



## Final Report

### Market Estimation & Investment Potential

### Stocktaking Exercise on Agro-Logistics in Bangladesh

For

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## **Executive Summary**

The agro-logistics sector of Bangladesh stands at a decisive crossroads. The country now produces more than 70 million metric tons of agricultural output annually, yet the systems that should move this food from farm to table remain fragmented, informal, and technologically outdated. Agriculture still employs nearly half of the national workforce and contributes around 11.6% of GDP, but the value captured from this production is far below potential. The central paradox is simple: Bangladesh grows enough food yet loses too much of it before it reaches consumers. This report demonstrates that the core reason is not insufficient production but inefficient logistics.

### **The Scale of the Market**

Using an expenditure-based estimation model, the study calculates the size of the national agro-logistics market at BDT 1,282.35 billion (about USD 10.5 billion) for FY 2023-24, equivalent to more than one-fifth of national GDP. Such a figure confirms that agro-logistics is not a peripheral service industry; it is a macro-critical sector shaping food prices, farmer incomes, and export competitiveness. Within this market, livestock and dairy logistics account for 46.7%, vegetables for 18.9%, fisheries for 14.5%, and the remaining share is divided among cereals, fruits, and poultry.

Yet alongside this large market, an estimated USD 2.4 billion in annual economic losses exists. These losses represent wasted farmer labor, lost nutrition, higher consumer prices, and missed export opportunities. The report argues that reducing even one-third of this leakage would generate economic returns comparable to several large infrastructure projects.

### **Structural Bottlenecks**

Four structural failures define the current system.

First, the cold-chain distortion. Bangladesh has roughly 2.7 million metric tons of cold storage capacity, but 90% to 95% of this is reserved exclusively for potatoes. High-value perishables such as tomatoes, mangoes, milk, meat, and fish have almost no access to temperature-controlled storage. Therefore, farmers rush to sell immediately after harvest, creating seasonal

price crashes followed by shortages a few months later. This “potato paradox” reflects investment driven by historical subsidies rather than modern dietary demand.

Second, transport fragility. Less than one percent of the agricultural transport fleet is refrigerated. Most produce travels in open trucks or buses exposed to heat, vibration, and dust. For fish and meat, a delay of only a few hours can destroy quality. The result is a supply chain that rewards speed over safety and discourages long-distance marketing.

Third, fragmented intermediation. Between farm and consumer, products often pass through five to seven intermediaries. These actors perform necessary functions of aggregation and credit, yet the system lacks transparency, grading standards, and contractual discipline. Farmers typically receive under 20% of the final retail price for vegetables and fruits, while bearing most production risks.

Fourth, the missing middle in finance. Small logistics providers and rural entrepreneurs cannot access affordable capital. Microfinance loans are too small and expensive, while commercial banks demand land collateral that service businesses rarely possess. As a result, modern packhouses, insulated trucks, and milk chilling centers remain scarce.

### **Subsector Realities**

The report examines seven major subsectors, each revealing different dimensions of the same problem.

Vegetables and fruits suffer the highest post-harvest losses, between 30% and 40%. Handling still relies on bamboo baskets and jute sacks that crush delicate produce. With almost no pre-cooling facilities, field heat accelerates decay before products even reach wholesale markets.

Fisheries face losses of 12% to 25%, and marine fisheries alone forfeit around USD 151 million annually because of poor icing and delayed landing. Domestic finfish is rarely processed; most is sold whole and fresh, limiting shelf life and value addition.

Dairy illustrates the tyranny of time. Raw milk begins to spoil within hours, yet only 10% of production enters a formal cold chain. More than 90% move through informal channels

dominated by traditional collectors. Therefore, Bangladesh imports large volumes of powdered milk despite rising domestic output.

Poultry and eggs show rapid production growth but weak downstream infrastructure. Over 95% of chickens are sold live in wet markets, and breakage and heat stress cause double-digit losses in eggs. Modern slaughterhouses and refrigerated distribution remain exceptions rather than norms.

Cereals appear less perishable but hide significant inefficiencies. Sun drying accounts for around 85% of grain handling, leaving harvests vulnerable to sudden rain and mold.

Mechanical dryers and hermetic storage are still rare outside a few commercial clusters.

### **Drives of Change**

Despite these constraints, powerful forces are pushing the sector toward transformation.

Urbanization is accelerating; by 2040, nearly 100 million Bangladeshis will live in cities. Urban consumers demand safer, cleaner, and more convenient food. Supermarkets and online groceries are expanding, creating parallel supply chains that reward traceability and consistent quality.

Bangladesh's LDC graduation in 2026 will require stricter compliance with global food safety standards such as GAP and HACCP. Export markets for halal meat, frozen seafood, and processed fruits cannot grow without certified cold chains and modern laboratories.

Technological costs are falling. Solar-powered cold rooms, digital fat testing for milk, and GPS-enabled fleet management are now commercially viable even for medium-sized firms. International investors are showing interest; temperature-controlled logistics alone could attract USD 440 million by 2031.

## 1. Introduction

Agriculture serves as a foundational pillar of the Bangladeshi economy, contributing approximately 11.66% to the national GDP and employing over 45% of the total workforce. Despite the sector achieving robust output growth exceeding 70 million metric tons annually, its long-term efficiency and global competitiveness are severely hindered by a fragmented and underdeveloped agro-logistics infrastructure. Agro-logistics in Bangladesh encompasses the entire ecosystem of post-harvest handling, aggregation, storage, cold chain management, and distribution that bridges the gap between smallholder farmers and end-consumers. Currently, this sector stands at a critical juncture, defined by structural vulnerabilities that result in massive economic leakage but also offer significant potential for private sector-led transformation (BIDA, 2022; World Bank Group, 2024; BBS, 2024).

### 1.1 The Agro-Logistics Challenge: Waste and Inefficiency

The primary challenge facing the sector is the staggering rate of post-harvest losses (PHL), which range from 26% to 45% across commodities (Mohammed et al., 2025)a. These losses are particularly acute in perishable value chains:

**Horticulture:** Approximately 30% to 40% of fruits and vegetables perish before reaching consumers due to inadequate storage and processing facilities (Hassan, 2024).

**Fisheries:** Annual monetary losses in marine fisheries alone are estimated at \$151 million due to delayed marketing and insufficient icing (Kumar Mandal et al., 2024).

**Livestock and Dairy:** High perishability and a lack of first-mile chilling infrastructure led to significant value erosion, with milk losses estimated at 9.07% and red meat at 21.4% (Bangladesh Sangbad Sangstha, 2024b).

**Cereals:** Cereal losses are driven by moisture management failures, with 10% to 17.8% of production lost during harvest, drying, and storage (The Daily Star, 2025a; Majumder et al., 2016). Sun drying accounts for 85% of the sector, which is highly vulnerable to erratic rainfall (Kumar Mandal et al., 2024).

Nationally, these inefficiencies translate into an estimated annual economic loss of \$2.4 billion. The lack of integrated cold chain solutions is a primary driver; of the approximately 400 to 450 cold storage units in the country, the vast majority are designed exclusively for potatoes, leaving a negligible capacity for other high-value perishables. Furthermore, transportation remains a bottleneck, with less than 1% of agricultural transport vehicles being refrigerated (The Business Standard, 2024a; Oman & Liang, 2019; The World Bank, 2021).

## **1.2 Investment Potential and Market Drivers**

Despite these structural gaps, the investment landscape for agro-logistics in Bangladesh is increasingly attractive. Rapid urbanization (projected to reach 100 million city dwellers by 2040) and a burgeoning middle class are driving a surge in demand for safe, high-quality, and convenient food products. Additionally, the upcoming LDC graduation in 2026 necessitates a shift toward international quality and safety standards, such as GAP and HACCP, to maintain export competitiveness (Mordor Intelligence, 2019; LightCastle Partners, 2023).

There is substantial momentum for modernization through various channels:

**Private Sector Interest:** Projections suggest that temperature-controlled logistics could attract approximately \$440 million in investment by 2031 (The Daily Star, 2024a).

**Export Opportunities:** Growth in halal-certified meats, frozen seafood, and ethnic products for the diaspora market presents a high-value return for improved logistics (The Business Standard, 2024).

**Policy Support:** The government's National Logistics Policy and specialized incentives, such as 15% VAT exemptions on machinery for cold storage, provide a favorable regulatory framework for new entrants (PricewaterhouseCoopers, 2025).

## **1.3 Objectives of The Study**

This component of the Stocktaking Exercise focuses on Market Size Estimation & Investment Potential. Its primary objective is to provide a clear evidence base for public and private action by:

- Quantifying the market size and value of agro-logistics across key commodities, including vegetables, fruits, dairy, poultry, fish, and cereals.
- Identifying growth trends, demand drivers, and supply gaps within existing logistics channels.
- Mapping financial instruments and identifying opportunities for Foreign Direct Investment (FDI), Public-Private Partnerships (PPPs), and private sector engagement.
- Recommending investment models aligned with national agricultural modernization and logistics policies.

#### **1.4 Study Rationale and Scope**

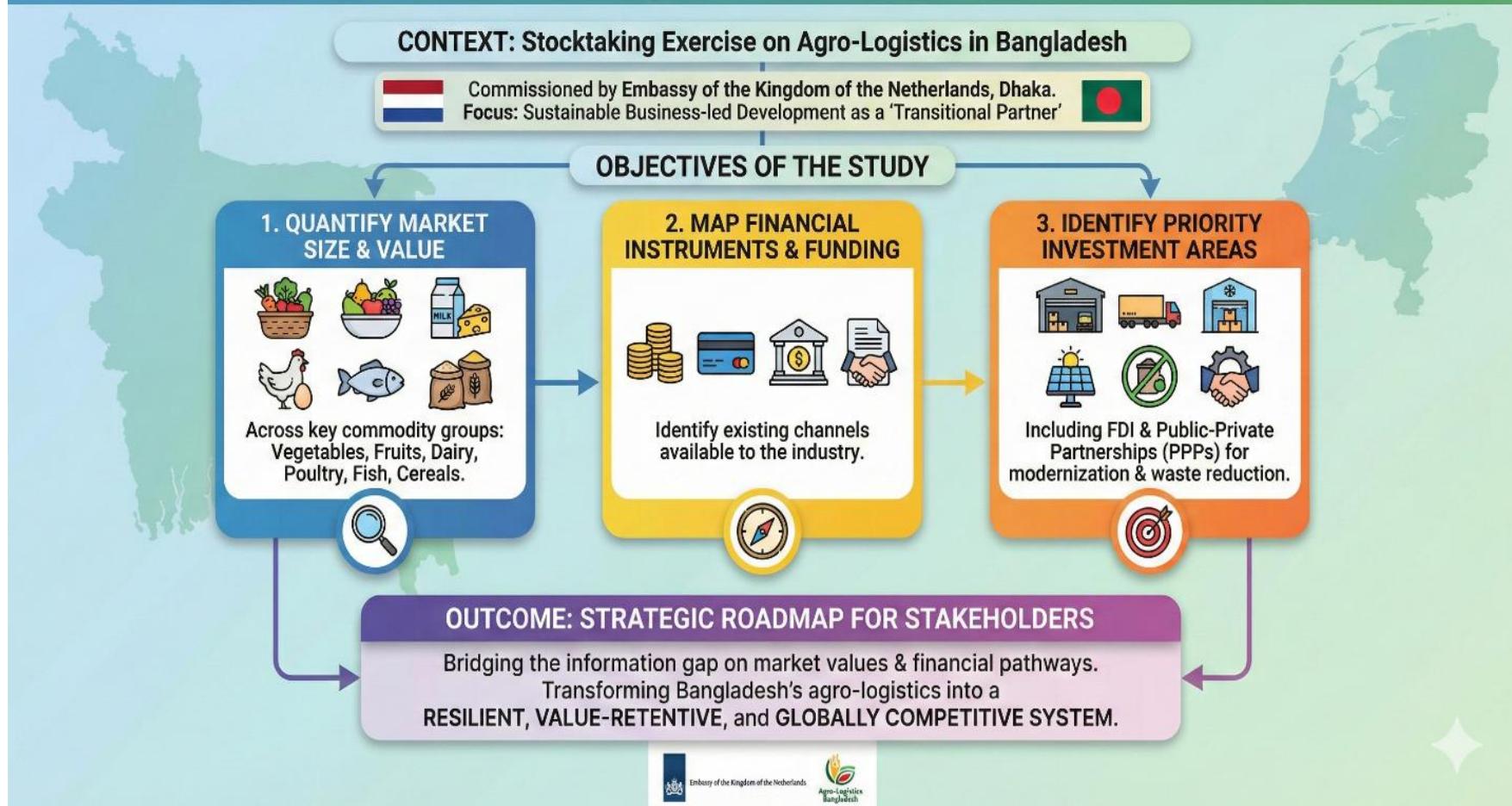
As part of the Stocktaking Exercise on Agro-Logistics in Bangladesh, this report focuses on Agro-logistics Market Estimation and Investment Potential. Commissioned by the Embassy of the Kingdom of the Netherlands, this study aligns with the Dutch government's designation of Bangladesh as a "transitional partner" focusing on sustainable business-led development.

The objective of this specific component is to:

- Quantify the market size and value of agro-logistics across key commodity groups: vegetables, fruits, dairy, poultry, fish, and cereals.
- Map existing financial instruments and funding channels available to the industry.
- Identify priority areas for investment, including FDI and Public-Private Partnerships (PPPs), aimed at modernizing infrastructure and reducing food waste.

# AGRO-LOGISTICS MARKET ESTIMATION & INVESTMENT POTENTIAL IN BANGLADESH:

## Study Rationale & Scope



*Figure 1: Objectives of The Study*

By bridging the current information gap regarding market values and financial pathways, this report provides a strategic roadmap for stakeholders to transform Bangladesh's agro-logistics into a resilient, value-retentive, and globally competitive system.

## 2. Methodology

To provide a robust estimate of the market size and investment landscape for agro-logistics in Bangladesh, this study employs a mixed-methods approach. This methodology combines quantitative market estimation, qualitative investment mapping, and extensive stakeholder consultations to generate actionable insights. The methodology is designed to adapt global best practices to the local context of smallholder farming and informal intermediaries.

### 2.1 Four-Phase Analytical Framework

The research is structured around a four-phase analytical framework designed to capture both formal and informal logistics systems across the seven subsectors.

**Phase 1: Foundation and Model Definition:** The initial phase involves a comprehensive review of secondary data from sources such as:

- Government and National Sources (Bangladesh Bureau of Statistics (BBS), Ministry of Agriculture (MoA), Ministry of Food (MoFood), Food Planning and Monitoring Unit Bangladesh (FPMU), Department of Agricultural Extension (DAE), Bangladesh Agricultural Research Institute (BARI), Bangladesh Rice Research Institute (BRRI), Bangladesh Economic Review (BER), Bangladesh Investment Development Authority (BIDA)).
- Reports and agro-logistics records from the International Food Policy Research Institute (IFPRI), the Food and Agriculture Organization of the United Nations (FAO), the World Bank Group, the International Finance Corporation (IFC), and the United Nations Industrial Development Organization (UNIDO).
- Commercial data on export, trade, customs, market, agro-logistics, value chain, cold chain, and post-harvest operations.

- Former Netherlands-Bangladesh integrated projects and sector analysis.

This data is used to finalize the analytical model, define market segments (input, logistics, processing, and distribution), and establish parameters for investment categories, including public-private partnerships (PPPs) and foreign direct investment (FDI).

**Phase 2: Data Gathering and Market Size Estimation** This phase utilizes a three-step framework that harmonizes top-down structural analysis with bottom-up quantitative estimation.

**Step 1: Market Definition and Segmentation (Top-Down):** The study covers seven priority subsectors: Vegetables, Fruits, Poultry, Fish, Cereals, Livestock (Meat & Dairy), and Poultry (Eggs). The "Agro-Logistics" boundary includes the flow of agricultural inputs (seeds, fertilizer, equipment) to farms and the movement of outputs from the farm gate to the final consumer or export port. Revenue is segmented by service type: Transportation (ambient vs. refrigerated), Storage/Warehousing (ambient vs. temperature-controlled), and Value-Added Services (VAS), including sorting, grading, and packaging.

**Step 2: Market Size Estimation Approaches (Bottom-Up):** The study employs the **Expenditure Approach** to determine the total market size for agro-logistics in Bangladesh. This approach determines the total annual expenditure generated by logistics activities across all supply chain nodes and the seven subsectors:

**Supply Chain Nodes:** Market size is calculated by summing the expenditures at each critical node: Production → Aggregation → Storage → Processing/Packaging → Cold Chain → Handling → Transport → Wholesale → Retail.

#### **Quantitative Metrics:**

**Transportation:** Estimated using Total Tonnage-Kilometers (TKM) of produce multiplied by the Average Cost per TKM (AFR) for different transport modes.

**Average Freight Rate (AFR):** Average cost per ton-km for different vehicle types (trucks, vans, light vehicles).

**Total Transportation Cost** = (TKM x Average Cost per TKM)

$$TKM = \sum_{Product\ i} (Vi \times Di \times Si)$$

Product i = Individual product category/subsector

$V_i$  = Total Marketable Agricultural Output Volume = Marketable Surplus of Agricultural Output

$D_i$  = Average Distance from Farm Gate to Retail or Export Spot

$S_i$  = Percentage (%) of marketable output volume

**Warehousing and Storage:** Calculated as the Total Storage Capacity (Area/Metric Tons) multiplied by the Average Annual Rental/Service Fee per MT/Area (ASC). This includes specialized segments like modern cold chain warehousing for perishables.

**Average Storage Cost (ASC):** Average annual cost per MT/Area for ambient and cold storage.

**Total Storage Cost** = (Total Storage Capacity x Average Annual Rental/Service Fee)

**Value-Added Services (VAS):** Includes revenue provided by logistics operators or supply chain intermediaries from packaging, sorting, grading, and quality control, estimated as a percentage of total logistics value/costs or a fixed cost per MT/Area of handled produce.

**Overall Formula:**

**Market Size** = (TKM x AFR) + (Storage Volume x ASC) + VAS Revenue

### **Phase 3: Investment Mapping & Gap Finding:**

**Investment Mapping:** Mapping of available financial instruments in Bangladesh, including agricultural loans, venture funds, Foreign Direct Investment (FDI), blended finance, and Public-Private Partnership (PPP) frameworks.

**Gap Identification:** Analysis of supply gaps and barriers that hinder access to finance for modernizing the logistics chain.

**Phase 4: Synthesis and Validation:** The final phase involves synthesizing findings into actionable investment portfolios. The results are refined by comparing the estimated agro-logistics market size against global benchmarks and ratios of agro-logistics-to-Agri-GDP in similar emerging economies in South and Southeast Asia.

### 3. Overview of the Bangladesh Agro-Logistics Market

The agro-logistics sector in Bangladesh serves as the critical link between a predominantly smallholder farming system and the rapidly expanding domestic and export markets. While Bangladesh has achieved remarkable growth in agricultural production, ranking among the top global producers of rice, potatoes, jackfruit, and mangoes, its logistics infrastructure remains fragmented, underdeveloped, and dominated by informal actors. The sector faces a critical challenge: 30% to 40% of agricultural production is lost before reaching consumers due to weak cold-chain infrastructure, poor road networks, and inadequate post-harvest handling (Daily Sun, 2026; The Business Standard, 2025b). Currently, the country possesses approximately 2.7 million metric tons of cold storage capacity, but 90% to 95% of this is dedicated exclusively to potatoes, leaving massive gaps for other perishable commodities (Bangladesh Sangbad Sangstha, 2024a; The World Bank, 2021). Despite these bottlenecks, the market for temperature-controlled logistics is projected to reach USD 440 million by 2031, driven by rapid urbanization and a rising middle class (The Business Standard, 2025a).

#### 3.1 Macroeconomic Context: Agriculture in the National Accounts

To understand the specific contributions of vegetables, fruits, and dairy, one must first situate them within Bangladesh's broader macroeconomic framework. The agricultural sector, historically the engine of the economy, is undergoing a relative contraction in GDP share typical of developing economies, even as its absolute output expands.

##### 3.1.1 Sectoral GDP Dynamics

According to provisional estimates by the Bangladesh Bureau of Statistics (BBS) for Fiscal Year 2023-24 (FY24), the broad agricultural sector contributed approximately 11.02% to 11.55% to

the national GDP at constant prices. This represents a slight decline from 11.30% in FY23 and 11.61% in FY22, a trend driven by the faster expansion of the industrial (37.95%) and service (51.04%) sectors. However, this percentage belies the sector's strategic importance; agriculture continues to employ approximately 38% to 45% of the country's total labor force, making it the single largest employer and the primary driver of rural consumption demand (Bangladesh Economic Review 2024; MCCI, 2024).

The sector's resilience is evident in its growth rates. Despite climatic shocks, including cyclones, flash floods, and variable rainfall, the agriculture sector maintained a growth rate of 3.21% in FY24 (Bangladesh Economic Review 2024). This growth is not uniform across all sub-sectors; while crop production faces maturity and yield stagnation in some areas, the fisheries and livestock sectors are experiencing dynamic expansion, reflecting a dietary shift toward higher protein consumption.

### **3.1.2 Comprehensive Data Synthesis: Production and GDP Matrix**

The following table consolidates the disparate production data and GDP contributions for the six priority subsectors. It highlights the disparity between production volume and formal economic recognition, often due to data aggregation in national accounts.

***Table 1: Sectoral Production and GDP Contribution in Bangladesh's Agricultural Sector FY 2023-24***

Subsector Category	Specific Commodity	Annual Production Amount (Million Metric Tons / Units) ( $V_i$ )	Sectoral Contribution to National GDP (%)	Share of Agricultural GDP (%)
Cereals	Rice	~40.27 MMT	Part of Crops & Horticulture (5.25% - 5.64%)	~56% (of Ag GDP for all crops)
	Maize	~5.20 MMT	Included in Crops & Horticulture	

	Wheat	~1.17 MMT	Included in Crops & Horticulture	
Vegetables	Vegetables (General)	17.09 MMT (excluding Potato)	Part of Crops & Horticulture (5.25% - 5.64%)	~
	Potato	11.57 MMT	Included in Crops & Horticulture	~
Fruits	Total Fruits	~5.50 MMT	Part of Crops & Horticulture (5.25% - 5.64%)	~
	Mango	~2.5 - 3.0 MMT	Included in Crops & Horticulture	~
	Watermelon	~1.98 MMT	Included in Crops & Horticulture	~
Fisheries	Total Fish	5.02 MMT	2.53%	22.26%
	Inland Aquaculture	~2.9 MMT(59% of total)	Included in Fisheries	~
Livestock	Meat (Total)	9.23 MMT (Includes poultry meat)	1.81% (Animal Farming Total)	16.54%
	Milk	15.04 MMT	Included in Animal Farming	~
Poultry	Eggs	23.75 Billion Units	Included in Animal Farming	~
	Poultry Meat	~1.6 - 2.0 MMT (Commercial)	~1.5% - 1.6% (Industry Estimate)	~
<b>Total</b>	<b>All Sectors</b>	<b>&gt;85 MMT (Aggregate Volume)</b>	<b>11.02% - 11.55% (Broad Agriculture)</b>	<b>~98%</b>

*Source: MCCI, 2024. Bangladesh's economy during FY2023-24 (FY24); (Asian Productivity Organization, 2025. Advancing shared prosperity: Best practices in productivity gainsharing in Asia's agrifood sector; USDA, 2025. Grain and feed annual: Bangladesh; Ahmed et al., 2024. food security and nutrition in Bangladesh: Evidence-based strategies for advancement. IFPRI).*

Note: GDP percentages for specific sub-crops (e.g., vegetables vs. fruits) are aggregated under "Crops and Horticulture" in official BBS statistics. The "Poultry" GDP contribution is an industry estimate derived from the BPICC, as official stats nest it within "Animal Farming".

## **3.2 Subsector-Wise Agro-Logistics Value Chain and Landscape**

### **3.2.1 Vegetables**

Bangladesh is the 20<sup>th</sup> largest vegetable producer globally, with an annual output of approximately 17.09 million tonnes in FY 2024-25. Despite high production, the vegetables sector suffers from post-harvest losses of 20% to 44% (FAOSTAT, n.d.; The Financial Express, 2025; The Business Standard, 2024a).

#### **3.2.1.1 Key Actors and Stakeholders of the Vegetables Value Chain**

**Input Suppliers:** This group includes approximately 20 medium-to-large private seed companies (e.g., Lal Teer, ACI) and a vast network of over 17,000 dealers and 160,000 retailers. Fertilizers are primarily managed by the government (BADC), while crop protection products are supplied by multinational firms like Syngenta and Bayer (LightCastle Partners, 2023a; Advance Consulting et al., 2021).

**Primary Producers:** The sector is dominated by small-holder farmers, 60% of whom cultivate one acre or less. Cultivation often involves a "basket" crop model where farmers grow a variety of vegetables across summer and winter seasons (The Business Standard, 2025b; LightCastle Partners, 2023a; Advance Consulting et al., 2021).

**Traders and Intermediaries:** The chain typically involves 4–7 transactions before reaching the consumer (Jahangir Alam Khan, 2025).

- **Farias:** Small village-level traders who procure small quantities directly from growers (Reza Hasan & Jannatun Naim, 2017).

- **Beparis:** Professional traders who aggregate large volumes from Farias or farmers and arrange transport to urban centers (Reza Hasan & Jannatun Naim, 2017)
- **Aratdars:** Fixed-establishment commission agents in wholesale markets who facilitate auctions between buyers and retailers (Reza Hasan & Jannatun Naim, 2017; Advance Consulting et al., 2021).
- **Retailers:** Predominantly traditional wet-market vendors, though modern supermarket chains (e.g., Shwapno, Agora) are emerging with parallel, more traceable supply chains (LightCastle Partners, 2023a; Advance Consulting et al., 2021).

