Caselets for Report 7 Partnership Development](#)
5. [Link of KII on the need for an availability of Partnership in Livestock and Dairy Development sector in Bangladesh](#)

Annexure 10. Summary of all field visits

The Agri-business consortium consisting of both national and international experts performed 40 field visits during the period from December 2021 to February 2023. Most of the field visits were carried out in two teams - each team consisting of national and international experts. International experts participated in 22 out of 40 field visits performed under this assignment. The main objectives of the field visits were to collect first-hand data and on-ground information for preparing different deliverables under the LDDP project. The team travelled to places near Dhaka city, adjacent towns as well as different districts of the LDDP focus area from all eight administrative divisions in the country.

During these field visits, the team collected primary information directly from the field by interviews with the respective stakeholders like farmers, traders, slaughterers, meat sellers and entrepreneurs. Especially, the teams met with the officials at the district and upazila level, DLS offices, LDDP project personnel, research organizations and training institutions under department of youth, rural development. They also visited the organizations working on renewable energy technologies in the livestock sector.

The team visited large, medium and small processing units involved in milk production, collection, processing, packaging and transforming to value-added products. The team also utilized these field visits to validate data and information made available from FGDs and KIIs which were collected through telephonic calls and email. All the collected data and information were tabulated, compiled and summarized based on the requirement of deliverables.

Some noticeable examples from the list of field visits are follows:

- Slaughtering slab at Mohammadpur Krishi market, Dhaka North City Corporation
- Dutch Dairy Farm (a private hi-tech dairy farm), Munshiganj district
- EON Bio Science (a private hi-tech dairy farm), Rangpur
- Masco Dairy Farm, Rupganj, Narayanganj
- Nahar Dairy farm at Chittagong
- Poultry processing plant of EON Bioscience, Mawna, Gazipur
- Khulna City Corporation (KCC), KCC allocated land for building a modern slaughterhouse.
- Bangladesh Livestock Research Institution (BLRI), Savar, Dhaka
- PRAN group: VMCC, Hub, processing units at different regions.
- Alamgir ranch (a big beef fattening farm)
- BRAC milk processing center
- Bengal meat, the only modern meat production industry
- Aftab poultry farm, Kazi poultry farm
- RDA, Bogura
- BAPARD, Gopalganj
- ILST, Netrokona, Gopalganj and Gaibandha
- NILPM, Gopalganj

The list of field visits made along with purpose, expert team, travel dates, officials met and their contact details are given in the Table below:

DETAILS OF THE FIELD VISIT								
No .	Travel date (Period)	Travel area (District)	Specific area of visit	Name of the Officials	Designation and Address	E-mail / Phone	Purpose	Name of the visitor
1	22-12-2021	Dhaka	Slaughterhouse, Krishi Market, Mohammedpur, Dhaka	Slaughterhouse Staffs at Mohammedpur			Information collection for Inception Report	Dr. Rezaul Karim, Mr. Mudasser Billah, Dr. Manab Chakraborty
2	23.12.2021	Munshingh	Dutch Dairy Farm; Lohagonj and Sreenagor, ULO office, Munshingh	-	ULO, DLS, Sreenagor, ULO office, Munshingh	ulosreenagar259@gmail.com (01717-338255)	Information collection for Inception Report	Dr. Md. Ali Akbar, Dr. Manab Chakraborty, Dr. Md. Jasimuddin Khan, S.M.A Samad, Md. Mostafa Kamal, Mirza Altaf Hossain, Md. Abul Kalam Azad, Md. Mudasser Billah, Md. Rezaul Karim,
3	10-12.01.2022	Rangpur	Rangpur Sadar, Mithapukur & Badarganj-Rangpur and EON Bioscience (Badarganj)	Momin Ud Dowlah	Chairman & Managing Director, Eon Group of Industries, 304 Tejgaon I/A, Dhaka	E-mail: ceo@eongroup.net. bd Tel: 00-88-02-9830915-18,	Information collection for Inception Report	Dr. Md. Ali Akbar, Dr. Md. Jasimuddin Khan, S.M.A Samad, Md. Mudasser Billah
4	11-12.01.22	Tangail, Natore & Rajshahi	Tangail, Natore & Rajshahi	Dr. Md. Rana Mia	DLO, DLS-Tangail(FGD with-LSP, LFA, LEO& others)	email: dlotangail2014@gmail.com (01712-238022)	Information collection for Slaughtering facilities	Mirza Altaf Hossain, Mr. Mostofa Kamal, Mr. Rezaul Karim

DETAILS OF THE FIELD VISIT								
No .	Travel date (Period)	Travel area (District)	Specific area of visit	Name of the Officials	Designation and Address	E-mail / Phone	Purpose	Name of the visitor
				Dr. Md. Go;am Mostafa	DLO, DLS, Natore	dlonatorelds15@gmail.com (01716-652984)	report & Value chain analysis report	
					Chief Executive Officer [CEO] of the RCC, Rajshahi			
5	13.03.2022	Narayangonj	MASCO, Kanchon, Rupgonj, Narayangonj	M A Sabur	Chairman, MASCO Dairy Enterprise, Kanchon, Rupgonj, Narayangonj,	E-mail :azam@mascogrp.com, Cell: 0162-495364	Information collection for Slaughtering facilities report (D#2)	Dr. Andrew Lambert de la Field, Dala Ram Pradhan, Dr. Md. Jasimuddin Khan, S.M.A Samad, Md. Mostafa Kamal, Mirza Altaf Hossain, Md.. Abul Kalam Azad, Md. Mudasser Billah, Md. Rezaul Karim,
6	15.03.2022	Gazipur	EON Group, EON Group, Maona, Sreepur, Gazipur.	Momin Ud Dowlah	Chairman, EON Group of Industries, 304 Tejgaon I/A, Dhaka -1208, Bangladesh	E-mail: ceo@eongroup.net. bd Tel: 00-88-02-9830915-18,	Information collection for Slaughtering facilities report (D#2)	Dr. Andrew Lambert de la Field, Dala Ram Pradhan, Dr. Md. Jasimuddin Khan, S.M.A Samad, Md. Mostafa Kamal, Mirza Altaf Hossain, Md. Abul Kalam Azad, Md. Mudasser Billah, Md. Rezaul Karim,

DETAILS OF THE FIELD VISIT								
No .	Travel date (Period)	Travel area (District)	Specific area of visit	Name of the Officials	Designation and Address	E-mail / Phone	Purpose	Name of the visitor
7	27-30.03.22	Khulna	Khulna KCC & Other		The Veterinary Officer/ Executive, KCC, Khulna	Email: reza_vet24@yahoo.com, kcc.foodsafety@yahoo.com	Information collection for Slaughtering facilities report (D#2)	Dr. Prasun Kumar Das, Dr. Md. Jasimuddin Khan, Mr. Rezaul Karim
8	29.03-01.04.22	Pabna	PRAN Pabna & Bengal Meat Processing Industries Ltd	Md. Maksudur Rahman	DGM (Operation), PRAN Dairy, PRAN-RFL Tower, Dhaka Chief Executive Officer, Bengal Meat Processing Industries Ltd, 110 Tejgaon I/A, Dhaka -1208, Bangladesh,	E.mail : dairymcc1@prangroup.com, Cell :01704-141000 E.mail : nurmd@bengalmeat.com, Cell :01755-649034	Information collection for Slaughtering facilities report (D#2)	Md. Mostafa Kamal, Md. Abul Kalam Azad, Mirza Altaf Hossain, Dr. Dala Ram Pradhan, Dr. Manab Chakraborty,
9	04.04.22	Dhaka	BLRI, Savar, Dhaka		DG, BLRI, Savar, Dhaka	dg@blri.gov.bd, Phone: +8802224491676	Information collection for Slaughtering facilities report (D#2)	Dr. Manab Chakraborty, Dala Ram Pradhan, Dr. Md. Jasimuddin Khan, S.M.A Samad, Mirza Altaf Hossain, Md. Abul Kalam Azad, Md. Mudasser Billah, Md. Mostafa Kamal, Md. Rezaul Karim

DETAILS OF THE FIELD VISIT								
No .	Travel date (Period)	Travel area (District)	Specific area of visit	Name of the Officials	Designation and Address	E-mail / Phone	Purpose	Name of the visitor
10	06.04.22	Narsingdi	PRAN, Narsingdi	Md. Maksudur Rahman	DGM (Operation), PRAN Dairy, PRAN-RFL Tower, Dhaka	E.mail : dairymcc1@prangroup.com, Cell :01704-141000	Information collection for Slaughtering facilities report (D#2)	Dr. Dala Ram Pradhan, Mirza Altaf Hossain, Dr. Jashimuddin Khan, Md. Abul Kalam Azad, Md. Muddasser Billah, SMA Samad, Md. Mostafa Kamal
11	21.04.22	Hobigonj	Pure Agro, Hobigonj	Md. Muttakim Chowdhury	Proprietor, Pure & Organic Dairy Farm, Andiura , Madhabpur, Habigonj	E-mail: muttakin781@gmail.com Cell: 00-88-01711-330781,	Information collection for Matching Grant Report (D#6)	Dr. Balasankari P. Krishnan; Md. Mostafa Kamal; Md Rezaul Karim & Md Abul Kalam Azad
12	22.04.22	Naroshingdhi	Char Amlab (Khamarer Mour), Belabo, Naroshingdhi	Md Abdul Hannan	Proprietor, G. Rahman Agro & Cattle Range, Char Amlab (Khamarer Mour), Belabo, Naroshingdhi,	E-mail: abnservices.bd@gmail.com Cell: 00-88-01875-280394/ 01819-211565,	Information collection for Matching Grant Report (D#6)	Dr. Balasankari P. Krishnan; Md. Mostafa Kamal; Md Rezaul Karim & Md. Abul Kalam Azad
13	28-31.05.22	Rangpur	Rangpur	Momin Ud Dowlah	Chairman & Managing Director, Eon Group of Industries, 304 Tejgaon I/A, Dhaka-1208, Bangladesh	E-mail: ceo@eongroup.net.bd Tel: 00-88-02-9830915-18,	Information collection for Value chain Analysis Report (D#3)	Dr. Md. Jasimuddin Khan, Md. Abul Kalam Azad, Md. Mostafa Kamal, Md. Abdus Samad, Md. Mudasser Billah, Md. Rezaul Karim
14	21.06.22	Dhaka	BLRI Savar		DG, BLRI, Savar, Dhaka	dg@blri.gov.bd, Phone: +8802224491676	Information collection for Value chain	Dr. Balasankari P. Krishnan, Dala Ram

DETAILS OF THE FIELD VISIT								
No .	Travel date (Period)	Travel area (District)	Specific area of visit	Name of the Officials	Designation and Address	E-mail / Phone	Purpose	Name of the visitor
							Analysis Report (D#3)	Pradhan, S.M.A Samad
15	21.06.22	Sirajganj	Sirajganj FGD	Md. Maksudur Rahman	DGM (Operation), PRAN Dairy, PRAN-RFL Tower, Dhaka	E.mail: dairymcc1@prangroup.com , Mobile : 01704-141000	Information collection for Value chain Analysis Report (D#3)	Dr. Md. Ali Akbar, Dr. Md. Jasimuddin Khan , Md. Abul Kalam Azad
16	22.06.22	Kushtia	Kushtia FGD	Lita Kayum	Head of Consumer Health Division, Shelaidah Dairy; Nasir Trade Centre; 89 C.R. Datto Road, Dhaka-1205,	E-mail: lita.kayum@hpl.com.bd , Mobile: 00-88-01844-245200	Information collection for Value chain Analysis Report (D#3)	Dr. Md. Ali Akbar, Dr. Md. Jasimuddin Khan , Md. Abul Kalam Azad
17	22.06.22	Meherpur	Meherpur FGD	FGD for Goat prodducer and trader re;ated field (PG)			Information collection for Value chain Analysis Report (D#3)	Dr. Manab Chakraborty, Md. Mostafa Kamal; Md. Rezaul Karim
18	26-27.06.22	Bogura	RDA Bogura	Md. Abdul Majid Pramanik, PhD	Joint Director, Rural Development Academy, Bogura	E-mail: dr.majid@rda.gov.bd, majid_rda@yahoo.com , Mobile: +8801717-702924	Information collection for Value chain Analysis Report (D#3)	Dr. Manab Chakraborty, Mirza Altaf Hossain, S.M.A Samad,
19	26-28.06.22	Noakhali	Companiganj , Noakhali	Dr. Taslima Ferdausi	ULO, DLS Companiganj	linahasan01718@gmail.com, (01718-458446)	Information collection for Value chain	Mrs. Balasankari Palghat Krishnan

DETAILS OF THE FIELD VISIT								
No .	Travel date (Period)	Travel area (District)	Specific area of visit	Name of the Officials	Designation and Address	E-mail / Phone	Purpose	Name of the visitor
							Analysis Report (D#3)	
20	30.06.2022	Gazipur	Bhabanipur and Sreepur, Gazipur	Md. Lutfor Rahman (from IDCOL	Representative- IDCOL (Bhabanipur and United Agro Ltd. at Sreepur, Gazipur)		Information collection for Value chain Analysis Report (D#3)	Mrs. Balasankari Palghat Krishnan
21	02-04.06.2022	Kishoregonj	Tarail , Kishoregonj	FGD for Duck producer and trader related field			Information collection for Value chain Analysis Report (D#3)	Dr. Prasun Kumar Das; Md. Mostafa Kamal; Md. Rezaul Karim;
22	01-04.08.2022	Gopalganj & Madaripur	Gopalganj & Madaripur	Dr. Md. Abdur Razzak	DLO, DLS, Madaripur	dlomadaripur@yahoo.com (01712-194783)	Information collection for Value chain Analysis Report (D#3)	Dr. Md. Ali Akbar, Dr. Md. Jasimuddin Khan , S.M.A Samad, Md. Abul Kalam Azad
				Dr. Md. Abdul Aziz Al Mamun	DLO, DLS, Gopalganj	azizmamun73@yahoo.com (01711-668658)		
23	01-04.08.2022	Cumilla, Chandpur & B. Baria	Cumilla	Dr. Md. Nazrul Islam.	DLO, DLS, Cumilla	dlocumilla2019@gmail.com (01324-290789)	Information collection for Value chain Analysis Report (D#3)	Md. Mostafa Kamal; Md. Rezaul Karim; Md. Mudasser Billah
			Lalmi, Cumilla	Dr. Arif Hasnat	ULO, DLS, Lalmi, Cumilla	ulolalmi@dls.gov.bd (01324-290808)		
			Chandpur	Dr. Md. Bokhtiar Uddin	DLO, DLS, Chandpur	bokhtiar.ulodls@gmail.com		
			Saharasti, Chandpur		ULO, DLS, Saharasti, Chandpur	drmaq77@gmail.com		

DETAILS OF THE FIELD VISIT								
No .	Travel date (Period)	Travel area (District)	Specific area of visit	Name of the Officials	Designation and Address	E-mail / Phone	Purpose	Name of the visitor
			Brahmanbaria	Dr. A.B.M. Shaifuzzaman	DLO, DLS, Brahmanbaria	dlobrahmanbaria@dls.gov.bd		
			Kasba, Brahmanbaria		ULO, DLS, Kasba, Brahmanbaria	ulokasba2016@gmail.com		
24	09-12.08.2022	Barishal & Patuakhali	Barishal & Patuakhali	Dr. Md. Nurul Alam,	DLO, DLS, Barishal,	E-mail: dloofficepatuakhali@gmail.com Mobile: +8801711-880314	Information collection for Value chain Analysis Report (D#3)	Dr. Md. Jasimuddin Khan , S.M.A Samad, Md. Abul Kalam Azad
				Dr. Md. Anwar Hossain	DLO, DLS, Patuakhali	2. E-mail: dloofficepatuakhali@gmail.com (Mobile: +8801711-880314)		
25	09-12.08.2022	Khulna & Jessore	Khulna & Jessore	Dr. Arun Kanti Mondal	DLO, Khulna	arunkanti2011@gmail.com, dlokhulnadls@gmail.com (01711-391821)	Information collection for Value chain Analysis Report (D#3)	Md. Mostafa Kamal; Md. Rezaul Karim; Md. Mudasser Billah
				Dr. Md. Rashedul Haque	DLO, Jashore	jessoredlo@gmail.com (01711-383297)		
26	15-18.08.2022	Mymensingh, Netrokona	Mymensingh, Netrokona	Md. Wahedul Alam,	DLO, DLS, Mymensingh	01711-045813,	Information collection for Value chain Analysis Report (D#3)	Dr. Md. Ali Akbar, Dr. Md. Jasimuddin Khan , S.M.A Samad, Md. Abul Kalam Azad
				Md. Shohidullah	DLO, DLS, Netrokona	01711-463455		

DETAILS OF THE FIELD VISIT								
No .	Travel date (Period)	Travel area (District)	Specific area of visit	Name of the Officials	Designation and Address	E-mail / Phone	Purpose	Name of the visitor
27	20-23.08.2022	Sylhet & Sunamganj	Sylhet & Sunamganj		DLO, DLS, Sylhet	dlosylhet@dls.gov.bd (+8801739348598)	Information collection for Value chain Analysis Report (D#3)	Md. Mostafa Kamal; Md. Rezaul Karim;
					DLO, DLS, Sunamganj	dls.sunamganj@gmail.com (01716382624)		
28	18-22.09.2022	Bagerhat, Khulna, Jashore, Jhenaidah	Bagerhat, Khulna, Jashore, Jhenaidah	Dr. Md Lutfur Rahman	DLO, Bagerhat	dloofficebagerhat@gmail.com (01711-143839)	Information collection for Value chain Analysis Report (D#3)	Dr. Md. Ali Akbar, Dr. Md. Jasimuddin Khan , S.M.A Samad, Md. Abul Kalam Azad
				Dr. Arun Kanti Mondal	DLO, Khulna	dlokhlunadls@gmail.com (01711-391821)		
				Dr. Md. Rashedul Haque	DLO, Jashore	jessoredlo@gmail.com (01711-383297)		
				Dr. Md Ashraf Ali	DLO, Jhenaidah (VS)	01718-590260		
29	18-22.09.2022	Rajshahi, Natore, Pabna, Shirajganj	Rajshahi, Natore, Pabna, Shirajganj	Dr. Md. Abdul Mozed	Divisional Livestock Officer, Rajshahi	maz_id10@yahoo.com (+880 1324289417)	Information collection for Livestock and Dairy Business Structure Analysis report (D#4)	Greg Wills, Md. Mostafa Kamal; Md. Rezaul Karim; Md. Mudasser Billah
				Dr. Zulfiker Md. Akhter Hossain	DLO, Rajshahi	zulfikerhossain69@gmail.com (01324-289419)		
				Dr. Md. Golam Mostofa	DLO, Natore	dlonatoredls15@gmail.com (01716-652948)		

DETAILS OF THE FIELD VISIT								
No .	Travel date (Period)	Travel area (District)	Specific area of visit	Name of the Officials	Designation and Address	E-mail / Phone	Purpose	Name of the visitor
				Dr. Md. Al-Mamun Hossain Mondal	DLO, Pabna	dlopabna@dls.gov.bd (01718578020 / 01324289570)		
				Dr. Gaurang Kumar Talukder	DLO, Sirajganj	dlosirajganj@dls.gov.bd (01712933909 (Personal), 01324289482 (Official))		
				DR. Mahfuzur Rahman	ULO, Shahjadpur, Sirajganj	uloshazadpur@gmail.com (01718678837 / 01324289489)		
				DR. MD. Monirul Islam	ULO, Paba, Rajshahi	monirdvm2001@gmail.com (01711-577930)		
				Dr. Chondon kumar Sarkar	ULO, Lalpur, Natore	cksarkerbau@gmail.com (01716-305408)		
30	28.09.2022	Gazipur	BRAC Milk processing centre, Gazipur	Mr. Anisur Rahman	Senior Director, BRAC Enterprises	Cell: 01730-784024	Livestock and Dairy Business Structure Analysis report(D#4)	Greg Willis, Md. Mostafa Kamal; Md. Rezaul Karim; Md. Mudasser Billah
31	15-20.10.2022	Chattogram , Cox's	Chattogram, Cox's bazar, Cumilla	Dr. Md Delwar Hossain,	DLO, DLS, Chattogram.	ctgdlo07@gmail.com (01711-447162)	Livestock and Dairy Business	Dr. Md. Ali Akbar, Mirza Altaf Hossain,

DETAILS OF THE FIELD VISIT								
No .	Travel date (Period)	Travel area (District)	Specific area of visit	Name of the Officials	Designation and Address	E-mail / Phone	Purpose	Name of the visitor
		bazar, Cumilla		Dr. Arif Hasnat,	DLO, DLS, Cox's bazar	dlocox2017@gmail.com (01819073661)	Structure Analysis report(D#4	S.M.A Samad, Md. Abul Kalam Azad
				Dr. Md. Nazrul Islam	DLO, DLS, Cumilla.	dlocumilla2019@gmail.com (01324290789)		
32	17-21.10.2022	Rangpur, Dinajpur	Kaunia of Rangpur district and Parbatipur of Dinajpur Districts	Dr. Md. Abdul Hye Sarker Director, Department of Livestock Services (DLS), Rangpur Division, Rangpur.	Director, Department of Livestock Services (DLS), Rangpur Division, Rangpur.	directorrangpur@dl.s.gov.bd (01718-127621)	Livestock and Dairy Business Structure Analysis report(D#4	Dr. Md. Jasimuddin Khan, Md. Mostafa Kamal; Md. Rezaul Karim; Md. Mudasser Billah
33	15.11.2022	Dhaka	BDFA, Mohammadpur (Beribadh), Dhaka	Mohammed Imran Hossain	President, BDFA, Sat Masjid Housing, Vanga Masjid, Beribadh, Mohammadpur, Dhaka.	bdfa2016.info@gmail.com (01819-263949)	Livestock and Dairy Business Structure Analysis report(D#4	Dr. Dala Ram Pradhan, Md. Abul Kalam Azad, Md. Muddasser Billah, SMA Samad, Md. Mostafa Kamal, Md. Rezaul Karim
34	16.11.2022	Dhaka	LRI, Mohakhali, Dhaka	Dr. Amalendu Ghosh,	Director, Livestock Research Institute (LRI), Mohakhali, Dhaka.	directorlri16@gmail.com (01795-642334)	Livestock and Dairy Business Structure Analysis report(D#4	Dr. Md. Ali Akbar, Dr. Dala Ram Pradhan, Dr. Md. Jasimuddin Khan, Mirza Altaf Hossain, Md. Abul Kalam

DETAILS OF THE FIELD VISIT								
No .	Travel date (Period)	Travel area (District)	Specific area of visit	Name of the Officials	Designation and Address	E-mail / Phone	Purpose	Name of the visitor
								Azad, Md. Muddasser Billah, SMA Samad, Md. Mostafa Kamal, Md. Rezaul Karim
35	26.12.2022	Manikganj	DLS, Manikganj	Dr. Md. Mahbubul Islam,	DLO, DLS, Manikganj	dlomanikganj414@ gmail.com (01324-290290)	Livestock and Dairy Business Structure Analysis report(D#4	Dr. Md. Ali Akbar, Dr. Md. Jasimuddin Khan, Mirza Altaf Hossain, Md. Abul Kalam Azad, Md. Muddasser Billah, SMA Samad, Md. Mostafa Kamal, Md. Rezaul Karim
36	16- 20.01.2023	Mymensing h & Netrokona districts	VTI, Mymensingh.	Dr. Md Lutfur Rahman	Director, VTI, Mymensingh.	vtimymensingh@g mail.com	Farmers Capacity Building report(D#5)	Dr. Md. Jasimuddin Khan, Mirza Altaf Hossain, Md. Muddasser Billah, Md. Mostafa Kamal
			YTC, Mymensingh.	Md. Salim Khan	Co-Ordinator, YTC, Mymensingh.	ytcymymensingh@d yd.gov.bd		
			BAU, Mymensingh	Mrs. Sonia Shohelli	Director, BAUEC, BAU, Mymensingh	director.bauec@ba u.edu.bd		
			DLS, Mymensingh	Dr. Md. Abdul Hai	DLO, DLS, Mymensingh	dlomymensingh.dls @gmail.com		
			DLS, Netrokona	Dr. Humayun Kabir	DLO, DLS, Netrokona	dlonetrokona@dls. gov.bd		
			ILST, Netrokona.	Dr. Samsad jahan sherajee	Director, ILST, Netrokona.	ssherajee72@gmai l.com		
37	22- 27.01.2023	Sylhet & Moulvibazar districts	DLS, Sylhet & Moulvibazar.	Dr. Md. Alamgir Kabir,	DLO, DLS, Sylhet.	dlosylhet@dls.gov. bd (01739-348598)	Farmers Capacity	SMA Samad, Md. Abul Kalam Azad, Md. Rezaul Karim

DETAILS OF THE FIELD VISIT								
No .	Travel date (Period)	Travel area (District)	Specific area of visit	Name of the Officials	Designation and Address	E-mail / Phone	Purpose	Name of the visitor
				Dr. A.Z.M. Wahidul Alam	DLO, DLS, Moulvibazar.	dlomoulvibazar@dls.gov.bd (01324-290683)	Building report(D#5)	
38	05-09.02.2023	Bogura & Gaibanda	DLS, Bogura	Dr. Md. Saiful Islam	DLO, DLS, Bogura	dlobogura@dls.gov.bd, (01711-006884)	Farmers Capacity Building report(D#5)	Dr. Md. Ali Akbar, Dr. Manab Chakraborty, Dr. Prasun Kumar Das, Dr. Dala Ram Pradhan, Md. Mostafa Kamal
			RDA, Bogura.	Khalil Ahmed	DG, RDA, Bogura.	dg@rda.gov.bd		
			DLS, Shajahanpur, Bogura.	Dr. Nargis Khanam	ULO, DLS, Shajahanpur, Bogura.	uloshajahanpurbogura@gmail.com, (01798-627647)		
			YTC, Bogura.	S M Mozibul Alam	Coordinator, YTC, Bogura.	ytcbogra@dyd.gov.bd (01709331052)		
			DLS, Gaibandha.	Dr. Md. Masudar Rahman Sarker	DLO, DLS, Gaibandha.	dlogaibandha@dls.gov.bd (01715-271633)		
			ILST, Gaibandha	Dr. Md Abdul Hai	Chief Instructor, ILST, Gaibandha	haidvm66@gmail.com (01711-578065)		
39	12-16.02.2023	Rajshahi & Natore	DLS, Rajshahi	Dr. Zulfiker Md. Akhter Hossain	DLO, DLS, Rajshahi	zulfikerhossain69@gmail.com (01324-289419)	Farmers Capacity Building report(D#5)	Dr. Md. Jasimuddin Khan, Mirza Altaf Hossain, Md. Muddasser Billah, Md. Rezaul Karim
			YTC, Rajshahi	Md. Afzal Hossain	Coordinator, YTC, Rajshahi	ytcrashahi@dyd.gov.bd (01752-118485)		
			DLS, Paba, Rajshahi	Dr. Subrato Kumar Sarkar	ULO, DLS, Paba, Rajshahi	drsubratovet@gmail.com (01712-889991)		

DETAILS OF THE FIELD VISIT								
No .	Travel date (Period)	Travel area (District)	Specific area of visit	Name of the Officials	Designation and Address	E-mail / Phone	Purpose	Name of the visitor
			DLS, Natore	Dr. Md. Golam Mostofa	DLO, DLS, Natore	dlnatore@dls.gov.bd (01324-289462)		
			YTC, Natore.	K. M. Abdul Matin	Deputy Director YTC, Natore.	ddnatore@dyd.gov.bd (01712 718984)		
40	12-16.02.23	Gopalganj and Chuadanga	DLS, Gopalganj.	Dr. Gobinda Chandra Sardar	DLO, DLS, Gopalganj.	dlogopalganj@dls.gov.bd (01711-309164)	Farmers Capacity Building report(D#5)	Dr. Md. Ali Akbar, Dr. Manab Chakraborty, Dr. Dala Ram Pradhan, SMA Samad, Md. Abul Kalam Azad
			DLS, Kotalipara, Gopalganj.	Dr. Puspen Kumer Sikder	ULO, DLS, Kotalipara, Gopalganj.	ulokotalipara.gopalganj@gmail.com (01324-290481)		
			DLS, Chuadanga.	Dr. Mihir Kanti biswas	DD, DLS, Chuadanga.	mihirbiswas1968@gmail.com (01719-571508)		
			VTI, Alamdanga, Chuadanga	Dr. Golam Haider	Director, VTI, Alamdanga, Chuadanga	vtialamdanga1978@gmail.com (01712-625885)		
41	19-24.08.23	Panchagarh, Rangpur and Pabna Districts	DLS, Kazi Farm Panchagarh EON Dairy,	Dr. Md. Abdur Rahim, Momin Ud Dowlah, Dhaka	DLO, DLS, Panchagarh, Chairman & Managing Director - Eon Group of Industries	drrahim2011@yahoo.com, mannan.ebsl@eongroup.net.bd	Draft Final Report (D-8)	Greg Willis, SMA Samad, Md. Abul Kalam Azad
			DLS & Bengal Meat Pabna, Nahar Agro, TMSS-Bogura,	Dr. Gaurang Kumar Talukder	DLO, DLS, Pabna,	gourangot@gmail.com, dlopabna@dls.gov.bd		

Annexure 11. List of officials contacted

No.	Date	Name of the Officials	Designation and Address
1	12.12.2021	Dr. Anwar Hossain	Veterinary Officer, Dhaka South City Coporation, Krishi Market, Mohammedpur, Dhaka
2	23.12.2021	Md. Gias Uddin	Chief Executive Officer Dutch Dairy Farm, Lohagonj. Munshingh
3	23.12.2021	Dr. Md. Kamruzzaman	Upazila Livestock Officer, Sreenagor, Munshigonj
4	10.01.2022	Momin Ud Dowlah	Chairman & Managing Director, Eon Group of Industries, 304 Tejgaon I/A, Dhaka
5	10.01.2022	Dr. Ismail Hussain	Director, Rangpur Division, Department of Livestock Services, Rangpur
6	10.01.2022	Dr. Md. Faruque	Upazila Livestock Officer, BaDRgonj Rangpur
7	11.01.2022	Md. Abdul Malek	Manager, SA Feed Ltd. Mithapukur, Rangpur
8	11.01.2022	Dr. Md. Rana Mia	District Livestock Officer, Tangail
9	11.01.2022	Dr. Md. Golam Mostafa	District Livestock Officer, Natore
10	12.01.2022	Dr. ABM Sharif Uddin	Chief Executive Officer, Rajshahi City Corporation, Rajshahi
11	13.03.2022	M A Sabur	Chairman, MASCO Dairy Enterprise, Kanchon, Rupgonj, Narayangonj,
12	15.03.2022	Md. Azziz Ahmed	Senior Officer (Administration) EON Poultry Industries, Maona, Sreepur, Gazipur.
13	30.03.2022	Dr. Rezaul Karim	Senior Veterinary Officer/ Executive, KCC, Khulna
14	29.03.2022	Md. Shariful Islam Tarafder	DGM (Operation), PRAN Dairy, Pabna.
15	04.04.2022	Dr. SM Zahangir Alam	Director General, Bangladesh Livestock Research Industries, Savar, Dhaka

No.	Date	Name of the Officials	Designation and Address
16	06.04.2022	Md. Maksudur Rahman	General Manager, PRAN Dairy, PRAN-RFL Tower, Dhaka
17	21.04.2022	Md. Muttakim Chowdhury	Proprietor, Pure & Organic Dairy Farm, Andiura , Madhabpur, Habigonj
18	22.04.2022	Md Abdul Hannan	Proprietor, G. Rahman Agro & Cattle Range, Char Amlab, Belabo, Naroshingdhi,
19	29.05.2022	Mr. Abdul Mannan	Deputy General Manager EON Bio-Science Ltd, Rangpur
20	30.05.2022	Mrs. Renu Bala	President, Pangerbhanga Dairy cooperatives, Kaunia, Rangpur
21	21.06.2022	Md. Maksudur Rahman	DGM (Operation), PRAN Dairy, PRAN-RFL Tower, Dhaka
22	22.06.2022	Sohel Rana	Factory Incharge, Ultra Milk Fatoty, Shilidaha, Kustia
23	26.06.2022	Md. Abdul Majid Pramanik, PhD	Joint Director, Rural Development Academy, Bogura
24	28.06.2022	Dr. Taslima Ferdausi	Upazila Livestock Officer, Companiganj, Noakhali
25	30.06.2022	Md. Lutfor Rahman	Representative-IDCOL (Bhabanipur and United Agro Ltd. at Sreepur, Gazipur)
26	01.08.2022	Dr. Md. Abdur Razzak	District Livestock Officer, Madaripur
27	04.08.2022	Dr. Md. Abdul Aziz Al Mamun	District Livestock Officer, Gopalganj
28	01.08.2022	Dr. Md. Nazrul Islam.	District Livestock Officer, DLS, Cumilla
29	01.08.2022	Dr. Arif Hasnat	Upazila Livestock Officer, DLS, Lalmai, Cumilla
30	02.08.2022	Dr. Md. Bokhtiar Uddin	District Livestock Officer, DLS, Chandpur
31	02.08.2022	Dr. Md. Maksud Alam	Upazila Livestock Officer, DLS, Saharasti, Chandpur
32	03.08.2022	Dr. A.B.M. Shaifuzzaman	District Livestock Officer, DLS, Brahmanbaria

No.	Date	Name of the Officials	Designation and Address
33	03.08.2022	Dr. Tarek Mahmud	Upazila Livestock Officer, DLS, Kasba, Brahmanbaria
34	09.08.2022	Dr. Md. Nurul Alam,	District Livestock Officer, DLS, Barishal,
35	11.08.2022	DR. Md. Anwar Hossain	District Livestock Officer, DLS, Patuakhali
36	10.08.2022	Dr. Arun Kanti Mondal	District Livestock Officer, Khulna
37	11.08.2022	Dr. Md. Rashedul Haque	District Livestock Officer, Jashore
38	16.08.2022	Md. Wahedul Alam	District Livestock Officer, DLS, Mymensingh
39	17.08.2022	Md. Shahidullah	District Livestock Officer, DLS, Netrokona
40	21.08.2022	Dr. Md. Rustam Ali	District Livestock Officer, DLS, Sylhet
41	22.08.2022	Dr. Md. Asaduzzaman	District Livestock Officer, DLS, Sunamganj
42	19.09.2022	Dr. Md Lutfur Rahman	District Livestock Officer, Bagerhat
43	20.09.2022	Dr. Arun Kanti Mondal	District Livestock Officer, Khulna
44	21.09.2022	Dr. Md. Rashedul Haque	District Livestock Officer, Jashore
45	20.09.2022	Dr. Md Ashraf Ali	District Livestock Officer, Jhenaidah (VS)
46	19.09.2022	Dr. Md. Nazrul Islam	Director, Divisional Livestock Office, Rajshahi
47	19.09.2022	Dr. Zulfiker Md. Akhter Hossain	District Livestock Officer, Rajshahi
48	19.09.2022	Md. Shirajul Islam	Manager, Govt. Goat Development Farm, Rajshahi
49	19.09.2022	Mrs Nipa khatun	Sheep farmer, Rajshahi
50	19.09.2022	Dr. MD. Monirul Islam	Upazila Livestock Officer, Paba, Rajshahi

No.	Date	Name of the Officials	Designation and Address
51	20.09.2022	Dr. Md. Golam Mostofa	District Livestock Officer, Natore
52	20.09.2022	Dr. Arunag Mondal	Deputy Director, AI, Nator
53	20.09.2022	Dr. Chondon kumar Sarkar	Upazila Livestock Office, Lalpur, Nator
54	21.09.2022	Dr. Md. Al-Mamun Hossain Mondal	District Livestock Officer, Pabna
55	21.09.2022	Dr. Gaurang Kumar Talukder	District Livestock Officer, Sirajganj
56	19.09.2022	Dr. Mahfuzur Rahman	Upazila Livestock Officer, Shahjadpur, Sirajganj
57	28.09.2022	Mr. Anisur Rahman	Senior Director, BRAC Enterprises
58	16.10.2022	Dr. Md Delwar Hossain,	District Livestock Officer, Chattogram.
59	17.10.2022	Dr. Arif Hasnat,	District Livestock Officer, DLS, Cox's bazar
60	18.10.2022	Dr. Md. Nazrul Islam	District Livestock Officer, DLS, Cumilla.
61	18.10.2022	Dr. Md. Abdul Hye Sarker	Director, Department of Livestock Services (DLS), Rangpur Division, Rangpur.
62	18.10.2022	Dr. Md. Jubaidul Kabir	Additional District Livestock Officer, Rangpur
63	18.10.2022	Dr ASM Sadequr Rahman	Upazila Livestock Officer, Rangpur Sadar, Rangpur
64	19.10.2022	Md. Ashraful Alam	Factory Manager, Rangpur Dairy Ltd, Mithapukur, Rangpur
65	20.10.2022	Mrs. Noor Jahan Akhter	Goat farmer, Mithapukur
66	20.10.2022	Dr. Shinchita Rahman	Upazila Livestock Officer, Kaunia, Rangpur
67	20.10.2022	Mst. Mahfuza	Goat farmer, Kaunia, Rangpur
68	21.10.2022	Dr. Mafujur Rahman	Upazila Livestock Officer, Parbotipur, Dinajpur

No.	Date	Name of the Officials	Designation and Address
69	21.10.2022	Dr. Atikur Raman	Veterinary Surgeon, Upazila Livestock Office, Parbotipur, Dinajpur
70	15.11.2022	Mohammed Imran Hossain	President, BDFA, Sat Masjid Housing, Vanga Masjid, Beribadth, Mohammadpur, Dhaka.
71	16.11.2022	Dr. Amalendu Ghosh,	Director, Livestock Research Institute (LRI), Mohakhali, Dhaka.
72	26.12.2022	Dr. Md. Mahbubul Islam,	District Livestock Officer, DLS, Manikganj
73	16.01.2023	Dr. Md Lutfur Rahman	Director, Veterinary Training Institute, Mymensingh.
74	16.01.2023	Dr. Parvin Sultana	Associate Professor, Veterinary Training Institution, Mymensingh
75	16.01.2023	Dr. Rawshan Nahar	Assistant Professor, Veterinary Training Institution, Mymensingh
76	16.01.2023	Md. Rukan Uddin	Senior Instructor, Youth Training Centre, Mymensingh.
77	16.01.2023	Md. BaDRujahan	Deputy Co-ordinator, Youth Training Centre, Mymensingh
78	16.01.2023	Dr. M. Enamul Haque Sarker	Additional Director, Bangladesh Agricultural University, Extension Centre, Mymensingh
79	16.01.2023	Mrs. Munni Akhter	Director, BAUEC, BAU, Mymensingh
80	17.01.2023	Shumary Khatun	District Livestock Officer, Mymensingh
81	17.01.2023	Dr. Rahela Parvin	Upazila Livestock Officer, Mymensingh Sadar
82	17.01.2023	Dr. Farida Yasmin	Upazila Livestock Officer (LR), Mymensingh
83	18.01.2023	Dr. Humayun Kabir	District Livestock Officer, Netrokona
84	18.01.2023	Dr. Samsad jahan sherajee	Director, ILST, Netrokona.
85	18.01.2023	Dr. Laila Iasmin	Upazila Livestock Officer, Netrokona Sadar
86	23.01.2023	Dr. Md. Alamgir Kabir,	District Livestock Officer, DLS, Sylhet.

No.	Date	Name of the Officials	Designation and Address
87	25.01.2023	Dr. A.Z.M. Wahidul Alam	District Livestock Officer, DLS, Moulvibazar.
88	06.02.2023	Dr. Md. Saiful Islam	District Livestock Officer, DLS, Bogura
89	06.02.2023	Md. Khalil Ahmed	DG, RDA, Bogura.
90	06.02.2023	Dr. Nargis Khanam	Upazila Livestock Officer, DLS, Shajahanpur, Bogura.
91	07.02.2023	S M Mozibul Alam	Coordinator, YTC, Bogura.
92	08.02.2023	Dr. Md. Masudar Rahman Sarker	District Livestock Officer, DLS, Gaibandha.
93	08.02.2023	Dr. Md Abdul Hai	Chief Instructor, ILST, Gaibandha
94	13.02.2023	Dr. Zulfiker Md. Akhter Hossain	District Livestock Officer, DLS, Rajshahi
95	13.02.2023	Md. Afzal Hossain	Coordinator, Youth Training Centre, Rajshahi
96	13.02.2023	Dr. Subrato Kumar Sarkar	Upazila Livestock Officer, DLS, Paba, Rajshahi
97	14.02.2023	Dr. Md. Golam Mostofa	District Livestock Officer, DLS, Natore
98	14.02.2023	Dr. Md. Mustofa Jaman	Upazila Livestock Office, Nator Sadar
99	14.02.2023	K. M. Abdul Matin	Deputy Director YTC, Natore.
100	13.02.2023	Dr. Gobinda ChanDRa Sardar	District Livestock Officer, Gopalganj.
101	13.02.2023	Dr. Puspen Kumer Sikder	Upazila Livestock Officer, Kotalipara, Gopalganj.
102	14.02.2023	Dr. Mihir Kanti biswas	Deputy Director, DLS, Chuadanga.
103	14.02.2023	Dr. Golam Haider	Director, VTI, Alamdanga, Chuadanga
104	14.04.2023	Dr. Md. Shahidul Islam	Grameen Sakti, Dhaka
105	14.04.2023	Engr. Delwer Hussain	Manager, Biogas program, Grameen Sakti, Dhaka
106	14.04.2023	Engr.Md. Arafat Mostofa	Deputy Manager, Biogas program, Grameen Sakti, Dhaka

No.	Date	Name of the Officials	Designation and Address
107	14.04.2023	Mr. Abdul Arif	Manager. Project Development, Grameen Sakti, Dhaka
108	09.04.23	Mr. Dipesh Nag	CEO, Grameen Danone Foods Limited, Dhaka
109	09.04.23	Surayya Siddiqua	Director, Sales & Marketing, Grameen Danone Foods Limited, Dhaka
110	10.04.23	Md. Rabi-ul- Hasan	Principal, Ahsanullah Institute of Technical and Vocational Education and Training (AITVET), Dhaka.
111	11.04.2023	Dr. Arnoud Hameleers	Country Director, International Fund for Agricultural Development (IFAD), Dhaka, Bangladesh
112	11.04.2023	Dr. Nabil Rahman	Country Program Analyst, International Fund for Agricultural Development (IFAD), Dhaka, Bangladesh.
113	12.04.23	Dr. Md. Baktear Hossain,	Director, South Asian Association for Regional Cooperation Agricultural Centre (SAC), Dhaka, Bangladesh
114	12.04.23	Dr. A.B.M Mohiuddin	Director, Project Implementation Unit (PIU), NATP2, Department of Livestock Services, Dhaka.
115	13.04.23	Md. Arafat Hossain	Team Leader, BMMDP (Bangladesh Micro Insurance Market Development Program/Surokka), Swisscontact-Swiss Foundation for Technical Cooperation.
116	13.04.23	Ms. Nurun Nahar	Country Director, Heifer International Bangladesh, Dhaka.
117	25.05.23	Emran Hossain	Secretary, Bangladesh Dairy Farmers Association (BDFA), Dhaka.
118	17.04.23	Professor Dr. A. K. M. Saifuddin	Director, Directorate of External Affairs, Department of Physiology Biochemistry and Pharmacology Faculty of Veterinary Medicine, Chattagram Veterinary University
119	17.04.23	Mr. Nurul Siddiquee	Chief of Party, Feed the Future Bangladesh Livestock and Nutrition Activity, ACDI/VOCA, Dhaka, Bangladesh.

No.	Date	Name of the Officials	Designation and Address
120	17.04.23	Professor D. Abdur Rab	Vice-Chancellor, International University of Business Agriculture and Technology (IUBAT), Dhaka
121	20.08.23	Dr. Md. Abdur Rahim, Dr.	District Livestock Officer, Department of Livestock Services, Panchagarh
122	22.08.23	Momin Ud Dowlah,	Chairman & Managing Director Eon Group of Industries, Dhaka
123	24.08.23	Gaurang Kumar Talukder,	District Livestock Officer, Department of Livestock Services, Pabna

Annexure 12. Selected photos of field visits and other important events



Inception Workshop



Meeting with PMUs at DLS





Field Visits



Orientation and Team Meetings

Annexure 13. Best Practice Livestock Management for Bangladesh

1. BEEF CATTLE

Current housing

Currently across Bangladesh, the long-term tethering of beef and dairy cattle when confined to barns for intensive feeding is common practice. However, it should come as no surprise that long term tethering of any animals is widely regarded a cruel practice and is forbidden across many countries of the world. No animal should be prevented from exercising. The practice is being increasingly scrutinized by international animal welfare groups, and countries such as Bangladesh are in their sights.