### ***3.2.1.2 Agro-Logistics Landscape of Vegetables***

**Transportation:** Nearly 95% of produce moves via road in non-refrigerated open trucks, vans, or buses. Less than 1% of the agricultural transport fleet is refrigerated, leading to high vibration and heat damage (Oman & Liang, 2019; The World Bank, 2021).

**Storage and Cold Chain:** Bangladesh has approximately 2.7–2.8 million metric tons of cold storage capacity, but 90–95% is dedicated exclusively to potatoes (World Bank, 2023; DAM, 2024). Multi-commodity cold storage for perishables like tomatoes or cauliflower is virtually non-existent, forcing farmers into "distress sales" to avoid spoilage (LightCastle Partners, 2023a).

**Handling and Packaging:** Most vegetables are handled at ambient temperatures using traditional bamboo baskets and jute sacks, which cause significant compression damage and bruising (Oman & Liang, 2019; The World Bank, 2021).

**Economic Leakage:** The supply chain is dominated by informal intermediaries, where farmers often receive less than 20% of the consumer price (Rifat et al., 2024; Advance Consulting et al., 2021). Logistics are characterized by ambient-temperature transport in open trucks, leading to rapid quality degradation (LightCastle Partners, 2023a; LightCastle Partners, 2023b).

**Investment Opportunities:** Significant potential exists for multi-commodity cold storage and for introducing Returnable Plastic Crates (RPCs) to replace traditional bamboo baskets (The Business Standard, 2024b). There is also a growing need for modern terminal markets and

localized pre-cooling units to remove field heat and extend shelf life (Advance Consulting et al., 2021).

# From Farm to Fork: The Fragmented Journey of Bangladesh's VEGETABLES

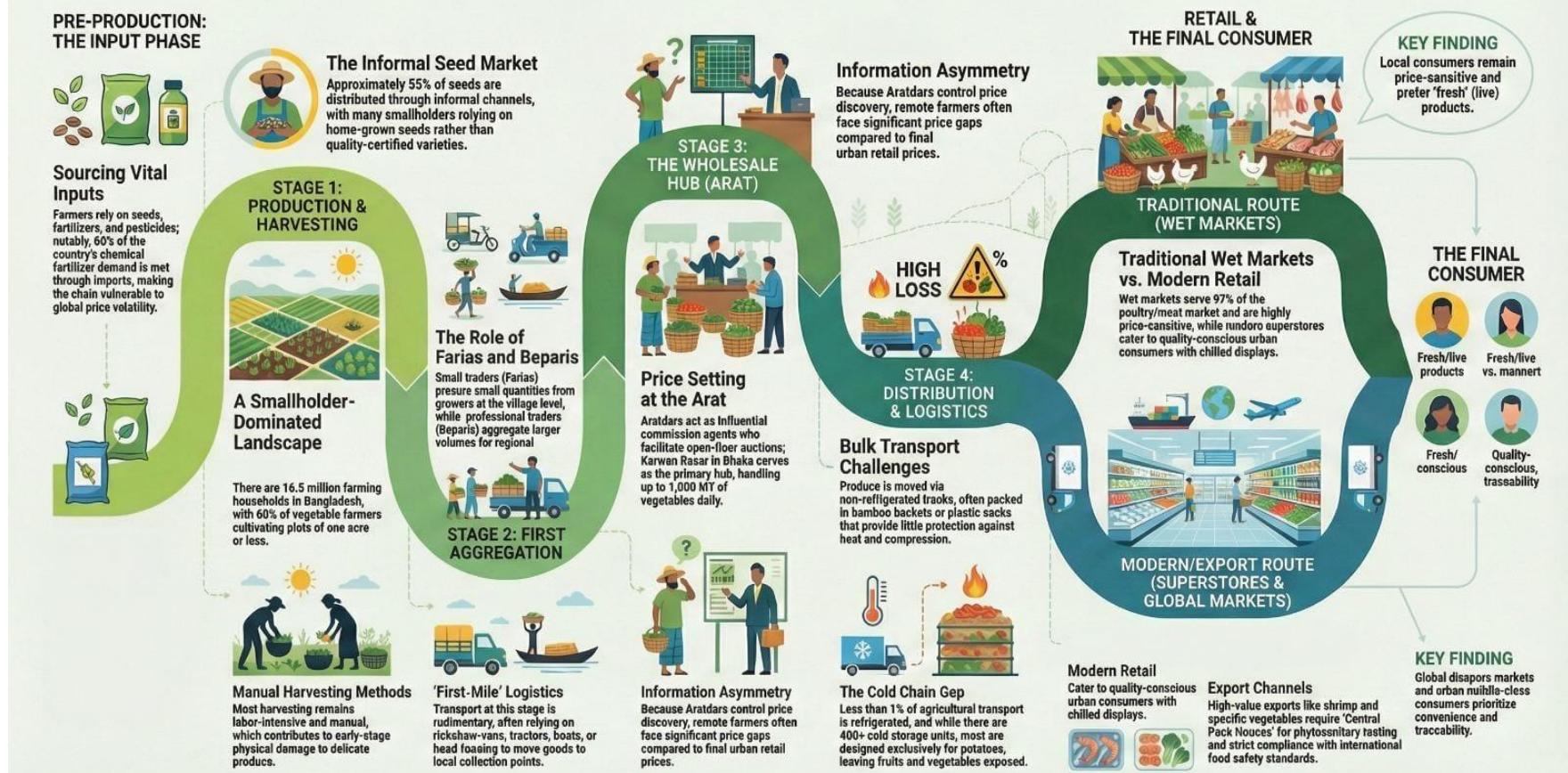


Figure 2: Vegetables Supply Chain in Bangladesh

### **3.2.2 Fruits**

The country produces 72 types of fruits, with a total annual production exceeding 12 million tonnes. Fruit production is highly seasonal, placing immense pressure on transport and storage during peak harvest windows (The Business Standard, 2025a; Ahmad, 2022).

#### ***3.2.2.1 Key Actors and Stakeholders of the Fruits Value Chain***

**Primary Production:** Dominated by a mix of smallholder orchards and increasingly commercialized horticultural operations. Many farmers are shifting from cereals to fruits, where gross margins can exceed USD 600 per hectare (The World Bank, 2021).

**First Aggregation (Faria/Paikar):** Small, mobile traders or village-level buyers who procure fruit at the farm gate. They provide immediate liquidity but often lack any cooling or specialized handling infrastructure (Islam Mithu & Rahman, 2019; LightCastle Partners, 2023a).

**Regional Intermediaries (Bepari/Agents):** Professional traders who aggregate larger volumes from farias or farmers to transport to major urban wholesale hubs. They typically arrange logistics and bear the risk of spoilage during transit (Islam et al., 2007; LightCastle Partners, 2023a).

**Wholesale Hubs (Aratdar):** Commission agents at major landing stations, such as Karwan Bazar, who facilitate price discovery through open auctions. They often provide short-term financing to beparis to secure supply (Rashid & Bashar, 2025; Islam et al., 2007).

**Retailers:** Predominantly traditional wet-market vendors, though modern supermarket chains (e.g., Shwapno, Agora) and online grocery startups are developing parallel, traceable supply chains for high-end consumers (Advance Consulting et al., 2021).

**Processors:** A very small segment; only about 1% of produce is sent for value-addition activities like juicing, pulping, or drying (Rashid & Bashar, 2025).

### ***3.2.2.2 Agro-Logistics Landscape of Fruits***

**Transportation:** Roughly 95% of fruit is transported by road. Less than 2% of the transport fleet is refrigerated, meaning most produce travels in open trucks or vans exposed to high ambient temperatures and vibrations, which accelerates bruising and rot (Advance Consulting et al., 2021; LightCastle Partners, 2023a).

**Cold Storage Gap:** Bangladesh has approximately 2.6–2.8 million metric tons of cold storage, but 90-95% is dedicated exclusively to potatoes. This leaves specialized fruits like mango and papaya with almost no access to buffer storage during peak seasonal gluts (Bangladesh Sangbad Sangstha, 2024b; Inspira Advisory & Consulting, 2023).

**Post-Harvest Losses:** Due to these systemic gaps, 30% to 40% of fruit perishes before reaching the consumer. Specific commodities face even higher risks, such as jackfruit (43.5%) and pineapple (42.6%) (Rahman, n.d.; Ahmad, 2022).

**Ripening and Treatment:** Traditional ripening (using smoke) is common, but the lack of modern ripening chambers with ethylene gas often leads to uneven quality or the illegal use of harmful chemicals like carbide (JICA, 2021).

**Economic Leakage:** Post-harvest wastage is alarmingly high, with an estimated 30% to 40% of fruit perishing before reaching markets. There is a near-total absence of regional fruit processing units for juices, jellies, and pulp (Ahmad, 2022; JICA, 2021).

**Investment Opportunities:** Opportunities are ripe for integrated packhouses in high-production clusters like Rajshahi and Jashore. Investors can capitalize on aseptic processing lines for mango pulp to substitute current imports and develop Vapor Heat Treatment (VHT) facilities to meet international phytosanitary standards for export (JICA, 2021).

# From Orchard to Market: Mapping Bangladesh's Fruit Supply Chain & Post-Harvest Challenges

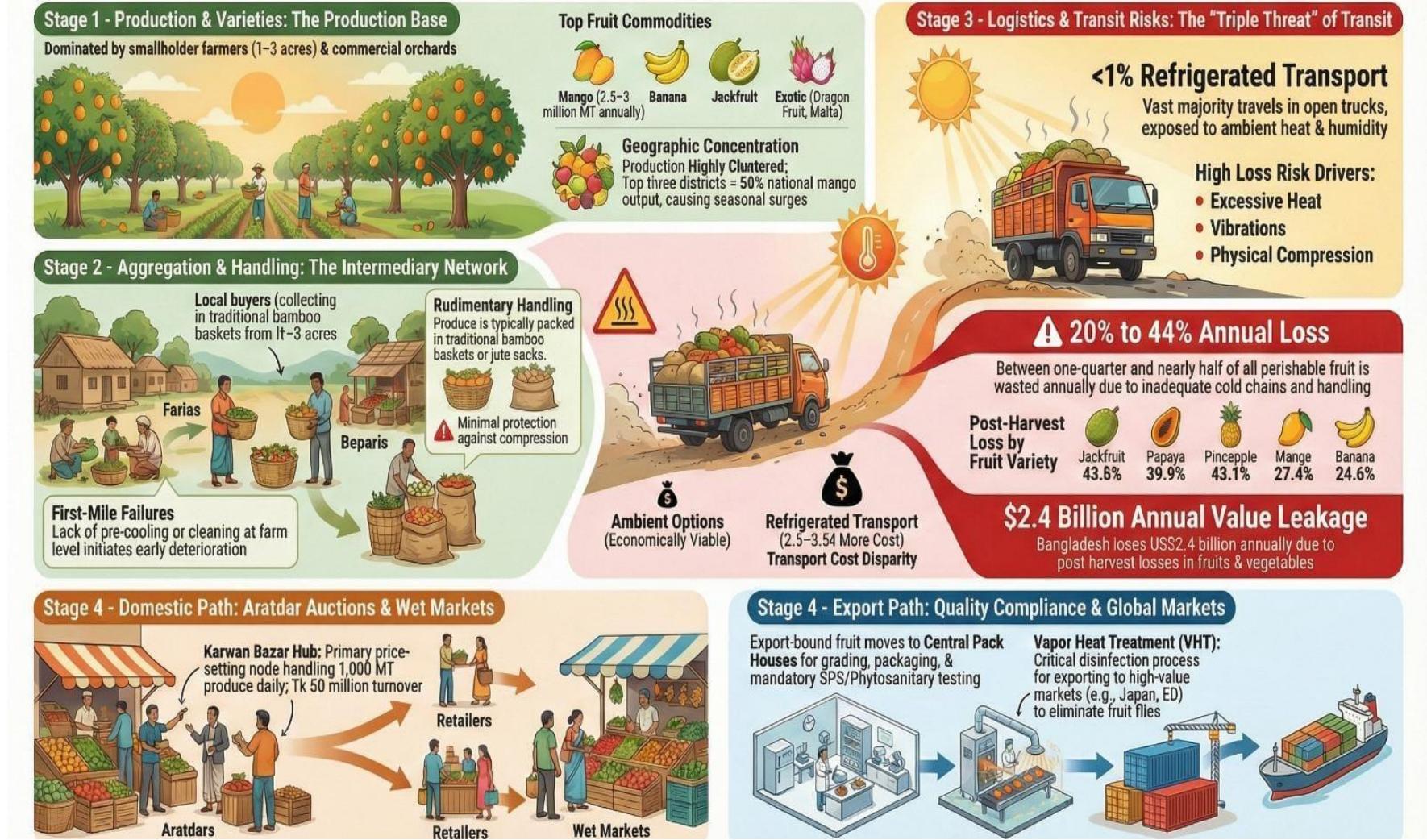


Figure 3: Fruits Supply Chain in Bangladesh

### **3.2.3 Dairy**

Bangladesh's dairy market is valued at approximately US\$2.47 billion, with milk production reaching 10.79 million tonnes in 2024 (Iqbal, 2024; IFCN Dairy, 2025).

#### ***3.2.3.1 Structure of the Dairy Value Chain***

The dairy value chain is divided into three primary channels that define how milk flows from the farm gate to the consumer:

**The Traditional Channel (75%–93% of the Market):** This is the dominant system where smallholder farmers (typically owning 1–3 cows) sell raw milk to traditional collectors known as "Goalas". These goalas deliver the milk immediately to local consumers, tea stalls, or traditional sweetmeat makers, who utilize nearly 75% of the total raw milk supply for products like *chhana*, curd, and ghee (World Bank Blogs, 2025; VetEffecT Consultancy & Recruiting, 2023; Oman & Liang, 2019).

**The Modern/Formal Channel (7%–15% of the Market):** This channel is governed by approximately 15–20 formal processors, including lead firms like Milk Vita, PRAN, BRAC (Aarong), and Akij (Farm Fresh). These companies operate through a network of Village Milk Collection Centers (VMCCs) and chilling plants, where milk is tested for fat content and purity before being transported to central factories for pasteurization or UHT processing ghee (World Bank Blogs, 2025; VetEffecT Consultancy & Recruiting, 2023).

**The Import Channel:** To bridge the supply deficit, Bangladesh spends nearly US\$37 billion (Tk 4,000 crore) annually on importing powdered milk and other dairy products from countries like Australia, New Zealand, and Denmark. These imports are used both for direct household consumption and as raw material for industrial dairy and bakery products (Iqbal, 2024; VetEffecT Consultancy & Recruiting, 2023; Rashid, 2022).

#### ***3.2.3.2 Agro-Logistics Landscape of Dairy***

Logistics remains the most critical structural bottleneck for the dairy sector due to the highly perishable nature of milk, which begins to sour within 2 to 4 hours without chilling (Centre for Food Safety, 2018).

**Cold Chain Limitations:** Nationwide, only 10% of dairy products benefit from any form of cold-chain storage. While there are roughly 400 to 600 chilling centers, they are heavily concentrated in northern milk belts like Pabna, Sirajganj, and Rangpur, leaving most other regions underserved (World Bank Blogs, 2025; VetEffecT Consultancy & Recruiting, 2023).

**Transportation Realities:** Less than 5% of agricultural transport vehicles are refrigerated, and most milk is moved via non-insulated vans, motorcycles, or bicycles in plastic or metal cans. This lack of temperature control during the "first mile" and transit results in significant quality degradation and forced "distress sales" at lower prices (Evans et al., 2023; Gazi, 2020).

**Processing and Value Addition:** Most formal processing is limited to pasteurization, while higher value-added products like butter, cheese, and specialized powders are frequently imported due to limited domestic industrial capacity (Oman & Liang, 2019).

**Economic Leakage:** Only 9% of milk is collected by industrial processors, while the remaining 91% is traded informally. Without cold storage at the farm or village level, milk often spoils within a few hours (World Bank Blogs, 2025).

**Investment Opportunities:** There is a critical need for village milk collection centers (VMCCs) equipped with digital fat-testing and chilling facilities. Public-Private Partnership (PPP) milk collection hubs that integrate "feed-for-milk" schemes represent a sustainable model to reduce production costs and improve milk quality (Oman & Liang, 2019; VetEffecT Consultancy & Recruiting, 2023).

## From Farm to Fork: The Journey of Milk in Bangladesh

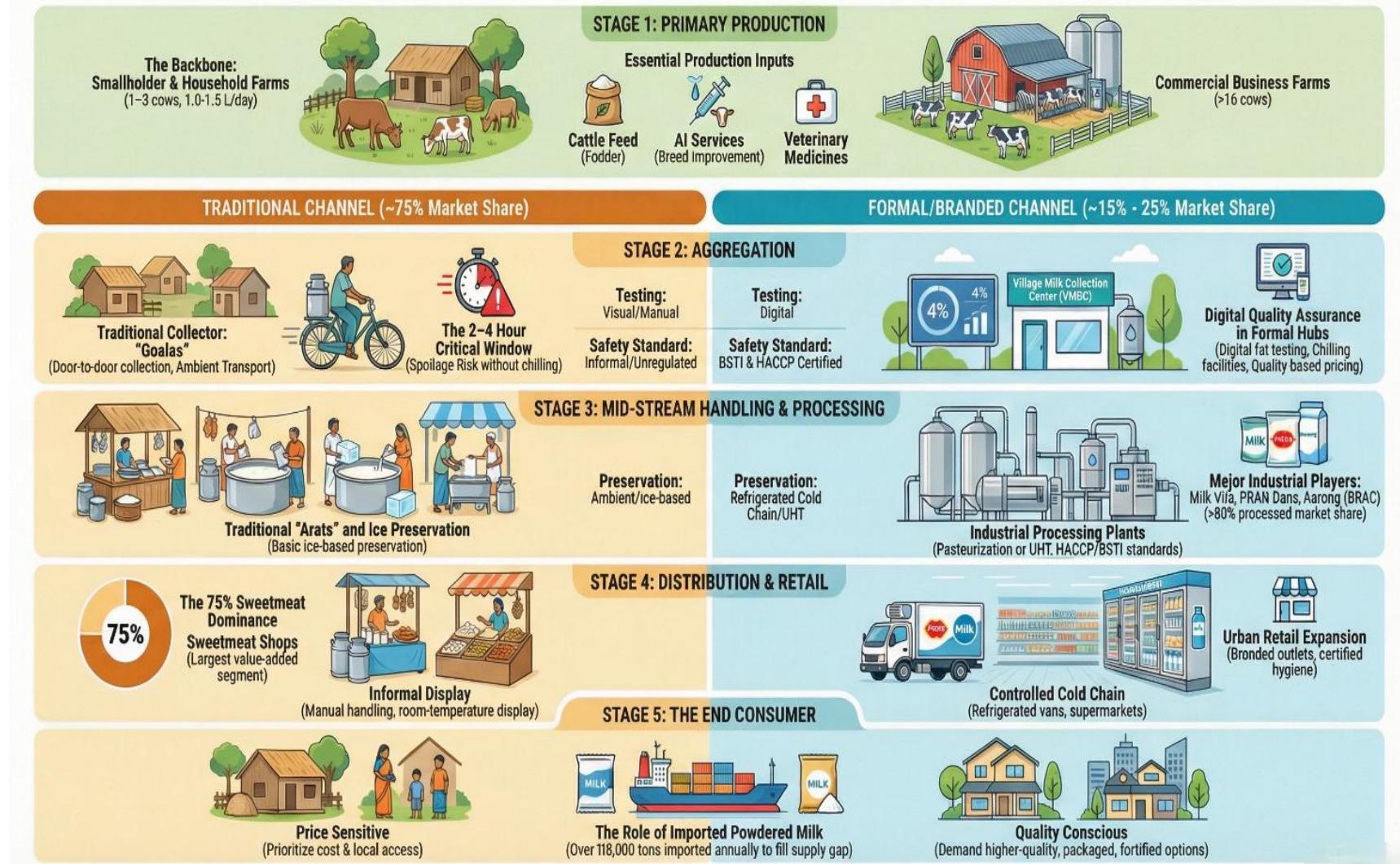


Figure 4: Dairy Supply Chain in Bangladesh

### **3.2.4 Poultry**

The poultry sector is the fastest-growing livestock segment, producing over 23 billion eggs and nearly 1.5 million tonnes of meat annually (The Daily Star, 2025a; Hossan, 2023).

#### ***3.2.4.1 Structure of the Poultry Value Chain***

##### **Upstream: Genetics and Feed**

**Genetics:** All Grand Parent (GP) stock is imported from countries such as France, the USA, and the Netherlands. These GP farms, operated by major integrators such as Kazi, CP, and Paragon, supply Parent Stock (PS) that produces Day-Old Chicks (DOC) (Larive International B.V. & LightCastle Partners Ltd., 2023).

**Feed Industry:** Feed represents approximately 70-80% of total production costs. The sector is heavily dependent on imported raw materials, with 40-50% of corn and 60-65% of soy sourced internationally (Larive International B.V. & LightCastle Partners Ltd., 2023).

##### **Midstream: Hatcheries and Farming**

**Hatcheries:** There are roughly 175 broiler and 125-layer breeding farms/hatcheries (Larive International B.V. & LightCastle Partners Ltd., 2023).

**Farming Models:** Commercial production is divided into three categories:

- **Integrated Farms:** Managed by large firms that control multiple stages of the chain (10-15% of broilers) (Larive International B.V. & LightCastle Partners Ltd., 2023).
- **Contract Farms:** Producers who receive inputs (DOC, feed) from integrators and follow an offtake agreement (50-60% of commercial broilers) (Larive International B.V. & LightCastle Partners Ltd., 2023).
- **Independent Farms:** Smallholders typically rear around 1,000 birds (Larive International B.V. & LightCastle Partners Ltd., 2023).
- **Dealers:** These actors play a pivotal role by providing DOC and feed to farmers on a 30-35 day credit cycle, effectively financing the production cycle (The Business Standard, 2025a).

## **Downstream: Marketing and Distribution**

**Wet Markets:** Over 95% of poultry meat and 90% of eggs are sold through traditional wet markets. Consumers have a strong preference for live birds to verify health and freshness before purchase (Mordor Intelligence, 2019; Apu, 2014).

**Modern Processing:** Mechanized slaughterhouses and cold storage facilities are limited to urban centers like Dhaka and Chattogram, covering only 2-3% of broilers consumed (Larive International B.V. & LightCastle Partners Ltd., 2023).

### ***3.2.4.2 Agro-Logistics Landscape of Poultry***

The poultry sector faces a critical "downstream gap" characterized by a lack of professional infrastructure.

**Transportation:** Logistics are dominated by road-based, non-refrigerated movement. Less than 2% of the agricultural transport fleet is refrigerated, leading to high bird stress and quality degradation during transit in open trucks or vans (IFC, 2021).

**Cold Chain:** Cold storage penetration is extremely low, serving only 10-15% of production (primarily the processed segment). The lack of an integrated cold chain beyond metropolitan areas limits the expansion of frozen and ready-to-eat products (Mordor Intelligence, 2019).

**Post-Harvest Losses:** Inefficiencies result in significant value erosion: 9% loss for milk, 7% for meat, and 12.9% for eggs (largely due to breakage and heat stress) (The Daily Star, 2025b).

**Economic Leakage:** Over 90% of poultry and eggs are sold through traditional wet markets. The chain lacks professional downstream infrastructure, including mechanized slaughterhouses and temperature-controlled distribution (Larive International B.V. & LightCastle Partners Ltd., 2023).

**Investment Opportunities:** There is a need for approximately 6 to 8 midsized modern slaughterhouses (25,000 birds/day) to meet rising urban demand. Investment in refrigerated transport and automated egg-grading and handling equipment can reduce breakage and improve food safety (The Business Standard, 2025a; Larive International B.V. & LightCastle Partners Ltd., 2023).