Recommended housing & feeding

- Cattle in feedlots can be productively confined in well designed and constructed feedlot pens with an appropriate density of animals considering the need for pen cleanliness and animal welfare (especially during feeding times when competition at feed bunks should be properly managed).
- Animals must not be tethered and should be free to roam the pens at all times, with animals grouped and fed according to age or weight or number of 'days on feed'.
- Feed bunks and at least one third of the pen area should be roofed for protection from rain and excessive sun/heat stress.
- In view of the high rainfall during Bangladesh's summer months, pen surfaces should be concreted wherever possible, especially when adjoining feed and water troughs, and where roofing is present. Concrete surfaces should be constructed to be non-slip as best possible.
- Feed bunks should be durable and enable fast delivery of feed from feedlot feed mixer wagons.
- Pen surfaces should also be sloped towards the rear of the pen and effluent drains should direct rainwater and pen washing water into effluent collection ponds, with sedimentation basins where possible – in accordance with local government environmental protection regulations.
- The images below are from successful feedlots in Vietnam and Sumatra, Indonesia.





- Where possible for larger feedlots, a feedlot mixer wagon (as shown above and in the DAIRY section below) should be used to homogeneously mix and rapidly deliver scientifically formulated total mix rations (TMRs).
- In order to optimise weight gains, feed conversion efficiencies, feedlot profitability, and to minimise methane and carbon emissions, feedlot TMRs should ideally consist of approximately 65% grain-based concentrate, 25% corn silage and 10% other roughages such as Napier Grass (although agronomists advise that the Brachiaria hybrid 'Mulato II' is a much superior alternative).
- The feedlot ration must contain good '*physically effective fibre*', although if chopped too long it can slow down feed intake. Ideally, fresh forages should be chopped into 2.5–3.0 cm lengths (as in photo above). (However, forages intended for Silage should be precision chopped into 1.5-2.5 cm lengths, to enable air exclusion.)

Breeding and calf rearing

Most modern beef cattle feedlots can also be suitable for breeding cows and rearing calves. An example of a calf 'creep feeding' area is shown below (from Sumatra). If necessary, calves can be supplemented with cows' milk or 'calf milk replacer' formulations, in addition to their calf weaner rations.

- Note that recent guidelines recommend that all beef or dairy calves receive a minimum of 3 litres of *colostrum* within the first 2 hours of life and an additional 3-4 litres within the first

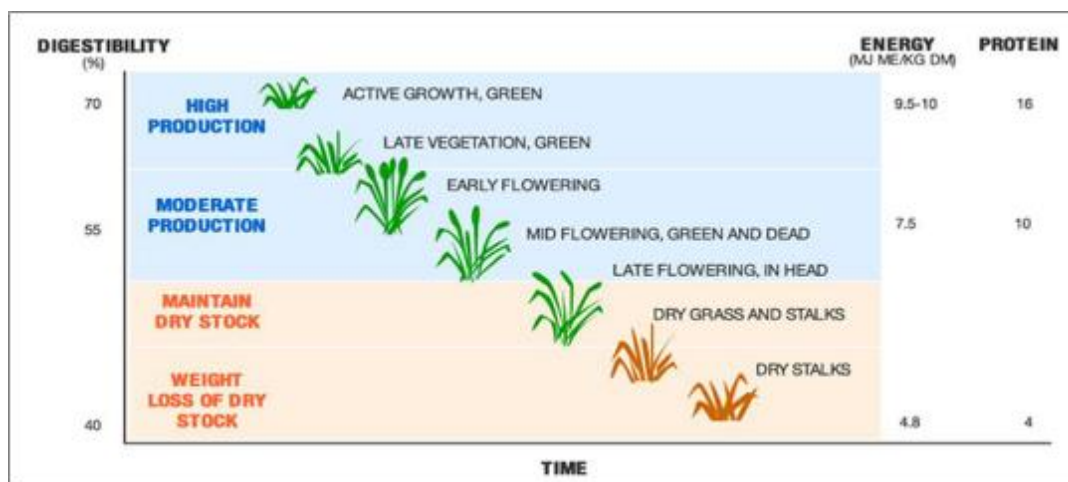
6- 12 hours. This means that in its first 12 hours of life, a calf should receive a total of 6-7 litres of high-quality colostrum – either from it's mother, or supplied from a 'colostrum bank' held in cold storage on the feedlot.

- (For successful passive transfer of IgG antibodies, colostrum quality needs to be a minimum of 50g/ltr of IgG, which equates to 22 Brix when measured with a refractometer.)



Low- cost supplementation of beef cattle on poor quality pasture

The natural decline in Digestibility, Energy and Protein composition of pasture grasses as they mature is illustrated in the diagram below. As can be seen, dry brown coloured grasses, such as in the photo below, have very little nutritional value for any livestock. This situation is common in nearly all countries during times of drought. Fortunately, there are low intake/low cost supplements (to provide additional protein) used very widely in northern Australia which could easily be replicated in Bangladesh for the dry season. There are also supplements that can be used during the wet season, if minerals such as Phosphorus are required.



1) Dry Season loose mixes containing Urea, Salt, Minerals & Trace Elements

Nitrogen derived from Urea (or Ammonium Sulphate) improves fibre digestibility, feed intake and animal performance by stimulating rumen micro-bacteria and protozoa. Cattle supplemented with nitrogen in dry seasons can consume from 30 -50% more dry pasture, therefore maintaining weight, or at least minimizing weight loss.

The cattle below are eating 300 grams/head/day of a free choice loose mix, costing only approx 20 Tk/head/day. Other formulations can be prepared to restrict intakes to only 100-200 grams per day.



THIS FORMULATION CONTAINS:

60 % Cottonseed Meal	15 % Dicalcium Phosphate
10 % Urea	10 % Salt
5 % Ammonium Sulphate	0.25 % Trace Minerals & Vitamins

ANALYSIS: Total CP 65 %, Met En 6.6 MJ/kg, Cal 4.1 %, Phos 3.5 %, Sod 3.7%, Sulp 1.5 %



2) Wet Season blocks, based on Molasses, Phosphorus, other Minerals & Trace Elements



A limitation of Urea based dry season loose mixes is that they should not be allowed to get wet with rain, as dissolved Urea can become toxic. However, hard lick blocks which will not deteriorate under high rainfall can be manufactured from Molasses in combination with various mineral additives to enable supplementation during the wet season. These are especially beneficial for providing Phosphorus in regions of P deficient soils, as P is best absorbed when pasture quality is high.

2. DAIRY CATTLE

Recommended housing & feeding

- The housing principles discussed in the Beef Cattle section above can be replicated in many ways when considering Dairy Cows and heifers kept under feedlot conditions.
- The images below are from successful dairy feedlots in Bangladesh, Turkiye and East Java, Indonesia.
- It is good to see Biosecurity dips with disinfectant for vehicles and people entering these farms.



- A key consideration for dairy cow welfare and milking performance in Bangladesh is the need to reduce or at least minimise Heat Stress. The photos below show ventilation fans in cow barns.
- Not shown here but also installed are misting nozzles which are automatically switched on for 10 seconds every minute. An 'Environmental Control System' supplied by De Laval is also used to monitor and control: 1.) Temperature, 2.) Relative Humidity, and 3.) Ammonia levels.
- Milking cow rations also contain 'Betaine' and other additives to help reduce heat stress.
- Note below the typical dairy 'push-up' open face feed bunk system as used in Europe and the US, as differing from the curved concrete feed bunks used by most beef feedlots around the world.



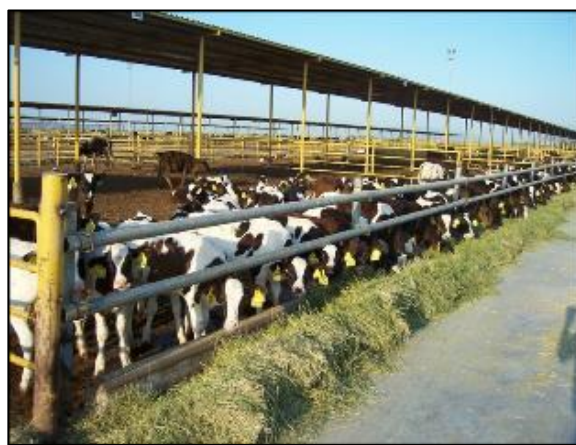
- Feeding systems and principles for Dairy Feedlots are similar to those described above for Beef Feedlots, except that ration formulations vary considerably. Milking cow herds should be fed at least 3 different rations according to 'days in milk' – early, mid and late lactation. High energy rations with a heavy dependency on grain-based concentrates are essential to enable high milk yields averaging around 20 litres/cow/day. But such rations must be well balanced with *physically effective fibre* to maintain rumen function. This strategy will enhance profitability and help ensure that early lac cows are not under-fed with energy and late lac cows are not over-fed (leading to fat cows at calving and metabolic problems arising early in the next lactation period).



- Management of best practice Milking Parlour cleaning and disinfecting routines is critical to ensure cow health and milk hygiene. This includes usage of Cleaning in Place (CIP) techniques, and the routine testing for Mastitis infections in teats, together with veterinary approved antibiotic treatment and monitoring programs. Regular external audits of these practices should take place at least twice per year.
- But equally as important for cow health and welfare are the daily comfort conditions provided by well designed 'free stalls' (with rubber or other cow mattresses) and concrete surfaces throughout the barn. These surfaces should be as 'kind' as possible to prevent excessive wear on hooves, but must also not be slippery.



- Good management of Calf Rearing and Heifer Growing are vital for optimizing future milking performance.
- Calves should be kept on cows for at least a few days to ensure sufficient intakes of *colostrum* (refer Beef section above), prior to being reared on either good quality cows' milk (no antibiotics) or commercial 'calf milk replacer' formulations. Weaning should be completed by approx 3 months of age, with scientifically formulated calf weaner and grower rations used for the next 6 – 12 months.
- Ideal heifer growth rates are approx 0.75 kg/head/day, to enable calving at 2 years of age, but also to prevent excessive development of fatty tissue in the udder.
- Shown below are individual calf pens to enable regulation of milk intakes (in Bangladesh), plus heifer rearing open pens (in Turkiye).



Silage making

- Forage crops intended for feeding fresh or for making silage should ideally be grown with the help of irrigation where possible. This will maximise yields and forage quality, if plants do not suffer moisture stress.
- There are many types of irrigation equipment available, some far more successful than others in terms of water use efficiency. Professional agronomic advice is recommended, in accordance with individual circumstances.
- Shown here are a 'raised sprinkler' spray irrigation system, plus an excellent crop of Corn nearly ready for cutting and ensiling (ideally further grain development will occur prior to harvest).



- Shown below is traditional silage making equipment, involving a forage chopper for precision chopping into 1.5-2.5 cm lengths and blowing into a large concrete silage bunker, followed by compaction with a tractor and covering with heavy duty plastic to enable effective air exclusion, which is critical for making high quality silage.



Options For 'Climate-Smart', Methane Reducing Forages For Dairy & Beef Cattle

The three forages detailed below are all considered 'Climate-Smart'. The two legume species – *Desmanthus* and *Leucaena* - have been shown in scientific trials in Australia to have enteric methane reducing capabilities (i.e., abilities to reduce intestinal methane emissions from ruminant livestock). The grass species – *Mulato II* – is a genetically advanced high yielding forage responsible for high weight gains and therefore faster turn-off of grazing beef cattle, goats or sheep, or more efficient milking performance of dairy cows. Such greater efficiencies are correlated with reduced overall emissions of carbon and methane.

Desmanthus Legume, 1st year stand (in Myanmar)**Brachiaria** Hybrid Cv **Mulato II** Grass (in Thailand)**Mulato II** with **Desmanthus** Cv **Progardes** (in Myanmar)**Mulato II** with **Arachis** Pinto (in Philippines)

Desmanthus Cv Progardes

- Perennial, permanent pasture for grazing or cutting.
- Rainfall required: 450-2,000 mm/yr.
- Soils preferred: clay-rich, neutral-alkaline.
- **Crude Protein of forage ranges from 12-20%.**
- Highly palatable source of protein, with excellent digestibility that converts to higher weight gains.
- Recommended for cattle, sheep and goats.
- Hard seed is ideal for 'faecal seeding' via cattle or horses.

Brachiaria hybrid Cv Mulato II (B. ruziziensis x B. decumbens x B. brizantha)

- Perennial, permanent pasture for grazing or cutting.
- Rainfall required: 700 mm/yr and above.
- Soils preferred: most soil types, pH: 5.0-8.0.
- Forage yields up to 27 tonnes DM/ha/year.
- **Crude Protein of grass approx 17%.**
- Tolerant of draughts and heavy grazing.
- Very palatable - recommended for cattle, sheep and goats.
- Suitable for direct grazing, cut-and-carry methods, hay and silage making.

Leucaena - Tropical Tree Legume (in Queensland, Australia)



Leucaena (L. leucocephala)

- Leucaena is a highly productive, perennial, deep rooted tropical tree legume (growing up to 18 m high).
- Is an ideal, high protein and palatable forage for beef or dairy cattle, and goats.
- Rainfall required: prefers 650-1,500 mm and up to 3,000 mm/yr and tolerates up to 7 months dry season.
- Does not tolerate waterlogged soils or extended periods of flooding (> 3 weeks).
- Requires temperatures of 25-30° C for optimum growth. Growth ceases at 15-16° C.
- Being a legume, it fixes nitrogen in soils, and has a mulching effect in preserving moisture.
- Dry matter yields of forage vary with soil fertility, rainfall, altitude, density and cutting frequency from 1.0-15 tonnes/ha/year. (Leaf yield is maximised by cutting at 6-12 week intervals during the growing season.)
- Very high yields (>15 t DM/ha/year) in SE Asia and Hawaii, with plants 0.5-1.0 m apart in rows 1.0-3.0 m apart.
- Digestibility of edible leaves and branches is 55-70%.
- **Crude Protein of the edible forage ranges from 19-28%.**
- Leucaena trees are usually first cut at 6 months of age, but this largely depends on the growing season and if branches are mature enough to cut. In good rainy seasons, large branches can be cut from trees 3 times per year, at approx 45% dry matter (or 55% moisture).
- Tolerant of prolonged dry periods and retains leaf into dry.
- Leucaena trees with grass pastures are the most productive, sustainable and profitable system of producing grassfed beef in northern Australia.
- Start normal grazing when plants are 3.0–4.0 m tall (15–24 months).

Limitations

- Do not graze until plants are more than 1.5-2.0 m tall (6-12 months).
- Highly productive on suitable soils, but is poorly adapted to acid infertile soils.
- Not suited to areas susceptible to waterlogging.

To optimize nutritional quality, Leucaena should be maintained at 1.0-1.5 metres high, as on the left. The trees on the right are higher than preferable.



Manure separation and biogas production

- ° Best practice environmental recommendations for intensive livestock industries should encourage the collection and processing of manure and effluent wherever possible. Effluent digesters prevent greenhouse gases such as methane formed in effluent ponds from reaching the atmosphere. Anaerobic digesters stop gases from escaping, either because the pond's surface is covered with plastic and then the effluent later pumped into sealed digester tanks, or the effluent is pumped directly into the digesters.
- ° Microorganisms in digesters convert approx 20-30% of volatile compounds in effluent into biogas. An average biogas yield from cow manure is approx 40 litres per kg manure.
- ° The infrastructure below (from a large dairy in Bangladesh) shows the separation of solids and liquids, such that solids will later be composted and used as fertilizer on the company owned padi rice, corn and Napier grass fields. Liquids are pumped to a tank for anaerobic digestion and the formation of biogas, which is currently used only for on-farm cooking, but with future expansion will supply nearby villages.



3. POULTRY – TABLE EGG LAYING HENS

Current housing

- Standards of laying hen poultry houses in Bangladesh largely depend on the scale of operations of the parent company. Kazi Farms Limited is the country's largest egg producer, and has vertically integrated operations involving parent stock (breeder) farms and hatcheries, very large commercial layer farms (some with 5 sheds, each with dimensions 122 x 14 x 4 metres, and each shed housing 73,600 hens in battery cages), as well as their own feed mills.
- Kazi Farms have fully controlled housing units equipped with efficient evaporative cooling systems and utilizing modern Viper control boards to regulate the internal environment of houses (for ventilation, temperature, humidity and ammonia.)

Suggested alternative housing

In view of increasing pressure over the past 10 years from egg customers and animal welfare groups in many countries for the banning of battery cages, and in fact the large number of food service companies world-wide that are now buying or pledging to buy only 'cage-free eggs', it is suggested that the industry in Bangladesh consider some relatively simple methods of 'enriching' the environment of battery cages, as illustrated below. Such modification of existing cages is a far less costly option in comparison with commencing cage-free 'barn laid' or 'aviary' or 'free range' production systems, and may satisfy some customers.

Below, left - Traditional 'BATTERY CAGES', as used all over Bangladesh. Below, right – 'ENRICHED CAGES' ('EU Type B') from a large farm in Turkiye, with partitions removed to create cages 360 cm x 120 cm x 68 cm high. These cages are 3 x length and 2 x width of a standard battery cage.



ENRICHED CAGES, showing orange plastic strips functioning as nesting arrangements, and with metal perches.



EXAMPLES OF GOOD BIOSECURITY AT FARM ENTRY, from the largest egg producer in Türkiye.

Left - Commercial feed truck being sprayed with Virkon-S disinfectant at farm entry.

Right – Biosecurity entrance gate and fencing at a ‘parent stock’ layer breeder farm.



4. POULTRY – BROILER CHICKENS

Current housing

- Standards of broiler chicken poultry houses in Bangladesh largely depend on the scale of operations of the parent company. Aftab Bahumukhi Farms Ltd is one of the country's largest broiler producers, and has vertically integrated operations involving parent stock (breeder) farms and hatcheries, very large commercial broiler farms, as well as their own feed mills. Like Kazi Farms, Aftab have advanced environmental control systems in houses.

Photos of Aftab's modern 'PARENT STOCK' ('BREEDER') housing (incl nesting boxes, feeders and perches)



Below, left - Example of good biosecurity provisions at broiler breeder farm entry in the US, showing disinfectant spray frame plus security fencing and gate.

Below, right – Modern heating fan used in commercial broiler house in Australia, most commonly with young chicks.



Shown below is COMMERCIAL BROILER housing typical of the styles found in Bangladesh. Note that bird proof netting on exterior walls is crucial to prevent the entry of wild birds and significantly reduce the risk of Avian Influenza, Newcastle Disease and other diseases of poultry.



5. DUCK BREEDER FARMS

Current housing

Judging by a recent farm visit, current duck breeder housing in Bangladesh appears well suited to the purpose.

The images below were captured on a Duck Breeder Farm run by staff from the Department of Livestock Services near Saidpur in NW Bangladesh. The farm appeared very clean and well managed, with impressive water streams available for swimming in a semi-outdoors area to the side of each of the main enclosed houses. These appealing areas were in fact fully protected from the entry of wild birds, which is important for biosecurity.



Scenes from inside the main houses, where ducks spend the night and lay their eggs in the morning in the corners created by short concrete partitions, as shown below.



This farm has its own Hatchery, equipped with modern incubators. Soon after hatching, day old ducklings are vaccinated and transferred to special brooding sections within houses, as shown below.



Annexure 14. Key biosecurity and biosafety risks and mitigation measures

1. Best Practice Biosecurity Protocols for Livestock Operations in Bangladesh

Key components of Livestock Biosecurity protocols that should be in place on all livestock farms - Beef & Dairy Cattle, Buffalo, Goats, Sheep, Poultry & Ducks – include the following:

1. Farm management teams need to be continuously aware of any disease outbreaks within the region of their farm, and also need to keep up to date with disease prevention methods.
2. On-going staff training & assessment in disease recognition and all biosecurity protocols.
3. Maintenance of farm perimeter fencing, including clearing of any adjoining vegetation.
4. Ensuring strict farm entrance protocols, such as biosecurity showers or disinfectant dips for all incoming personnel, animal transport and feed trucks.
5. Certifying the health status of all incoming animals.
6. Quarantining of incoming animals on arrival, plus usage of hospital pens where necessary.
7. Certifying the cleanliness of incoming feed commodities, bedding, trucks, equipment, semen, veterinary products, staff food.
8. Certifying the cleanliness of drinking water and general washing water.
9. Best practices for the transfer of sale or culled animals outside the farm.
10. Implementation of strict rodent, insect, vermin, feral animal & other pest control programs.
11. Strict house/barn clean-out & disinfection between batches of animals.
12. Carcass burning or burial, carcass composting, and effluent disposal.
13. Strict implementation of vaccination and medication programs.
14. Veterinary laboratory protocols for serological monitoring of animals for vaccination failure or for warning of disease outbreaks.
15. Policies in place for staff contact with outside animals and regular monitoring of staff for health status.
16. Comprehensive Contingency Plans in place for emergency disease outbreaks.
17. Regular audits of all biosecurity and contingency plan procedures.

Photo below (left) - Biosecurity disinfectant sprays and pool in front of the weighbridge at a large beef feedlot in Malaysia.

Photo below (right) – Typical lesions on upper hoof and tongue of cattle with Foot & Mouth Disease (FMD).



2. Best Practice Food Safety protocols for Dairy Farms in Bangladesh

Key Food Safety Protocols that should be in place on Bangladesh dairy farms include the following protocols that are mentioned in this Audit Checklist.

FOOD SAFETY MANAUAL -

- Staff Infectious Diseases Policy documented and being adhered to.
- All monitoring records completed, including:
 - Milk Vat thermometer checks completed.
 - Milk Vat cooling times recorded.
 - Refrigeration Service completed.
 - Plate Cooler check completed.
 - Detergent temperatures recorded.
 - Milking Machine Service records up to date.

PRE-REQUISITE PROGRAMS -

- Dairy Building Inspection Reports.
- Internal Audit Reports.
- Thermometer Calibration Reports.
- Staff Training Records up to date.
- Pest Control Treatment Records.

HYGIENE AND SANITATION -

- Do all buildings comply with hygiene requirements?
- Are all equipment, fixtures and fittings in a sanitary condition? This includes the cow bail areas as well as surrounding equipment such as cooling towers and feed silos.
- Are all cattle yards and calf pens maintained in a clean condition?

WATER AND MILKING PARLOUR TESTS -

- Water Quality Tests have been recorded.
- Milking Parlour Tests have been recorded.