# The Bangladesh Poultry Value Chain: A Journey from Hatchery to Table

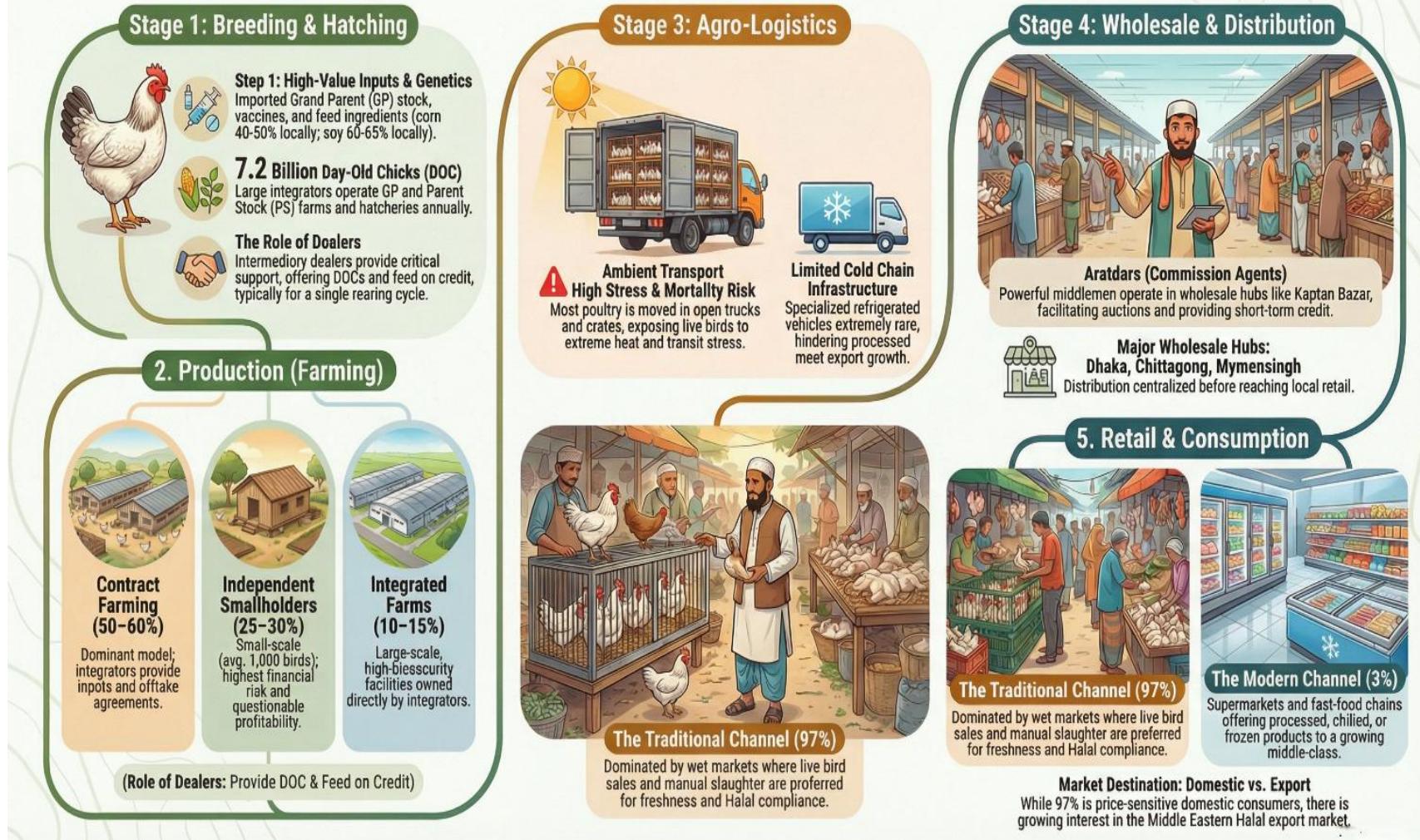


Figure 5: Poultry Supply Chain in Bangladesh

### **3.2.5 Fish**

Fish accounts for 60% of national animal protein intake, with total production reaching 5.02 million metric tons in 2023-24 (Rouf et al., 2024).

#### ***3.2.5.1 Structure of the Fish Value Chain***

The value chain is categorized into three primary production sources, each with distinct logistical pathways:

**Inland Aquaculture (Culture):** This is the primary driver of growth, accounting for approximately 57% to 59% of total production. It is dominated by pond-based systems producing Indian major carps (Rohu, Catla, Mrigal), exotic carps, tilapia, and pangasius (Rouf et al., 2024; Apu, 2014; Ahmed et al., 2024).

**Inland Capture (Open Water):** This includes fish harvested from rivers, floodplains, and *beels*. While historically significant, its share has declined due to environmental degradation and habitat loss (Apu, 2014).

**Marine Fisheries:** Comprising both artisanal and industrial trawlers, this segment provides critical high-value species like Hilsa (the national fish) and marine shrimp (Shemon et al., 2018).

**Key Actors and Intermediaries:** The chain is characterized by a multi-tiered, intermediary-dense network that often prioritizes rapid turnover over quality preservation.

**Upstream Suppliers:** Includes hatcheries (clustered in Jashore for carps and Cox's Bazar for shrimp) and feed millers (Apu, 2014, Larive International & LightCastle Partners, 2021).

**Primary Producers:** Includes roughly 13.8 million fish farmers and over 1.3 million fishers (Apu, 2014).

**Midstream Aggregators:** Intermediaries include Farias (village collectors), Beparis (assemblers/transporters), and Aratdars (commission agents/auctioneers) (Larive International & LightCastle Partners, 2021; Shafiuddin, 2021).

**Processors:** Significant primarily in the export shrimp sector, which utilizes HACCP-compliant plants. Domestic finfish are rarely processed and are mostly sold whole or fresh (Larive International & LightCastle Partners, 2021).

**Downstream Retailers:** Approximately 80% to 90% of fish is sold through traditional wet markets, with emerging parallel chains in modern superstores and online platforms (Larive International & LightCastle Partners, 2021).

### ***3.2.5.2 Agro-Logistics Landscape of Fish***

Logistics remains the most significant bottleneck, leading to estimated post-harvest losses of 20% to 36% (The Business Standard, 2025e).

**Transportation:** Roughly 95% of fish move via road, predominantly in non-refrigerated open trucks, vans, or buses. Less than 1% of the agricultural transport fleet is refrigerated (Shafiuddin, 2021).

**Cold Chain and Preservation:** Mechanical cold chain penetration is less than 5% for domestic finfish. Preservation relies almost entirely on loose ice, which is often insufficient during peak seasons or long fishing trips (Kumar Mandal et al., 2024).

**Storage Gaps:** While the country has over 400 cold storage units, approximately 90% to 95% are dedicated exclusively to potatoes, leaving a massive shortfall for multi-commodity or fish-specific storage (The Business Standard, 2025b).

**Economic Leakage:** Post-harvest losses in the fisheries sector are estimated at 12.5% to 25%, primarily due to delayed icing and poor handling at landing centers. Marine fisheries alone lose approximately US\$151 million annually due to these inefficiencies (Kumar Mandal et al., 2024; The Daily Star, 2025b).

**Investment Opportunities:** Strategic investments are needed in Specific Pathogen Free (SPF) hatcheries to combat disease outbreaks in shrimp. Further potential lies in insulated/refrigerated fish vans and the establishment of value-added fish processing (e.g., fillets and ready-to-eat products) to serve urban markets (Kabir et al., 2019; Larive International & LightCastle Partners, 2021a).

# From Water to Table: The Bangladesh Fish Value Chain & Logistics Roadmap

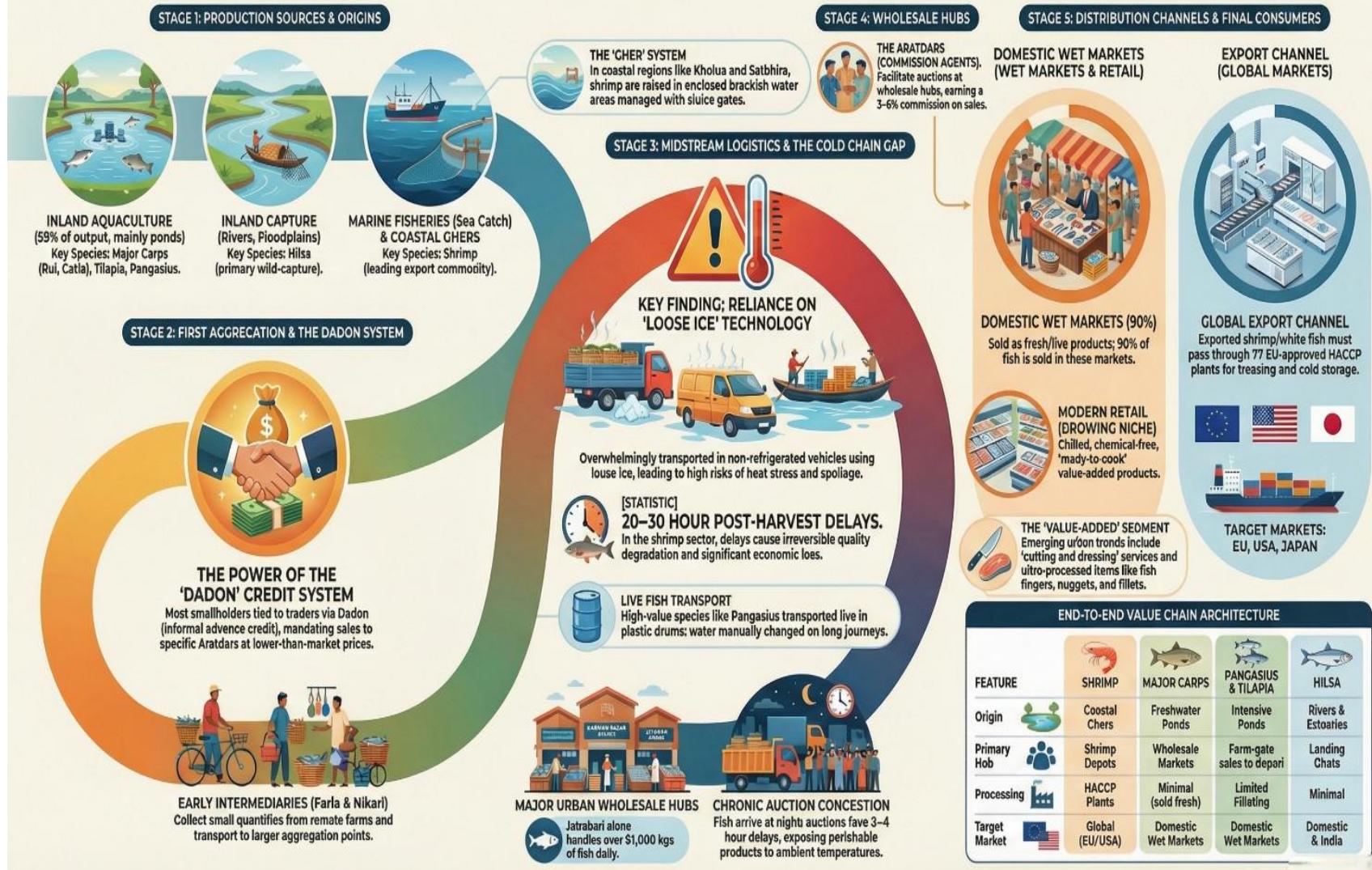


Figure 6: Fish Supply Chain in Bangladesh

### **3.2.6 Cereals**

Cereals, led by rice, occupy 75% of total arable land. Rice production has reached approximately 39 million metric tons annually (Fresh Plaza, 2025; FAO, 2025).

#### ***3.2.6.1 Structure of the Cereals Value Chain***

**Rice (The Staple Chain):** The rice value chain is long, fragmented, and predominantly domestic. It involves millions of smallholder farmers and a complex network of intermediaries, including farias (village traders), beparis (regional traders), and aratdars (commission agents). Value addition and losses are heavily concentrated between the harvest and milling stages due to multiple processing steps like parboiling and husking (Rahman et al., 2020).

**Maize (The Industrial/Feed Chain):** Driven by the poultry and aquaculture sectors, the maize chain is increasingly buyer-driven and industrially coordinated. Risk is concentrated during drying and aggregation, where high moisture levels create significant threats of aflatoxin contamination (Rahman et al., 2020).

**Wheat (The Import-Centric Chain):** Because Bangladesh relies on imports for over 80% of its wheat consumption, this chain is highly centralized and port-centric. Control is dominated by a few large importers, millers, and government agencies like the Directorate General of Food (DGFOOD) (Ministry of Food, Bangladesh, 2024).

#### ***3.2.6.2 Agro-Logistics Landscape of Cereals***

**Drying Infrastructure:** Drying is the most critical control point, yet it remains a major weakness. Sun drying on open yards or roadsides accounts for 75–90% of all cereal drying, making the process highly vulnerable to rainfall and re-wetting (Abedin et al., 2012; The Daily Star, 2025b).

**Storage Systems:** Cereal storage is a mix of three levels:

- **Farm-level:** Smallholders use traditional golas, jute bags, or plastic sacks with minimal protection against rodents and moisture (Hossain et al., 2019).
- **Private sector:** Traders and millers operate warehouses for bagged storage, often lacking temperature or humidity controls (Hossain et al., 2019).

- **Public sector:** The government maintains a network of silos and warehouses (LSDs/CSPs) for public procurement and food security reserves (Ahmed et al., 2024).

**Milling and Processing:** Bangladesh possesses thousands of rice mills. There is a gradual transition from traditional husking mills (which have high breakage rates) to modern automatic and semi-automatic mills that improve recovery and quality (JICA, 2021; The Daily Star, 2011).

**Transportation:** Logistics are overwhelmingly road-based (over 80–85%), relying on trucks and pickups for bagged transport. Bulk handling via rail or inland waterways remains underutilized except for specific government food distribution routes (Food Planning and Monitoring Unit, 2024).

**Economic Leakage:** Cereal losses are driven by moisture management failures, with 10% to 17.8% of production lost during harvest, drying, and storage. Sun drying accounts for 85% of the sector, which is highly vulnerable to erratic rainfall (The Daily Star, 2025b; Saha et al., 2017).

**Investment Opportunities:** There is a massive need for mechanical and community-level dryers to standardize grain moisture. Investment in hermetic storage bags and modern silos near production clusters can drastically reduce rodent- and pest-related storage losses (Hassan, 2024; Abedin et al., 2012).

# From Farm to Fork: The Cereal Value Chain and Logistics Journey in Bangladesh

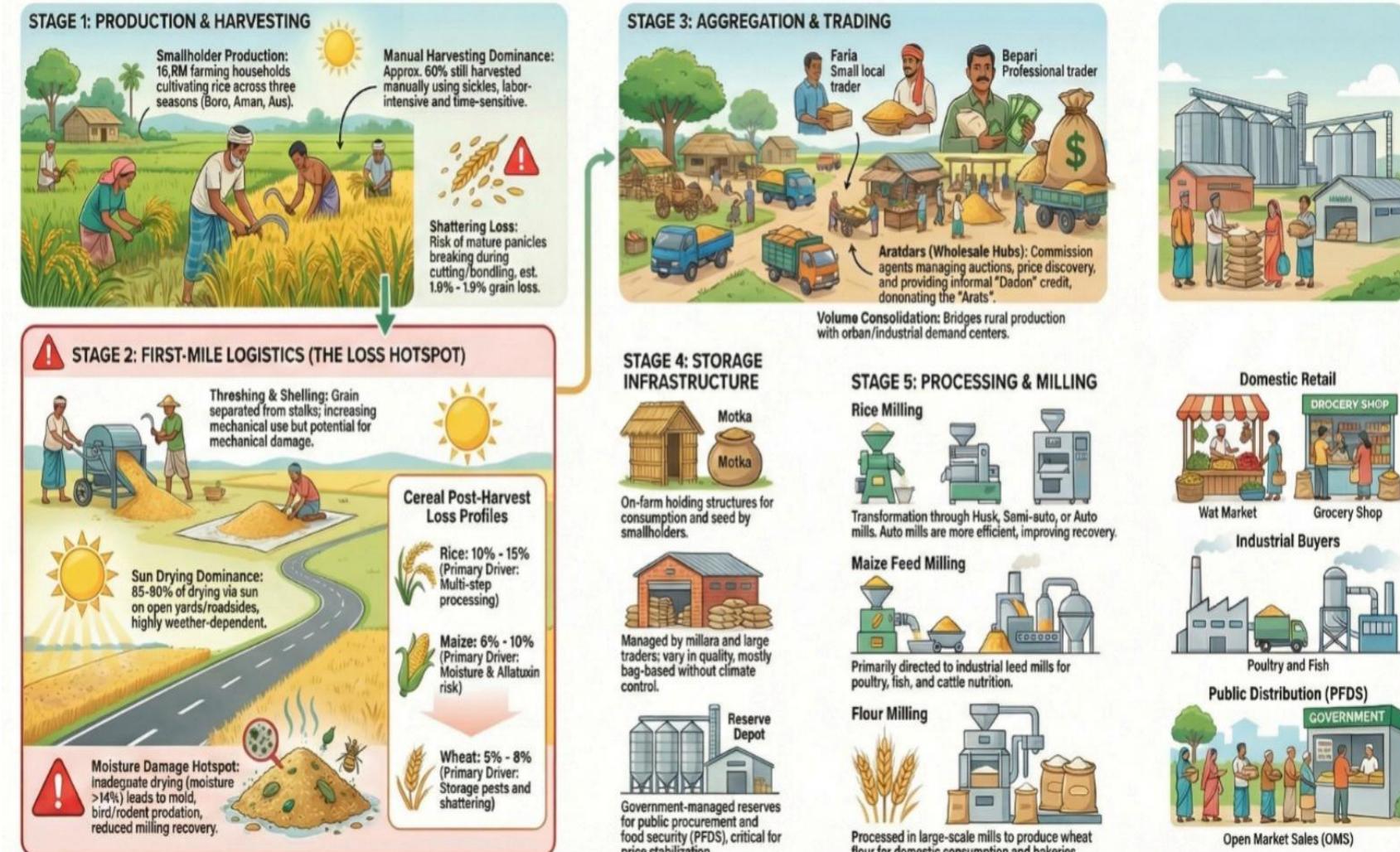


Figure 7: Cereal Supply Chain in Bangladesh

### **3.2.7 Livestock (Beef & Goat)**

Bangladesh has achieved self-sufficiency in meat, with a surplus of over 1 million cattle reported recently (Hossan, 2023; UNB, Dhaka, 2019).

#### ***3.2.7.1 Structure of the Livestock Value Chain***

The structure of the livestock value chain is intermediary-heavy and largely driven by traditional market practices rather than formal contracts.

**Primary Production:** The sector is dominated by smallholder households (typically 1–3 cows or a few goats) who practice mixed farming. Livestock often serves as a "bank on hooves" for these farmers, providing insurance against crop failure (VetEffecT Consultancy & Recruiting, 2023; FAO, 2019).

**Primary Collection and Trade:** Local traders, known as Beparis, aggregate animals from various small farms to reach a marketable volume. In the red meat sector, these traders exert significant power, often locking farmers into sales through the informal *dodon* credit system (UNB, Dhaka, 2019; Rahman et al., 2014).

**Aggregation Nodes:** Live animals are primarily traded at rural "Hats" (weekly markets), where they are sold to wholesalers or larger traders for transport to urban centers (Rahman et al., 2014).

**Slaughter and Processing:** This node is a major structural bottleneck. Over 90% of slaughtering is informal, occurring in wet markets, backyards, or on roadsides with minimal veterinary inspection. Only one major commercial processor, Bengal Meat, operates a modern, export-oriented facility (Oman & Liang, 2019; VetEffecT Consultancy & Recruiting, 2023).

**Retail and Distribution:** Retail is almost exclusively handled by traditional wet-market butchers who sell "hanging meat" at ambient temperatures. Modern retail (supermarkets) currently accounts for less than 1% of total beef consumption (Oman & Liang, 2019; Rifat et al., 2024).

### ***3.2.7.2 Agro-Logistics Landscape of Livestock***

Logistics inefficiencies represent the single largest constraint to the sector's modernization and value retention.

**Transport-Induced Losses:** Most cattle and goats are transported live in open trucks over long distances. This results in 3% to 5% live-weight loss for cattle and up to 10% mortality for goats due to stress and dehydration (Hossan, 2023).

**Cold Chain Gaps:** There is a near-total absence of temperature-controlled logistics for meat. Cold storage currently serves less than 7% of meat products. Without chilling facilities, butchers must sell the entire carcass within hours of slaughter to avoid spoilage (World Bank Blogs, 2025; Department of Livestock Services, 2024).

**Seasonal Logistics Overload:** During Eid-ul-Azha, approximately 60% of annual cattle slaughter occurs within a three-day window, completely overwhelming the existing transport and slaughter infrastructure (Department of Livestock Services, 2024).

**By-Product Logistics:** While bones and hides have established collection chains for the gelatin and leather industries, other by-products like animal blood are largely wasted due to a lack of collection facilities in informal slaughter points (Oman & Liang, 2019).

**Economic Leakage:** The value chain is almost entirely informal, with 93% of meat processed without cold storage (World Bank Blogs, 2025). Live-animal transport results in a 3% to 5% weight loss due to stress and dehydration (Oman & Liang, 2019).

**Investment Opportunities:** The sector is poised for large-scale meat exports, particularly to the global halal market, provided it meets international disease-free standards (UNB, Dhaka, 2019). Investment in modern abattoirs with integrated waste management (biogas/blood collection) and certified food safety traceability systems using blockchain can unlock this potential (Oman & Liang, 2019; Rifat et al., 2024).

# FROM FARM TO FORK: MAPPING THE BANGLADESH BEEF VALUE CHAIN

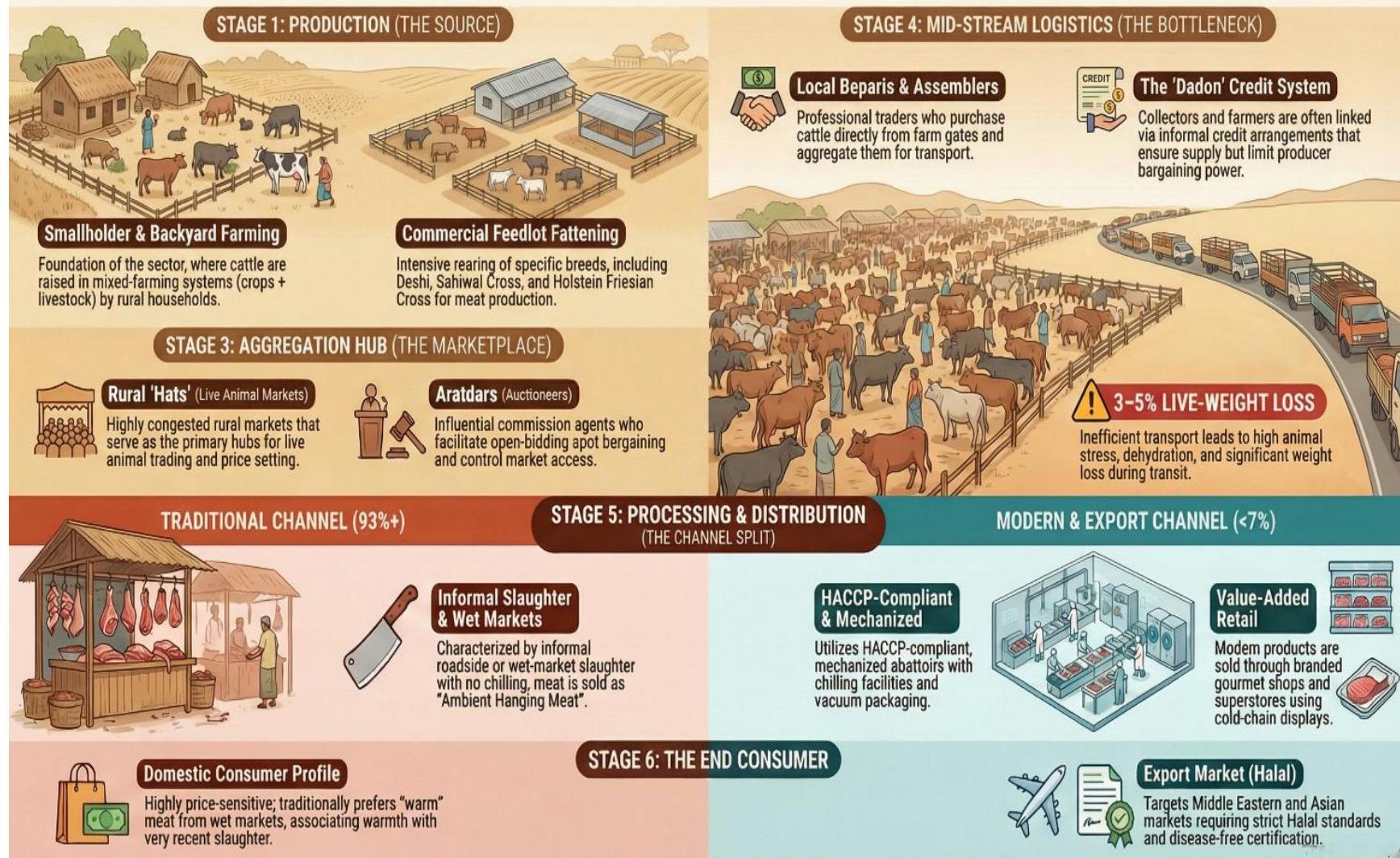


Figure 8: Livestock Supply Chain in Bangladesh

### **3.2.8 Poultry (eggs)**

The poultry sector in Bangladesh supplies approximately 36% of the nation's total protein intake, with egg production reaching approximately 23.35 billion pieces in FY 2021-22 (U.S. Department of Agriculture, Foreign Agricultural Service, 2025; Karim, 2022). Despite this high volume, the subsector relies on a fragmented, intermediary-heavy value chain where over 90% of eggs constitute "warm" produce sold through wet markets rather than cold chains (Larive International B.V. & LightCastle Partners Ltd., 2023).

#### ***3.2.8.1 Key Actors and Stakeholders of the Poultry (eggs) Value Chain***

The value chain is structured around four primary tiers of actors who manage the flow of inputs, production, and distribution.

**Upstream (Genetics & Inputs):** This segment is dominated by large integrated companies (e.g., Kazi Farms, Paragon, CP) that import Grand Parent (GP) stock from countries like France and the Netherlands to produce Parent Stock (PS) and Day-Old Chicks (DOC) (Larive International B.V. & LightCastle Partners Ltd., 2023). The feed industry is also critical, utilizing imported maize (55-65%) and soy to produce feed, which constitutes nearly 70% of total production costs (U.S. Department of Agriculture, Foreign Agricultural Service, 2025).

**Midstream (Production):** This includes a mix of commercial layer farms and smallholder farmers. There are approximately 125 formal layer breeding farms/hatcheries and over 18,000 independent layer farms. Dealers act as vital intermediaries here, providing feed and DOCs to farmers on credit (30-35 days), thereby binding the farmers to sell eggs back through specific channels (Larive International B.V. & LightCastle Partners Ltd., 2023).

**Downstream (Trading & Aggregation):** The distribution network relies on Aratdars (commission agents) and Paikars/Wholesalers. Eggs are typically sold by farmers to dealers or collectors, who then transport them to wholesale hubs (Arats) in major districts like Dhaka and Chattogram (Larive International B.V. & LightCastle Partners Ltd., 2023).