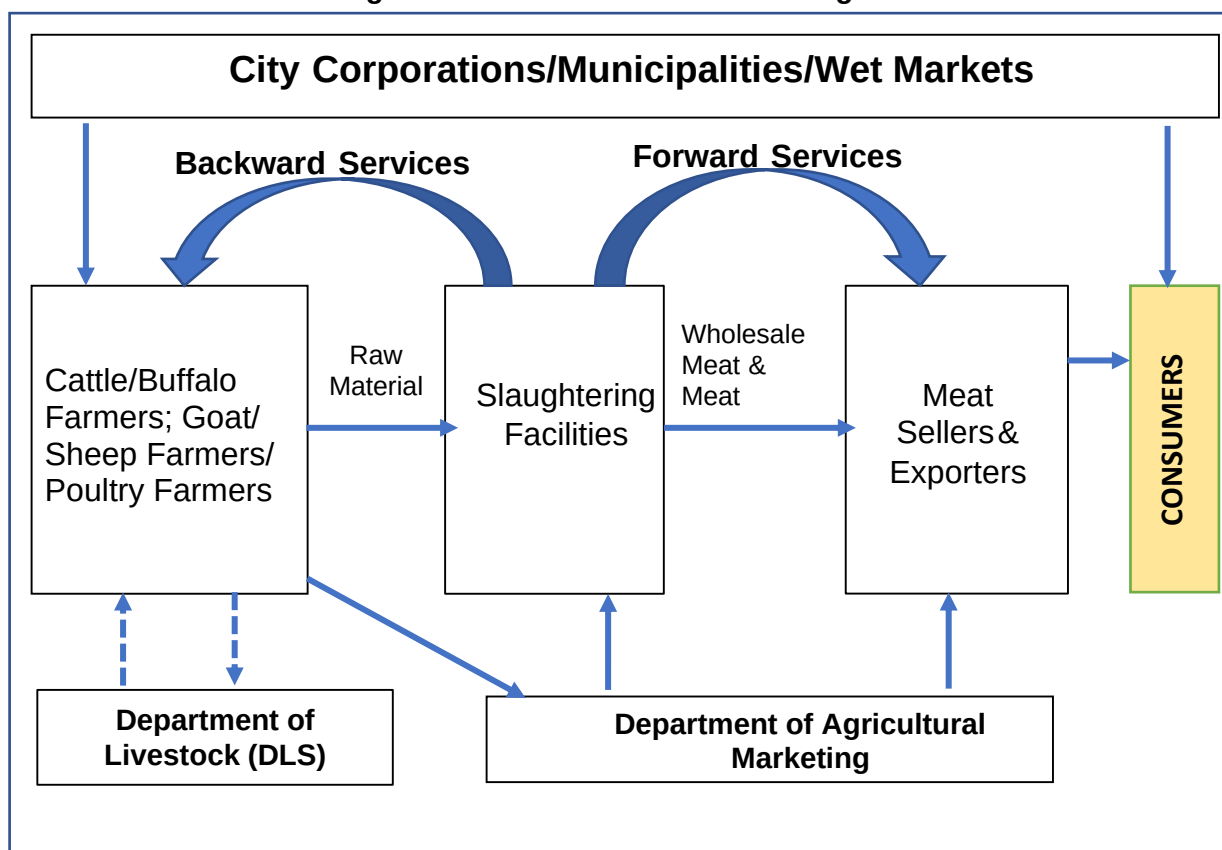
PROCESS CONTROL -

- Have all rubbers, inflations and droppers been replaced as required?
- Are all Cleaning Chemicals approved for their intended use?
- Is Sanitizer being drained from the plant before milking?
- Are all Veterinary Drugs being purchased at an approved source?
- Are all drugs being stored correctly? Is the Drug Register current and available?
- Do the drugs in the drug storage area match the drugs listed on the drug register?
- Do all veterinary prescription drugs have a label indicating usage and Withholding Periods?
- Are all animals that are being treated with drugs marked correctly and prevented from being milked?
- Are records available for all veterinary treated animals?
- Is Antibiotic milk being withheld from calves for slaughter?
- Are all treated animals milked correctly, that is, last or into a test bucket?
- Is the Agricultural Chemicals Register current and available?
- Have any areas of the farm been sprayed with agricultural chemicals? If yes, are records kept of the spraying?
- Is there a system in place to identify paddocks sprayed with chemicals, together with the withholding periods (for example, a sign on the gate)?

Annexure 15. Business Models for Small Size Slaughtering Facilities at the Upazila Level

Majority of the livestock owners (about 80 percent) in Bangladesh⁴² normally raise 1 or 2 cattle/buffaloes (for slaughtering during the festival time), 5 to 10 goats/sheep (for commercial purpose) and 50-100 poultry birds (chicken and duck for periodic sales) as the backyard system. These smallholders are the major customers to the local slaughtering slabs/facilities which are targeted under the LDDP scheme for upgraded wet markets. These are expected to establish strong backward (with producers of the animals) and forward linkages (market and consumers). The backward linkage will ensure the quality and hygiene of raw material availability by encouraging and promoting livestock owners to produce the animals by providing easy access for sale and better prices for their animals. The forward linkage will guarantee the slaughtering facilities to reach the right market players/entities and as per the preferences of the consumers.

Figure. Backward and forward linkages



(Source: Drawn based on information from the field)

⁴²Alam, M K; Keiko, Y and Hossain, M M (2020). Present Working Conditions in Slaughterhouses and Meat Selling Centres and Food Safety of Workers in Two Districts of Bangladesh; *Pertanika J. Soc. Sci. & Hum.* Vol 28, No.2; pp 867 – 881.

Upgrading of the small sized slaughtering slabs of the wet markets with a capacity of 10-15 cattle, 20-25 goats/sheep and 200-400 chickens may consider the simple business model to provide hygienic meat supply to the local retailers and consumers. As the LDDP project is supporting the infrastructural facilities required for the slaughtering slabs, there is a requirement of only the equipment for efficient butchering. In this regard, a simple business plan format has been developed for the entrepreneurs as per the below table. The calculations of costs and benefits for slaughter slabs are based on the estimated incomes and expenditures. The two critical parameters are the number of animals slaughtered per day and the slaughtering fee per animal:

Revenue & Expenses	Year (figures in BDT)					
	Y1	Y2	Y3	Y4	Y5	Y6
A. Annual Revenue Stream						
1. No of cattle per day	10	11	12	13	14	15
Slaughtering fee per head of cattle	150	155	160	170	175	180
Income from Cattle per annum (300 days)	450,000	511,500	576,000	663,000	735,000	810,000
2, No of Goats/Sheep per day	20	21	22	23	24	25
Slaughtering fee per Goats/Sheep	50	55	60	70	75	80
Income from Goats/Sheep per annum (300 days)	300,000	346,500	396,000	483,000	540,000	600,000
3. No of Chicken per day	200	225	250	300	350	400
Slaughtering fee per chicken	15	20	25	30	350	40
Income from chicken per annum (300 days) (3)	900000	1350000	1875000	2700000	36750000	4800000
Total Estimated Revenue (1+2 +3)	1,650,000	2,208,000	2,847,000	3,846,000	38,025,000	6,210,000
B. Annual Recurring Expenses						
1. Annual consumables (estimates of power, fuel, transport, communications, maintenance , sundry expenses)	144000	156000	168000	180000	192000	204000
2. Expenses for Staff/helpers (including salary, insurances)	600000	720000	840000	960000	1080000	1200000
3. Expenses for Vet Doctors	96000	108000	120000	132000	144000	156000
4. Misc. Expenses	40000	50000	60000	70000	80000	90000
Total Estimated Expenses (1+2 +3 +4)	880000	1034000	1188000	1342000	1496000	1650000
Gross Operating Surplus (A-B)	770,000	1,174,000	1,659,000	2,504,000	36,529,000	4,560,000
Revenue Sharing						
Entrepreneur (operator) @40%	308000	469600	663600	1001600	14611600	1824000
Local Authority @60%	462000	704400	995400	1502400	21917400	2736000

Annexure 16. Business models for medium size slaughtering facilities at the district level

The medium sized producers (5-10 cattle/buffaloes) generally wanted to visit the organized slaughtering facilities at the wet markets which are under the proposed upgradation under the LDDP scheme. The medium-large categories of producers or traders (more than 10 cattle/buffaloes) are generally relying on the medium sized slaughtering facilities available at the district level. As a medium-sized slaughterhouse, the business model needs to have three major components: (a) Investments in plants and machinery, (b) working capital and (c) marketing arrangements. A brief on all three of the above are provided below:

(a) Investments in Plant and Machinery:

For running a medium sized slaughtering facility, the initial requirements and investments may include the following elements:

- **Slaughter Equipment:** This includes all machinery and tools used for the slaughter process, such as stunners, dehorers, and skinners.
- **Refrigeration Units:** Slaughterhouses require refrigeration units to store and preserve meat products. These can include chillers, cold rooms, and blast freezers.
- **Waste Management Systems:** Proper disposal of waste is crucial in a slaughterhouse to maintain hygiene and prevent contamination. This can include waste treatment plants, incinerators, and waste storage facilities.
- **Building and Facility Upgrades:** As a slaughterhouse grows and expands, it may require upgrades to its building and facilities to accommodate more animals, improve workflow, and maintain safety standards. This can include things like building extensions, installation of new ventilation systems, and upgrades to flooring and drainage.
- **Transportation Vehicles:** Slaughterhouses often require trucks or other transportation vehicles to transport animals, finished products, and waste. This can include refrigerated trucks for product delivery and waste removal trucks.

(b) Working capital:

The operating expenses required to run a slaughterhouse to run the business are as follows:

- **Staff Costs:** This includes wages, benefits, and any training expenses for the employees, including butchers, slaughterers, and administrative staff.
- **Accountancy Fees:** There is a need to hire an accountant to keep track of the financial records, prepare tax returns, and provide financial advice for the slaughterhouse.
- **Insurance Costs:** The slaughterhouse is responsible for ensuring the safety of the employees and the public. This includes liability insurance, workers' compensation, and property insurance.
- **Software Licenses:** To keep track of the inventory and sales, the slaughtering facility may need to purchase software specifically designed for slaughterhouse operations.
- **Banking Fees:** This includes fees for maintaining a business bank account, processing transactions, and obtaining loans or lines of credit.

- **Utilities:** Running a slaughterhouse requires a significant amount of energy and water. There is a need to budget for electricity, gas, and water bills.
- **Raw Materials:** This includes the cost of purchasing animals for slaughter, as well as any feed or supplements needed to raise them.
- **Packaging Materials:** There is a need to purchase packaging materials such as plastic wrap, containers, and labels to package and label the products.
- **Cleaning Supplies:** To maintain a sanitary and safe environment for the employees and customers, the enterprise will need to purchase cleaning supplies for the slaughterhouse.
- **Maintenance and Repairs:** Slaughterhouse equipment, such as slaughter tables and refrigeration units, will require regular maintenance and occasional repairs.
- **Marketing and Advertising:** To attract customers and promote the products, the enterprise may need to budget for marketing and advertising expenses, such as creating a website, printing flyers, and attending trade shows.
- **Transportation Costs:** If the entrepreneurs are purchasing animals from other farms, you will need to budget for transportation costs, including fuel and vehicle maintenance.
- **Permits and Licenses:** As slaughterhouse owners, they will need to obtain various permits and licenses, such as a business license, food safety permits, and environmental permits.
- **Rent or Mortgage:** Those entrepreneurs do not own the property where your slaughterhouse is located, you will need to budget for rent or mortgage payments.
- **Taxes:** As a business owner, the entrepreneurs are responsible for paying various taxes, including income tax, property tax, and sales tax.

As the LDDP project is supporting the infrastructural facilities required for the slaughtering slabs, there is a requirement of only the equipment for efficient butchering. In this regard, a simple business plan format has been developed for the entrepreneurs as per the below table. The calculations of costs and benefits for slaughter slabs are based on the estimated incomes and expenditures. The two critical parameters are the number of animals slaughtered per day and the slaughtering fee per animal:

Revenue & Expenses	Year (All figures are in BDT)					
	Y1	Y2	Y3	Y4	Y5	Y6
A. Annual Revenue Stream						
1. No of cattle per day	100	110	120	130	140	150
Slaughtering fee per head of cattle	150	155	160	170	175	180
Income from Cattle per annum (300 days)	4,500,000	5,115,000	5,760,000	6,630,000	7,350,000	8,100,000
2, No of Goats/Sheeps per day	50	55	60	65	70	75
Slaughtering fee per Goats/Sheep	50	55	60	70	75	80
Income from Goats/Sheep per annum (300 days)	750,000	907,500	1,080,000	1,365,000	1,575,000	1,800,000
Total Estimated Revenue (1+2 +3)	5,250,000	6,022,500	6,840,000	7,995,000	8,925,000	9,900,000

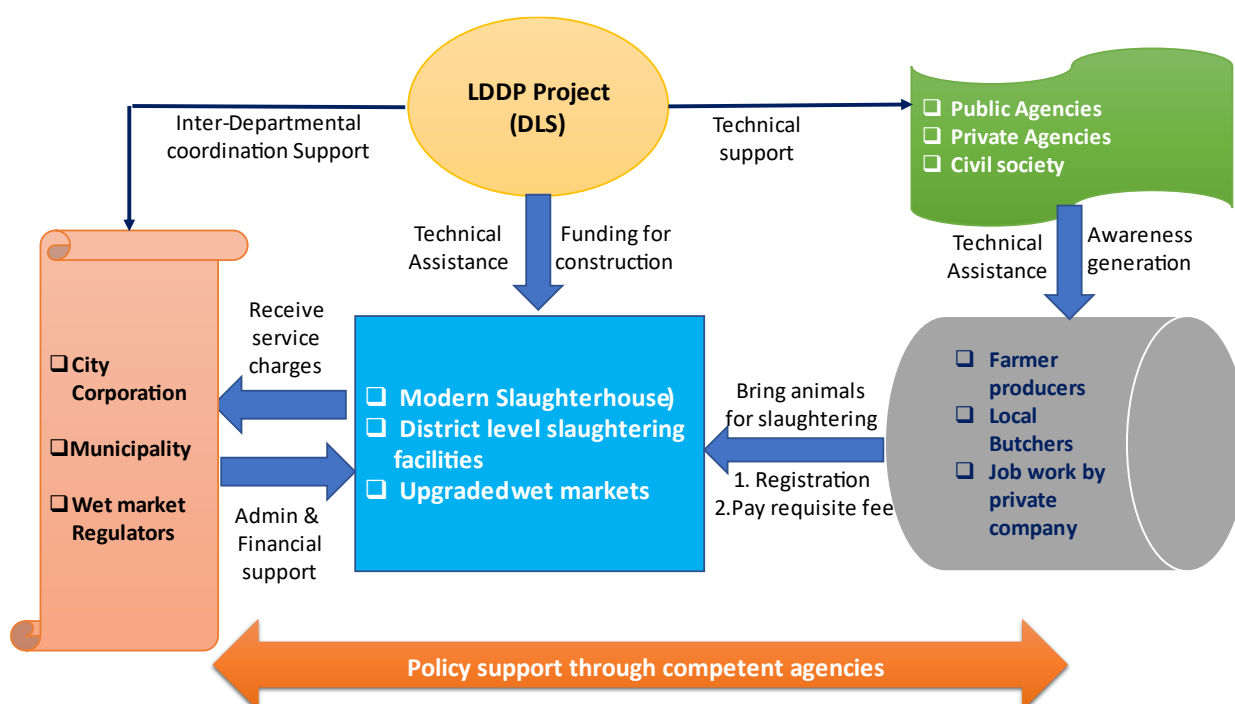
Revenue & Expenses	Year (All figures are in BDT)					
	Y1	Y2	Y3	Y4	Y5	Y6
B. Annual Recurring Expenses						
1. Annual consumables (estimates of power, fuel, transport, communications, maintenance , sundry expenses)	1200000	1440000	1680000	1920000	2160000	2400000
2. Expenses for Staff/helpers (including salary, insurances)	2160000	2400000	2880000	3120000	3360000	3600000
3. Expenses for Vet Doctors	360000	480000	600000	720000	840000	960000
4. Misc. Expenses (Training & meetings)	360000	420000	480000	540000	600000	660000
Total Estimated Expenses (1+2 +3 +4)	4080000	4740000	5640000	6300000	6960000	7620000
Gross Opearting Surplus (A-B)	1,170,000	1,282,500	1,200,000	1,695,000	1,965,000	2,280,000
Revenue Sharing						
Operator/Private entity @40%	468000	513000	480000	678000	786000	912000
District Authority @60%	702000	769500	720000	1017000	1179000	1368000

Annexure 17. Business models for large size slaughtering facilities at the division level

While developing the business models for climate resilient public infrastructure in the form of proving safe slaughtering facilities, we propose three (3) types of business process which may be accepted based on their merits and context. Success of all the three business models generally depending on the central competencies which are defined as the capacity of the organization/agency holds in which its competitors cannot match or imitate. Furthermore, an intensive integration (both vertical and horizontal⁴³) is a prerequisite for achieving the objectives. A detailed narration is provided below:

In case of **Business Model 1 (BM 1)** wherein the slaughtering facilities will be operated by the public agency (city corporation/municipality/other public agency) with the help of the professionals recruited by them for this purpose (Figure 8). This operational model may be termed as Build Operate and Transfer (BOT) in case on new constructions (city corporation and District level facilities) whereas in case of wet markets we may term this as Rehabilitate Own Operate Transfer (ROOT) which creates the opportunities of delivering public services are much higher as it may ensure delivering safe food without hampering the environment which in fact will fulfil the major objectives of sustainable social business and public services.

Figure. Business Model 1 Slaughtering facility run by public agency

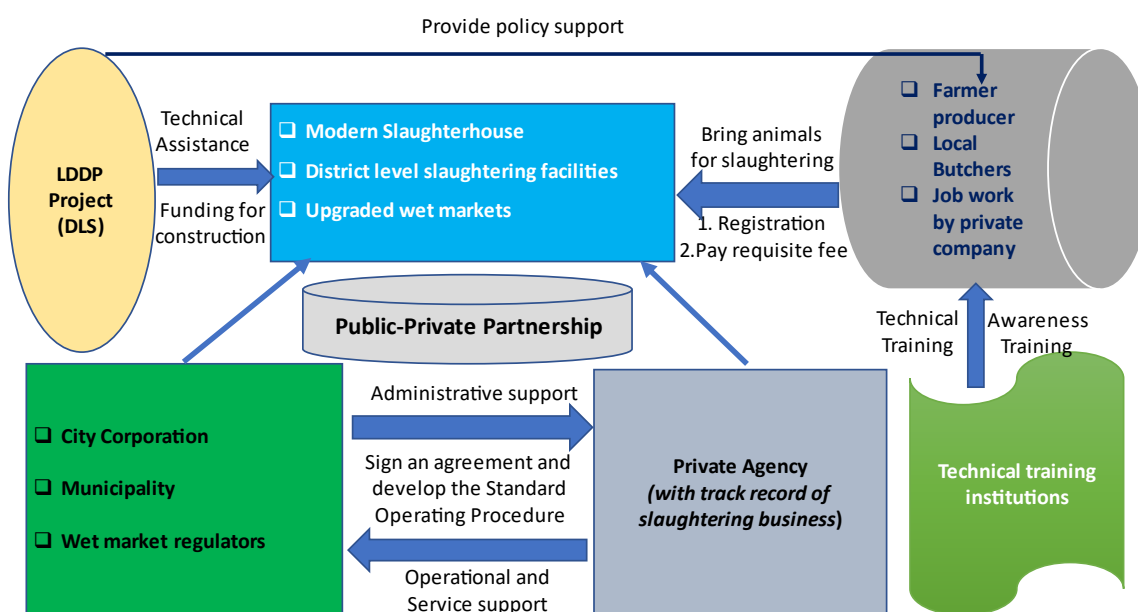


(Source: AFC-SSIL, 2022)

⁴³ *Vertical integration* is the incorporation of various actors in the supply chain which can be of two types: (a) downwards vertical integration and (b) forward vertical integration. *Horizontal integration* defined as the expansion/replication of the productive capacity in different geographical locations.

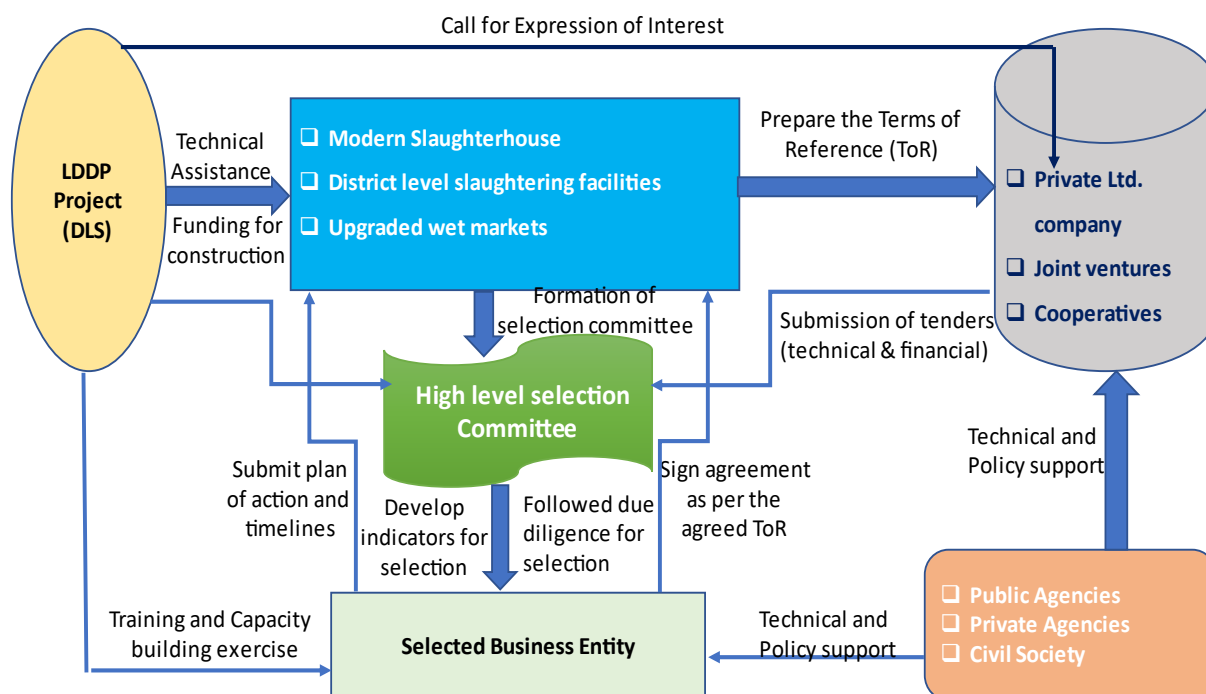
The **Business Model 2 (BM 2)** is proposed to consider that slaughtering facilities will be operated under Public-Private-Partnerships. In this operational Business model, the public agency will be selecting the interested private partners purely based on merits and experiences in the same filed. In this operational business model, under the generic BOT it is possible to extend PPP further considering that the services of the private entity will be sought during the operational stage through a service or operation and maintenance (O&M) contract awarded to a private company. Both the public and private entities will be bringing their core competence to run the facility efficiently and achieve the three-fold bottom line of sustainability: financial, environmental and social.

Figure. Business Model 2: Slaughtering facility run under PPP mode



(Source: AFC-SSIL, 2022)

In case of **Business Model 3 (BM 3)** of the slaughtering facility infrastructure developed by the local authorities (with the funding from LDDP) and run by private entities under a long-term lease agreement with the local authority/public agency. In this operational business model (Figure 10), the public authority will follow the government approved standard operating procedures to complete the due diligence in selecting the right private entities to run the slaughtering facilities at an agreed fees which may be reviewed from time to time with the consent of both the parties. This agreement needs to be long-term (generally 5-10 years) with the clause of termination from both side as this business need a gestation period of 3-5 years for awareness generation in the field to use the hygienic system of slaughtering and the importance of safe food for public health.

Figure. Business Model 3: Slaughtering facility run under PPP mode

(Source: AFC-SSIL, 2022)

Table. Projected Income & Expenditure of Modern Slaughterhouse (City Corporations)
(Amount in BDT)

Sl. #	Description of Items	Projected Year of operation				
		Year 1	Year 2	Year 3	Year 4	Year 5
		(60% efficiency)	(70% efficiency)	(80% efficiency)	(85% efficiency)	(90% efficiency)
1	Revenue	18900000	19835000	20816750	21847588	22929967
1.1	Collection of slaughtering fees	4800000	5040000	5292000	5556600	5834430
1.2	Collection of fees for cleaning and deskinning	9600000	10080000	10584000	11113200	11668860
1.3	Collection of Annual Registration Fee & renewal charges	200000	200000	200000	200000	200000
1.4	Fee for refrigeration services	600000	630000	661500	694575	729304

Sl. #	Description of Items	Projected Year of operation				
		Year 1	Year 2	Year 3	Year 4	Year 5
		(60% efficiency)	(70% efficiency)	(80% efficiency)	(85% efficiency)	(90% efficiency)
1.5	Fee for certification of good health	1500000	1575000	1653750	1736438	1823259
1.6	Job Work from other private companies	2000000	2100000	2205000	2315250	2431013
1.7	Misc Fee-based income	200000	210000	220500	231525	243101
2	Expenditure	20108000	22118800	24330680	26763748	29440123
2.1	Cost of keeping animals in slaughterhouse for check up	4368000	4804800	5285280	5813808	6395189
2.2	Payment for labour Services	6240000	6864000	7550400	8305440	9135984
2.3	Payment to Employees	4800000	5280000	5808000	6388800	7027680
2.4	Electricity cost	2400000	2640000	2904000	3194400	3513840
2.5	Direct Water Cost	300000	330000	363000	399300	439230
2.6	Maintatnce of Shed & building	1500000	1650000	1815000	1996500	2196150
2.6	Misc. cost items	500000	550000	605000	665500	732050
3	Gross Profit (+)/ Loss (-) (Item #1-Item #2)	-1208000	-2283800	-3513930	-4916161	-6510156

(Source; AFC-SSIL, 2022)

The above table indicates that the modern slaughterhouse proposed in 3 city corporation if operated by the city corporations will not be able to cover the operational costs (considering the assumptions are right while calculating the financials of this business). The above-mentioned situation strengthens our recommendations to improve the efficiency by adopting the Business Model 2 (PPP model on operational and maintenance partnership) and Business Model 3 (Invite the private sector for operating the facilities with regular monitoring and certain restrictions).

Annexure 18: VMCC project cost-benefit analysis

Sl.	Component	Cost (Tk)	% allocated
1	Land	0	
2	Site development (fencing, solar lighting)	50,000	
3	Building works (flooring, electric wiring, piping)	50,000	
	Civil works	100,000	5%
4	Mobile milking machines @Tk 60000 - 10 Nos	600,000	
5	Cost of 2 Bulk Milk Cooler with DG set	1,100,000	
6	Installation and commissioning (5%)	55,000	
7	Milk testing lab equipment, scale etc	30,000	
	Plant, machinery and equipment	1,785,000	95%
	Total cost	1,885,000	100%
	Fund Sources		
1	Matching grant (40% of project cost, or Tk 12.45 lakh, whichever is lower)	754,000	40%
2	Loan from Society members	1,131,000	60%
	Total funding	1,885,000	100%

KEY ASSUMPTIONS:

Sl.	Parameter	Estimate
A	Income	
1	Installed capacity (LPD)	4000
2	Capacity Utilisation (%)	
	First year	75%
	Second year	80%
	Third year onwards	90%
3	Reduction in souring and curdling of milk as % of milk procured	1%
4	Saving of income due to reduction in souring /curding (Tk/lit of sour milk)	4
5	Reduction in spillage and pilferage in cans during transportation as % of milk procured	1%
6	Cost of raw material - Milk (Tk/lit)	42
7	Payment received from Hubs for chilling of milk (Tk/lit)	0.1
8	Saving in investment and repair of cans (Tk/lit)	0.1
9	Saving in transporation cost of milk (Tk/lit)	0.15
10	Income from hiring mobile milking machines (Tk/lit)	0.04
B	Expenditure	
1	Power and fuel consumption (Tk)	0.07
2	Repairs and maintenance (Tk)	0.02
3	Manpower - two person (Tk per month)	10000
4	Cost of building lease (Tk per month)	1500
C	Others	
1	Depreciation (%)	10%
2	Interest rate (%)	10%
3	Repayment period (years)	8

BALANCE SHEET

	Yr1	Yr2	Yr3	Yr4	Yr5	Yr6	Yr7	Yr8
Asset								
Current Assets								
Cash inflow	930,750	992,800	1,116,900	1,116,900	1,116,900	1,116,900	1,116,900	1,116,900
Accounts Receivable								
Prepaid Expenses								
Investments								
Total Current Assets	930,750	992,800	1,116,900	1,116,900	1,116,900	1,116,900	1,116,900	1,116,900
Property & Equipment								
Land	-	-						
Civil Works	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000
Plant, machinery & equipment	1,785,000	1,785,000	1,785,000	1,785,000	1,785,000	1,785,000	1,785,000	1,785,000
Less accumulated depreciation	(188,500)	(377,000)	(565,500)	(754,000)	(942,500)	(1,131,000)	(1,319,500)	(1,508,000)
Other assets								
Intangible assets								
Less accumulated amortisement								
Total Asset	2,627,250	2,500,800	2,436,400	2,247,900	2,059,400	1,870,900	1,682,400	1,493,900
LIABILITIES AND SHAREHOLDER'S EQUITY								
Current Liabilities								
Accounts Payable	-	-						
Notes payable								
Cash outflow	658,150	650,583	649,585	635,448	621,310	607,173	593,035	578,898
Depreciation (accumulated)	(188,500)	(377,000)	(565,500)	(754,000)	(942,500)	(1,131,000)	(1,319,500)	(1,508,000)
Repayment (accumulated)	141,375	282,750	424,125	565,500	706,875	848,250	989,625	1,131,000
Deferred revenue								
Total current liabilities	611,025	556,333	508,210	446,948	385,685	324,423	263,160	201,898
Long term debt	989,625	848,250	706,875	565,500	424,125	282,750	141,375	-
Total liabilities	1,600,650	1,404,583	1,215,085	1,012,448	809,810	607,173	404,535	201,898
Shareholders' equity								
Common stock - Matching grant	754,000	754,000	754,000	754,000	754,000	754,000	754,000	754,000
Net inflow	272,600	342,218	467,315	481,453	495,590	509,728	523,865	538,003
Total Liabilities and shareholders' equity	2,627,250	2,500,800	2,436,400	2,247,900	2,059,400	1,870,900	1,682,400	1,493,900
Check	-	-	-	-	-	-	-	-

CASH FLOW STATEMENT

Sl.	Particular	Yr1	Yr2	Yr3	Yr4	Yr5	Yr6	Yr7	Yr8
	Milk procurement	3,000	3,200	3,600	3,600	3,600	3,600	3,600	3,600
A	INFLOW								
1	Payment received from Milk Hub for Chilling	109,500	116,800	131,400	131,400	131,400	131,400	131,400	131,400
2	Saving due to reduction in souring and curding of milk	43,800	46,720	52,560	52,560	52,560	52,560	52,560	52,560
3	Saving due to non spillage	459,900	490,560	551,880	551,880	551,880	551,880	551,880	551,880
4	Saving in repair and replacement of cans	109,500	116,800	131,400	131,400	131,400	131,400	131,400	131,400
5	Net saving on transportation cost of milk	164,250	175,200	197,100	197,100	197,100	197,100	197,100	197,100
6	Income from milking machines	43,800	46,720	52,560	52,560	52,560	52,560	52,560	52,560
	TOTAL INFLOW	930,750	992,800	1,116,900	1,116,900	1,116,900	1,116,900	1,116,900	1,116,900
B.	OUTFLOW								
1	Electricity and fuel	76,650	81,760	91,980	91,980	91,980	91,980	91,980	91,980
2	Repair and maintenance	21,900	23,360	26,280	26,280	26,280	26,280	26,280	26,280
3	Manpower cost	240,000	240,000	240,000	240,000	240,000	240,000	240,000	240,000
4	Building lease	18,000	18,000	18,000	18,000	18,000	18,000	18,000	18,000
5	Interest	113,100	98,963	84,825	70,688	56,550	42,413	28,275	14,138
6	Depreciation	188,500	188,500	188,500	188,500	188,500	188,500	188,500	188,500
7	Repayment	141,375	141,375	141,375	141,375	141,375	141,375	141,375	141,375
	TOTAL OUTFLOW	799,525	791,958	790,960	776,823	762,685	748,548	734,410	720,273
	NET INFLOW	131,225	200,843	325,940	340,078	354,215	368,353	382,490	396,628
	CASH ACCRUALS								
	Net profit	272,600	342,218	467,315	481,453	495,590	509,728	523,865	538,003
	Depreciation	188,500	188,500	188,500	188,500	188,500	188,500	188,500	188,500
	Interest	113,100	98,963	84,825	70,688	56,550	42,413	28,275	14,138
	Total Accrual	574,200	629,680	740,640	740,640	740,640	740,640	740,640	740,640
	Less								
	Repayment	141,375	141,375	141,375	141,375	141,375	141,375	141,375	141,375
	Interest	113,100	98,963	84,825	70,688	56,550	42,413	28,275	14,138
	Repayment +Interest	254,475	240,338	226,200	212,063	197,925	183,788	169,650	155,513
	Net available	319,725	389,343	514,440	528,578	542,715	556,853	570,990	585,128
	DSCR	2.26	2.62	3.27	3.49	3.74	4.03	4.37	4.76
	ADSCR								3.57

INCOME EXPENDITURE STATEMENT

Sl.	Particular	Year							
		Yr1	Yr2	Yr3	Yr4	Yr5	Yr6	Yr7	Yr8
	Milk procurement	3,000	3,200	3,600	3,600	3,600	3,600	3,600	3,600
A	INCOME								
1	Payment received from Milk Hub for Chilling	109,500	116,800	131,400	131,400	131,400	131,400	131,400	131,400
2	Saving due to reduction in souring and curding of milk	43,800	46,720	52,560	52,560	52,560	52,560	52,560	52,560
3	Saving due to non spillage	459,900	490,560	551,880	551,880	551,880	551,880	551,880	551,880
4	Saving in repair and replacement of cans	109,500	116,800	131,400	131,400	131,400	131,400	131,400	131,400
5	Net saving on transportation cost of milk	164,250	175,200	197,100	197,100	197,100	197,100	197,100	197,100
6	Income from milking machines	43,800	46,720	52,560	52,560	52,560	52,560	52,560	52,560
	TOTAL INCOME	930,750	992,800	1,116,900	1,116,900	1,116,900	1,116,900	1,116,900	1,116,900
B.	EXPENDITURE								
1	Electricity and fuel	76,650	81,760	91,980	91,980	91,980	91,980	91,980	91,980
2	Repair and maintenance	21,900	23,360	26,280	26,280	26,280	26,280	26,280	26,280
3	Manpower cost	240,000	240,000	240,000	240,000	240,000	240,000	240,000	240,000
4	Building lease	18,000	18,000	18,000	18,000	18,000	18,000	18,000	18,000
5	Interest	113,100	98,963	84,825	70,688	56,550	42,413	28,275	14,138
6	Depreciation	188,500	188,500	188,500	188,500	188,500	188,500	188,500	188,500
	TOTAL EXPENDITURE	658,150	650,583	649,585	635,448	621,310	607,173	593,035	578,898
	NET PROFIT	272,600	342,218	467,315	481,453	495,590	509,728	523,865	538,003
	CASH PROFIT (net profit + depreciation)	461,100	530,718	655,815	669,953	684,090	698,228	712,365	726,503
	NET PROFIT BEFORE INTEREST	385,700	441,180	552,140	552,140	552,140	552,140	552,140	552,140

IRR Calculation			Net Present Worth		
	Year	Amount		0	(1,885,000)
Investment/project cost	0	(1,885,000)		1	385,700
Cash in flow	1	385,700		2	441,180
	2	441,180		3	552,140
	3	552,140		4	552,140
	4	552,140		5	552,140
	5	552,140		6	552,140
	6	552,140		7	552,140
	7	552,140		8	552,140
	8	552,140	Total		4,139,720
IRR		20%	NPV @15%		2,248,998
Rate of Interest		10.00%	Initial Outlay		(1,885,000)
			NPV Value (NPV+Initial Outlay)		363,998

REPAYMENT SCHEDULE OF TERM LOAN in BDT

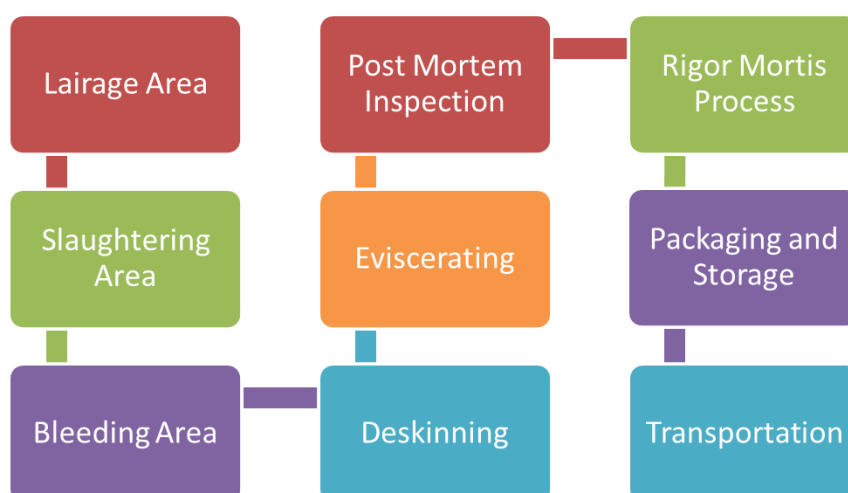
Year	Loan amount	Principal	Interest	Total outgo
1	1,131,000	141,375	113,100	254,475
2	989,625	141,375	98,963	240,338
3	848,250	141,375	84,825	226,200
4	706,875	141,375	70,688	212,063
5	565,500	141,375	56,550	197,925
6	424,125	141,375	42,413	183,788
7	282,750	141,375	28,275	169,650
8	141,375	141,375	14,138	155,513

Annexure 19. Environmental issues related to slaughtering facilities and its business model

Bangladesh's economy is heavily dependent on agriculture and livestock sectors. There is a large segment of the rural population whose livelihoods are dependent on meat value chain related activities. Improved slaughtering facilities are expected to improve livelihoods of the actors involved by enabling them to target the high-end markets and at the same time create access to safe products, decreasing the food safety burden caused by noncompliant practices and capacities. Consequently, women and children are the most vulnerable group when it comes foodborne illnesses, causing not only health issues but social impacts. According to a study by World Bank⁴⁴, unhygienic conditions at slaughterhouses can lead to severe illnesses creating productivity loss in the form of higher health care costs and inability to work in the amount of \$1.5 billion per year. In some cases, consumption of noncompliant meat has also resulted in loss of precious lives.

Slaughterhouses are a key source of water pollution and environmental degradation. Laws regulating these facilities are weak and poorly enforced, for the animals killed in the process, the workers putting body and limb on the line, and the environmental health and safety of neighboring communities. From direct disposal of pollutants to toxic runoff and water usage, slaughterhouses are significantly impairing North American rivers and streams and further endangering aquatic wildlife. Slaughtering requires large amounts of water for cleaning and sterilization. The resulting wastewater contains concentrated agricultural compounds including fat, oil, protein and carbohydrates, which are biodegradable but require a high biological oxygen demand to biodegrade. The main polluting agent in slaughterhouse wastewater is blood. Wastewater also contains insoluble organic and inorganic particles polluting waterways.

The process flowchart for environment-friendly slaughtering facilities is provided below:



⁴⁴ World Bank (2019). The Safe Food Imperative: Accelerating Progress in Low- and Middle-Income Countries. <https://openknowledge.worldbank.org/entities/publication/83a34062-c6c8-5edf-857c-62a643c16bb8>

- All types of slaughtering facilities (small, medium and large) need to follow the environmental safeguarding to support the ecosystem, through sustaining the existing flora and fauna and not introducing any material or product that will affect or change them in a negative way.
- Additionally, the infrastructure and services that need to be developed and implemented will be planned in an environment friendly way, where the introduction of proper waste management practices will be encouraged.
- The slaughterhouses do not only aim to scale up the number of animals slaughtered but also improve the level of compliance at the slaughterhouse, thus improving quality and hygiene and creating value addition.
- For beef cattle, water consumption occurs in every step of the slaughter process, from live receiving to cleaning and sanitation. Average water usage for slaughtering cattle is estimated at 300-400 liters per animal.
- Slaughterhouse wastewater can contain antibiotic-resistant strains of E. coli, fueling the spread of antibiotic-resistant bacteria. Without a clear pretreatment standard, some slaughterhouses discharge to public wastewater treatment plants without treating waste, worsening overflow at treatment plants.
- Air and water pollution from slaughter facilities leads to health problems including headaches, breathing and heart difficulties, and irritation in the nose, eyes and throats. Residents may be unable to open windows or go outside due to dangerous toxins in the air.

Annexure 20. Key climate-smart interventions in the livestock sector

1.1 Interventions in Farming Practices

- Droughts are characterized by severe demand for feed/fodder sources and can be mitigated by promoting drought-resistant crops for feed and fodder production to adapt to climate change
- Planned feed and fodder value chain enhancement for high yield with good quality products even during climate hazards
- Smart feed and fodder value chain monitoring tools to help in identifying problems and addressing them
- Capacity development of the farmers at the farm level on seed selection, climate-smart farm activities, and effective management
- Intervention in animal health through a selection of specific breeds for the Bangladesh scenario to help the animals cope with disaster events
- Climate-smart sheds to improve animal health and productivity along with efficient water and energy use
- Management of farm waste for the proposed climate smart sheds
- Monitoring animal feed and balanced nutrition for livestock to improve its quality
- Knowledge of various insurance schemes to help reduce financial losses in case of climatic events

1.2 Integrated Farming and the ‘Circular Economy’

- Integrated farming systems that utilize/manage all the products, by-products, and wastes generated through integral linkages of the Circular Economy
- ‘Circular Economy’ and ‘Circular Agriculture’ to utilize by- and waste products as animal feed to reduce carbon emissions from burning and from waste ‘landfill’
- The integration and linkages of a ‘Mixed farming technique’ at smallholder farms are currently lagging, and need to be improved for further livelihood through artisanal products like cheese, butter, ghee, etc
- The agricultural products can also be used along with dairy, meat, and other products adding value and creating a unique identity for the farmers in a region in remote locations, where the potential is high and penetration of commercial processors is low.

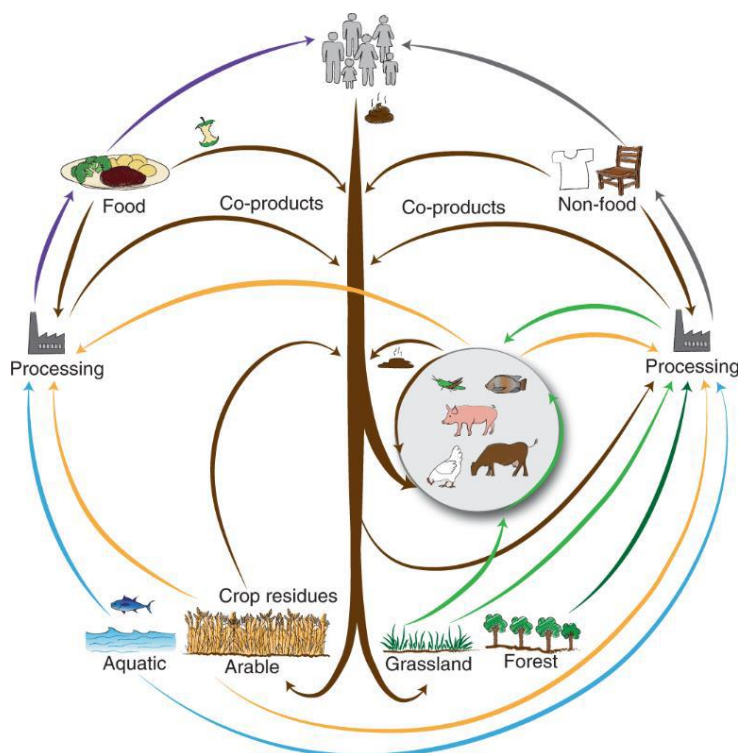


Figure. The Circular Economy in Integrated Farms⁴⁵

Five types of integrated farming that are being observed in Bangladesh are:

1. Crop-Livestock-Poultry-Fish (C-L-P-F)
2. Crop-Livestock-Poultry (C-L-P)
3. Crop-Livestock-Fish (C-L-F)
4. Crop-Poultry-Fish (C-P-F)
5. Crop-Livestock (C-L)

The C-L-P-F integrated farming system has the highest potential and is reported to increase the socio-economic status in rural regions⁴⁶. The lack of energy security in these systems is a major drawback that can be mitigated through integrated livestock manure management (energy from biogas systems and value-added manure products) as highlighted in the monitoring report on Bangladesh Second Country Investment Plan Nutrition-Sensitive Food Systems⁴⁷.

Utilization of renewable energy sources (solar PV, solar thermal, etc.) can also offer a cheap and reliable power supply for businesses/farms operating in remote locations. The current challenges faced in the integrated farming systems can be mitigated through:

- Coordinated extension services focusing on integrated farming,
- Marketing support,
- Agro-ecological research activities.

⁴⁵ <https://www.nature.com/articles/s43016-021-00340-7>

⁴⁶ https://www.researchgate.net/publication/342347722_Integrated_farming_and_its_impact_on_farmers%27_live_lihood_in_Bangladesh

⁴⁷ <http://fpmu.gov.bd/agridrupal/sites/default/files/file/MR-2021/MonitoringReport2021.pdf>

Energy security, water quality/conservation, energy efficiency measures, technology upgradation, and waste management are some of the key aspects that need to be taken into consideration for upgrading to integrated farming from the business-as-usual scenario.