**Retail:** The market is bifurcated into Traditional Wet Markets, which handle over 90% of egg sales, and Modern Retail/HORECA (Hotels, Restaurants, Catering), which accounts for only

about 10% of the volume but is gradually growing (Larive International B.V. & LightCastle Partners Ltd., 2023).

### ***3.2.8.2 Agro-Logistics Landscape of Poultry (eggs)***

The agro-logistics landscape for eggs is characterized by ambient-temperature handling and rudimentary transport infrastructure, leading to significant quality and physical loss.

**Transportation:** Logistics are dominated by road transport using open trucks, pickups, and even motorcycles for last-mile delivery. There is a near-total absence of refrigerated transport; eggs are moved in plastic crates or paper trays often stacked without adequate cushioning, exposing them to high vibration and heat stress during transit (FAO, 2019).

**Storage and Packaging:** Cold storage penetration for eggs is negligible. Most eggs are stored at ambient temperatures at Arats and retail points, accelerating internal quality degradation. While plastic trays are becoming common, the lack of automated grading and packing facilities results in manual handling that increases breakage risks (FAO, 2019; Larive International B.V. & LightCastle Partners Ltd., 2023).

**Market Flow:** The supply chain is highly sensitive to seasonality; heat stress in summer significantly reduces shelf life and hatchability, while logistical disruptions (e.g., during festivals) cause price volatility (FAO, 2019).

**Economic Leakage:** Post-harvest losses for eggs are estimated at approximately 12.9% to 13%, primarily driven by physical breakage from rough handling and quality deterioration due to heat exposure in non-refrigerated transport (BdNews24, 2024; Prevention Web, 2024).

**Investment Opportunities:** To meet the projected demand of an additional 7.6 billion eggs by 2025, there is a critical investment opportunity of EUR 3–5 million for modern egg handling, grading, and packing equipment, alongside the development of cold chain logistics to reduce breakage and spoilage (Larive International B.V. & LightCastle Partners Ltd., 2023).

# The Journey of an Egg: Bangladesh's Poultry Value Chain

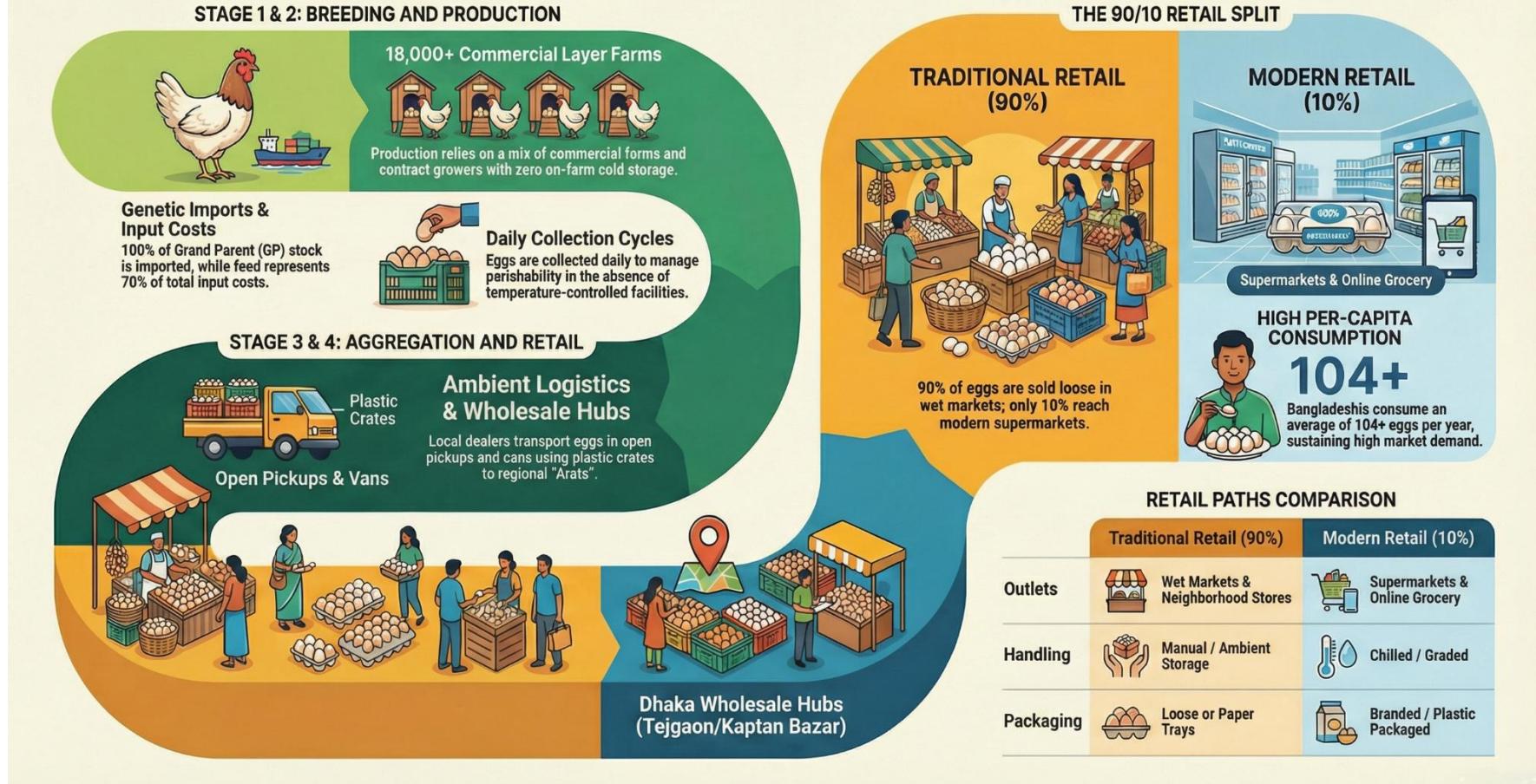


Figure 9: Poultry (eggs) Supply Chain in Bangladesh

### **3.3 Current Online/Digital Agro-Logistics Marketplaces in Bangladesh**

The agro-logistics landscape in Bangladesh is undergoing a significant transformation driven by the adoption of digital technologies and the emergence of online marketplaces, a trend that was notably accelerated by the COVID-19 pandemic. The crisis compelled approximately 30% of value chain actors to incorporate digital tools for purchasing and sales, leading to an exponential increase in Business-to-Consumer (B2C) and Business-to-Business (B2B) e-commerce platforms, as well as social e-commerce via applications like WhatsApp (World Bank, 2022). This digital shift is supported by a growing ecosystem of logistics and e-commerce entities; the E-Commerce Association of Bangladesh (E-CAB) lists approximately 500 e-commerce and 2,000 f-commerce (Facebook commerce) companies, which increasingly rely on third-party logistics providers such as Pathao, E-Courier, and Paperfly to handle the physical distribution of goods (*Bangladesh's Freight and Logistics Industry: Role in Economic Development and Policy Impact*, n.d.). These digital marketplaces function by creating parallel supply chains that bypass traditional, intermediary-heavy networks, thereby connecting rural production zones more directly with urban consumption hubs (LightCastle Partners, 2023a).

Prominent examples of these active digital platforms include iFarmer, Chaldal, and various online grocery services. iFarmer, launched in 2019, operates as an agri-tech platform that aggregates smallholder farmers to provide them with access to finance, agricultural inputs, and market connections (International Finance Corporation (IFC), 2021). By 2023, iFarmer managed a network of over 46,000 farmers and had facilitated more than \$10 million in financing, effectively addressing the capital and logistical constraints faced by small producers (International Finance Corporation (IFC), 2021). Similarly, Chaldal, a major online grocery company, has established its own supply network that connects farmers and small-scale retailers directly to the platform. This vertical integration allows Chaldal to manage the logistics from the farm level to the consumer, ensuring product quality and traceability while reducing the reliance on traditional wholesale markets (LightCastle Partners, 2023a). Other platforms contributing to this digital ecosystem include FoodPanda, HungryNaki, Pathao, Daraz Mart, and SodaiHut, which cater to the growing urban demand for home delivery of fresh produce (LightCastle Partners, 2023a). Additionally, the Department of Fisheries has

initiated projects to introduce online wholesale marketplaces specifically designed to allow fish farmers to bid and sell directly to buyers, further circumventing traditional middlemen (Ali et al., 2025).

The economic effect of these digital marketplaces on farmers is profound, primarily manifesting as increased income through fair pricing and reduced transaction costs. In the traditional system, intermediaries and traders often capture the majority of the profit margins, leaving farmers with a small fraction of the final consumer price; however, digital platforms utilize their networks to cut out these middle layers, ensuring that farmers receive a fairer price for their produce (LightCastle Partners, 2023a; Rifat et al., 2024). For instance, Chaldal's direct connection model is explicitly noted to ensure that farmers get a fairer price and can achieve a better lifestyle (LightCastle Partners, 2023a). Furthermore, by facilitating access to finance and quality inputs, platforms like iFarmer enable farmers to invest in better production methods, which increases productivity and, consequently, their overall earnings (International Finance Corporation (IFC), 2021). The transparency introduced by digital tools and mobile communication also reduces information asymmetry, empowering farmers to negotiate better rates and avoid distress sales (Iqbal, 2024; Kabir et al., 2019). These digital interventions are gradually dismantling the exploitative elements of the traditional supply chain, offering a pathway for smallholders to escape the "low-equilibrium trap" of high risk and low returns (Ali et al., 2025).

### 3.4 SWOT Analysis on Agro-Logistics Subsectors

Subsectors	Strengths	Weaknesses	Opportunities	Threats
Vegetables	<p><b>Global Production Hub:</b> Bangladesh is the 20th largest producer of vegetables globally, with an annual output of ~17.09 million tonnes.</p> <p><b>Production Diversity:</b> Farmers utilize a "basket" crop model, growing a wide variety of summer and winter vegetables, ensuring year-round supply potential.</p>	<p><b>Cold Storage Monoculture:</b> 90–95% of the country's cold storage is dedicated exclusively to potatoes, leaving high-value vegetables like tomatoes and cauliflower with no preservation infrastructure.</p> <p><b>Inadequate Transport:</b> 95% of produce moves in open trucks without refrigeration, leading to high heat stress and quality degradation.</p> <p><b>High Post-Harvest Losses:</b> Between 20% to 44% of production is lost annually due to poor handling and lack of storage.</p>	<p><b>Packaging Innovation:</b> Introduction of Returnable Plastic Crates (RPCs) to replace traditional bamboo baskets can significantly reduce compression damage.</p> <p><b>Value-Added Infrastructure:</b> Investment in multi-commodity cold storage and pre-cooling units at aggregation points to remove field heat and extend shelf life.</p>	<p><b>Climate Vulnerability:</b> Reliance on open-field farming makes the sector highly susceptible to erratic rainfall and floods.</p> <p><b>Price Volatility:</b> The "rush to market" culture due to lack of storage causes severe seasonal price crashes for farmers.</p>
Fruits	<p><b>Diverse Portfolio:</b> Production of 72 different types of fruits, with total annual output exceeding 12 million tonnes.</p> <p><b>High Margins:</b> Shifting from cereals to fruit orchards offers farmers significantly higher gross margins (&gt;\$600/ha).</p>	<p><b>Extreme Perishability:</b> Losses are staggeringly high for specific fruits like Jackfruit (43.5%) and Pineapple (42.6%) due to their short shelf life and poor handling.</p> <p><b>Chemical Ripening Issues:</b> Lack of modern ripening</p>	<p><b>Export Compliance:</b> Establishing Vapor Heat Treatment (VHT) facilities to meet phytosanitary standards for exporting mangoes and other fruits to high-value markets.</p> <p><b>Aseptic Processing:</b> Investment in pulping lines to</p>	<p><b>Seasonal Gluts:</b> The intense seasonality of fruits like mango creates logistical bottlenecks that overwhelm existing transport capacity.</p> <p><b>Food Safety Scares:</b> Consumer distrust due to chemical ripening practices</p>

		<p>chambers leads to the use of harmful chemicals or uneven ripening, affecting quality.</p> <p><b>Processing Void:</b> Less than 1% of fruit is processed into juice or pulp, leading to massive wastage during peak seasons.</p>	<p>produce shelf-stable mango pulp, substituting current imports.</p>	can dampen domestic demand.
Dairy	<p><b>Strong Domestic Demand:</b> A market value of ~\$2.47 billion with a deep cultural preference for fresh milk and traditional sweets.</p> <p><b>Formal Sector Growth:</b> Emergence of established processors like Milk Vita, PRAN, and BRAC (Aarong) creating structured collection channels.</p>	<p><b>The "4-Hour" Trap:</b> Raw milk spoils within 2–4 hours without chilling, yet only 10% of production enters a formal cold chain.</p> <p><b>Informal Dominance:</b> 91% of milk flows through informal channels (Goalas) with no quality testing or temperature control.</p> <p><b>Transport Failure:</b> Milk is often transported in non-insulated plastic/metal cans on bicycles or vans, leading to rapid bacterial growth.</p>	<p><b>Village Milk Collection Centers (VMCCs):</b> establishing local hubs equipped with solar-powered chillers and digital fat-testing machines.</p> <p><b>Value-Added Products:</b> Shifting production from liquid milk to high-margin products like yogurt, cheese, and butter.</p>	<p><b>Import Competition:</b> The country spends ~\$370 million annually importing powdered milk, which undercuts local liquid milk prices.</p> <p><b>Adulteration:</b> Risk of contamination in the informal chain affects consumer confidence.</p>
Poultry (Meat)	<p><b>Rapid Growth:</b> The fastest-growing livestock segment, with integrated firms (Kazi, CP) driving commercialization.</p>	<p><b>Wet Market Dependence:</b> Over 95% of birds are sold live in wet markets; modern slaughtering and processing</p>	<p><b>Modern Slaughterhouses:</b> Investment in automated slaughterhouses (25,000 birds/day capacity) to supply</p>	<p><b>Disease Outbreaks:</b> High density of farms and poor biosecurity in wet markets make the sector vulnerable</p>

	<p><b>Feed Industry:</b> A well-developed feed mill sector supporting production.</p>	<p>cover only 2-3% of the market.</p> <p><b>Transport Stress:</b> Live birds are transported in open trucks, leading to stress, weight loss, and mortality.</p> <p><b>Feed Import Reliance:</b> 40-50% of corn and 60-65% of soy for feed are imported, exposing the sector to global price shocks.</p>	<p>hygienic meat to urban supermarkets.</p> <p><b>Frozen/Processed Market:</b> Growing urban demand for ready-to-cook and frozen poultry products.</p>	<p>to Avian Influenza.</p> <p><b>Price Volatility:</b> Global fluctuations in maize and soy prices directly impact production costs.</p>
Fish	<p><b>Dietary Staple:</b> Fish accounts for 60% of national animal protein intake; Bangladesh is a top global producer.</p> <p><b>Aquaculture Boom:</b> Strong growth in pond-based aquaculture (59% of production).</p>	<p><b>"Loose Ice" Technology:</b> Preservation relies entirely on melting ice; mechanical cold chain penetration is &lt;5%.</p> <p><b>Toxic Preservatives:</b> Risks of formaldehyde use to extend shelf life in the absence of proper cooling.</p> <p><b>Export Rejections:</b> Marine fisheries lose ~\$151 million annually due to poor post-harvest handling and quality issues.</p>	<p><b>Cold Chain Integration:</b> Investment in insulated fish vans and solar-powered ice plants at landing stations.</p> <p><b>Value Addition:</b> Processing facilities for filleting and ready-to-cook fish products for domestic urban markets.</p>	<p><b>Environmental Degradation:</b> Decline in open-water capture fisheries due to habitat loss.</p> <p><b>Disease:</b> Shrimp sector vulnerability to pathogens, requiring investment in SPF (Specific Pathogen Free) hatcheries.</p>
Cereals	<p><b>Strategic Importance:</b> Rice occupies 75% of arable land; the sector is central to national food security.</p>	<p><b>Sun Drying Reliance:</b> 85-90% of drying is done on open roads/yards, making it highly weather-dependent and</p>	<p><b>Mechanical Drying:</b> Massive market potential for mechanical dryers to standardize moisture content and</p>	<p><b>Climate Change:</b> Erratic rainfall and flash floods during harvest season can destroy sun-drying crops.</p>

	<p><b>Milling Transition:</b> Gradual shift from traditional husking to modern automatic rice mills.</p>	<p>prone to losses.</p> <p><b>Storage Pests:</b> Traditional storage leads to significant losses from rodents and moisture.</p> <p><b>High Import Dependency (Wheat):</b> Over 80% of wheat is imported, making the chain port-centric and vulnerable to external shocks.</p>	<p>reduce mycotoxins.</p> <p><b>Silo Modernization:</b> Investment in modern grain silos and hermetic storage bags to prevent pest damage.</p>	<p><b>Aflatoxin Contamination:</b> Poor drying leads to fungal growth, threatening food safety and feed quality.</p>
Livestock	<p><b>Self-Sufficiency:</b> The country has achieved self-sufficiency in meat with a recent surplus of cattle.</p> <p><b>High Value Assets:</b> Livestock acts as a "bank on hooves" for smallholders, providing financial security.</p>	<p><b>Transport Weight Loss:</b> Live animal transport in open trucks causes 3-5% weight loss and high stress.</p> <p><b>Slaughter Hygiene:</b> &gt;90% of slaughter is informal (roadsides/wet markets) with no veterinary oversight or chilling.</p> <p><b>Cold Chain Absence:</b> &lt;7% of meat enters cold storage; butchers must sell "warm meat" immediately.</p>	<p><b>Halal Export:</b> Potential to export to global halal markets if disease-free standards and traceability are met.</p> <p><b>Modern Abattoirs:</b> Establishing hygienic slaughterhouses with integrated waste management (biogas/blood processing).</p>	<p><b>Disease Control:</b> Foot and Mouth Disease (FMD) and other transboundary diseases restrict export potential.</p> <p><b>Seasonal Overload:</b> 60% of slaughter happens during Eid-ul-Azha (3 days), overwhelming all logistics infrastructure.</p>
Poultry (Eggs)	<p><b>High Consumption:</b> A primary protein source with production of &gt;23 billion eggs annually.</p> <p><b>Industrial Base:</b> Presence of large</p>	<p><b>Fragile Handling:</b> High breakage rates (~13%) due to manual handling and use of paper trays/plastic crates without cushioning.</p>	<p><b>Automation:</b> Investment in automated egg grading and packing machines to standardize quality and reduce breakage.</p>	<p><b>Heat Stress:</b> Summer heat waves significantly reduce shelf life and hatchability.</p> <p><b>Price Fluctuations:</b> Supply chain disruptions during</p>

commercial layer farms and breeding hatcheries.	<p><b>Ambient Storage:</b> Eggs are stored at room temperature, leading to rapid internal quality degradation in heat.</p> <p><b>Lack of Grading:</b> Absence of automated grading means eggs are sold mixed, reducing value for higher-quality produce.</p>	<p><b>Cold Chain Logistics:</b> Developing a cool chain (reefer vans) to maintain freshness during transport.</p>	festivals or crises cause extreme price volatility.
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Source: Synthesized from Advance Consulting, Resilience Consulting, & Edge Consulting. (2021). Horticulture study of Bangladesh. In Ref No. # 202011095 / PST2oBDo2. Netherlands Enterprise Agency; Larive International & LightCastle Partners. (2021). Aquaculture sector study Bangladesh. Netherlands Enterprise Agency; Larive International B.V., & LightCastle Partners Ltd. (2023). Poultry sector study Bangladesh revise 2023. Netherlands Enterprise Agency; VetEffect Consultancy & Recruiting. (2023). Sector study dairy Bangladesh. In REF: PST2oBCD03. Netherlands Enterprise Agency; Japan International Cooperation Agency (JICA). (2021). People's Republic of Bangladesh Ministry of Industries (Molnd) Bangladesh Infrastructure Finance Fund Limited (BIFFL) People's republic of Bangladesh preparatory survey for food value chain improvement project final report. JICA; Kumar Mandal, A., Rashid, M. M. O., Sarkar, M. S. K., & Rahaman, M. T. (2024). Post-harvest losses in marine fisheries of Bangladesh. *Heliyon*, 10(15), e35531; Kabir, R. I., Narayanan, S., Belton, B., Hernandez, R., & Haque, M. M. (2019). Shrimp value chain in Bangladesh. *Jahangirnagar University Journal of Marketing (JUJM)*, 7(8), 7–30; Majumder, S., Bala, B. K., Arshad, F. M., Haque, M. A., & Hossain, M. A. (2016). Food security through increasing technical efficiency and reducing postharvest losses of rice production systems in Bangladesh. *Food Security*, 8(2), 361–374; Ministry of Food, Bangladesh. (2024). Quarterly food grain stock and distribution report. Directorate General of Food, Ministry of Food, Government of Bangladesh; Bangladesh Economic Review 2024. (2024). Chapter two: Gdp, savings and investment (pp. 9–18). Ministry of Finance (MoF), Government of Bangladesh; Department of Livestock Services. (2024). Livestock economy at a glance 2023–2024. Ministry of Fisheries and Livestock, Government of Bangladesh; Food Planning and Monitoring Unit. (2024). Bangladesh food situation report: October 2024. In <https://fpmu.gov.bd/>. Ministry of Food, Government of Bangladesh; Ministry of Food, Bangladesh. (2024). Quarterly food grain stock and distribution report. Directorate General of Food, Ministry of Food, Government of Bangladesh; The World Bank. (2021). The world bank program on agricultural and rural transformation for nutrition, employment, and resilience in Bangladesh(PARTNER) (P176374); U.S. Department of Agriculture, Foreign Agricultural Service. (2025, March 31). Grain and feed annual. (Report BG2025-0004); USDA; World Bank Group. (2024, March 8). Agricultural weather index insurance in Bangladesh (UNFCCC case study). United Nations Framework Convention on Climate Change.

#### **4. Commodity-Wise Market Size Estimation**

The Bangladesh agricultural sector is currently navigating a pivotal transition from a subsistence-based production model to a highly commercialized agribusiness ecosystem. This transformation is driven by the necessity to optimize the supply chain for a population exceeding 170 million while operating within the constraints of finite arable land and increasing climate vulnerability. Central to this transition is the effectiveness of the agro-logistics market, which encompasses the multimodal movement, storage, and handling of agricultural commodities from the farm gate to the final consumer or export terminal. The following report presents an exhaustive analysis of the agro-logistics market in Bangladesh, based on the systematic formulas of Phase 2 of the Four-Phase Analytical Framework for national logistics modernization.

## 4.1 The Mathematical Model

Table 2: Mathematical Model for Agro-Logistics Market Estimation

Segment	Variable / Component	Formula or Definition	Key Data Parameters & Sources
Total Market Size ( $M_{Total}$ )	Aggregate Annual Expenditure	$M_{Total} = \sum (C_{Trans,i} + C_{Store,i} + C_{VAS,i})$	Commodities include rice, maize, wheat, vegetable, potato, fruit, mango, fish, livestock (poultry & red meat), and poultry (egg).
Transportation Cost ( $C_{Trans}$ )	Commodity-wise Total Transport Cost	$C_{Trans,i} = (TKM_i \times AFR_i)$	AFR: Based on 2023-2024 market surveys, World Bank logistics reports, and transport association data, BDT 10-12/ton-km (non-perishables); BDT 18-25/ton-km (perishables)
	Tonnage-Kilometer ( $TKM_i$ )	$TKM_i = (MS_i \times D_i)$	$D_i$ : Average distance from regional hubs to major cities (e.g., Dhaka).
	Marketable Surplus ( $MS_i$ )	$MS_i = V_i - (C_f + S_r + F_a + W_p + K)$	$V_i$ : Total Production Volume (MMT). Losses: $C_f$ (family consumption), $S_r$ (seed requirement for subsistent farming), $F_a$ (feed for livestock), $W_p$ (On-farm post-harvest losses), $K$ (payment in kind)
Storage Cost ( $C_{Store}$ )	Warehousing Revenue	$C_{Store} = V_{(stored,i)} \times T_{Duration} \times ASC_i$	$V_{stored,i}$ : Volume entering storage; $St_i$ = Percentage of marketable surplus stores in formal facilities; $T_{Duration}$ = Average storage duration. $V_{stored,i} = (MS_i \times St_i)$
	Storage Rate ( $ASC_i$ )	Rental/Service fee per MMT	Potato (2024): BDT 8.0/kg per season (BDT 8,000/MT) per BCSA guidelines.
Value-Added Services ( $C_{VAS}$ )	Auxiliary Revenue	$C_{VAS} = \sum (\text{Revenue from sorting, grading, packaging, milling, etc.})$	Based on auxiliary functions across the supply chain.