1.3 Interventions for pollution/GHG mitigation

- Manure management through domestic and community-scale interventions to address GHG emissions.
- Domestic-scale manure management through anaerobic digesters at domestic levels is extensively carried out by government entities like Infrastructure Development Company Limited (IDCOL) and the Local Government Engineering Department (LGED)
- Community-scale manure management is another viable solution to address the socioeconomic and energy demands
- Proper implementation through the best available technologies with smart monitoring tools integrates value chain players
- The development of suitable business models for sustained operations in meeting fertilizer and energy needs locally
- Dairy wastewater treatment is another important process to satisfy environmental norms. A large quantity of dairy wastewater is handled through an effluent treatment plant at dairies. Circulation-based anaerobic digesters such as Upflow Anaerobic Sludge Blankets (UASB) have been identified as the best available technology⁴⁸. Water conservation activity will also be realized using such systems since the treated water can be utilized for gardening, crate washing, floor cleaning, etc.
- To address issues of tannery waste and to meet the requirements/ environmental regulations of the international market, the GOB proposes to build advanced effluent treatment plants in each of the tannery zones. Around 220 tanneries are shifted from the old tannery cluster to Savar where a sufficient wastewater treatment facility exists⁴⁹.

1.4 Interventions at the socio-economic level

- Socio-economics of the local community needs can be addressed through capacity development and modern tools exposure
- Youth and women's involvement in livestock value chains as entrepreneurs can be improved further through self-governed cooperatives offering mutual benefits
- Access to micro-credits and other climate finance services can help communities invest and be equipped to fight climate change
- The involvement of private players is reported to enhance business operations
- Incorporating energy efficiency measures and renewable energy installation in the design and construction of community infrastructure for long-term financial benefits
- Community awareness programs should be implemented with a special focus on adaptation, food security, diseases, and water conservation/management.

2. Climate-Smart technologies for milk processing

2.1 Solar PV-based freezers

At the grass root level chillers are required for the livestock farmers to ensure the quality of milk at the producer level in the dairy sector. In the case of the meat sector, though

⁴⁸

https://www.researchgate.net/publication/264841746_Biomethanation_of_Dairy_Waste_Water_Through_UASB_at_Mesophilic_Temperature_Range

⁴⁹ [https://www.unido.org/sites/default/files/files/2019-](https://www.unido.org/sites/default/files/files/2019-05/Bangladesh%20dairy%20and%20beef%20vc%20report%20%28Wei%27s%20final%20version%29%20.pdf)

[05/Bangladesh%20dairy%20and%20beef%20vc%20report%20%28Wei%27s%20final%20version%29%20.pdf](https://www.unido.org/sites/default/files/files/2019-05/Bangladesh%20dairy%20and%20beef%20vc%20report%20%28Wei%27s%20final%20version%29%20.pdf)

refrigeration is not required for the farmers but is required at the subsequent levels of the supply chain. Solar PV-based freezer is a solution that can aid farmers at distant locations by preserving the quality of products thus bringing higher returns.

Ice produced using the Solar PV-based freezer can be used in insulated cans to transport milk or meat products. A simple schematic of solar PV-based freezer system and its use is presented in figure below.

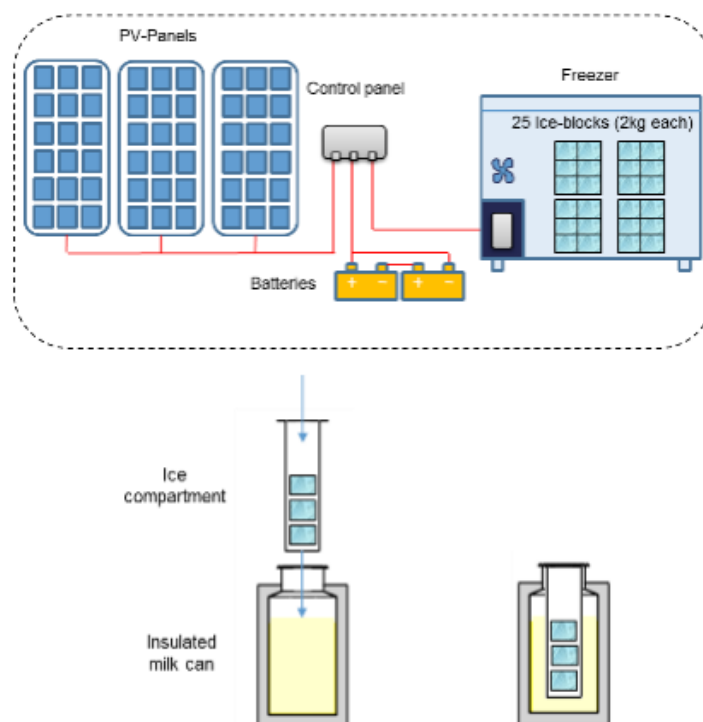


Figure. Schematic of milk chiller for small dairy farmers⁵⁰

Box A: Case study of solar milk chillers in Sidi Bouzid, Tunisia⁵¹

The technology was implemented in the Sidi-Bouzid region of Tunisia through funding from BMZ, Germany in collaboration with INRAT and the University of Hohenheim under a grant agreement with ICARDA. The focused region contributes around 293,000 litres of milk per day mainly through smallholder farmers with less than 5 cows. It is estimated that 20-30% of the collected milk is lost due to poor hygiene at the source. The milk cooling system consists of 40-litre cans with insulation that can be removed. The ice is produced by solar-powered freezers. The system can cool 60 liters of milk to a temperature below 15°C which will preserve the milk for up to 6 hours until reaching VMCC. Through this project 10 milk cooling systems were implemented at 7 locations. The cost of each system is around USD 2,800 and the payback period varies from 3-4 years. This system can be shared by a cluster of smallholder farmers and enterprises for cost-effectiveness.

⁵⁰ https://energypedia.info/images/0/00/User_Guide_-_On-farm_Solar_Milk_Cooling_System.pdf

⁵¹ <https://www.fao.org/climate-smart-agriculture-sourcebook/production-resources/module-b2-livestock/b2-case-studies/case-study-b2-4/ar/>



Solar milk chillers in Tunisia

2.2 Cold chain powered by renewable energy

The use of renewable energy for cold chain networks is not new to Bangladesh. PRAN had already experimented with solar-powered VMCCs (Nadosayedpur, Goihata, etc.). The amount of milk cooled at such center is around 2,000 litres. The solar powered VMCC41 sites by PRAN are shown in Figure where 10-20 kWp solar systems are installed. The current cost of such systems is around BDT 50,000 per kWp. Biogas-powered cold chains also have enormous potential which was not explored so far in Bangladesh.



Figure. Solar-powered VMCC by PRAN

Box B: Micro-grid powering bulk milk chillers in India⁵²

A micro-grid based bulk milk chillers had been installed by NGO Named Tara Urja in India. The milk chilling capacity is around 1,200 litres per day. The facility at Shivapura village in Uttar Pradesh sources milk from 80 smallholder farmers. The enterprise focuses on milk processing mainly ghee. This project also provides power to other agro-processing and other commercial enterprises nearby.

3. Slaughterhouses and energy requirements

In general, electricity and fuels such as diesel (for power generators), biomass, charcoal and liquefied petroleum gas (LPG) (for heating needs) are the commonly used energy sources in slaughtering facilities. The electricity consumption may vary based on the animals

⁵² <https://www.taraurja.com/program/details/MED-program/Bulk-MilkChiller/56465a53536c42525054303d/>

slaughtered. For example, the electricity consumption in modern slaughterhouses is in the range of 20-310 kWh/cattle and 0.4-1.2 kWh/poultry⁵³. In particular, the refrigeration system consumes around 45% of the total electricity consumption in slaughterhouses. Pumps are used for water supply in the facility and motors are used in the operation of conveyors/hangers. Other small loads include handheld equipment, hoists, etc. The fuels are mainly used for hot water generation required for cleaning the carcass and sanitizing equipment & facility⁵⁴. The use of biomass fuels such as wood and charcoal for hot water generation also leads to air pollution around the slaughterhouse facility. Figure below shows the contribution of different electrical loads to total electricity consumption in typical slaughtering facilities.

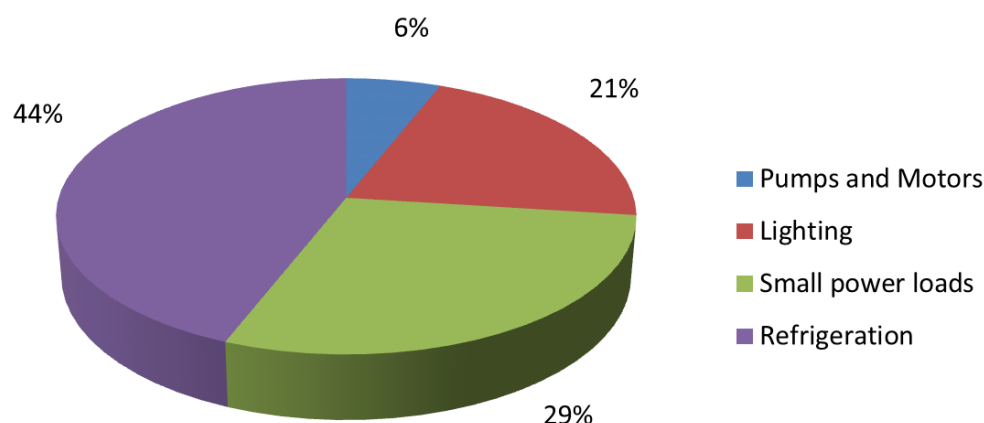


Figure. Contribution of electrical loads in a typical slaughterhouse

The operational pattern of the slaughterhouse (major type of livestock handled, daily hours of service, use of cold storage) also impacts the energy requirements.

3.1. Public slaughterhouses:

In the case of public slaughterhouses managed by city administration/local government authorities, the cattle are slaughtered in the early morning hours (2 am - 6 am) and in the late evening hours (6 pm – 10 pm). The traders bring their cattle to the slaughterhouse to get them butchered for a service fee during this time and then the meat products are distributed across the city for retail sale to consumers. Thus, the operation of public facilities can be intermittent 8 hours per day. Given this operation pattern, the need for a chilling or refrigeration unit to store meat products is relatively low. Electricity is sourced from the grid connection and the diesel generator is used in case of emergency purposes only.

3.2. Private slaughterhouses:

In the case of private enterprises, the operation can be different where the facility may be operating all through the day continuously delivering meat products to their clients/consumers. Therefore, the energy load of chilling or refrigeration units will be high here requiring higher electricity consumption. Electricity is sourced from the grid connection and diesel generators may be used for emergency power supply. This note mainly deals with the public sector slaughtering facilities. However, the interventions discussed and recommendations made may apply to private enterprises as well. Most of the slaughterhouses in Bangladesh lack basic amenities such as sufficient lighting, proper ventilation, adequate water/hot water supply, and

⁵³ <https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/slaughterhouses>

⁵⁴ https://www.deswater.com/DWT_articles/vol_190_papers/190_2020_98.pdf

environment-friendly waste disposal for a safe and hygienic work environment. Adopting EE and RE systems can help overcome some of these challenges.

3.3. Potential EE and RE technologies

Slaughterhouses are one of the major sources of water pollution and GHG emissions, especially in developing countries. Although it is not an energy-intensive sector compared to other industrial sectors, improving energy efficiency & generating clean energy from slaughtering wastes can be potential interventions for lowering the dependence on fossil fuels & their costs. In addition, this can support slaughterhouses to abide by the health & safety regulations and other environmental norms set by national and local policies.

The following are the most widely used EE and RE measures that can help in achieving efficient slaughterhouse operation:

- Efficient lighting
- Solar water heaters
- Solar PhotoVoltaic (PV) power generation
- Waste-to-Energy (WTE)
- Energy efficient appliances

3.3.1. Efficient lighting

Bangladesh's residential, commercial, and public buildings represent about 35% of the total electricity consumption. Particularly, the replacement of conventional lamps & compact fluorescent lamps (CFLs) with energy-efficient lighting systems such as Light Emitting Diode (LED) lamps will reduce electricity consumption and also improve the comfort of slaughterhouse staff by offering good quality ambient lighting. Switching from CFLs to LEDs can offer around a 25% reduction in energy consumption. There are different types of LED lighting and the most appropriate ones can be chosen as per different floors/operational areas of slaughterhouses. Figure below shows sample LED lamp applications available.



Figure. Different LED lighting applications

3.3.2. Solar water heaters

In slaughtering operations, hot water at a temperature of 60°C – 80°C is required to clean the carcass and also in cleaning & sanitizing the equipment/facilities. The traditional way of heating water in tanks requires manual operation of burning of wood or charcoal or LPG using burners/stoves as per requirement. This can be a limitation where there is no adequate staff or space to install stoves/tanks. Burning of biomass will also lead to smoke generation affecting nearby communities. However, solar water heaters do not need manual operation and do not generate smoke. It does not need additional ground space as it can be mounted on the rooftop of a slaughterhouse.

A few water technologies that can be employed are (i) Flat plate solar water heaters and (ii) Evacuated tube solar water heaters, which are shown in figure below.



Figure. Flat plate & Evacuated tube solar water heating systems

3.3.3. Solar PV power generation

Solar PV power generation can be the best solution in remote slaughtering facilities where there is dependence on diesel generators due to remote location or unreliable power supply from the national grid. The technology also has a well-established market in Bangladesh with several market players. Solar PV power generation can be implemented together with various applications such as lighting, water pumping, refrigeration, etc., based on space available for installation (rooftop or ground mounted) and financial resources. Both grid-tied as well as off-grid systems can be employed.

3.3.4. Waste to Energy (WtE)

In Bangladesh, around 10 million livestock are slaughtered annually producing 7.6 million tons of meat for consumption each year. As a consequence, the slaughterhouses produce large amounts of solid wastes and wastewater and if directly disposed of, these would result in environmental & ecological problems and the risk of clogging the wastewater drainage systems. Anaerobic treatment of these wastes in a biogas digester can be an effective solution to handle these wastes and prevent environmental damage. The biogas generated can be captured and used for heating water or generating electricity. The final sludge can be used as fertilizer in agriculture farms.

Some of the ongoing biogas generation projects (from slaughterhouse waste) in Bangladesh are as follows:

- “Bangladesh Scaling-up Renewable Energy Project” – funded by the World Bank for the generation of biogas from slaughterhouse waste in Rajshahi city.
- Technical assistance for the implementation of a biogas facility at Tongi, Gazipur city – provided by GIZ

The lessons learned from these projects can be considered while implementing the biogas facility through this project. Approximately 7,915 tons of slaughterhouse waste are generated annually from the slaughterhouses in Dhaka city alone and has the potential to generate 2.15 million m³ of biogas.

There are three types of biogas digesters which are (i) fixed dome, (ii) floating drums, and (iii) flexible balloons.

(i) Fixed dome digester

Fixed dome digester is robust, reliable and requires only little maintenance. The size of these plants can range anywhere from 2 – 16 m³. The biogas system is made up of several interconnected parts. The schematic of fixed dome digester is given in figure below. The specific role of each component is summarised below:

Inlet - The main purpose of the inlet is to mix organic material and water into a semi solid state. This mixture is fed into the digester via an inlet pipe.

Digester - The digester holds the mixture of manure and water, creating a conducive environment for anaerobic digestion where microorganisms produce biogas. The digester is cylindrical in shape and is usually made of brick masonry with a concave concrete cover or dome. Typically, the digester is built underground with only the plumbing, inlet and outlets visible.

Dome - The purpose of the dome is to collect the gas produced in the digester. This is typically plastered in several layers and painted with a special paint in order to minimise gas leakage. Gas accumulates under the dome creating pressure and pushing down the level of the slurry and consequently increasing the slurry level in the connected slurry tank. It is the difference in slurry levels between the slurry tank and the inside of the dome that maintains the pressure to push the gas into the outlet pipe.

Outlet - The outlet valve releases the collected gas under the dome to biogas appliances such as stoves or lamps.

Slurry tank - The slurry tank holds the slurry that the gas pressure from under the dome displaces. This slurry overflows into a composting tank as more manure is fed into the digester. This slurry can then be used as a fertiliser.

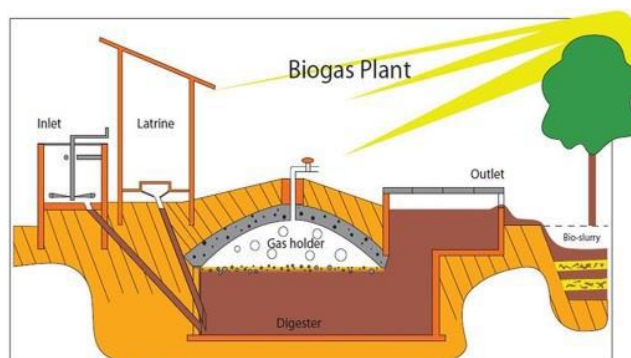


Figure. Schematic of fixed dome digester

(ii) Floating drum technology

The basic functioning of the floating drum digester is similar to the fixed dome. The key difference of this technology is a cylindrical or dome-shaped digester with a moving, floating gas holder or drum that floats depending on the amount of gas in the digester. The gas holder either floats directly in the digester slurry or a separate water jacket. The drum in which the biogas collects will usually have an internal or external guide frame that provides stability and keeps the drum upright.

As biogas is produced and more gas is released, the drum is pushed up, indicating a rise in the amount of gas. When the gas is used up, the drum sinks. This provides a useful visual indicator of how much gas is available to users. The costs of building/installing the floating drum type depend upon the size, the materials used, and the model of the digester. Floating drum digesters need some maintenance depending on how well they are managed. Maintenance involves cleaning, painting, and fixing leaks.

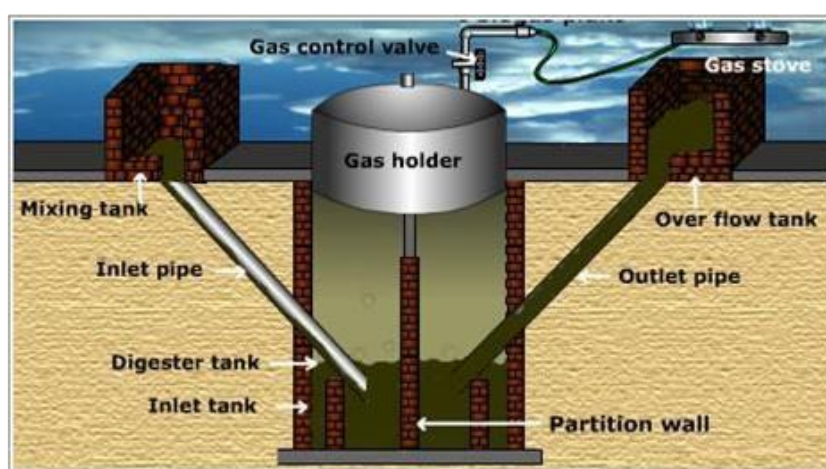


Figure. Floating drum biogas system

(iii) Flexible balloon digesters

Flexible balloon digesters are constructed from a large plastic or rubber bag and are thus mobile, which is the main difference from the fixed dome and floating drum digesters that are constructed on site.

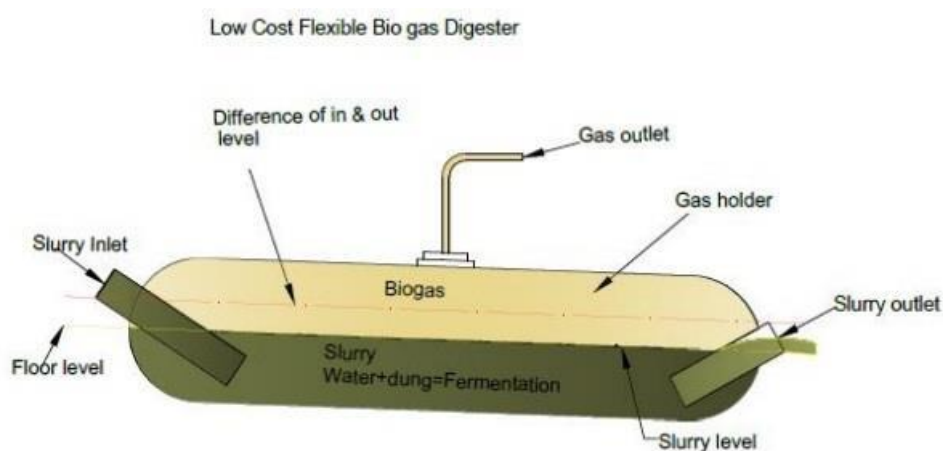


Figure. Flexible balloon digester system

The operation however follows largely the same principle as fixed-dome or floating drum digesters. The balloon material should be weather and ultra-violet (UV) radiation-resistant, especially stabilized reinforced plastic or rubber.

3.4. Energy efficiency measures

The conventional motors, pumps, refrigerators, etc., at the slaughterhouse facility can be replaced with energy-efficient appliances to reduce the energy consumption and its associated cost in the slaughterhouse. Bangladesh has already established Energy Performance Standards (EE labeling) for ballasts, ceiling fans, fluorescent lamps, portable fans, refrigerators, and freezers. As of 2019, EE labeling is available for fluorescent lamps, ballasts, ceiling fans, portable fans, and refrigerators. The larger the slaughterhouse capacity and size, the higher the energy consumption, and the equally higher potential exists for energy savings and cost savings from the use of energy-efficient appliances. In general, the adoption of energy-efficient appliances can help achieve around 5-10% energy savings.

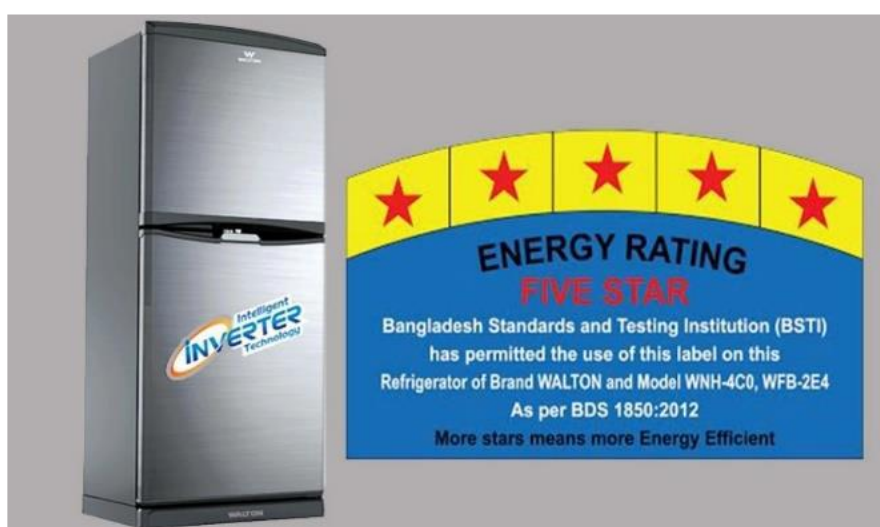


Figure. Energy star-rated electrical appliances

The National Agricultural Mechanization Policy (2020) promotes scientific measures in agricultural techniques to promote productivity in modern agriculture. The government has joined hands with the World Bank, Asian Development Bank and several other development agencies to promote and implement conservative energy measures in the agriculture sector including livestock and dairy. The farmers receive grid electricity at only 50% of the consumer price and it is challenging to expect them to adopt energy efficiency measures, even among the few technology-driven farmers.

4. Economics of sustainable clean energy technologies

The slaughtering facilities, especially those operated for public services, are not an energy-intensive one. Therefore, energy-efficient technologies based on electricity such as efficient lighting & appliances for public slaughtering facilities may offer some reduction in electricity costs, but it may not be significant in the overall cost savings. However, if the energy requirements (both electricity and heating) are replaced with sustainable alternative energy technologies such as solar energy and biogas, then the cost savings/revenue generation will be significant. This cost savings will support lowering the budget/expense of the local government authorities to operate those facilities. Clean energy technologies together with EE systems can improve the overall economic attractiveness of the investment.

Therefore, the economics of key RE/waste-to-energy (WTE) technologies for the slaughtering facilities are discussed below. The analysis is based on the collected data for Bangladesh conditions and where not available, from the regional and international references. The economic analysis for each technology is carried out for three different scenarios of cattle handling capacity as follows:

- Small-scale facility (less or equal to 50 cattle per day)
- Medium-scale facility (between 50 to 200 cattle per day)
- Large-scale facility (more than 200 cattle per day)

The analysis presented here is only for demonstration purposes. However, in the practical condition, the economics of these interventions may vary due to various factors such as actual energy requirement in slaughterhouses, operational pattern, space availability, technologies available in the domestic market, etc. Pre-feasibility study will be required to decide on the exact scale/technology of RE/WtE intervention most appropriate for a given slaughtering facility.

Refer to the tables presented in “**Annex:3 - Economic evaluation of clean energy interventions in slaughtering facilities**” in “**Deliverable D#02. Slaughtering Facility Report**” for further details.

5. Technology upgradation and key recommendations for addressing the increasing climate change impacts

The competitiveness of the dairy and livestock sector in Bangladesh can be improved by incorporating the best suitable technologies at all levels. Technology upgradation measures in the livestock and dairy sector can include:

- Nutrition control
- Health monitoring and tracking
- Improving resource efficiency (feed, energy, water, etc.)
- Cold chain

Below are recommendations for addressing the climate change impacts in the livestock and dairy sector, if possible and as applicable, under the LDDP project:

- Sustainable fodder production and supply can be targeted through advanced climate-adapted varieties, with hydroponic systems in drought-prone regions.
- Efficient waste collection from agro-processing (food product wastes), livestock (waste by-products from slaughterhouses), and dairy wastes (whey) and utilization as the inputs to feed production to reduce requirements of fresh raw materials and to ensure availability of feed volumes in the market even during adverse climate conditions.
- More effective grazing lands for the livestock through community cooperation and agro-forestry during floods, droughts, and pasture loss during overgrazing
- Crop-Buffalo-Duck-Fish type integrated farms at flood-prone zones can be scaled up based on the lessons learned from previous endeavors by the GOB and other development agencies.
- Climate-smart infrastructure resilience to floods and heat waves such as sufficient storm drains near village milk collection centers (VMCC), storage warehouses, elevated livestock sheds, and good ventilation, can be promoted through awareness and skill development.

- Micro-grids or off-grid-based RE generation (biogas, Solar PV, wind) can be encouraged at farms in remote locations such as the Char Islands for reliable electricity access during floods and other climate events.
- At the VMCC level, biogas initiatives for energy independence and to aid farmer networks with value-added bio-fertiliser products.
- Biogas use for the transport sector can be promoted to attain NDC targets and to enable manure management (a sub-sector) through a circular economy for WTE.
- Establishment of weather communication systems for climate warnings across the value chain for timely dissemination of information to safeguard livestock.
- Access to formal financial services can be encouraged by offering micro-credits, soft loans, and micro-insurance to mitigation risks

Annexure 21. Strategies for linking producers with dairy hubs

Currently, a number of branded large milk processing organizations are operating in the country such as Milk Vita, Aarong dairy, PRAN dairy, Aftab milk, Farm fresh, Eon dairy, American dairy and so on. The latest entrant of EON Dairy Ltd. is marketing high tech specialized antibiotic free fresh whole pasteurized milk in Bangladesh in hectic mode in the shape of online marketing structure. The efforts for corporation of pasteurization milk marketing in Bangladesh nowadays is of oligopolistic nature. Milk Vita, the largest pioneering cooperative dairy venture in Bangladesh is gradually decreasing its market share from 80% to 40%; followed by PRAN and Aarong with a 24% market share each (Noyon & Ali 2021).

In the root based VMCC structure, there will be well equipped testing facilities for testing raw milk for ensuring qualitative measures. In each VMCC, it is desired to collect 2000 litre/day raw milk, then it must be chilled at 4 Degree Celsius and it should be transferred to the processing plant or dairy hub for producing different types of market required milk and milk products (Pasteurized/UHT milk; yogurt; butter; ghee; cheese; powder milk; diversified sweetmeat products, etc.). The operational activities of VMCC is simple and on the other hand the operational activities of dairy hub are technical and massive. VMCC may be operated by trained milk producers of Producers Group (PG) obeying predesigned rules and regulations. But dairy hub operational activities require skilled and professional manpower. That is why VMCC may be linked with the interested renowned milk processing organization initially. Days will come in the time ahead that milk producers' group will shoulder all activities of VMCC and as well as dairy hub for the sake of the development of dairy/livestock sector in Bangladesh. Then the main beneficiaries will be the farmers' PG and 300 VMCC. These 300 VMCC and 20 dairy hubs will be replicated in the whole country.

Through VMCC and dairy hub system, money circulates from urban areas to the root based rural folks round the year enriching dairy development support services such as modern AI facilities, quality fodder production knowhow, scientific feed formulation facilities, scheduled year round vaccination programme, deworming, scientific cattle housing technical facilities and disease prevention and treatment, etc.

Annexure 22. Policy Implementation Matrix

Major policy initiatives in the livestock sector would require strong support from the MoFL, Planning Ministry and Prime Minister's Office. Some policy actions suggested such as finalizing existing draft policies require minimal budgetary support. Others will require significant organizational preparedness and resources. Translating policy objectives into concrete actions and putting them into practice involves overcoming various challenges and harnessing on factors that contribute to successful implementation.

Table. Policy Implementation Matrix

Ref #	Policy	Actions	Responsible	Timeframe	Budget source
1	Gazetting livestock policies	Finalise and notify draft National Livestock Extension Policy, 2013; National Breeding Policy, 2019; and National Dairy Development Policy, 2019.	MoFL	Short term	No budgetary implication
2	Establish Prani Sampad Bikas Foundation (PSBF) as a Government company	• Within the next 6 months ◦ Undertake techno-economic-legal feasibility study ◦ Explore interest of financial institutions (domestic, foreign), government agencies, donors, and technical assistance providers • PSBF will be a dedicated specialized fund for livestock sector • Fund corpus and fully operationalize PSBF	MOFL	• Short term (<1 year) • Short term (<1 year) • Medium term (1-3 years) • Long term (3-4 year)	Financing will be required after successfully completing feasibility stage. • Initial corpus from the Government would be required and development finance institutions. • The corpus would be augmented by internal accruals, market borrowings, and securitization of the portfolio.

Ref #	Policy	Actions	Responsible	Timeframe	Budget source
3	Complement the Bangladesh Climate Change Strategy and Action Plan (BCSSAP), 2008 and revised Nationally Determined Contribution, 2021	Chalk out concrete programmes to be undertaken by Bangladesh over the short, medium and long term within six strategic areas – food security, social protection and health; comprehensive disaster management; infrastructure; research and knowledge management; mitigation and low carbon development; and capacity building and institutional strengthening.	DLS	Medium term (<3 years)	DLS/LDDP can finance the work of a small expert committee. Resources for climate change mitigation and adaptation programmes can be obtained from a growing number of multilateral climate finance initiatives, impact investors, and foundations.
4	Launch National Milk Mission ⁵⁵ to increase milk availability	- Set goal of raising milk availability to 273 ml/day/head up from 209 ml/day/head available in 2022 (WHO norm is 250 ml/day/head). - Provide subsidized animal health insurance to milching cows and buffaloes through DLS-registered 5500+ producer groups - Run campaigns during winter and pre-monsoon season to reduce morbidity among cattle	DLS	Long term (>3 years)	Budgetary support will be needed to fund the bovine health insurance scheme, FMD immunization, running campaigns on media and on the ground.

⁵⁵ Parallels with India may be drawn. Dairy Development Mission in India has set out a national goal of 300-million-ton milk production by 2023-24 along with increasing the productivity of 40.77 million breedable Indigenous non-descript cows from 2.15 Kg per day to 5.00 Kg per day during the same period. Comprehensive enhancements across the dairy value chain would be necessary. This includes addressing cattle health issues, improving breeding techniques, bolstering infrastructure, and integrating unorganized farmers into milk cooperatives. For Bangladesh, the focus on increasing milk production aligns with the growing demand for fresh milk and value-added dairy products.

Annexure 23. Prani Sampad Bikas Foundation (PSBF)

Roadmap for transformation of livestock and dairy sector in Bangladesh



Structure of Presentation

Current Status

Vision 2041

Constraints

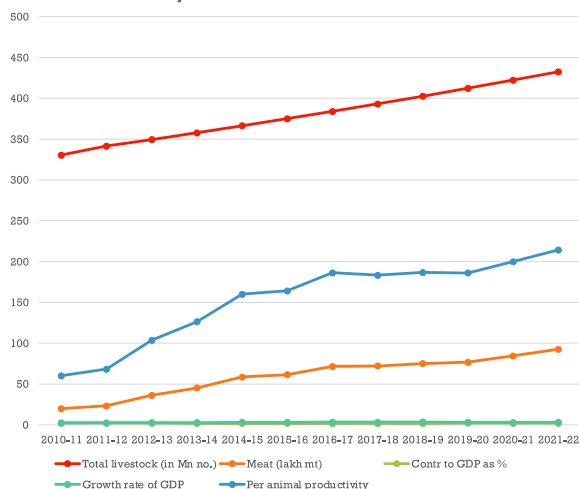
Deliveries made

New Vista

Six Strategies

CURRENT STATUS

Livestock Economy at a Glance



Livestock contributes 1.9% in GDP and 16.5% in Agriculture GDP (DLS 2022). Its' share in GDP is stagnating around 1.9%.

Cattle ownership is skewed towards marginal and small farmers (89%). They are owned by farm owners (43%), owner cum tenant (30%), tenant farmers (6%), and non-farm owners (22%)

Livestock accounts for 14% of the total labour force, and 1/3rd of total agricultural employment. It provides livelihood to 16 Mn households.

DLS has 8000+ employees. Many training institutions (Why?). Much of the training is not practical. Many private service providers.

Agriculture Year Book, 2020 (pp. 527) distribution of cattle ownership marginal and small 89%, medium 10%, large 1%. By ownership owners 43%, owner cum tenant 30%, tenant 6%, non farm 22%.

Vision 2041

The first goal is to attain Upper Middle-Income Status by 2031

Source: FAO Stat

Figure 1 Per capita meat consumption 2019-2021 (kg/annual)

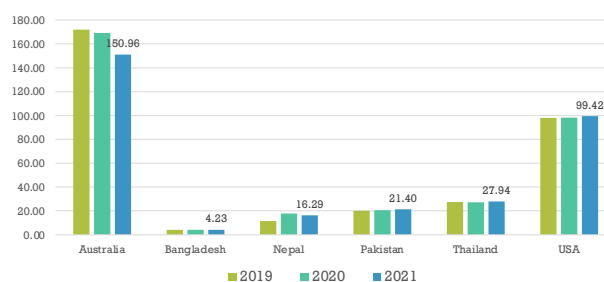
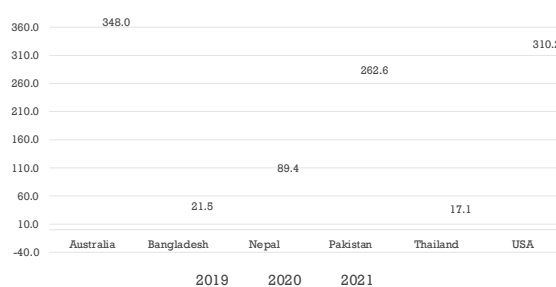
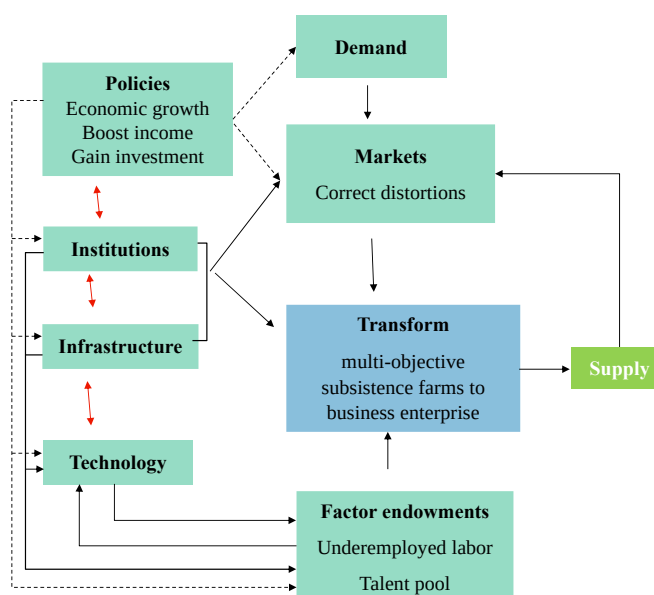


Figure 2 Per capita milk consumption 2019-2021 (kg/annual)



CONSTRAINTS

- Low productivity
- Low prices
- Disease outbreaks
- Weak infrastructure
- Dominance of subsistence producers
- Food safety concerns
- Inadequate data



AFCI/SSIL Deliveries

The agribiz consortium provided/providing support to the PMU, LDDP on implementation of matching grant scheme.

	Deliverables							
	D#1 Inception Report	D#2 Slaughter Facilities	D#6 Grants Modality report	D#3 Value chain	D#4 Business Structure	D#5 Capacity Building	D#7 Partnership Report	D#8 Draft final report
Submission date	25/12/2021	11/04/2022	19/05/2022	26/09/2022	02/01/2023	28/03/2023	25/06/2023	25/09/2023*
* Expected								



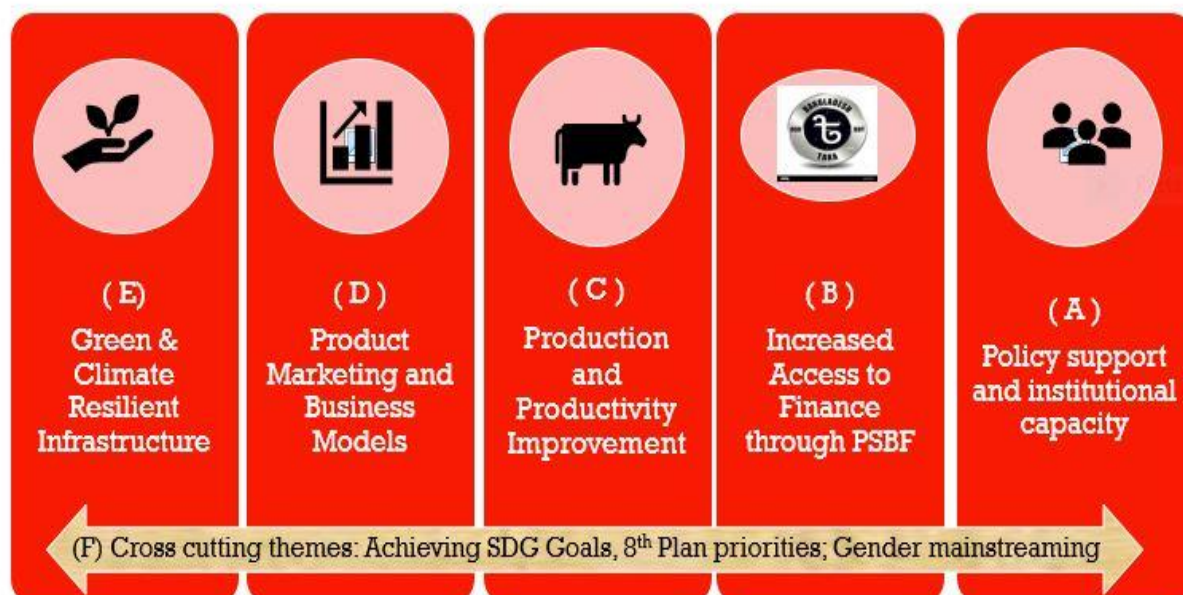
Agreement Signing Ceremony of Matching Grant on 18/6/2023

NEW VISTA

Proposed vision,
mission, and objectives
for the 'New Livestock
Development Paradigm'

- **Vision:** Pro-producer, pro-planet progress (P⁵)
- **Mission:** National abundance in meat and self sufficiency in milk.
- **Immediate objectives (2024-2031):**
 - **Raise meat availability to 156 (gm/day/head).**
Current (2022) availability 147.84 (gm/day/head) which is higher than WHO norm of 120 (gm/day/head).
 - **Raise milk availability to 325 (ml/day/head).**
Current (2022) milk availability is 208.61 (ml/day/head) which is lower than WHO norm of 250 (ml/day/head).
 - **Transform subsistence farming to business farming linked with market supply chains.**

SIX STRATEGIES



(A) Policy support and institutional capacity



The national parliament passed the Dairy Development Bill on 25 October 2023

Activity:

- Development of Livestock Master Plan for selected divisions.
- Develop policies related to feeding, breeding, dairy production and animal health, import of semen and live animals.
- Approval of the national parliament of the Dairy Development Board Bill 2023 as an act,
- Final approval of draft National Livestock Extension Policy, 2013; National Breeding Policy, 2019; and National Dairy Development Policy, 2019.

Output:

- Livestock Master Plan for Bangladesh
- Policies on related to feeding, breeding, dairy production and animal health, import of semen and live animals.
- Finalise and announce National Livestock Extension Policy; National Breeding Policy; and National Dairy Development Policy.

(B) Increased Access to Finance through PSBF

Activities

- Establish Prani Sampad Bikas Foundation (PSBF) as a legal entity after due consultation and approval of the Government.
- Appoint the Board of Directors of PSBF for its self-governance.
- The Board will appoint CEO and other key staff.
- Corpus fund of US\$ 100 million to PSBF. PSBF will raise the balance US\$200 million from other donors.
- Facilitate leverage by investees of 2x capital from other financial institutions and private entrepreneurs.

Output

- US\$900 million of investment in livestock and dairy sector
- Hundreds of enterprises made commercially viable
- Major boost to entrepreneurship in the country
- Standard operating procedures (SOP) and other policies to guide PSBF operations.
- Training to over 500 individuals and 200 enterprise every year.

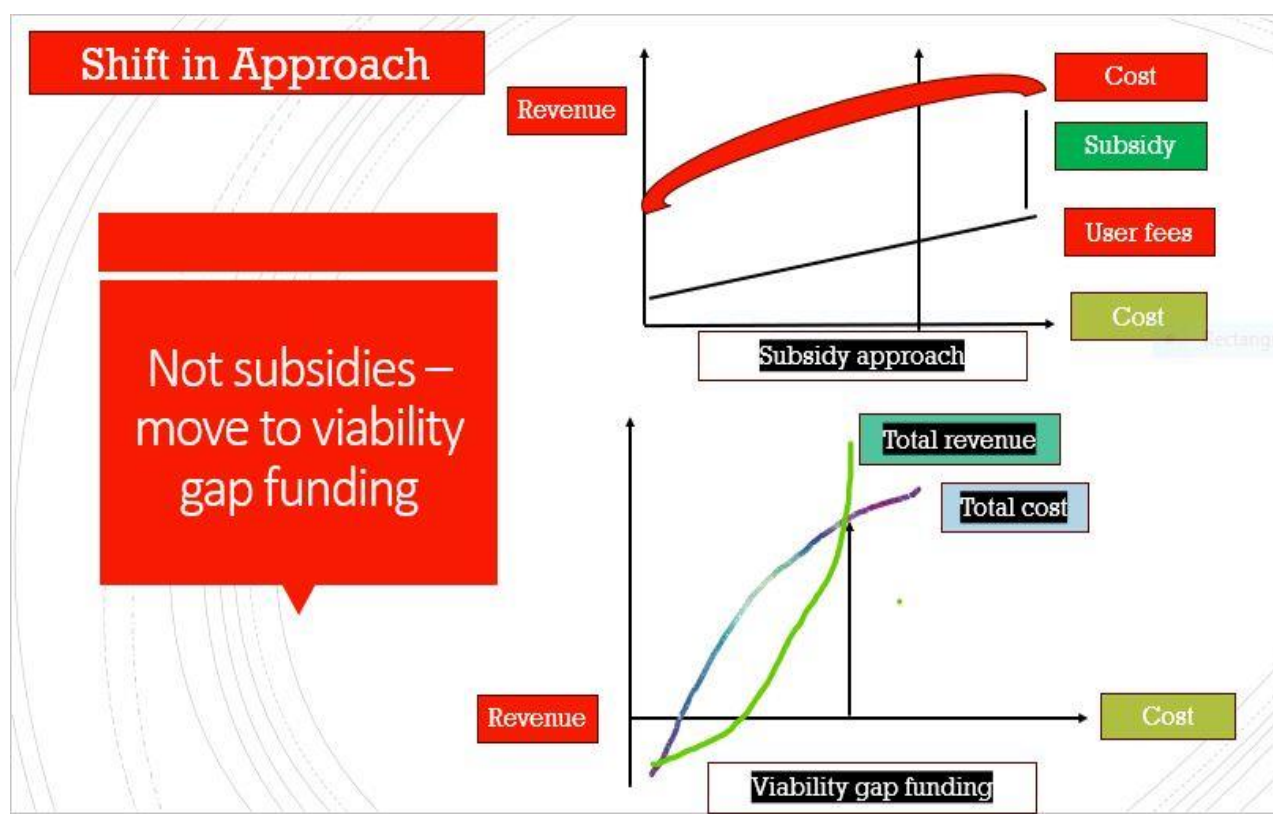
PSBF Selection Criteria and Focus Areas

Criteria for selection of projects	Areas of partnership and investment interest
• Benefits producers • In line with national priorities • Commercially viable • Risks of the project are manageable • Economies of scale within reasonable time • Credit worthiness of prospective investees	• Feed and fodder • Veterinary hospitals, clinics, diagnostic labs • Integrated meat processing units • Value-added milk products • Animal by-product utilization • Mass scale vaccine and vet medicine production and distribution • Training and capacity building of professionals and para-professional • Technology providers • Export oriented units

Comparison between PKSF and PSBF

Common criteria: Both Institution are Govt. run companies, providing technical and financial assistance to create employment and transform rural economy.