## 4.2 Commodity-Wise Supply Chain Costs Data

Table 3: Commodity-Wise Supply Chain Costs Data

Subsector	Commodities	Key Surplus Hub to Dhaka Chak Bazar	Weighted Avg. Distance ( $D_i$ ) km	Avg. Freight Rate (AFRI) BDT/ton-km	Weighted Avg. Institutional Storage Duration ( $T_{Duration}$ ) (month)	Avg. Storage Cost ( $ASC_i$ ) (BDT ton-month)
Cereals	Rice	Naogaon, Dinajpur, Rangpur (Sadar)	250	9.0 (trucks)	5 (across harvest cycles)	240 (BDT 20 per sq. ft. x assuming 1 ton occupies ~12 sq. ft.)
	Maize					
	Wheat					
Vegetables	Fresh Vegetables	Jessore	194	18.0 (Pickups)	Negligible (direct market access)	Negligible (direct market access)
	Potato	Bogura (Mahasthan/Sadar)	210	12.0 (Standard truck)	9 (cold storage)	8,000 (government/association fixed rate)
Fruits	Fruits (non-mango)	Barishal (Guava/Amra hub)	180	19.0 ("Fruit Specials" trains or fast trucks)	Negligible (direct market access)	Negligible (direct market access)
	Mango	Rajshahi/Chapai Nawabganj	280	20.0 (high demand in mango season and return-empty risk of trucks)	Negligible (direct market access)	Negligible (direct market access)
Fisheries (Marine)	Fish	Coastal/South-East, Cox's Bazar (Marine)	400	30.0 (calculated on the gross weight (fish + water + ice))	Negligible (direct market access)	Negligible (direct market access)
Livestock (Meat)	Red Meat and Poultry Meat	Kushtia/Meherpur	260	20.0 (high volume, low density, Livestock trucks)	9 (On-farm/on-hoof livestock fattening)	200 (cold storage)
Dairy	Milk	Sirajganj (Shahjadpur)	143	25.0 (Tanker rate)	Negligible (direct market access)	Negligible (direct market access)
Poultry Eggs	Chicken Eggs	Mymensingh (Sadar)	125	25.0 (perishable good)	3.0 (temperature room, basket)	18 (per dozen)

Source: Department of Agricultural Marketing (DAM). (2025). Wholesale Market Directory and Spatial Analysis. Ministry of Agriculture, Government of Bangladesh; Ministry of Finance, Government of Bangladesh. (2024). FieldOffice distance calculator. Integrated Budget and Accounting System (iBAS++); pbazaar.com. (2026). Warehouse to rent in Dhaka godown for rent in Bangladesh. pbazaar.com; Economic Relations Division, Government of Bangladesh. (2024). Logistics final report; Bangladesh Bureau of Statistics (BBS). (2024). Report on the Agriculture and Household Survey 2023. Statistics and Informatics Division; LightCastle Partners. (2025, September). Aquaculture in Bangladesh: Key updates from the Fisheries Yearbook 2023–24.

#### 4.3 The Market Size of Agro-Logistics Industry FY 2023-24

Table 4: Agro-Logistics Market Size Calculation

Commodity Category	Transportation Cost ( $C_{Trans}$ ) (BDT Bn)	Storage Cost ( $C_{Store}$ ) (BDT Bn)	Cost of Value-Added Services ( $C_{VAS}$ ) (BDT Bn)	Total Market Size (BDT Billion)	Total Market Size (USD Billion)
Cereals (Rice, Maize, Wheat)	14.96	1.47	47.75	64.18	0.52
Vegetables (General)	22.08	Negligible	44.26	66.34	0.54
Potato	9.91	127.46	33.44	170.81	1.4
Fruits (General)	6.02	Negligible (direct market access)	22	28.02	0.23
Mango	6.8	Negligible (direct market access)	18.23	25.03	0.2
Fisheries	39.46	Negligible (direct market access)	65.76	105.22	0.86
Livestock (Meat)	42	0.44	403.81	446.25	3.65
Dairy (Milk)	20.43	Negligible (direct market access)	120.02	140.45	1.15
Poultry (Eggs)	50.1	0.01	160.31	210.42	1.72
Total Aggregate	211.76	129.38	915.58	1,256.71	10.28

## **5. Investment Landscape: Current and Emerging Trends**

The agro-logistics sector in Bangladesh is undergoing a critical transition from an informal, labor-intensive system to a semi-industrialized, capital-intensive network. This shift is driven by the necessity to reduce the estimated US\$2.4 billion in annual post-harvest losses and to meet the demands of a growing urban middle class and international export markets. The investment landscape is characterized by a dichotomy between highly fragmented informal financing for smallholders and increasing structured investment by large domestic conglomerates and international development partners (The Business Standard, 2024a).

### **5.1 Typology of Investors in the Agro-Logistics Market**

The investor profile in Bangladesh's agro-logistics sector comprises three distinct categories, each playing a specific role in the value chain.

#### **5.1.1 Private Sector Investors (Domestic & International)**

**Large Domestic Conglomerates:** Leading agribusiness firms such as PRAN-RFL Group, ACI Agrolink, Kazi Farms, Paragon Group, City Group, and Akij are the primary drivers of formal logistics investment. These entities are vertically integrating their supply chains, investing in private carriage fleets, collection hubs, and industrial processing facilities to secure raw material quality (Larive International B.V. & LightCastle Partners Ltd., 2023; VetEffecT Consultancy & Recruiting, 2023; Gazi, 2020).

**SMEs and Intermediaries:** This group includes cold storage owners (primarily for potatoes), rice millers, and transport fleet owners. While numerous, their investments are often fragmented and lack modern technological integration (JICA, 2021).

**Foreign Direct Investors (FDI):** Foreign interest is nascent but growing. Notable examples include Nippon Express, which acquired a stake in Cold Chain Bangladesh Limited, and Sumitomo Corporation, indicating a shift toward global-standard logistics partnerships (Mordor Intelligence, 2019; Innovision Consulting Private Limited, 2016).

### 5.1.2 Public Sector and Government Agencies

The public sector actors in Bangladesh's agro-logistics sector can be categorized by their respective segments. The following table outlines the critical actors, their roles, facilities, infrastructure, and investment offers within the public services sector of Bangladesh's agro-logistics industry.

**Table 5: Critical Actors and Factors in Public Services for Agro-Logistics**

Critical Actor	Key Functions & Factors in Agro-Logistics	Facilities & Infrastructure Provided	Attractive Offers, Incentives & Schemes
<b>Bangladesh Agricultural Development Corporation (BADC)</b>	<p><b>Input Supply Chain Control:</b> Controls the supply chain for agricultural inputs, specifically seeds and non-nitrogen fertilizers.</p> <p><b>Seed Multiplication:</b> Plays a dominant role in the production and supply of quality seeds (rice, wheat, jute, potato).</p>	<p><b>Seed Processing Centers:</b> Operates facilities for seed multiplication and preservation.</p> <p><b>Irrigation Infrastructure:</b> Manages irrigation projects, including the installation of deep tube wells and solar-operated pumps.</p> <p><b>Cold Storage:</b> Maintains some public cold storage facilities, primarily for potatoes.</p>	<p><b>Quality Seed Supply:</b> Targets supplying 250,000 MT of high-quality seeds to improve productivity.</p> <p><b>Input Distribution Network:</b> Utilizing its own channels and selected distributors to ensure input availability.</p>
<b>Bangladesh Investment Development Authority (BIDA)</b>	<p><b>Investment Facilitation:</b> The primary authority for promoting and overseeing private investment, including agribusiness.</p> <p><b>Regulatory Simplification:</b> Acts as the nodal agency for the</p>	<p><b>Online OSS Platform:</b> Provides a digital platform for company registration, land registration, and utility connections.</p>	<p><b>Accelerated Services via OSS:</b> Company registration: 1–7 days Land registration: 28 days. Environmental clearance: 7–45 days. Utility connections</p>

	"One-Stop Service" (OSS) to streamline business setups.		(Gas/Electricity): 5–30 days.
<b>Public Private Partnership (PPP) Authority</b>	<p><b>Infrastructure Development:</b> Facilitates partnerships to build large-scale logistics infrastructure that requires significant capital.</p> <p><b>Logistics Hubs:</b> Focuses on port and storage infrastructure to relieve pressure on state-operated terminals.</p>	<p><b>Terminal Operations:</b> Developing food import/export clearance and storage services (e.g., at Pangaon and Mongla ports) via concessions.</p> <p><b>Agro-Processing Zones:</b> Promoting the establishment of agro-processing zones through PPP models where the government provides land.</p>	<p><b>Risk Sharing:</b> Allows the private sector to operate infrastructure while the government provides land and basic utilities.</p> <p><b>Concessions:</b> Long-term operational rights for logistics hubs (e.g., La Unión port hub).</p>
<b>Economic Zones (EZ) &amp; Export Processing Zones (EPZ)</b>	<p><b>Industrial Clustering:</b> Provides designated areas with "plug-and-play" infrastructure to encourage rapid economic development and export-oriented production.</p> <p><b>Land Allocation:</b> Solves the critical issue of industrial land scarcity for agro-processors.</p>	<p><b>Serviced Industrial Plots:</b> Plots equipped with gas, electricity, and water connections.</p> <p><b>Sabroom LCS &amp; SEZ:</b> Designated trade routes and zones to facilitate cross-border logistics.</p>	<p><b>Fiscal Incentives:</b> Tax holidays (5–7 years, up to 15 years for power). Duty-free import of machinery. 100% foreign equity allowed. Full repatriation of capital and profits.</p>
<b>Ministry of Agriculture (MoA)</b>	<p><b>Policy Formulation:</b> The core ministry for agricultural development, overseeing agencies like DAE, DAM, and BADC.</p> <p><b>Project Implementation:</b> Implements large-scale</p>	<p><b>Research &amp; Extension:</b> Oversees research institutes (BARI, BRRI) and extension networks (DAE) that support post-harvest management.</p>	<p><b>Subsidies &amp; Grants:</b> Subsidies for farm mechanization (harvesters, etc.). Innovation funds for scaling up post-harvest processing</p>

	projects like PARTNER to transform agriculture.	<b>Technology Villages:</b> Establishing growth centers and technology villages under the PARTNER program.	technologies and food safety facilities.
<b>Ministry of Commerce (MoC)</b>	<b>Trade Regulation:</b> Controls and promotes domestic and foreign trade.  <b>Export Promotion:</b> Works through the Export Promotion Bureau (EPB) to facilitate access to international markets.	<b>Trade Information Centers:</b> EPB provides platforms connecting exporters with foreign importers.  <b>Business Promotion Councils:</b> Specifically the Agro-Products Business Promotion Council (APBPC) for policy advocacy.	<b>Cash Incentives:</b> 20% cash incentive for exporting agro-processed products. 10% incentive for frozen food exports. Tax exemptions for "Thrust Sectors" like agro-processing.
<b>Department of Agricultural Marketing (DAM)</b>	<b>Market Regulation:</b> Responsible for creating a favorable business environment for traders and consumers.  <b>Price Monitoring:</b> Collects and disseminates wholesale and retail price data.	<b>Market Infrastructure:</b> Construction and renovation of wholesale markets and assembly centers.  <b>Online Pricing:</b> Dissemination of market price information via websites.	<b>Market Linkages:</b> Facilitates connections between farmers and markets, though often constrained by capacity.
<b>Bangladesh Infrastructure Finance Fund Limited (BIFFL)</b>	<b>Financing Authority:</b> A state-owned Non-Bank Financial Institution (NBFI) providing long-term financing for infrastructure projects.  <b>Project Implementation:</b> Serves as the implementing agency for	<b>Green Financing:</b> Financing for energy-efficient and eco-friendly infrastructure projects.	<b>Two-Step Loan (TSL):</b> Provides concessional loans for agribusiness and food processing industries. Interest rates for end-borrowers capped at approx. 6% (significantly lower than

	donor-funded projects like the JICA Food Value Chain Improvement Project.		the 9-13% commercial rate).
<b>Infrastructure Development Company Limited (IDCOL)</b>	<b>Infrastructure Financing:</b> State-owned NBFI focusing on renewable energy and physical infrastructure. <b>Cold Chain Focus:</b> financing energy-efficient cold chain solutions.	<b>Solar Irrigation:</b> Financing for solar-powered irrigation pumps. <b>Renewable Energy Infrastructure:</b> Financing for biogas and solar projects that can power off-grid cold storage.	<b>Long-term Credit:</b> Offers financing for physical infrastructure and energy efficiency projects essential for cold chain operations.

Source: Synthesized from Japan International Cooperation Agency (JICA). (2021). People's Republic of Bangladesh Ministry of Industries (MoInd) Bangladesh Infrastructure Finance Fund Limited (BIFFL) People's republic of Bangladesh preparatory survey for food value chain improvement project final report. JICA; Gazi, Md. A. I. (2020). Supply chain management for agro products in Bangladesh; logistics support for capturing market by ensuring balanced distribution. International Journal of Management, Accounting and Economics, 7(6), 277–294; Ahmed, A., Mehrab Bakhtiar, M., Mahzab, M., Al-Hasan, M., Anowar, S., Ghostlaw, J., Mir, R., Islam, R., Kabir, A., Karim, Aminul, I., Khandaker, N., Shaima, R., Shamma, S., & Simi. (2024). Food security and nutrition in Bangladesh: Evidence-Based strategies for advancement. IFPRI; International Finance Corporation (IFC). (2021, December 7). Ripe for investment. IFC; Larive International B.V., & LightCastle Partners Ltd. (2023). Poultry sector study Bangladesh revise 2023. Netherlands Enterprise Agency; World Bank. 2022. Agrifood systems in Northern Central America: Agrologistics for modern family farms. Garcia, A., Perego, V.M.E., Prasann, A., Millán, F., Horton, J., Bueso, F.J., Channa, H., Mora, E., Traverso, M.V., Horst, A.C., Benjamin, M.P. © World Bank; Innovision Consulting Private Limited. (2016). Study on the roles and opportunities for private sector in agro-food processing industry of Bangladesh. Swiss Contact; Larive International & LightCastle Partners. (2021). Aquaculture sector study Bangladesh. Netherlands Enterprise Agency; Climate Resilient Food Systems Alliance. (2023). Bangladesh A country diagnostics conducted by climate resilient food systems alliance. Climate Resilient Food Systems Alliance; The World Bank. (2022). The world bank program on agricultural and rural transformation for nutrition, employment, and resilience in Bangladesh(PARTNER) (P176374); Mordor Intelligence. (2019). Bangladesh frozen food market size & share analysis - growth trends and forecast (2025 - 2030); Advance Consulting, Resilience Consulting, & Edge Consulting. (2021). Horticulture study of Bangladesh. In Ref No. # 202011095 / PST20BD02. Netherlands Enterprise Agency.

### 5.1.3 International Actors

The international actors in Bangladesh's agro-logistics ecosystem can be categorized by their respective segments. The following table details their roles, country of origin, and respective engagements/investments.

**Table 6: International Actors in Bangladesh Agro-Logistics Ecosystem**

Segment / Sub-sector	Actor / Organization	Country	Functions / Role	Engagement & Investment Details
Logistics & Cold Chain	Nippon Express Holdings	Japan	Logistics Service Provider (3PL)	Acquired a 20% equity stake in Cold Chain Bangladesh Limited (CCBL) to provide end-to-end logistics and warehousing services.

	<b>LixCap</b>	USA	Advisory & Investment	Provides business advice for cold chain development; identified \$2.4 billion in annual post-harvest losses to justify investment in temperature-controlled logistics.
	<b>Celtic Cooling</b>	Netherlands	Technology Provider	Designs and installs energy-efficient refrigeration and climate control systems for cold storage.
	<b>Yusen Logistics</b>	Japan	Logistics Service Provider	Identified as a major market leader operating in the Bangladesh cold chain market.
<b>Aquaculture &amp; Fisheries</b>	<b>WorldFish (CGIAR)</b>	International (HQ: Malaysia)	Research & Innovation	Implements projects like ECOFISH-BD; focuses on value chain innovation, genetics (hatcheries), and reducing post-harvest losses.
	<b>Charoen Pokphand (CP) Foods</b>	Thailand	Input Supplier & Integrator	Major player in aqua-feed and poultry feed; engages in contract farming and supplies hatcheries/feeds.
	<b>Skretting (Nutreco)</b>	Netherlands / Norway	Feed Manufacturer	Produces high-quality fish and shrimp feed; identified as a potential partner for feed efficiency improvements.
	<b>De Heus</b>	Netherlands	Feed Manufacturer	Produces complete range feeds and concentrates; active in Bangladesh to

				support animal protein value chains,.
	<b>Solidaridad Network</b>	Netherlands (Global)	NGO / Development Partner	Implements the SaFaL II project in the coastal region to improve market linkages, food safety, and logistics for shrimp and dairy.
<b>Dairy &amp; Livestock</b>	<b>World Bank</b>	International (HQ: USA)	Development Financier	Approved \$500 million credit for the Livestock and Dairy Development Project (LDDP) to improve productivity, market access, and climate resilience for 2 million smallholders.
	<b>Heifer International</b>	USA	NGO / Capacity Building	Works with women farmers in Northern Bangladesh to improve value chains in dairy, beef, and goat sectors.
	<b>Nestlé</b>	Switzerland	Processor / Buyer	Active in the dairy market; engages in sourcing and processing milk products,.
	<b>American Dairy Limited</b>	USA / Bangladesh	Genetic Improvement / AI	Involved in Artificial Insemination (AI) programs to improve cattle breeds.
	<b>Danida</b>	Denmark	Donor	Financed the Rural Microenterprise Transformation Project (RMTP) with PKSF to develop safe meat and dairy product markets.

<b>Horticulture (Fruits &amp; Veg)</b>	<b>Syngenta</b>	Switzerland / China	Input Supplier (Seeds/ Chemicals)	Supplies crop protection and hybrid seeds; utilizes extensive retail network to reach farmers.
	<b>Bayer Crop Science</b>	Germany	Input Supplier	Active in crop protection and hybrid seed distribution.
	<b>East West Seed</b>	Netherlands / Thailand	Seed Company	Produces and distributes tropical vegetable seeds; focuses on knowledge transfer to farmers.
	<b>USAID (DAI)</b>	USA	Development Partner	Implemented the Agricultural Value Chains (AVC) project to strengthen fruit/vegetable value chains in the Southern Delta.
	<b>Naktuinbouw</b>	Netherlands	Regulatory / Inspection Support	Dutch inspection service for horticulture; identified as a potential partner to support Bangladesh in phytosanitary systems and variety protection.
<b>Cross-Cutting / Policy &amp; Finance</b>	<b>JICA</b>	Japan	Development Partner	Implements the Food Value Chain Improvement Project; provides Two-Step Loans (TSL) via BIFFL to finance agribusiness and food processing industries.
	<b>IFC (World Bank Group)</b>	International	Private Sector Investor	Providing financing to private agribusinesses (e.g., PRAN) and working with Green Delta Insurance

				to develop weather index-based agriculture insurance.
<b>Swisscontact</b>	Switzerland	Technical Assistance	Implemented the Katalyst project (market systems development) to improve competitiveness in agro-processing and vegetable sectors.	
<b>Embassy of the Kingdom of the Netherlands (EKN)</b>	Netherlands	Donor / Strategic Partner	Designated Bangladesh as a transitional partner; commissions sector studies (Dairy, Horticulture, Poultry) to facilitate Dutch-Bangla trade and investment.	
<b>FAO</b>	United Nations	Technical Assistance	Leads the 3ADI+ program (with UNIDO) for dairy and beef value chain development; supports food safety and nutrition security policies.	

Source: Synthesized from Data Bridge Market Research. (2025, December). Bangladesh cold chain market size, share and trends analysis report – industry overview and forecast to 2033; Mordor Intelligence. (2019). Bangladesh frozen food market size & share analysis - growth trends and forecast (2025 - 2030); The Business Standard. (2024a, February 28). Bangladesh faces \$2.4b annual post-harvest losses: LixCap; Apu, N. A. (2014). Farmed fish value chain development in Bangladesh: Situation analysis and trends worldfish/ILRI Project Report (pp. 6–107). International Livestock Research Institute (ILRI); Innovation Consulting Private Limited. (2016). Study on the roles and opportunities for private sector in agro-food processing industry of Bangladesh. Swiss Contact; Kabir, R. I., Narayanan, S., Belton, B., Hernandez, R., & Haque, M. M. (2019). Shrimp value chain in Bangladesh. Jahangirnagar University Journal of Marketing (JUJM), 7(8), 7–30; The Business Standard. (2025a, January 18). Building a resilient poultry supply chain in Bangladesh; Larive International & LightCastle Partners. (2021). Aquaculture sector study Bangladesh. Netherlands Enterprise Agency; Larive International B.V., & LightCastle Partners Ltd. (2023). Poultry sector study Bangladesh revise 2023. Netherlands Enterprise Agency; VetEffect Consultancy & Recruiting. (2023). Sector study dairy Bangladesh. In REF: PSTzoBDo3. Netherlands Enterprise Agency; Oman, S., & Liang, W. (2019). The dairy and beef value chain in Bangladesh Diagnostics, investment models and action plan for development and innovation. Food and Agriculture Organization of the United Nations (FAO) and the United Nations Industrial Development Organization (UNIDO); Rashid, S. M. H. U. (2022). Safe meat & dairy product market development sub-project. Palli Karma-Sahayak Foundation (PKSF); Ahmed, A., Mehrab Bakhtiar, M., Mahzab, M., Al-Hasan, M., Anowar, S., Ghostlaw, J., Mir, R., Islam, R., Kabir, A., Karim, Aminul, I., Khandaker, N., Shaima, R., Shamma, S., & Simi. (2024). Food security and nutrition in Bangladesh: Evidence-Based strategies for advancement. IFPRI; Advance Consulting, Resilience Consulting, & Edge Consulting. (2021). Horticulture study of Bangladesh. In Ref No. # 202011095 / PSTzoBDo2. Netherlands Enterprise Agency; Japan International Cooperation Agency (JICA). (2021). People's Republic of Bangladesh Ministry of Industries (MoInd) Bangladesh Infrastructure Finance Fund Limited (BIFFL) People's republic of Bangladesh preparatory survey for food value chain improvement project final report.

## 5.2 Capital Mobilization: How the Sector Gathers Funds

The mechanism for gathering capital varies drastically between the formal and informal segments of the market.

### **5.2.1 Formal Financing Channels**

**Commercial Banking & Refinancing Schemes:** The Bangladesh Bank mandates that private banks allocate a percentage of their portfolio to agriculture. Specific refinance schemes exist for agro-processing and dairy, offering concessional interest rates (e.g., 4%–10%) to encourage capital expenditure in machinery and cold chain infrastructure (JICA, 2021).

**Non-Bank Financial Institutions (NBFI)**s: Institutions such as IDLC Finance and IPDC finance SMEs and corporate agro-processors, often focusing on machinery procurement and facility expansion (JICA, 2021).

**Equity and Grants:** Large investments often utilize a mix of equity and donor-backed matching grants (e.g., USAID projects) to fund high-risk infrastructure like cold chains (Innovision Consulting Private Limited, 2016).

### **5.2.2 Informal Financing (The "Dadon" System)**

For the vast majority of the "first mile" logistics (production to aggregation), capital is gathered through the Dadon system. This is a tied-credit arrangement where traders (Araatdars or Mahajans) provide advance cash to farmers or smaller aggregators. In exchange, the borrower is obligated to sell their produce to the lender, often at a predetermined or suppressed price (Innovision Consulting Private Limited, 2014; Coulter & Disney, 1987). This system finances working capital for harvest and initial transport, but restricts the farmer's ability to invest in better logistics or to choose alternative markets (Shafiuddin, 2021).

### **5.2.3 International Sourcing for Agro-Logistics Ecosystem Solution**

The agro-logistics ecosystem in Bangladesh relies heavily on imports for hardware (machinery, vehicles) and technology. While high-end technology is sourced from Europe, the USA, and Japan, cost-effective solutions are predominantly sourced from China and India. The trade structure involves formal importers (large conglomerates and agents) who supply to both formal processors and informal intermediaries.

*Table 7: International Sources for Agro-Logistics Ecosystem Solutions*

Segment / Category	Source Country / Region	Exporters / Sellers (International Brands/Types)	Importers / Buyers (Domestic)	Trade Volume / Monetary Value / Specifics
<b>Refrigerated Transport (Reefers)</b>	<b>Malaysia</b> (Cooling Units) <b>India</b> (Vehicle Chassis)	<b>Exporters:</b> Manufacturers in Malaysia (cooling units) and India (vans/chassis)	<b>Formal:</b> Logistics companies, Large Processors (e.g., PRAN, Kazi Farms). <b>Informal:</b> Transport agencies renting to intermediaries.	<b>Unit Cost:</b> Approx. BDT 3.0 million (USD 35,000) per van. <b>Fleet Size:</b> <1% of total transport fleet is refrigerated. <b>Projected Need:</b> Investment need for new vans estimated at USD 43.1 million.
<b>Food Processing Machinery (General)</b>	<b>Germany, Italy, Netherlands, Denmark, USA, Japan, Australia</b>	<b>Exporters:</b> Global manufacturers of processing, packaging, and utility equipment.	<b>Formal:</b> Large conglomerates (PRAN, Akij, Square). <b>Importers/Agents:</b> Royal International, Ahmed Agro Agency, Orion Associates, Sumaiya Corp.	<b>High-End Investment:</b> Large conglomerates primarily seek quality/tech transfer from these nations. <b>Import Duty:</b> Machinery for preparing animal feed has a 1% statutory import duty rate.
<b>Potato Processing Line</b>	<b>India, China</b> (Low/Mid Tech)	<b>Exporters:</b> Chinese and	<b>Formal:</b> Potato chip/flake	<b>Cost Comparison:</b> India/China Line:

	<b>Industrialized Nations</b> (High Tech)	Indian manufacturers.	manufacturers (e.g., Bombay Sweets).	BDT 50–70 million. <b>Industrialized Line:</b> BDT 200 million
<b>Filling Machines (Packaging)</b>	<b>China, Japan</b>	<b>Exporters:</b> Chinese and Japanese manufacturers.	<b>Formal:</b> Snack and processed food manufacturers.	<b>Cost Comparison:</b> China: BDT 1 million. Japan: BDT 10 million.
<b>Post-Harvest Technology (Horticulture)</b>	<b>India, China</b> (Current dominant) <b>Netherlands</b> (Potential)	<b>Exporters:</b> Current technology is mainly sourced from India/China due to price competitiveness. <b>Potential:</b> Dutch companies for grading/sorting.	<b>Formal:</b> Service providers and large agribusinesses. <b>Informal:</b> Traders (limited adoption).	<b>Market Situation:</b> Low-cost solutions preferred. Dutch tech viewed as high-quality but currently less prevalent due to cost.
<b>Poultry &amp; Feed Machinery</b>	<b>China, Taiwan, Netherlands</b>	<b>Exporters:</b> China: Changzhou Fengyu Silo. Taiwan: Chia Tung Development. Netherlands: Almex, Ottevanger, Van Aarsen.	<b>Formal:</b> Feed millers (e.g., Paragon, Nourish). <b>Importers:</b> Chicks & Feeds Ltd (Supply & install).	<b>Sector Impact:</b> 50% of aqua feed ingredients are domestic; the remainder is imported. The feed equipment sector is heavily import-dependent.
<b>Cold Chain Logistics Services (FDI)</b>	<b>Japan</b>	<b>Investor:</b> Nippon Express Holdings, Yusen Logistics.	<b>Partner:</b> Cold Chain Bangladesh Limited (CCBL).	<b>Investment:</b> Nippon Express acquired a 20% equity stake in CCBL to provide

				integrated logistics
<b>Packaging Materials (Flexible)</b>	<b>Global / Mixed</b>	<b>Exporters:</b> Raw material suppliers from various countries. <b>Local Production:</b> 60% produced domestically.	<b>Formal:</b> Food processors. <b>Association:</b> Bangladesh Flexible Packaging Industries Association.	<b>Volume:</b> ~40% of flexible packaging is imported directly. Domestic production saves 25–30% of costs.
<b>Genetics (Poultry &amp; Fish)</b>	<b>France, USA, Netherlands, Thailand</b>	<b>Exporters:</b> Poultry: Cobb, Hubbard (via integrators like Kazi/CP). <b>Aqua:</b> Hendrix Genetics, Til Aqua (Netherlands), CP (Thailand).	<b>Formal:</b> Hatcheries, Integrated Farms (Kazi, Paragon, CP).	<b>Structure:</b> Grand Parent (GP) stock is imported to produce Parent Stock locally.
<b>Bulk Commodities (Wheat/Maize)</b>	<b>Global Market</b>	<b>Exporters:</b> Global grain traders <b>Origins:</b> Brazil, USA (Soy/Corn).	<b>Formal:</b> Directorate General of Food (Public), Private Flour/Feed Mills.	<b>Wheat:</b> ~85% imported (6–7 million MT), costing USD 2.0–2.5 billion/year. <b>Feed:</b> Heavy reliance on imported corn/soy for feed mills.