PKSF	PSBF
• Capital US\$ 530 mn (2021) of which grant 31%. • Welfare driven • Provide subsidized loans for agricultural, livestock, fisheries purpose. • Supports mainly low income households	• Capital US\$ 300 mn (proposed). Source DFI borrowings, grants. • Market driven • Will provide loans, equity, guarantees for livestock and dairy only. • Any viable economic enterprise



C.1 Support to government animal husbandry and advisory support services

Activity:

- Breed improvement of cows, buffaloes, Black Bengal goats, and Garole sheep will emphasize traits that confer resilience to climate-induced stresses,
- enabling investments in building (or rehabilitating) and equipping artificial insemination (AI) and breed improvement centers,
- The promotion of improved feed production techniques (the use of agricultural by-products, composition of balanced feed, feed storage technologies)

Output:

- Improved breed certified by BLRI
- New GAHP extension materials
- Improved feed and fodder practices
- Training of extension agents in climate resilient livestock practices.

(C) Production and Productivity Improvement

(C) Production and Productivity Improvement

C.2 SUPPORT TO PRIVATE ANIMAL HEALTH SERVICES STRENGTHENING

Activity

- Establish a program to support the development of private veterinary services delivery.
- Finance infrastructure and equipment, clinical and laboratory diagnostics, and disease control and eradication.
- Strengthen quality control and use of veterinary medicines.
- Support the private sector to produce vaccines and other biologicals under a limited period guaranteed buy back scheme.

Output

- A robust network of private veterinary hospitals, clinics, and diagnostics labs
- Increased capacity for disease control and eradication
- More supply of domestically produced veterinary vaccines and other biologicals.



Karachi

(D) Product Marketing and Business Models



Gabtoli

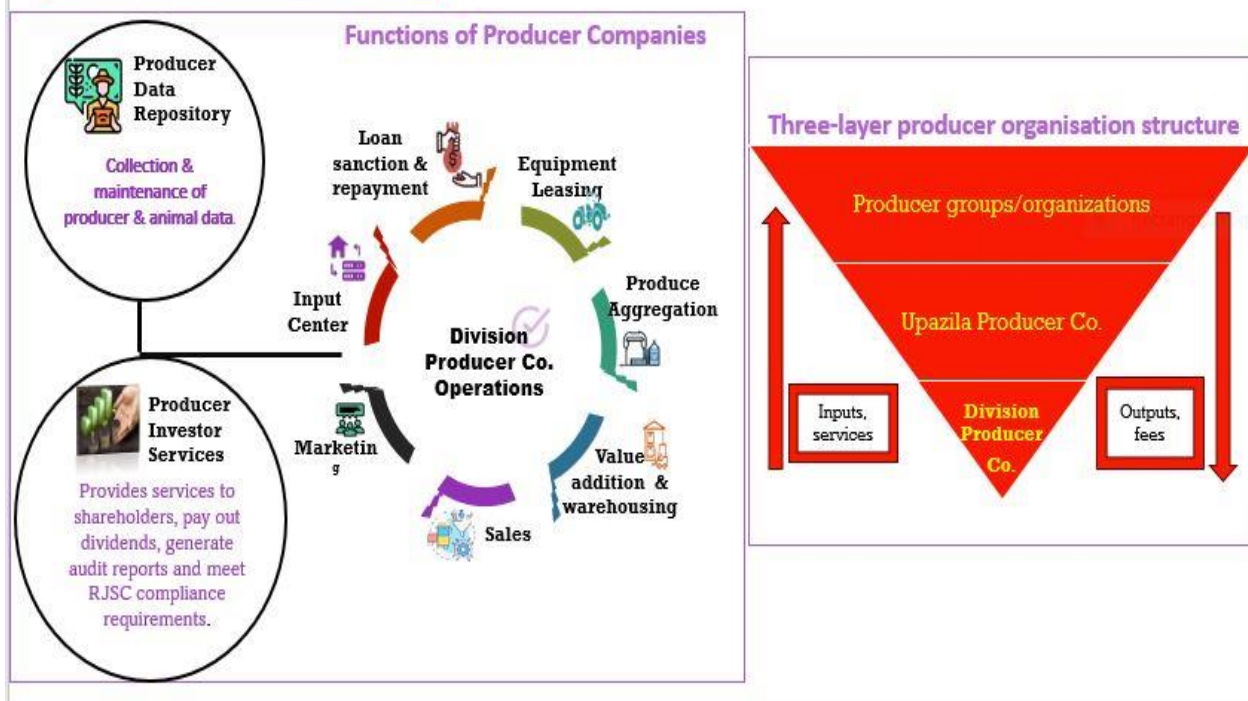
Activity

- Establish Livestock Producer Companies at Division and Upazila level.
- Corporatize and Upgrade Cattle and other livestock markets
- Support private Business Development Services who offer technical assistance

Output

- 8 Division level livestock producer companies with at least 12 000 membership
- 100 cattle and livestock markets upgraded and modernised.
- A national on-line roster of business development service providers.

Business Models



Milk bazar in Rangpur

(E) Green and Climate Resilient Infrastructure



Pran Shahjadpur in Sirajganj

Activity

(a) Public infrastructure

- Rehabilitate or construct 200 livestock service centres at upazila and union parishads, and 8 District veterinary hospitals with diagnostic laboratories.
- Establish 4 veterinary quarantine stations in support of Bangladesh, Bhutan, India and Nepal (BBIN) rail, road, and waterways connectivity initiatives.

(b) Community and private infrastructure

- 100 Animal Disaster Shelter Homes and fodder depots co-located with the livestock service centres;
- 100 village milk collection centres and 10 milk hubs built by public money, run by private companies/producer organisations.
- 8 livestock slaughter facilities in PPP mode or by the private sector.

Output

- More climate resilient infrastructure to support service delivery

AFCI/SSIL Interest

- (A) Policy support and institutional capacity
 - Prepare policy briefs
 - Organise policy dialogues
- (B) Increased Access to Finance through PSBF
 - Help set up and operationalising PSBF
 - Market research on demand for credit, equity, guarantees
 - Initiate buy-in from donors on funding PSBF
- (C) Production and Productivity Improvement
 - Independent advisory and technical support on Good Animal Husbandry Practices (GAHP)
- (D) Product Marketing and Business Models
 - Road map for corporatization of cattle markets
 - Set up first District level and Upazila producer company
- (E) Green Resilient Infrastructure - advice as and when needed.
- (F) Cross cutting themes
 - General technical advice
 - Contribute to the preparation of a new project proposal for livestock and dairy development (2024-2031).

(F) Cross cutting themes : SDG Goals, 8th Plan priorities & Gender mainstreaming

Activity

- Implementation of the Sustainable Development Goals (SDG)
- Improvements on social, environmental and labor related compliances.

Output

- Creating sustainable jobs and income.
- Improved competitiveness on global market.

Annexure 24. Environmental and Social (E & S) safeguards compliance for Livestock Sector

1. Background and objectives

- 1.1 The project interventions are expected to cater better and more sustainable livestock management developing market linkages and value-chain and improving risk management and resilience of the livestock production systems. Matching Grant Schemes (MGSs) will promote access to rural financing for interested Producer Organizations (POs) and buyer agri-businesses (Abs) for development of small chilling, processing and storage facilities, adapt technologies for product diversification and climate smart agriculture (CSA), and arranging mobile milking machines as well as on-farm shops. The operations under the grants support, unlike the main project interventions, envisaged to have some environmental and social (E&S) risks of varied scale. The project's E&S risks will be identified and managed following the national legislations relevant to livestock services & infrastructure and the World Bank E&S safeguards operational policies. As instrument for E&S risks assessment and management, DLS has adopted an Environmental and Social Management Framework (ESMF) combining resettlement policy framework (RPF) and small ethnic community development framework (SECDF). A separate standalone Pest Management Plan (PMP) has also been adopted to cover pest control procedures and pesticide related hazards under the project.
- 2.1 The objective of the E&S operational manual is to provide standard operating procedures to respond to the project ESMF/PMP objectives, requirements, and procedures. This project was approved on a moderate E&S risks cap and no activities will be eligible for project finance those may induce severe or high E&S risks to the nature and the community. Business plans with activities with E&S risks higher than moderate will be excluded from appraisal for matching grant support. Only "low" and "moderate" risk MGSs will be reviewed for selection and funding.
- 3.1 Low risk MGS: The livestock development activities which are environment friendly coupled with elements of social safeguards can help Bangladesh to achieve a balance whereby the livestock development enterprises minimize the overall output of greenhouse gases. These activities may be categorized as 'low risk' livestock development, for example, the activities which are promoting a circular bioeconomy (involves recycling resources) at every possible step in the livestock development systems to minimize the loss of resources and environmental impact may be considered as 'low risk' activities. Under the Matching grant Schemes (MGS) the following activities may be considered as low-risk to environment friendly enterprises: (a) Roughage bailing activities which in fact demonstrating the feeds and fodder storage options; (b) Feeds and Fodder production activities (small scale feed mills & TMR activities) which are majorly derived from plants, but some manufacturers add ingredients to processed feeds that are of animal origin; (c) Climate resilience manure enterprise development can be used to generate fertilizer and biogas as a source of renewable energy; and (d) Establishment of Village Milk Collection Centre and Hubs.
- 4.1 Moderate risk MGS: The entrepreneurial activities in livestock and dairy development sector are considered as important sources to pull down the environmental balance notwithstanding their criticality to develop the sector. However, it was observed that some of the activities are capable of optimizing their environmental footprint and social impact using socio-environment friendly technologies. These activities are considered as 'moderate risk' enterprises. Out of the activities under the MGS, the following activities have been considered having 'moderate risk' to environmental and social outcomes: (a) Milk processing centres (both mini and large units) which are undertaking intensive livestock farming and using fossil fuel-

based energy for processing the outputs; (b) Preparation of total mixed ration (TMR) in an industrial set up may carry moderate risk which however can be reduced by using crop residues (which are also burned in some places of Bangladesh).

2. Environmental and social management

2.1 Each Sub-grant and Matching Grant proposal/intervention has to complete E&S Management (ESM) process starting with E&S Screening using the Environmental and Social Screening Tools (**Table-I and Table-II**). The information required for E&S risks assessment need to be provided by the entrepreneurs in their business plan. The PMU will review the business plans for E&S management process/plans (ESMP) for consideration during the sanction. The Grant Proposal/ Interventions need to be categorized into “Low Risk” and “Moderate Risk”. The proposal categorized as “Moderate Risk” has to carry out Environment and Social Impact Assessment (ESIA) following the project ESMF.

2.3 The ESIA will guide to prepare mitigation plan or ESMPs need to be reviewed by the Environment and Social Safeguard Specialist at the PMU prior to approval. The purpose of review is to assure the completeness and quality of the information gathered in an ESIA/ESMP. Often, this process leads to a requirement for additional information on potential impacts, mitigation measures or other aspects. It is important to remember that the main aim of an ESIA/ESMP is to provide good information for two audiences: decision makers and people potentially affected by a Matching Grant supported sub-project or intervention.

- a. In addition, this addendum Environmental and Social Safeguards Guidelines (ESSG) need to be consulted and procedure be used to ensure their work fulfills appropriate standards and regulatory requirements by Environmental Conservation Rule 1997.
- b. A comprehensive review of the adequacy and quality of an ESIA/ESMP report would address many or all of the following issues:
 - Is the statement of the key findings complete and satisfactory, e.g., for significant impacts, proposed mitigation measures, etc.?
 - Is the information clearly presented and understandable by the LDDP team and the public?
 - Is the information relevant and sufficient for the purpose of Matching Grant supported sub-project or intervention setting?

2.4 The issues of Indigenous People (OP/BP 4.10) may not evolve normally because the three hill districts with 42% of the total small ethnic community populace of the country are outside the Matching Grant supported sub-project or area. But due to existence of few small ethnic communities in the Matching Grant supported sub-project or area, this framework provides basic guidelines as per World bank OP/BP 4.10. A framework for small ethnic communities has been furnished in Chapter-7 explaining their inclusion in Matching Grant supported sub-project or, involvement in consultation, avoidance of intervention in case they disagree on any component.

2.5 The Matching Grant supported sub-project or does not envisage private land acquisition. Therefore, no major issues on resettlement is envisaged to arise. But, in course of developing a Matching Grant supported sub-project or any other interventions, resettlement issues may evolve during implementation process. In case of any such resettlement the Involuntary Resettlement (OP/BP4.12) issues with guiding principles have been included in the ESMF.

3. Overall Management of Environmental Issues

The following principles will be followed in the overall environmental management of sub-component to be implemented under the LDDP Matching Grant supported sub-project or intervention.

- Activities with severe negative environmental impacts will not be supported by LDDP Matching Grant supported sub-project or interventions.
- Activities involving financing of Producers Organization will go through environmental screening and assessment process.
- All supported activities will ensure compliance with the relevant Environmental Codes of Practices.
- Review of negative list of attributes for its correct applicability
- Categorization of sub-components for its selection process.
- Development of site specific ESIA and ESMP
- Institutional arrangements for implementation process.
- Monitoring and evaluation of the implementation process.
- Recommended safety level of the quality standard for livestock products for Sanitary and Phyto-sanitary (SPS) measures regulated by the World Organization for Animal Health (OIE) and Codex Alimentarius Commission.

4. Citizen Engagement, Consultation and Participation

Consultations on the Matching Grant supported sub-project or schemes are required for an effective citizen engagement during identification, design and implementation process. MG proposals required to present (where applicable) citizen engagement plan through consultation with stakeholders and related communities, during screening and selection process MG process. This is required to ensure that an effective, inclusive and culturally suitable consultation is conducted on various environment and social impact studies. Public consultation is an important area of this ESMF and ESSG which bears a major importance to PMU, LDDP and the World Bank requirements for an effective stakeholders' involvement. However, involvement of public or people's participation is necessary for the smooth and sustainable implementation process of the interventions.

5. Environmental Monitoring, Evaluation and Social management plan

5.1 Environmental monitoring will be carried out during implementation (at a regular interval). Matching Grant supported sub-project will have a monitoring, evaluation and reporting system for assessing the environmental impact. Regular monitoring will be carried out through internal monitoring process of the Matching Grant supported sub-project. This process will involve a rigorous checking of real indicator values on the ground against threshold values set at the planning stage of the Matching Grant supported sub-project or. Mid-term and Final evaluation will be carried out by the PMU, LDDP. A third party monitoring firm will be hired to ensure compliance of safeguard implementation in accordance to the ESMP and ESMP.

5.2 Social screening is essential for assessing possible risks that may emanate from the proposed MG activities in course of its preparation, detailed planning, implementation, operation and maintenance. The screening should be based on existing socioeconomic status of population who are supposed to be potentially benefited or affected by the interventions directly or indirectly. Social screening identifies probable impacts of the proposed activity in general context, hinging on stakeholder's responses to issues that may affect various socioeconomic variables in person or in general, expert intuitions and judgment, detailed social risks and impacts will be assessed on the basis of this social screening which provides the broader layout of types and nature of potential risks and impacts. Once the scope of Matching Grant supported sub-project or activities is identified through scoping and screening, the social impact assessment (SIA) work can be initiated. The Social Management Plan (SMP) with the ESMP provides guidance to the LDDP Matching Grant supported sub-project or and any actors on the social development requirements during implementation of the Matching Grant supported sub-project or and applies to all Matching Grant supported sub-project or activities and construction site.

Any Matching Grant supported sub-project or component giving rise to unacceptable social and environmental losses not amenable to redress may be subject to be dropped from investment portfolio during implementation.

6. Grievance Redress Mechanism

All the Matching Grant supported sub-project or intervention need to follow the procedure of the Grievances Redress Mechanism (GRM) as outlined in GRM guideline by LDDP as below:

6.1 Grievance on different issues may likely to arise due to pollutant generated from the anticipated and planned livestock and dairy development activities during and after the implementation process and planned activity or anticipated ramification. These could be minimized through following some mechanism. A grievance redress committee (GRC) should be formed with the representation from:

- i. Officials of the LDDP Matching Grant supported sub-project.
- ii. Stakeholder's representative.
- iii. Local government representative and any other person(s) as may deem necessary.

6.2 Any grievance arises from environmental or social issues may be referred to GRC for redressal. The grievance must be redressed at local level through consultation amongst the community or person affected and LDDP Matching Grant supported sub-project officials, local government representative, and/or local administration. For example, the Upazila level committee will be constituted and headed by Upazila Livestock Officer, Upazila Agriculture Officer, Pourashava or Union Parishad Chairman and Livestock Extension Officer and stakeholder's representative. The GRC should document all complaints received and action taken on the complaint (for each and individual basis) and should report monthly to the Matching Grant supported sub-project Implementation Unit and quarterly or half yearly to the WB (as per demand) with the progress report or separately as monitoring report. Unsettled issues should be referred to Matching Grant supported sub-project Central Unit (PCU) at Dhaka for their necessary action on the issues.

The Grievance Redress Mechanism (GRM) has been published on the LDDP website and is now available online which is accessible to anyone (<https://ee.kobotoolbox.org/x/QNzIG0lg>). The interested parties may also lodge their suggestions or complaints in the online centralized GRS available at <https://www.grs.gov.bd/>.

Table-I: Environmental Safeguard

Checklist no. 1: Environmental Impact Screening Checklist for LDDP Grants

Screening Criteria/ Environmental Parameters	Environmental Assessment				
	Positive Impact *	No Impact	Adverse Impact **		
			Low	Moderate	Severe
Does the grant supported activity site/s and activities fall within/and/or will impact the following environmentally sensitive area?					
Protected areas					
Wetland					
Reserve forest					
National Park					
Buffer zone of protected areas					
Special area for protecting biodiversity					
Near cultural heritage sites					
Areas with rare/endangered flora/fauna					
Will there be any minor construction which will have					
Ecological					
Fisheries					
Aquaculture					
Eutrophication					
Wetland					
Bushes/trees					
Animals					
Species diversity					
Engendered species					
Physical-chemical					

Erosion and siltation					
Flooding					
Drainage congestion					
Air pollution					
Noise pollution					
Solid waste					
Chemical waste					
Water Pollution					
Disaster management					
Human interest related					
Loss of agricultural land					
Heath					
Navigation					
Health and safety					
				Yes	No
Access to site is safe and easy (example tall columns, sea) for installation team and inspection staff					
Hazardous/dangerous substances used					

Checklist no.2: Environment Assessment of LDDP Matching Grants (Assessment of each selected Grant and associated site attached)

S l . N o .	Location of activity site/premises with Longitude/Latitude (1)	Whether the intervention fall in environmentally sensitive areas (2)		Whether the installation have any impact on environment (3)		Whether the intervention has impact on health and safety of human (4)		Re ma rks
		Yes	No	Yes	No	Yes	No	
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								

1) Potential Environmental Impact during Establishment Phase:

a) Ecological impacts:

· Felling of trees Significant ☐ Moderate ☐
Minor ☐
· Clearing of vegetation Significant ☐ Moderate ☐ Minor ☐

b) Physicochemical impacts:

Noise pollution	Significant ☐	Moderate ☐	Insignificant ☐
Air pollution	Significant ☐	Moderate ☐	Insignificant ☐
Water pollution	Significant ☐	Moderate ☐	Insignificant ☐
Soil pollution	Significant ☐	Moderate ☐	Insignificant ☐

2) Potential Environmental Impact during Operational Phase: Physicochemical impacts:

a) Pollution levels

Noise pollution	Significant ☐	Moderate ☐	Insignificant ☐
Air pollution	Significant ☐	Moderate ☐	Insignificant ☐

Water pollution	Significant ☐	Moderate ☐	Insignificant ☐
Soil pollution	Significant ☐	Moderate ☐	Insignificant ☐

b) *Bio-securities issues:*

Transmission diseases from farm to farm	Yes ☐	No ☐	Unlikely ☐
Transmission of cross-country diseases	Yes ☐	No ☐	Unlikely ☐
Odor and fly problems to neighbors	Yes ☐	No ☐	Unlikely ☐
Transmission of zoonotic diseases	Yes ☐	No ☐	Unlikely ☐

3) *Summary of Possible environmental impacts of the sub-component:*2) *Overall Comments:*

.....

.....

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4.3.1.1 *Table-II: Social Screening Checklist*

Screening criteria				
1. Type of work Please Tick mark (v):	New Construction		Renovation	
2. Any other information (please specify)				
Please Tick mark as per the responses (v):	Yes	No	Unlikely	
3. General information				
a) Does the proposed sub-component involve all types and classes of the people in the location of sub-components (very poor, women, transgender, ethnic minorities)	☐	☐	☐	
b) Does the project comply with all required parameters laid out in the project proposal	☐	☐	☐	
4. Social Impact				
a) Is there any chance of resettlement of people living in the land for the implementation of the sub-component?	☐	☐	☐	
b) Is there any chance of land acquisition from public for the implementation of the sub-component?	☐	☐	☐	
c) Is there any chance of destruction of homestead land?	☐	☐	☐	
d) Is there any chance of resettlement of people living in the government land for the implementation of the sub-component?	☐	☐	☐	
e) Is there any chance of destruction of religious and cultural place?	☐	☐	☐	

f) Is there any chance of loss of employment of the people of lower down the living standard for the implementation of the sub-component?	☐	☐	☐
g) Is there any chance of destruction of cultural tradition of people?	☐	☐	☐
5. Livelihood information			
a) Is there any chance of losing access to the usual productive area due to implementation of the sub-component?	☐	☐	☐
b) Is there any chance of losing means of livelihood due to the implementation of the sub-component?	☐	☐	☐
c) Is there any chance of losing private community-based livestock rearing facilities like grazing field?	☐	☐	☐
d) Is there any chance of losing existing social or financial safety network due to implementation of the sub-component?	☐	☐	☐
6. Small ethnic communities			
a) Is any sub-component located in an area where small ethnic communities live?	☐	☐	☐
N.B. If yes, please answer the following questions			
b) Are the ethnic people involved in the planning and implementation of the sub-component?	☐	☐	☐
c) Is there any chance of ethnic people be affected?	☐	☐	☐
Positive	☐	☐	☐
Negative	☐	☐	☐
Not any one	☐	☐	☐
If the answer of the question number 6(c) is positive, please tick the indicators of mitigation measures:			
• Financial rehabilitation of affected persons	☐	☐	☐
Social rehabilitation of affected persons	☐	☐	☐
7. Gender mainstreaming plan			
a) Conduct consultation with the women and vulnerable section	☐	☐	☐
b) Capacity building programme for identified vulnerable section	☐	☐	☐
c) Provisioning of wage parity, work distribution and other facilities	☐	☐	☐
8. Other relevant information			
Will a social management plan (SMP) be required? Yes [] No []			
Name & Signature of the Assessor:			
Date:			