Source: Synthesized from Japan International Cooperation Agency (JICA). (2021). People's Republic of Bangladesh Ministry of Industries (MoInd) Bangladesh Infrastructure Finance Fund Limited (BIFFL) People's republic of Bangladesh preparatory survey for food value chain improvement project final report. JICA; Innovision Consulting Private Limited. (2016). Study on the roles and opportunities for private sector in agro-food processing industry of Bangladesh. Swiss Contact; Advance Consulting, Resilience Consulting, & Edge Consulting. (2021). Horticulture study of Bangladesh. In Ref No. # 202011095 / PST2oBD02. Netherlands Enterprise Agency; Larive International & LightCastle Partners. (2021). Aquaculture sector study Bangladesh. Netherlands Enterprise Agency; Larive International B.V., & LightCastle Partners Ltd. (2023). Poultry sector study Bangladesh revise 2023. Netherlands Enterprise Agency; FAO. (2019). Developing sustainable value chains for small-scale livestock producers. Edited by G. Leroy & M. Fernando. FAO Animal Production and Health Guidelines No. 21. Rome; Mordor Intelligence. (2019). Bangladesh frozen food market size & share analysis - growth trends and forecast (2025 - 2030); Shafiuiddin, M. (2021). Assessment of value chain for commercially important fish marketing approach in Bangladesh. Social Change, 10(1), 140–164; Kabir, R. I., Narayanan, S., Belton, B., Hernandez, R., & Haque, M. M. (2019). Shrimp value chain in Bangladesh. Jahangirnagar University Journal of Marketing (JUJM), 7(8), 7–30.

## 5.3 Deployment of Capital: Where is the Money Going?

Investments are currently heavily skewed toward specific commodities and supply chain nodes.

**Cold Storage (Potato Dominance):** Bangladesh possesses approximately 400–450 cold storage units with a capacity of ~5.5 million MT. However, 90–95% of this capacity is dedicated exclusively to potatoes. Capital deployment for multi-commodity cold storage (fruits, vegetables, fish) remains negligible due to higher technical complexity and energy costs (Larive International & LightCastle Partners, 2021; JICA, 2021).

**Transport Logistics:** Investment in transport is dominated by ambient vehicles. Less than 1% of the agricultural transport fleet is refrigerated. Private sector capital is primarily used to procure open trucks and covered vans, with limited recent investment in reefer vans by export-oriented firms (JICA, 2021).

**Processing Infrastructure:** Significant capital has been invested in processing facilities (juice, snacks, dairy) by conglomerates such as PRAN and Akij to capture higher-value margins. This drives demand for upstream logistics to feed these factories (Innovision Consulting Private Limited, 2016; VetEffecT Consultancy & Recruiting, 2023).

## 5.4 Emerging Trends and Financial Projection for the Next Ten Years

### 5.4.1 Emerging Trends in the Bangladesh Agro-Logistics Industry

The agro-logistics landscape in Bangladesh is currently undergoing a structural transformation driven by the convergence of policy reform, infrastructure development, and technological adoption. A primary trend is the diversification of cold chain infrastructure; investors and operators are shifting focus from traditional potato-centric cold storage (which currently constitutes 90-95% of capacity) toward multi-commodity, temperature-controlled facilities capable of handling high-value perishables like fruits, vegetables, and fisheries (The Business Standard, 2024a). This is supported by a surge in private sector and Foreign Direct Investment (FDI), exemplified by Nippon Express's entry into the market and local conglomerates like PRAN and ACI expanding vertically integrated supply chains to secure raw material quality

(Mordor Intelligence, 2019). Digitalization is emerging as a critical enabler, with startups like iFarmer and Chaldal introducing blockchain for traceability and utilizing app-based aggregation to bypass traditional intermediaries, thereby improving price transparency and reducing the "inventory carrying" administrative costs (Aziz et al., 2025; Rifat et al., 2024). Furthermore, the sector is being reshaped by the National Logistics Policy and infrastructure mega-projects (such as the Padma Bridge and Bay Terminal), which are reducing transit times and integrating multimodal transport options (*Bangladesh's Freight and Logistics Industry: Role in Economic Development and Policy Impact*, n.d.). Finally, the impending LDC graduation in 2026 is acting as a catalyst for compliance-driven investments in HACCP and GAP standards to maintain export competitiveness in frozen foods and fisheries (BIDA, 2022).

#### **5.4.2 Long-Term Financial Projection (FY 2023-2024 to FY 2033-2034)**

**Baseline:** The total agro-logistics market size is estimated at approximately USD 10.28 Billion (1256.71 Billion BDT) as of FY 2023-24.

##### **Growth Drivers (Emerging Trends):**

**Value Capture from Waste:** The gradual recovery of the USD 2.4 billion annual post-harvest loss through improved cold chains will directly expand the formal market value (The Business Standard, 2024a).

**LDC Graduation (2026):** Mandatory compliance with global standards (HACCP/GAP) post-2026 will force a shift from low-cost informal logistics to higher-value, professional services.

**Urbanization:** With the urban population approaching 100 million by 2040, demand for processed and packaged food (requiring Value-Added Services) will increase exponentially.

**Investment Influx:** The projection accounts for the entry of FDI (e.g., Nippon Express) and the expansion of digital aggregators (e.g., iFarmer), which will monetize previously informal "first-mile" activities.

**Growth Rate (CAGR):** A conservative Compound Annual Growth Rate (CAGR) of ~9% is applied. This reflects the transition from a subsistence logistics model to a semi-industrialized one, outpacing standard agricultural GDP growth due to the "catch-up" effect in infrastructure.

**Table 8: Long-Term Financial Projection: Agro-Logistics Industry (FY 2023-34)**

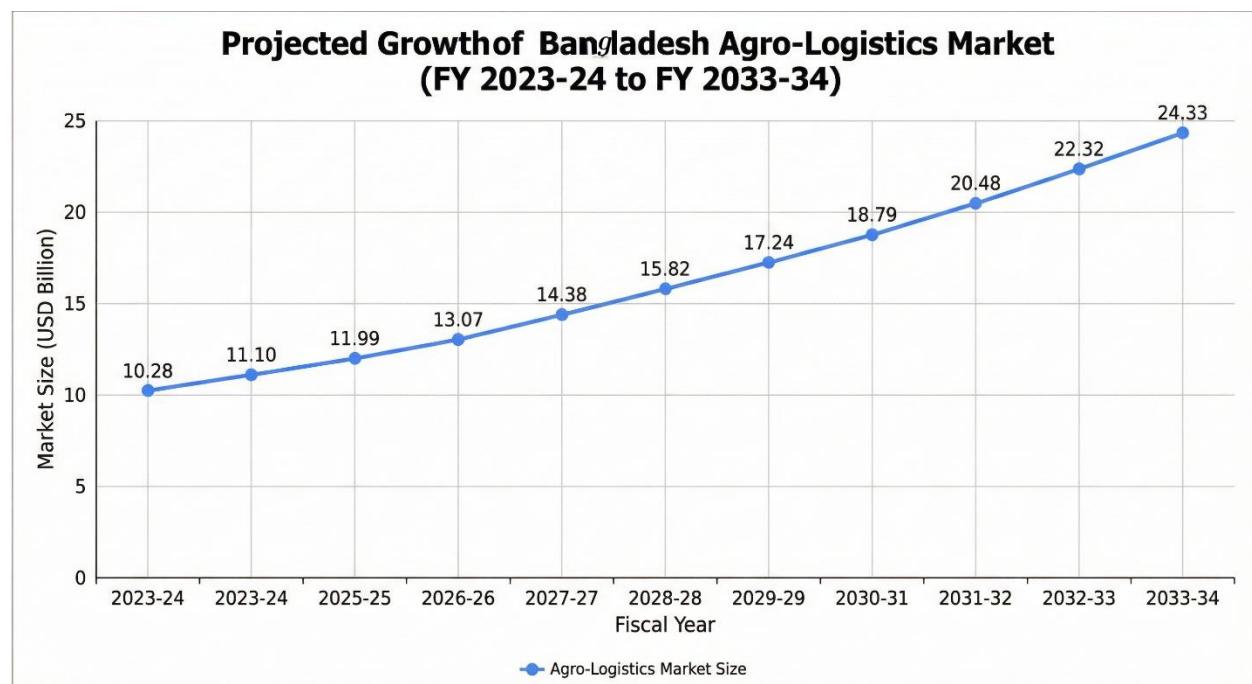
Fiscal Year	Market Size (USD Billion)	Market Size (BDT Billion)*	Growth Phase & Key Drivers
<b>2023-24</b>	10.28	1,256.71	Baseline. Current state is dominated by potato storage and ambient transport.
<b>2024-25</b>	11.10	1,357.25	The Investment Phase: Initial deployment of World Bank/JICA funds (PARTNER/LDDP projects) improves first-mile aggregation.
<b>2025-26</b>	11.99	1,465.83	Digital Integration: Expansion of "Tech-Enabled Collection Centers" and digital aggregators (e.g., iFarmer) formalizing rural logistics.
<b>2026-27</b>	13.07	1,597.75	LDC Graduation Impact: Sharp rise in value-added services (packaging/grading) to meet strict international compliance for exports.
<b>2027-28</b>	14.38	1,757.53	Cold Chain Diversification: Shift from potato-only storage to multi-commodity hubs for high-value perishables (fruits/fish).
<b>2028-29</b>	15.82	1,933.28	Infrastructure Dividends: Full operational benefits of mega-projects (Padma Bridge, Bay Terminal) reducing transit times and costs.
<b>2029-30</b>	17.24	2,107.28	Processing Boom: Increased domestic processing of dairy and meat reduces import reliance, driving demand for industrial logistics.
<b>2030-31</b>	18.79	2,296.93	TCL Market Realization: Temperature-Controlled Logistics (Cold Chain) sub-sector reaches maturity, contributing significantly to total value.
<b>2031-32</b>	20.48	2,503.66	Export Scale-Up: Bangladesh becomes a regional hub for halal meat and frozen fish exports, utilizing certified cold chains.

<b>2032-33</b>	22.32	2,728.99	Urban Standardization: Modern retail (supermarkets) dominates urban food distribution, mandating traceable, cold-chain logistics.
<b>2033-34</b>	24.33	2,974.60	Projected Maturity: The sector evolves into a fully integrated, tech-driven ecosystem, reclaiming the majority of the initial \$2.4B waste as economic value.

Note: Exchange Rate Assumption: Constant baseline rate of approx. 122.2 BDT/USD as derived from the FY 2023-24 baseline to maintain consistency.

#### Strategic Insight for Investors:

This projection indicates that the market size will likely more than double over the next decade. The primary engine of this growth is not merely increased agricultural production, but the formalization of value. By moving from "ambient, informal transport" to "temperature-controlled, digital logistics," the industry captures the value that is currently lost to spoilage and inefficiency.



**Figure 10: Agro-Logistics Market Size Trajectory**

## 5.5 Investment Landscape Mapping: Public vs. Private

The following tables illustrate the dichotomy in investment focus and scale.

**Table 9: Public vs. Private Sector Investment Focus in Agro-Logistics**

Investment Category	Public Sector Focus	Private Sector Focus
<b>Infrastructure</b>	Rural roads, landing stations, wholesale market sheds (often low-tech), public silos for cereals.	Dedicated fleet (trucks/vans), factory warehousing, processing plants, private cold storage.
<b>Commodity Focus</b>	Cereals (Rice/Wheat) for food security; Potatoes (BADC storage).	High-value horticulture, Dairy processing, Poultry integration, Fisheries (Shrimp).
<b>Source of Funds</b>	ADP (Annual Development Program), Donor Loans (WB, JICA).	Commercial Bank Loans, Equity, Reinvested Profits, Supplier Credit (Dadon).
<b>Key Gap</b>	Maintenance of facilities and modern management of wholesale markets.	First-mile cold chain (pre-cooling) and refrigerated transport for domestic markets.

Source: Synthesized from Japan International Cooperation Agency (JICA). (2021). *People's Republic of Bangladesh Preparatory Survey for Food Value Chain Improvement Project Final Report*; VetEffecT Consultancy & Recruiting. (2023). *Sector Study Dairy Bangladesh*; Islam, M. S., Akteruzzaman, M., & Ahmed, N. (2007). *Study on Marketing and Value Chain of Some Commercially Important Coastal and Marine Aquatic Products of... Bangladesh Fisheries Research Forum (BFRF)*.

**Table 10: Estimated Investment Potential vs. Current Losses (The Investment Case)**

Metric	Value / Status	Implication
<b>Annual Post-Harvest Losses</b>	US\$ 2.4 Billion	Represents the immediate "value capture" opportunity for logistics investors.
<b>Projected Cold Chain Market (2031)</b>	US\$ 440 Million	Indicates strong growth potential for logistics service providers.
<b>Existing Cold Storage Capacity</b>	~5.5 Million MT (90% Potato)	Massive undersupply for non-potato perishables (Fish, Fruits, Veg).
<b>Refrigerated Transport Penetration</b>	< 1% of total fleet	Critical bottleneck; high potential for reefer leasing models.

<b>Processing Investment (Sample)</b>	US\$ 15 Million loan to PRAN (IFC)	Shows viability of large-ticket lending to established integrators.
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Source: Synthesized from *The Business Standard*. (2024a, February 28). *Bangladesh faces \$2.4 billion annual post-harvest losses: LixCap; Japan International Cooperation Agency (JICA)*. (2021). *People's Republic of Bangladesh Preparatory Survey for Food Value Chain Improvement Project Final Report*; Innovision Consulting Private Limited. (2016). *Study on the Roles and Opportunities for Private Sector in Agro-food Processing Industry of Bangladesh*. Swiss Contact.

## 5.6 The Investment Sufficiency Gap

The mapping of the investment landscape reveals a critical structural deficit. While the current investment demand, which is driven by a \$2.4 billion annual loss and the requirement to feed 170 million people is immense; the existing investment is structurally misaligned.

**Volume Mismatch:** The projected market for temperature-controlled logistics (\$440 million by 2031) is only a fraction of the current annual economic loss (\$2.4 billion), suggesting that even with planned investments, the sector will remain undercapitalized (*The Business Standard*, 2024a).

**Asset Mismatch:** A large volume of funds is locked in potato cold storage, leading to concentration and overcapacity in some regions, while high-value commodities such as mangoes, milk, and fish face a near-total lack of commercial storage (JICA, 2021).

**Financing "Missing Middle":** While large conglomerates secure international financing (IFC/FMO) and micro-enterprises use microcredit, the "missing middle", SME logistics providers and mid-sized aggregators, lack access to affordable capital to upgrade from open trucks to reefer vehicles (JICA, 2021).

Therefore, existing public and private investments are insufficient to meet the modernization demands of Bangladesh's agro-logistics sector. Bridging this gap requires shifting capital from static storage assets to dynamic, integrated cold-chain networks and first-mile value addition.

## **5.7 Current Investment Plans**

There are substantial investment plans and ongoing projects across the agro-logistics chain in Bangladesh involving government bodies, private enterprises, and foreign entities operating through various financial modalities.

The Government of Bangladesh is actively investing in agro-logistics infrastructure through several large-scale initiatives primarily utilizing development finance and public funding modalities. A major undertaking is the Program on Agricultural and Rural Transformation for Nutrition, Employment, and Resilience (PARTNER), a US\$500 million investment financed by the World Bank using a Program-for-Results (PforR) instrument; this project aims to establish "Technology Villages," "Growth Centers," and scale up post-harvest processing technologies, including multi-chamber storage facilities and testing laboratories (The World Bank, 2021). Additionally, the government is constructing 196 new silos across 53 districts to improve the storage capacity for rice, wheat, and maize (Rahman, n.d.). In the livestock sector, the Livestock and Dairy Development Project (LDDP), backed by a US\$500 million credit from the World Bank, is strengthening value chains by financing infrastructure such as slaughterhouses and cooling facilities to improve market access and food safety (VetEffecT Consultancy & Recruiting, 2023). Furthermore, the Department of Agricultural Extension (DAE) has implemented a pilot scheme to set up 230 onion storage facilities in six districts to address post-harvest losses (Hossain, 2024). These efforts are supported by broader infrastructure mega-projects like the Padma Bridge and the Karnafuli Underwater Tunnel, which are government-funded or financed through loans, designed to enhance regional connectivity and reduce logistics bottlenecks (*Bangladesh's Freight and Logistics Industry: Role in Economic Development and Policy Impact*, n.d.).

The private sector is playing a pivotal role through direct equity investments, joint ventures, and concessional financing. Large domestic conglomerates such as PRAN-RFL Group, ACI, Golden Harvest, and Kazi Farms are heavily investing in processing capacities, cold chains, and contract farming operations (Larive International & LightCastle Partners, 2021; Mordor Intelligence, 2019; Advance Consulting et al., 2021). For instance, PRAN Group received long-

term loans amounting to US\$15 million and US\$65 million from the International Finance Corporation (IFC) to expand production capacity and integrate small farmers into the retail supply chain (JICA, 2021; Innovision Consulting Private Limited, 2016). Similarly, Golden Harvest has utilized IFC-funded loans to expand its cold chain network for frozen foods. In the fisheries sector, companies like ACI Seafood, Primus Seafood, and Alpha Seafood have made significant domestic investments in processing plants in the Satkhira, Bagerhat, and Khulna regions (Larive International & LightCastle Partners, 2021). A notable example of private innovation is Giant Agro Processing Company Limited, which, in collaboration with Dutch private sector companies, established the country's first onion processing and storage center with a 400-tonne capacity (Hossain, 2024). New entrants are also emerging; for example, in October 2024, Sharika Foods and Lovello Ice Cream PLC entered the frozen food market, expanding the sector's processing and logistics footprint (Mordor Intelligence, 2019).

Foreign countries and international entities are engaging in the sector through Foreign Direct Investment (FDI), technical assistance, and specific loan schemes. Japan is a significant actor; Nippon Express Holdings recently acquired a 20% equity stake in Cold Chain Bangladesh Limited (CCBL), marking a strategic FDI entry to provide end-to-end logistics solutions (Mordor Intelligence, 2019; Larive International & LightCastle Partners, 2021; Data Bridge Market Research, 2025). Additionally, the Japan International Cooperation Agency (JICA) is funding the Food Value Chain Improvement Project, which utilizes a Two-Step Loan (TSL) modality via the Bangladesh Infrastructure Finance Fund Limited (BIFFL) to provide concessional financing to agribusinesses for food processing, cold storage, and logistics equipment (JICA, 2021). The Netherlands is actively supporting the sector through initiatives like the SaFaL II project (implemented by Solidaridad) to improve market linkages in the coastal region and through "Impact Clusters" involving Dutch companies in areas like onion storage (VetEffecT Consultancy & Recruiting, 2023; Hossain, 2024). The United States, through USAID and USDA, is funding projects like the Agricultural Value Chains (AVC) and the Bangladesh Trade Facilitation (BTF) project, which focuses on mobilizing investment for cold chain infrastructure (The Business Standard, 2024a; Innovision Consulting Private Limited, 2016). Furthermore, China is involved through the Belt and Road Initiative (BRI), pledging

infrastructure financing that supports economic corridors like the BCIM (Bangladesh-China-India-Myanmar), which facilitates cross-border agro-logistics (*Bangladesh's Freight and Logistics Industry: Role in Economic Development and Policy Impact*, n.d.; JICA, 2021).

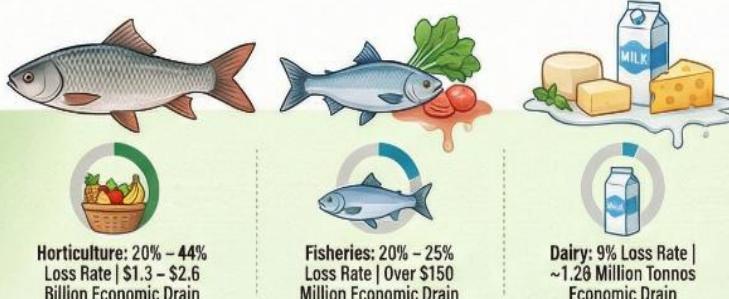
The investment modalities are diverse, ranging from Public-Private Partnerships (PPPs) to specific credit lines. The PPP model is increasingly being adopted for high-value infrastructure; for instance, the government is promoting PPPs to establish agro-processing zones and milk collection hubs where the public sector provides land and utilities while the private sector manages operations (Oman & Liang, 2019; Innovision Consulting Private Limited, 2016). In the financial domain, the Bangladesh Bank operates refinance schemes for agro-based product processing industries, offering lower interest rates to encourage capital investment (JICA, 2021). Moreover, international development partners are leveraging blended finance and matching grants, such as those under the LDDP to de-risk private investments in small-scale chilling and processing facilities (VetEffecT Consultancy & Recruiting, 2023; JICA, 2021). This multifaceted investment landscape indicates a structural shift towards modernizing Bangladesh's agro-logistics chain through a combination of state-led infrastructure development, private sector operational expansion, and strategic foreign technical and financial cooperation.

# The Bangladesh Agro-Logistics Investment Funnel: Bridging the \$2.4 Billion Gap

## FROM POTENTIAL TO REALITY **REALITY**

Estimated value of fruits and vegetables lost annually due to post-harvest inefficiencies.

**\$2.4 BILLION  
ANNUAL POTENTIAL**



## PROJECTED PROJECTED MARKET

Expected size of the temperature-controlled logistics market in Bangladesh by 2031.

**\$440 MILLION  
PROJECTED MARKET**



## THE STRUCTURAL BOTTLENECK

### THE FINANCIAL BARRIER:

Lack of long-term, low-interest capital for non-potato cold chains and reefer transport.

## CURRENT 'ACTUAL FLOW' STAGNATION

Logistics currently limited to ad-hoc machinery imports and static, potato-only storage.

**Current Stagnation**



**95% POTATO-CENTRIC STORAGE:**  
Almost all existing cold storage capacity is specialized for potatoes, leaving other perishables underserved.



**<1% REFRIGERATED TRANSPORT:**  
Less than 1% of the current agricultural transport fleet is refrigerated or insulated.

*Figure 11: Investment Landscape of Bangladesh Agro-Logistics Market*

## 6. Mapping of the Financial Instruments and Landscape

### 6.1 Overview of the Financial Landscape

The financial landscape for agro-logistics in Bangladesh is characterized by a "dual economy" structure. On one end, large conglomerates and industrial processors access low-cost international capital and formal banking facilities. On the other end, the vast majority of smallholder farmers, traders (Farias/Beparis), and small-scale logistics operators rely heavily on high-cost informal credit and microfinance. This dichotomy creates a financing gap known as the "Missing Middle," where Small and Medium Enterprises (SMEs) in logistics (e.g., cold chain operators, transport fleet owners) struggle to secure affordable capital for modernization (JICA, 2021).

### 6.2 Current Financial Instruments and Their Contribution

The existing financial instruments can be categorized into three distinct tiers: formal, semi-formal, and informal.

**Table 11: Mapping of Financial Instruments in Bangladesh Agro-Logistics Market**

Category	Instrument Name	Key Providers	Target Beneficiaries	Contribution to Logistics
Informal	Dadon / Dadander (Tied Credit)	Aratdars (Commission Agents), Wholesalers	Farmers, Farias, Beparis	Finances first-mile aggregation and transport. Locks producers into selling to the lender, often below market price.
	Trade Credit (Supplier/Buyer Credit)	Feed Mills, Dealers, Wholesalers	Farmers, Retailers	Lubricates the supply chain by allowing delayed payments (30-35 days) for inputs (feed/chicks) or stock.
Semi-Formal	Micro-credit	MFIIs (e.g., BRAC, ASA), NGOs	Smallholders, Micro-merchants	Provides working capital for harvest and basic transport. High interest rates (20-30%+) limit use for long-term infrastructure assets.

	Agri-Tech Finance	Startups (e.g., iFarmer, WeGro)	Smallholders, Aggregators	Facilitates capital for inputs and aggregation by connecting retail investors to farmers; increasingly financing logistics/aggregation points.
Formal	Commercial Bank Loans	Private Banks (e.g., BRAC Bank, City Bank), State Banks (BKB, RAKUB)	Large Processors, Integrators	Finances fleet acquisition, processing machinery, and large cold storage construction. Often requires heavy collateral (land/buildings).
	Refinance Schemes	Bangladesh Bank (via PFIs)	SMEs in Dairy, Agro-processing	Provides concessional funds (4-10% interest) for dairy farming and agro-processing in rural areas.
	Two-Step Loans (TSL)	Donor-backed (e.g., JICA via BIFFL)	Agribusiness & Food Processing	Long-term concessional financing for capital machinery, cold chains, and food safety compliance.
	Foreign Direct Investment (FDI)	International Investors (e.g., IFC, FMO)	Conglomerates (e.g., PRAN)	Finances major infrastructure like industrial parks, automated processing lines, and integrated logistics hubs.

Sources: Synthesized from Shafiuiddin, M. (2021). *Assessment of Value Chain for Commercially Important Fish Marketing Approach in Bangladesh*. *Social Change*, 10(1); Apu, N. A. (2014). *Farmed fish value chain development in Bangladesh: Situation analysis and trends* WorldFish/ILRI PROJECT REPORT; Larive International B.V., & LightCastle Partners Ltd. (2023). *Poultry sector study Bangladesh Revise 2023* Commissioned by the Netherlands Enterprise Agency; Ali, H., Belton, B., Haque, M. M., Hernandez, R., Jahan, K. M., Ignowski, L., & Reardon, T. (2025). *Wholesalers and the transformation of the "hidden middle" of the aquaculture value chain in Bangladesh*. *Food Security*, Springer; Ahmed, A., Mehrab Bakhtiar, M., Mahzab, M., Al-Hasan, M., Anowar, S., Ghostlaw, J., Mir, R., Islam, R., Kabir, A., Karim, Aminul, I., Khandaker, N., Shaima, R., Shamma, S., & Simi. (2024). *Food Security and Nutrition in Bangladesh: Evidence-Based Strategies for Advancement*. IFPRI; International Finance Corporation (IFC). (2021, December 7). *Ripe for Investment*.

### 6.3 Challenges of Current Financial Instruments

Despite the variety of instruments, the agro-logistics sector remains undercapitalized due to systemic bottlenecks.

**The "Dadon" Trap and Value Erosion:** The informal *Dadon* system is the dominant source of working capital for the "first mile." However, it compels farmers to sell produce to the lender

immediately after harvest, preventing them from utilizing storage to wait for better prices. This system perpetuates the "rush to market" culture, causing congestion and higher post-harvest losses (Shafiuddin, 2021; Ali et al., 2025).

**High Cost of Borrowing:** While Bangladesh Bank mandates single-digit interest rates for agriculture, in reality, microfinance rates often exceed 20-30%. For commercial loans, hidden costs and rigid terms make the effective cost of capital high, discouraging investment in low-margin logistics assets like reefer vans (Ahmed et al., 2024; JICA, 2021).

**Collateral Mismatch:** Commercial banks typically require land or buildings as collateral. However, logistics assets (e.g., trucks, plastic crates, and leasehold storage space) are often not accepted as primary security. This excludes many SME logistics providers who do not own real estate (JICA, 2021).

**The "Missing Middle":** Microfinance is too small for cold storage investment, while commercial banks view SMEs as high-risk. Consequently, medium-sized enterprises (e.g., local packhouse operators) lack access to long-term loans required for infrastructure projects with 5-10-year payback periods (JICA, 2021).

**Lack of Insurance:** The absence of comprehensive agricultural or transit insurance means that financial institutions view the sector as high-risk. Lenders are unwilling to extend credit to a sector exposed to natural disasters and perishability risks without risk-mitigation tools (World Bank Group, 2024; VetEffecT Consultancy & Recruiting, 2023).

#### **6.4 Mitigation Strategies**

To unlock investment, the financial ecosystem must evolve from asset-based lending to cash-flow and value-chain-based lending.

**Warehouse Receipt Systems (WRS):** Implementing a legal framework enables stored produce to serve as collateral. This enables farmers/traders to access credit while produce is in storage, breaking the *Dadon* cycle and incentivizing the use of modern storage facilities (World Bank, 2022; Rashid & Bashar, 2025).

**Blended Finance and Credit Guarantees:** Utilizing donor funds (e.g., from the World Bank or the Netherlands) to provide "First Loss Guarantees" can de-risk lending for commercial banks. This encourages them to lend to logistics SMEs they would otherwise reject (Larive International B.V. & LightCastle Partners Ltd., 2023).

**Equipment Financing (Leasing):** Promoting hire-purchase or leasing models for refrigerated trucks and cold storage machinery. In this model, the asset itself serves as collateral, removing the need for land mortgages (Ahmed et al., 2024).

**Digital Credit Profiling:** Integrating digital transaction data (from startups like iFarmer) into credit scoring allows banks to lend based on transaction history rather than physical collateral (Ahmed et al., 2024).

## 6.5 Suitability Argument and Selection of Best Instruments

### 6.5.1 Relative Suitability Analysis

- Informal loans are fast but exploitative and unscalable for infrastructure.
- Commercial bank loans are scalable but inaccessible to the majority due to collateral requirements.
- Microfinance has reached but is too expensive for capital-intensive logistics investments.
- Refinance Schemes (Central Bank) are theoretically ideal (low interest rates) but suffer from low disbursements due to bank reluctance and bureaucratic hurdles (JICA, 2021).

### 6.5.2 The Best Financial Instrument for Bangladesh's Agro-Logistics Industry

Based on the current ecosystem needs, the Two-Step Loan (TSL) / Refinancing Scheme, combined with Technical Assistance, is identified as the most suitable instrument.

#### Selected Instrument: Two-Step Loan (TSL) with Concessional Interest

Specifically modeled after the JICA-BIFFL Foreign Direct Investment Promotion Project (FDIPP) or similar donor-backed refinance schemes.

#### Reasons for Selection:

**Addresses the "Missing Middle":** TSLs specifically target SMEs and mid-sized agribusinesses that are ignored by microfinance and corporate banking. It provides loans up to BDT 500 million to cover the exact capital expenditure required for cold storage or processing lines (JICA, 2021).

**Long-Term Tenor:** Unlike standard bank loans (3-5 years), TSLs offer tenors of 2 to 10 years (including grace periods). This aligns with the cash flow realities of cold chain infrastructure, which has a longer payback period (JICA, 2021).

**Concessional Interest Rates:** By leveraging low-cost donor funds (e.g., JICA funds at ~0.65% to the government), TSLs can offer end-borrowers' rates around 6%, significantly lower than the market rate of 12-15%. This makes low-margin logistics businesses viable (JICA, 2021).

**Embedded Technical Assistance:** These instruments often come with capacity-building components (e.g., helping firms achieve HACCP/ISO certification). This de-risks the investment by ensuring the borrower has the technical capability to manage the logistics infrastructure efficiently (JICA, 2021).

# The "Smart" Financing Bridge for Agro-Logistics

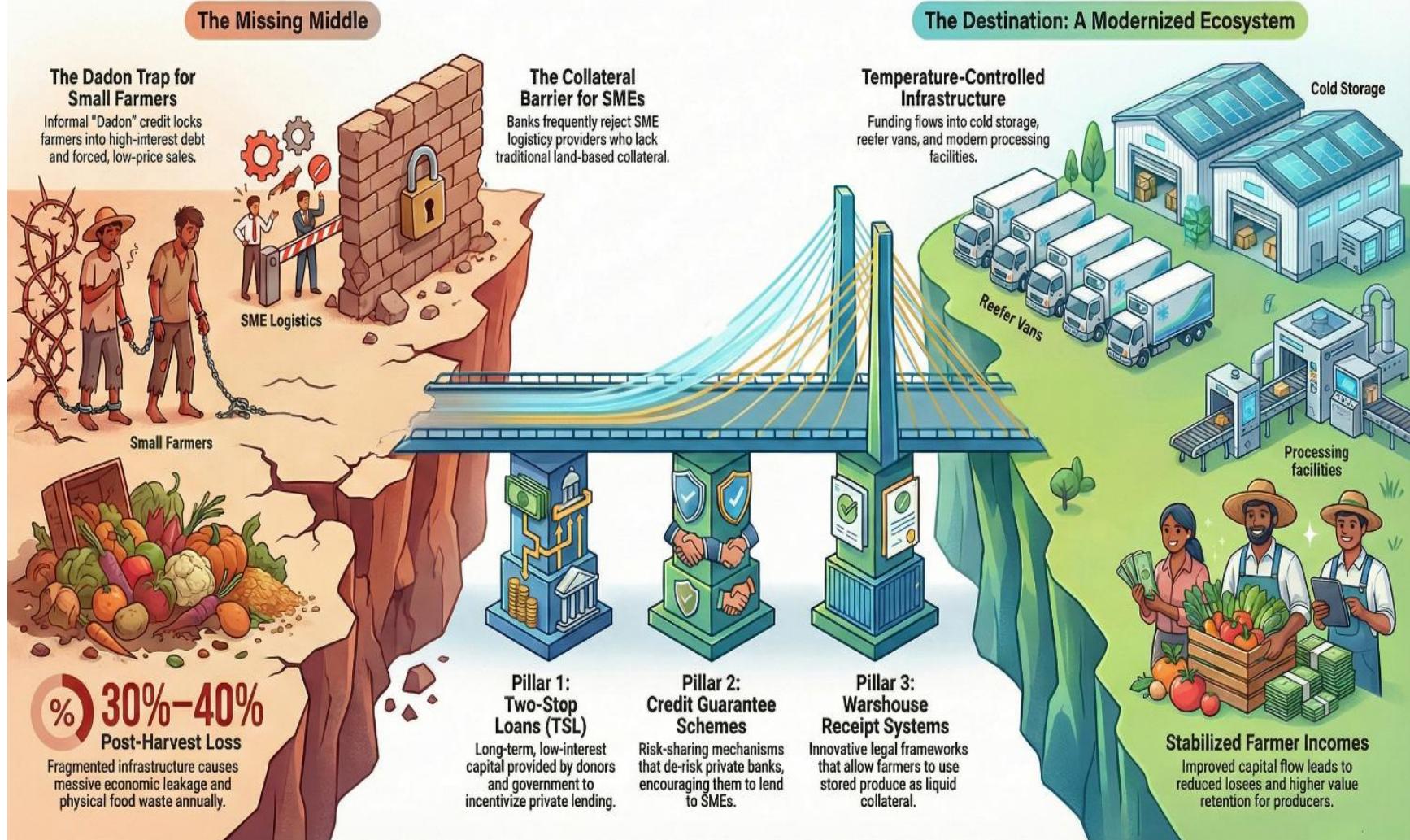


Figure 12: The Ideal Agro-Logistics Financing Ecosystem

*Table 12: Comparative Analysis of Financial Instruments*

Instrument	Interest Rate	Collateral Need	Suitability for Logistics Infrastructure	Scalability
<b>Informal (Dadon)</b>	0% (nominal) but price cut is high	Verbal/Crop Pledge	<b>Very Low</b> (Consumable/Input only)	Low
<b>Microfinance</b>	20% - 30%+	Social Guarantee	<b>Low</b> (Too expensive/small ticket)	High
<b>Commercial Loan</b>	9% - 13%	High (Land/Building)	<b>Medium</b> (Only for large corporates)	Medium
<b>Two-Step Loan (TSL)</b>	<b>5% - 6%</b>	Moderate	<b>High</b> (Tailored for Capex & SMEs)	Medium
<b>Venture/Equity</b>	N/A (Share profit)	None	<b>High</b> (For Tech/Innovation)	Low (Niche)

*Source: Synthesized from Japan International Cooperation Agency (JICA). (2021). People's Republic of Bangladesh*

*Preparatory Survey for Food Value Chain Improvement Project Final Report; Ahmed, A., Mehrab Bakhtiar, M., Mahzab, M., Al-Hasan, M., Anowar, S., Ghostlaw, J., Mir, R., Islam, R., Kabir, A., Karim, Aminul, I., Khandaker, N., Shaima, R., Shamma, S., & Simi. (2024). Food Security and Nutrition in Bangladesh: Evidence-Based Strategies for Advancement. IFPRI.*

## 7. FDI and Private Sector Engagement Opportunities

### 7.1 Overview of Engagement Potentials

The agro-logistics market in Bangladesh is transitioning from a subsistence-based, state-supported model to a commercialized, private-sector-led ecosystem. The current investment climate is characterized by a "Quiet Revolution" in the midstream segments of the value chain, wholesalers, logistics providers, and processors, who are increasingly professionalizing operations to meet rising domestic and export demand (Ali et al., 2025).

The potential for Foreign Direct Investment (FDI) is anchored in the widening gap between agricultural output (>70 million metric tons) and the capacity to manage it efficiently (BIDA, 2022). With the country graduating from Least Developed Country (LDC) status in 2026, there is an urgent need to replace informal, labor-intensive logistics with technology-driven, capital-intensive infrastructure to ensure compliance with international standards like GAP and HACCP (Mordor Intelligence, 2019). The government has designated agro-processing and logistics as "thrust sectors," offering fiscal incentives such as tax holidays and 100% foreign equity ownership to attract capital (Larive International B.V. & LightCastle Partners Ltd., 2023).

### 7.2 Why the Private Sector Engages: Drivers of Investment

Private sector participation is driven by robust market fundamentals and demographic shifts.

**Market Size & Demographics:** A population of 170 million, with a growing middle class, is driving demand for processed, safe food. Private consumption accounts for nearly 69% of GDP, fueling the need for efficient logistics to service urban centers (*Bangladesh's Freight and Logistics Industry: Role in Economic Development and Policy Impact*, n.d.; Innovision Consulting Private Limited, 2016).

**Value Capture from Waste:** The sector loses approximately US\$2.4 billion annually in post-harvest losses (20-44% for perishables) (The Business Standard, 2024a; Oman & Liang, 2019).

Investors view this leakage as a value-capture opportunity; modern logistics can reclaim this lost value.

**Export Competitiveness:** Bangladesh exports over 700 agri-products to 140+ countries.

However, export growth is stifled by poor logistics. Investing in cold chains and processing allows companies to access premium markets in the EU and the Middle East (BIDA, 2022; Advance Consulting et al., 2021).

**Production Volume:** The country is a top global producer of rice, potatoes, and freshwater fish, ensuring a consistent supply of raw materials for logistics and processing businesses (Innovision Consulting Private Limited, 2016).

### 7.3 Modes of Engagement: Private Companies and Startups

The private sector ecosystem is bifurcated between asset-heavy conglomerates and tech enabled startups.

**Conglomerates (Vertical Integration):** Large entities like PRAN-RFL, ACI, Kazi Farms, and Golden Harvest have engaged in vertical integration. They are building their own "farm-to-fork" logistics networks, including collection hubs, refrigerated transport fleets, and processing centers, to bypass inefficient intermediaries. For instance, PRAN utilizes IFC funding to expand processing and logistical capacity (Mordor Intelligence, 2019; JICA, 2021).

**Startups (Tech-Enabled Aggregation):** A new wave of startups is addressing the "first-mile" logistics gap. Companies like iFarmer and WeGro use digital platforms to aggregate produce from smallholders, providing them with inputs and finance while managing the logistics to transport goods to urban retailers or processors (*Bangladesh's Freight and Logistics Industry: Role in Economic Development and Policy Impact*, n.d.; Ahmed et al., 2024; International Finance Corporation (IFC), 2021).

**Retail-Led Logistics:** Supermarket chains like Shwapno (ACI Logistics) are establishing backward linkages with farmers, creating dedicated supply chains that require investments in sorting, grading, and temperature-controlled transport to ensure shelf-quality (Gazi, 2020; JICA, 2021).

## 7.4 Current Examples of FDI and Private Engagement

The following figure illustrates the diverse nature of recent high-profile engagements in the sector.



*Figure 13: Key Examples of Investment and Engagement in Agro-Logistics*

## 7.5 Benefits of FDI and Private Sector Engagement

The engagement of foreign and private actors generates multi-dimensional economic benefits:

**Reduction of Post-Harvest Losses:** Investments in cold chains can recover a significant portion of the \$2.4 billion in losses annually, directly boosting agricultural GDP (The Business Standard, 2024a).

**Technology Transfer:** FDI brings advanced technology (e.g., Dutch cooling systems, Japanese logistics management), which is "embedded" in the investment, raising local standards (World Bank, 2022; VetEffecT Consultancy & Recruiting, 2023).

**Market Formalization:** Corporate engagement forces a shift from informal, verbal contracts to formal, traceable supply chains, improving food safety and tax revenue generation (Kabir et al., 2019).

**Employment Generation:** The expansion of logistics hubs, processing plants, and fleet operations creates off-farm employment, absorbing rural labor (*Bangladesh's Freight and Logistics Industry: Role in Economic Development and Policy Impact*, n.d.).

## 7.6 Challenges for FDI in Agro-Logistics

Despite the potential, structural and systemic barriers impede large-scale FDI.

**Infrastructure Deficits:** While road connectivity has improved (e.g., Padma Bridge), traffic congestion and a lack of multimodal integration (rail/river) increase transit times and costs (*Bangladesh's Freight and Logistics Industry: Role in Economic Development and Policy Impact*, n.d.; World Bank, 2022).

**Energy Reliability:** Cold chain operations are energy-intensive. Unreliable power supply and high electricity costs increase operational risks for temperature-controlled warehousing (VetEffecT Consultancy & Recruiting, 2023; Data Bridge Market Research, 2025).

**Regulatory Fragmentation:** The logistics sector is governed by over 17 ministries and 28 agencies, leading to bureaucratic red tape and a lack of coordination (Kabir et al., 2019).

**The "Missing Middle" Financing Gap:** While microenterprises use microcredit and large corporations access international capital, mid-sized logistics SMEs lack access to affordable capital for fleet or warehouse expansion (Rifat et al., 2024).

**Land Issues:** Scarcity of industrial land and complex acquisition processes hinder the establishment of large-scale logistics parks or packhouses (Oman & Liang, 2019).

## 7.7 Strategies for Mitigating Challenges

To unlock further investment, specific strategies must be employed:

**Public-Private Partnerships (PPPs):** Governments should partner with private investors to build multi-commodity packhouses and cold storage facilities on public land, reducing the burden of land acquisition for investors (JICA, 2021; Innovision Consulting Private Limited, 2016).

**Special Economic Zones (SEZs):** Promoting agro-processing and logistics zones (like the Bay Terminal project) provides investors with "plug-and-play" infrastructure, reliable utilities, and one-stop administrative services (Larive International & LightCastle Partners, 2021; Mordor Intelligence, 2019).

**Blended Finance Models:** Utilizing donor funds (e.g., from the World Bank or the Netherlands) to de-risk private investments through credit guarantees or low-interest "Two-Step Loans" (TSL) can bridge the financing gap for SMEs (Rifat et al., 2024; JICA, 2021).

**Policy Harmonization:** Implementing the National Logistics Policy to streamline regulations and digitize customs procedures (e.g., ASYCUDA World) will reduce administrative costs and transit times (*Bangladesh's Freight and Logistics Industry: Role in Economic Development and Policy Impact*, n.d.).

# Harvesting Value: The Virtuous Cycle of Bangladesh's Agro-Logistics Transformation

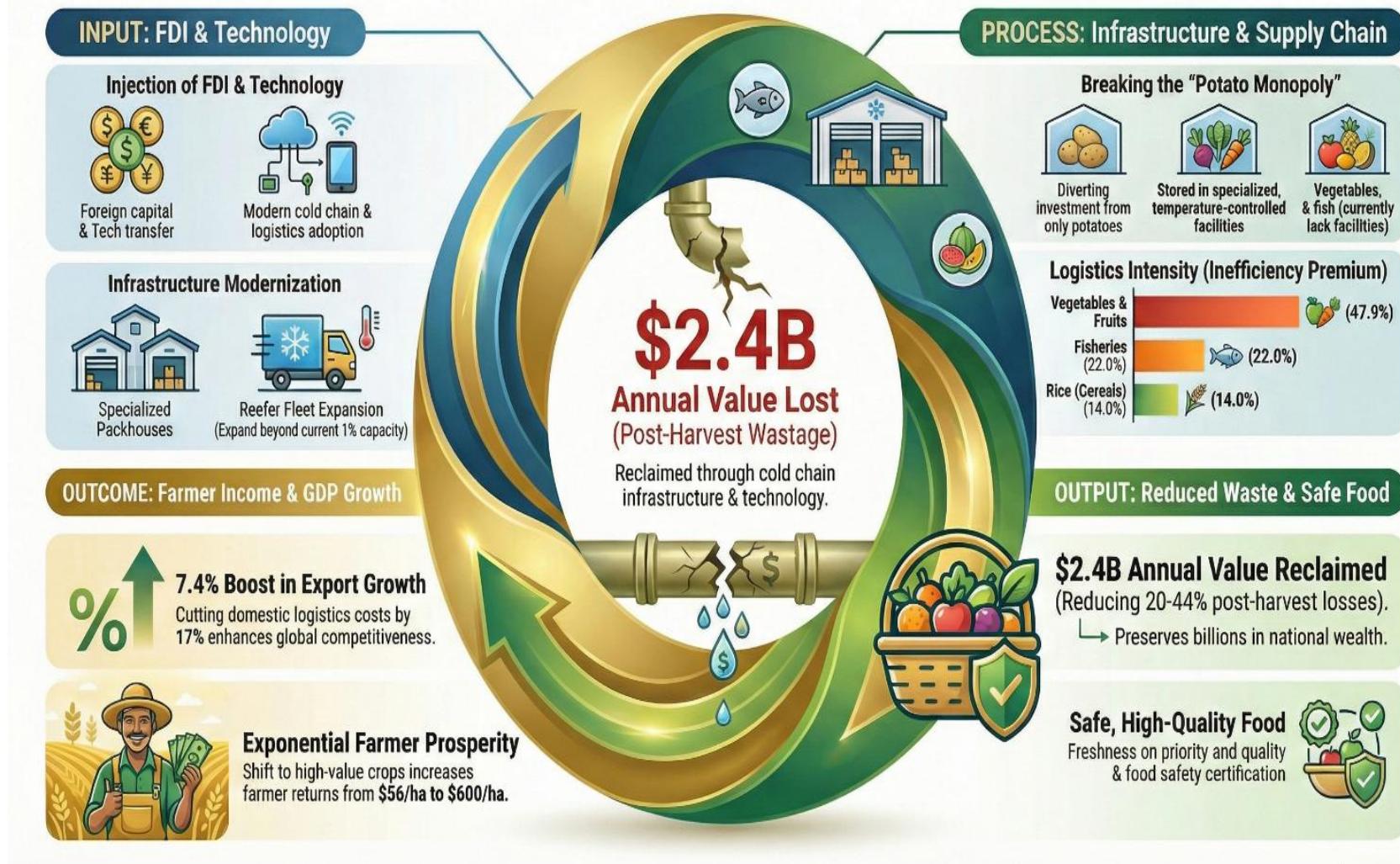


Figure 14: The Virtuous Cycle of Agro-Logistics Investment

Therefore, while the Bangladesh agro-logistics market faces significant infrastructural and regulatory hurdles, the high volume of production and consumption offers a lucrative frontier for private and foreign investment. Strategic engagement through PPPs and technology adoption can transform these structural inefficiencies into profitable business opportunities.

## 8. Market Gaps and Investment Barriers

### 8.1 Overview of Market Gaps and Investment Barriers

Despite Bangladesh's robust agricultural output, producing over 70 million metric tons annually, the sector is paradoxically defined by abundance at the farm gate and scarcity/high cost at the consumer end. This disconnect is caused by a fractured agro-logistics system that results in post-harvest losses (PHL) valued at approximately US\$2.4 billion annually (The Business Standard, 2024a). While the demand for temperature-controlled logistics (TCL) is projected to reach US\$440 million by 2031, the market is currently riddled with structural gaps and investment barriers that prevent capital from efficiently flowing into the necessary infrastructure (The Business Standard, 2024c).

### 8.2 Critical Market Gaps in Agro-Logistics

Market gaps represent the specific areas where the demand for logistics services exceeds the current supply or where the quality of existing services fails to meet industry requirements.

#### 8.2.1 The "Cold Chain Gap": The Potato Paradox

**Description:** Bangladesh possesses approximately 2.6 to 2.8 million metric tons of cold storage capacity. However, 90% to 95% of this capacity is designed exclusively for potatoes (a single commodity with a ~2–4°C temperature range) (Bangladesh Sangbad Sangstha, 2024b; World Bank Blogs, 2025).

**Generation:** This gap was created by historical policy prioritizing food security staples (potatoes) over high-value perishables, resulting in a monoculture of storage infrastructure (Food and Agriculture Organization (FAO), 2025).

**Consequence:** There is a near-total absence of multi-commodity cold storage for fruits, vegetables, fish, and meat. Consequently, 30-40% of horticulture and 20-36% of fisheries products are lost, as they cannot access the existing potato-centric infrastructure (Advance Consulting et al., 2021; Apu, 2014).

### 8.2.2 The "Transport Gap": The Missing Cool Chain on Wheels

**Description:** Logistics are overwhelmingly road-dominated (95%), yet less than 1% of the agricultural transport fleet is refrigerated (Oman & Liang, 2019).

**Generation:** The high capital cost of reefer trucks (2.5–3.5 times the cost of ambient trucks) and the lack of a "cold chain culture" among traditional intermediaries (Farias/Beparis) prevent adoption (International Finance Corporation (IFC), 2021).

**Consequence:** Perishables are transported in open trucks, covered vans, or buses, leading to compression damage, heat stress, and rapid spoilage. This gap forces "distress sales" where farmers sell quickly at low prices to avoid total loss (Bangladesh Sangbad Sangstha, 2024b).

### 8.2.3 The "Processing Gap": Value Addition Void

**Description:** Only 1% of horticulture produce and a small fraction of dairy are processed (LightCastle Partners, 2023a).

**Generation:** A lack of consistent quality raw materials (due to logistics failures upstream) makes it risky for processors to run factories at full capacity.

**Consequence:** During peak harvest seasons, surplus production rots instead of being converted into juices, pulps, or powdered milk, destabilizing market prices (Innovision Consulting Private Limited, 2016).

### 8.2.4 The "Traceability Gap": Information Asymmetry

**Description:** There is a lack of testing laboratories, digital tracking, and certification infrastructure (GAP/HACCP) at the logistics nodes (Larive International & LightCastle Partners, 2021; Reza Hasan & Jannatun Naim, 2017).

**Generation:** Informal intermediaries dominate the chain and have no incentive to invest in transparency or record-keeping (Kumar Mandal et al., 2024).

**Consequence:** High-value export markets (EU/UK) reject Bangladeshi produce due to sanitary and phytosanitary (SPS) non-compliance, trapping the sector in lower-value domestic markets (Advance Consulting et al., 2021).

**Table 13: Summary of Market Gaps and Economic Impact**

Market Gap	Affected Commodities	Primary Cause	Economic Consequence
<b>Monoculture Storage</b>	Fruits, Veg, Fish, Meat	95% capacity dedicated to potatoes only.	20-44% wastage in perishables; volatile seasonal prices.
<b>Ambient Transport</b>	All Perishables	<1% reefer penetration; high import duties on reefers.	Physical damage and heat stress during transit; reduced shelf life.
<b>First-Mile Void</b>	Dairy, Fish, Horticulture	Lack of village-level chilling or pre-cooling centers.	Rapid bacterial growth in milk/fish before reaching processors.
<b>Processing Deficit</b>	Fruits, Dairy	Limited industrial capacity; inconsistent raw material supply.	Value erosion during gluts; reliance on imported milk powder/juices.

Source: Synthesized from *The Business Standard*. (2024a, February 28). Bangladesh faces \$2.4b annual post-harvest losses: LxCap; Islam Mithu, A., & Rahman, S. (2019, December 20). Karwan Bazar chronicles: The hubbub and the halted relocation project. *The Business Standard*; Oman, S., & Liang, W. (2019). *The dairy and beef value chain in Bangladesh Diagnostics, investment models and action plan for development and innovation*. Food and Agriculture Organization of the United Nations (FAO) and the United Nations Industrial Development Organization (UNIDO); International Finance Corporation (IFC). (2021, December 7). *Ripe for Investment*.

### 8.3 Investment Barriers in the Agro-Logistics Market

Investment barriers act as the choke points that prevent public and private capital from addressing the market gaps identified above.

#### 8.3.1 Financial Barriers: The "Missing Middle"

**Analysis:** Large conglomerates (e.g., PRAN, City Group) can access international finance (IFC/FMO), and micro-farmers access NGOs. However, Small and Medium Enterprises (SMEs), which are best suited to operate local packhouses or transport fleets, fall into the "missing middle".

**Generation:** Commercial banks often require land as collateral and do not view logistics assets (trucks, cold rooms) as sufficient security. Furthermore, interest rates for commercial loans (9-13%) are often too high for low-margin logistics businesses (Larive International B.V. & LightCastle Partners Ltd., 2023; JICA, 2021).

**Consequence:** SMEs cannot afford the high CAPEX required for modern cold storage or reefer vans, leaving the sector dependent on traditional, inefficient intermediaries (The Business Standard, 2024a).

### 8.3.2 Infrastructure and Energy Barriers

**Analysis:** Cold chain infrastructure is energy-intensive. Bangladesh faces challenges with unreliable power supply and high electricity costs for industrial use (Data Bridge Market Research, 2025; VetEffecT Consultancy & Recruiting, 2023).

**Generation:** Dairy and agro-farms are often charged electricity at commercial rates rather than agricultural rates, significantly increasing OPEX.

**Consequence:** Operational costs for cold storage become prohibitive, discouraging new entrants and forcing existing operators to compromise on temperature consistency (VetEffecT Consultancy & Recruiting, 2023).

### 8.3.3 Regulatory and Policy Fragmentation

**Analysis:** The logistics sector is governed by over 17 ministries and 28 agencies, creating a labyrinth of red tape (*Bangladesh's Freight and Logistics Industry: Role in Economic Development and Policy Impact*, n.d.; Kabir et al., 2019).

**Generation:** There is no single "Ministry of Logistics." Different bodies regulate transport, food safety, import of machinery, and land use, often with conflicting mandates.

**Consequence:** Delays in obtaining licenses and utility connections increase the "time-to-market" for investors. Import duties on refrigerated vans remain high, directly disincentivizing fleet modernization (The Business Standard, 2024a).

#### **8.3.4 Land and Location Constraints**

**Analysis:** Scarcity of industrial land near production clusters (e.g., Rajshahi for mangoes, Khulna for fish) is a major hurdle.

**Generation:** Rapid urbanization and complex land tenure laws make acquiring land for large-scale logistics parks difficult (Climate Resilient Food Systems Alliance, 2023; Oman & Liang, 2019).

**Consequence:** Investors cannot establish the "hub-and-spoke" models required for efficient aggregation, leading to continued fragmentation (SNV, 2025).

# The Investment Blockade:

## Why Modern Logistics Fails the Farmer

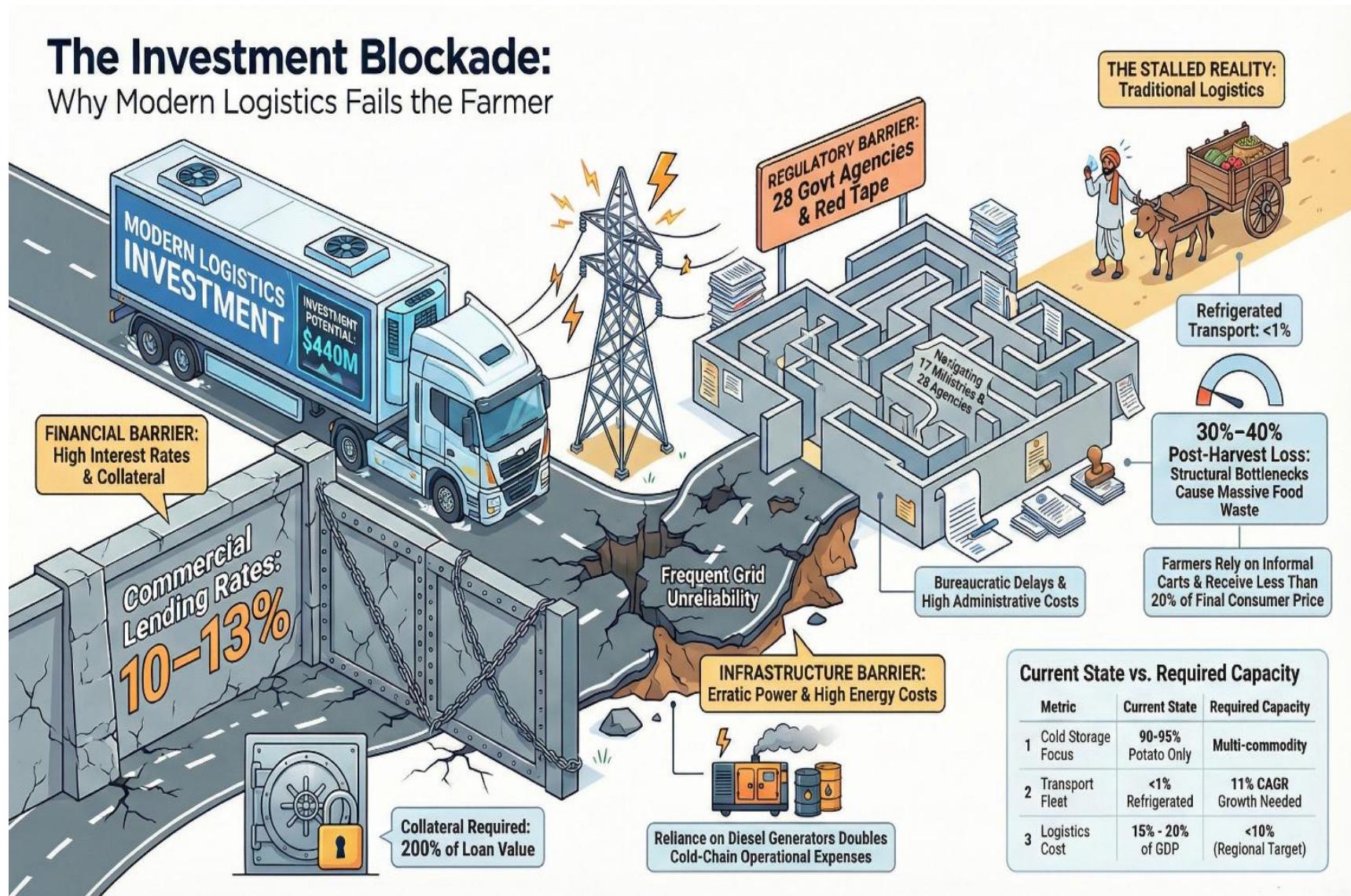


Figure 15: The Investment Barrier Blockade

## **8.4 Why Mitigation is Essential**

Mitigating these gaps and barriers is not merely an operational improvement but a strategic necessity for the national economy.

**Ensuring Food Security for a Growing Population:** With a population heading toward 186 million by 2030, Bangladesh cannot afford to lose 34% of its food to logistics failures. Efficient logistics increases food availability without requiring additional land or water resources (The Business Standard, 2025f; Larive International B.V. & LightCastle Partners Ltd., 2023).

**Competitiveness Post-LDC Graduation (2026):** As Bangladesh graduates from Least Developed Country status, it will lose trade preferences. To compete globally, it must meet strict compliance standards (GAP/HACCP). Only a modern, traceable logistics chain can ensure this compliance and unlock high-value export markets (LightCastle Partners, 2023b, Mordor Intelligence, 2019).

**Economic Resilience and Farmer Income:** Transforming the "Dadon" (tied credit) system into formal logistics financing allows farmers to store produce and sell when prices are favorable, rather than being forced into distress sales. This directly combats rural poverty. (Larive International B.V. & LightCastle Partners Ltd., 2023; *Bangladesh's Freight and Logistics Industry: Role in Economic Development and Policy Impact*, n.d.).

The Bangladesh agro-logistics market is characterized by a high volume of production but a low quality of logistical execution. The market gaps are physical (lack of cold chain/reefers) and informational (lack of traceability), while the investment barriers are financial (high cost of capital) and structural (regulatory complexity). Addressing these requires a shift from "production-centric" policies to "logistics-centric" investments, specifically targeting the "first mile" aggregation and the "missing middle" of SME financing.

## **9. Strategic Recommendations & Policy Linkages**

To transform the Bangladesh agro-logistics sector from a source of value leakage (US\$2.4 billion annual loss) into a driver of economic growth (projected US\$440 million cold chain

market by 2031), a coordinated investment strategy is required. The following recommendations target Public, Private, and Foreign Direct Investment (FDI) actors, directly linking operational strategies with the national regulatory framework to maximize profitability and compliance.

## 9.1 Strategic Investment Recommendations

### 9.1.1 Infrastructure: Transition from Single-Commodity to Multi-Modal Hubs

**Recommendation:** Investors should shift focus from traditional potato-centric cold storage (currently 90-95% of capacity) to Multi-Commodity Cold Storage and Integrated Packhouses. These facilities must be located in production clusters (e.g., Rajshahi for mangoes, Jashore for vegetables, Khulna for fisheries) rather than consumption centers (JICA, 2021).

**Reasons Behind Potato Cold Storage Investment:** The potato sector utilizes approximately 90% to 95% of the country's total cold storage capacity (approx. 5.5 million MT) (JICA, 2021). Potato cold storage owners function as informal banks. They provide loans to farmers and traders, using the stored potatoes as collateral (JICA, 2021). This allows farmers to access immediate cash without selling at harvest-time low prices. Cold storage owners earn revenue from both storage rental fees and interest on these loans, creating a dual revenue stream that ensures profitability.

Potatoes are harvested in a single peak season (January–March) but are consumed year-round. They are robust tubers that can be stored for 6–9 months at a single steady temperature (approx. 3°C for table varieties) (Advance Consulting et al., 2021). This guaranteed long-term occupancy ensures the facility generates revenue for the majority of the year. About 50% of the total potato harvest enters cold storage, stabilizing prices and ensuring supply during lean months. The market is accustomed to consuming stored potatoes, unlike leafy vegetables or fish, where consumers prefer freshness or live purchase (JICA, 2021).

**Profitability Mechanism:** By capturing the 20–44% of horticulture produces currently lost, investors can effectively increase marketable volume without increasing production costs. Integrated packhouses allow for sorting, grading, and packaging services (Value Added Services), which command premium pricing in urban retail and export markets.

## **Target Investors:**

- **Private SME Owners:** The sector is fragmented, consisting of approximately 428 to 450 units owned largely by individual businessmen organized under the Bangladesh Cold Storage Association (BCSA) (JICA, 2021; Innovision Consulting Private Limited, 2016).
- **Major Agro-Processors:** Large conglomerates have invested in storage and contract farming primarily to secure specific "industrial varieties" (like Courage and Lady Rosetta) required for chips and starch. PRAN-RFL Group uses contract farming and storage for chips and starch production. Bombay Sweets, a major snack producer, is investing in contract farming for processing-grade potatoes. Besides, Akij Food & Beverage Ltd is a market leader in the potato chips market (Cheese Puffs). Golden Harvest invests in cold chain for frozen foods, including potato-based snacks like samosas (Innovision Consulting Private Limited, 2016).
- **Foreign/Joint Ventures:** Recently, Nippon Express acquired a 20% stake in Cold Chain Bangladesh Limited (CCBL) to provide integrated logistics, signaling new foreign interest (Mordor Intelligence, 2019).
- **PPP:** Development of land and utilities for logistics parks by the government, with operations managed by private entities (Innovision Consulting Private Limited, 2016).

## **Why Investors Are Not Scaling to Other Crops**

Despite the success in potatoes, investors face significant structural and technical barriers to adapting these facilities for multi-commodity use (fruits, vegetables, fish).

**Technical Incompatibility:** Most potato cold storages are designed as bulk warehouses (two-story buildings) where potatoes are stacked in sacks. This design crushes softer fruits and vegetables (e.g., tomatoes, mangoes), which require palletized shelving and air circulation (Yahia, 2010). Potatoes are stored at ~3°C. However, processing potatoes require 10–12°C, and onions/garlic require humidity control rather than just cooling. Fish and meat require freezing (< -18°C) (JICA, 2021). Converting a potato store to a multi-purpose facility requires expensive retrofitting for compartmentalization and humidity control.

**High Capital Expenditure (CAPEX):** Building a multi-purpose cold storage facility (with chambers for different crops) costs roughly double the amount of a standard potato cold storage. The return on investment (ROI) is riskier because other crops (like tomatoes or leafy greens) have short storage lives (days vs. months for potatoes), leading to uncertain occupancy rates (JICA, 2021).

**Operational Risks:** Erratic power supply is a major threat. While potatoes can withstand slight temperature fluctuations, highly perishable goods like fish or milk spoil rapidly if the cold chain breaks, leading to total loss (Yahia, 2010). Unlike potatoes, which act as a "bank deposit," highly perishable items like mangoes or leafy greens degrade too quickly to serve as reliable collateral for loans, removing the lucrative financing revenue stream for storage owners.

**Consumer Preferences:** Bangladeshi consumers have a strong preference for "warm" (freshly slaughtered/harvested) meat and fish, often associating chilled/frozen products with lower quality or preservatives. This suppresses the domestic demand that would justify large-scale cold chain investments for non-potato crops (World Bank Blogs, 2025).

### **Why Cold Storage Expansion is Realistic Despite Energy Barriers**

Expanding cold storage in Bangladesh is considered realistic and necessary, but it is not feasible if it relies solely on the current grid infrastructure due to high costs and instability. To make expansion viable, the sector requires a structural shift toward renewable energy integration, policy reforms regarding electricity tariffs, and decentralized cooling technologies.

**Why the Current Model Fails due to the Energy Barrier:** The primary barrier to expanding cold storage beyond potatoes (which require less energy-intensive cooling at ~3°C) to perishables like fish and meat (requiring freezing below -18°C) is operational expenditure (OPEX). Agro-industries often pay electricity at commercial rates (approx. BDT 12.39 or USD 0.102 per kWh) rather than lower agricultural rates. This high OPEX discourages investment in energy-intensive multi-commodity storage (Global Seafood Alliance, 2023; VetEffecT Consultancy & Recruiting, 2023). The grid is unreliable, characterized by frequent load shedding. To maintain temperature integrity, operators must rely on diesel generators, which produce expensive energy and harmful emissions. This dual-dependency (grid + diesel backup)

significantly inflates operational costs, making cold chain storage financially unviable for low-margin crops (Data Bridge Market Research, 2025; Oman & Liang, 2019). New industries face a regulatory hike in natural gas tariffs (fixed at Tk 40/cubic meter for new connections), placing new entrants at a structural disadvantage compared to incumbent operators (Global Seafood Alliance, 2023).

**"Smart" Infrastructure for Mitigating Energy Barrier:** Expansion is possible if the infrastructure model shifts from "grid-dependent large warehouses" to "energy-efficient and decentralized systems." For rural areas with poor grid access, solar photovoltaic (PV) systems are identified as a viable solution. Solar energy can power ice makers, freezers, and milk chillers. Although upfront costs are high, low running costs offset them over time, making them suitable for off-grid locations (FAO, 2024). Large dairy enterprises (e.g., Dutch Dairy) are investing in biogas installations to convert manure into energy, reducing reliance on the national grid and lowering methane emissions (VetEffecT Consultancy & Recruiting, 2023). Financial instruments like green financing and ESG-linked loans are emerging to support the high initial CAPEX of solar-outfitted warehouses, which lowers long-term OPEX (Mordor Intelligence, 2019). To bypass the cost of industrial refrigeration, low-cost innovations like CoolBot (which transforms standard air conditioners into refrigeration units) and evaporative cooling systems are being piloted. These reduce energy consumption and are more accessible for smallholder aggregation centers (World Bank, 2022; Innovision Consulting Private Limited, 2016). In the fisheries sector, the immediate infrastructure need is not necessarily high-tech freezers but solar-powered ice plants at landing sites. Access to ice remains the most critical (and energy-dependent) factor for fish preservation (FAO, 2024; Ali et al., 2025). Stakeholders (e.g., the Bangladesh Dairy Farmers Association) are actively demanding a waiver from commercial electricity rates, arguing that dairy and cold storage should be classified under the agro-based sector to receive subsidized utility rates. Without this policy "infrastructure," physical expansion remains economically perilous (VetEffecT Consultancy & Recruiting, 2023).

**Regional Feasibility:** In the northern region, there is high feasibility for solar-powered Village Milk Collection Centers (VMCCs). With high cattle density, decentralized solar chilling can prevent milk spoilage before it reaches the grid-connected processors (Oman & Liang, 2019).

In the coastal region, there needs high need for ice plants and insulated transport. The region suffers from salinity and heat stress; here, renewable energy (solar/wind) is crucial because extending the grid to remote landing stations is often cost-prohibitive (Islam et al., 2007; FAO, 2024). In peri-urban areas, grid connectivity is better, but traffic congestion necessitates energy-efficient reefer vans or insulated trucks to prevent spoilage during transit delays for horticulture goods (JICA, 2021; Innovision Consulting Private Limited, 2016).

### **9.1.2 Transport Logistics: Modernization of the Cold Fleet**

**Recommendation:** Establish Third-Party Logistics (3PL) fleets specializing in refrigerated (reefer) and insulated transport. Currently, less than 1% of the fleet is refrigerated. There is an immediate need to introduce reefer vans for high-value perishables (meat, dairy, export-grade fish) and insulated covered vans for vegetables (MAERSK, 2024).

**Profitability Mechanism:** 3PL providers can charge premium freight rates for "guaranteed freshness" delivery to supermarkets and processing zones. Reducing transport-induced weight loss in livestock (currently 3-5%) and spoilage in fish (due to inadequate icing) directly improves the bottom line for traders and processors, justifying higher transport fees (MAERSK, 2024)..

#### **Target Investors:**

- **Private Sector/SMEs:** Leasing models for reefer trucks to overcome high CAPEX barriers.
- **FDI:** Joint ventures for fleet management systems and vehicle assembly.

### **9.1.3 First-Mile Aggregation: Tech-Enabled Collection Centers**

**Recommendation:** Investment in Village Milk Collection Centers (VMCCs) with chilling facilities and Community Drying Centers for cereals. These should be integrated with digital platforms for traceability and payments (FICCI, 2025).

**Profitability Mechanism:** Chilling milk at the source reduces spoilage bacteria, allowing processors to produce high-margin value-added products (yoghurt, cheese) rather than low-margin UHT milk. Mechanical drying for cereals (rice/maize) prevents aflatoxin contamination, preserving grain value for industrial feed use.

## Target Investors:

- **Startups/Agri-Tech:** Platforms like iFarmer or WeGro to facilitate financing and aggregation.
- **Private Dairy/Feed Mills:** Backward linkage investments to secure quality raw materials (International Finance Corporation (IFC), 2021).

## 9.2 Policy Linkages and Regulatory Alignment

To ensure the viability of these investments, they must be aligned with existing and emerging national policies. The following matrix links strategic actions to the specific regulatory instruments in Bangladesh.

**Table 14: Strategic Policy Linkages for Agro-Logistics Investment**

Investment Area	Relevant Policy/Regulation	Strategic Linkage & Benefit
Cold Chain Machinery Import	National Industrial Policy 2016 & NBR SROs	<b>Tax Incentives:</b> The government offers 15% VAT exemption and reduced import duties on capital machinery for cold storage and processing. Investors must leverage these provisions to lower CAPEX.
Food Safety & Compliance	Food Safety Act 2013	<b>Market Access:</b> Compliance with this Act is mandatory for supplying supermarkets and export channels. Investments in testing labs and traceability align with the Bangladesh Food Safety Authority's (BFSA) mandate, protecting investors from regulatory crackdowns.
Export Infrastructure	National Agriculture Policy 2018	<b>Export Facilitation:</b> The policy explicitly encourages GAP (Good Agricultural Practices) and export-oriented infrastructure. Aligning packhouse

		operations with these standards unlocks 20% cash incentives for agro-exports.
<b>Logistics Hubs</b>	<b>National Logistics Policy (Draft) &amp; SME Policy 2019</b>	<b>Cost Reduction:</b> The logistics policy aims to reduce logistics costs (currently 15-20% of GDP). Investments in multimodal hubs (river/road) align with national priority corridors, ensuring government support for utility connections.
<b>Fish &amp; Shrimp Processing</b>	<b>Fish and Fish Product (Inspection and Quality Control) Ordinance 1983</b>	<b>Licensing:</b> HACCP compliance is mandatory for export. Investors must align processing plant designs with DoF guidelines to secure export licenses.

Source: Synthesized from Mordor Intelligence. (2019). *Bangladesh Frozen Food Market Size & Share Analysis - Growth Trends and Forecast (2025 - 2030)*; Innovision Consulting Private Limited. (2016). *Study on the Roles and Opportunities for Private Sector in Agro-food Processing Industry of Bangladesh*. Swiss Contact; VetEffecT Consultancy & Recruiting. (2023). *Sector study dairy Bangladesh*. In REF: PST2oBCD03. Netherlands Enterprise Agency; (JICA). (2021). *People's Republic of Bangladesh Ministry of Industries (Molnd) Bangladesh Infrastructure Finance Fund Limited (BIFFL) People's Republic of Bangladesh Preparatory Survey for Food Value Chain Improvement Project Final Report*; Apu, N. A. (2014). *Farmed fish value chain development in Bangladesh: Situation analysis and trends* WorldFish/ILRI PROJECT REPORT; Kabir, R. I., Narayanan, S., Belton, B., Hernandez, R., & Haque, M. M. (2019). *Shrimp Value Chain in Bangladesh*. Jahangirnagar University Journal of Marketing (JUJM), 7(8).

### 9.3 Implementation Roadmap for Profit Maximization

#### Phase 1: Public-Private Partnership (PPP) for Wholesale Market Upgrades

**Action:** Upgrade major wholesale markets (e.g., Karwan Bazar, Bogura) into "Terminal Markets" with loading bays, sanitation, and cold rooms.

**Profit Model:** The public sector provides land; the private sector operates the facility, collecting user fees from traders for storage and handling services. This resolves the congestion that currently causes massive spoilage.

#### Phase 2: Digital Integration for Traceability

**Action:** Implement blockchain or digital tracking for high-value exports (shrimp, mango).

**Profit Model:** Traceable products command a 5-15% price premium in EU/Middle East markets. Digital systems reduce the administrative costs associated with phytosanitary certification (Cortez-Clavo et al., 2025; Rifat et al., 2024).

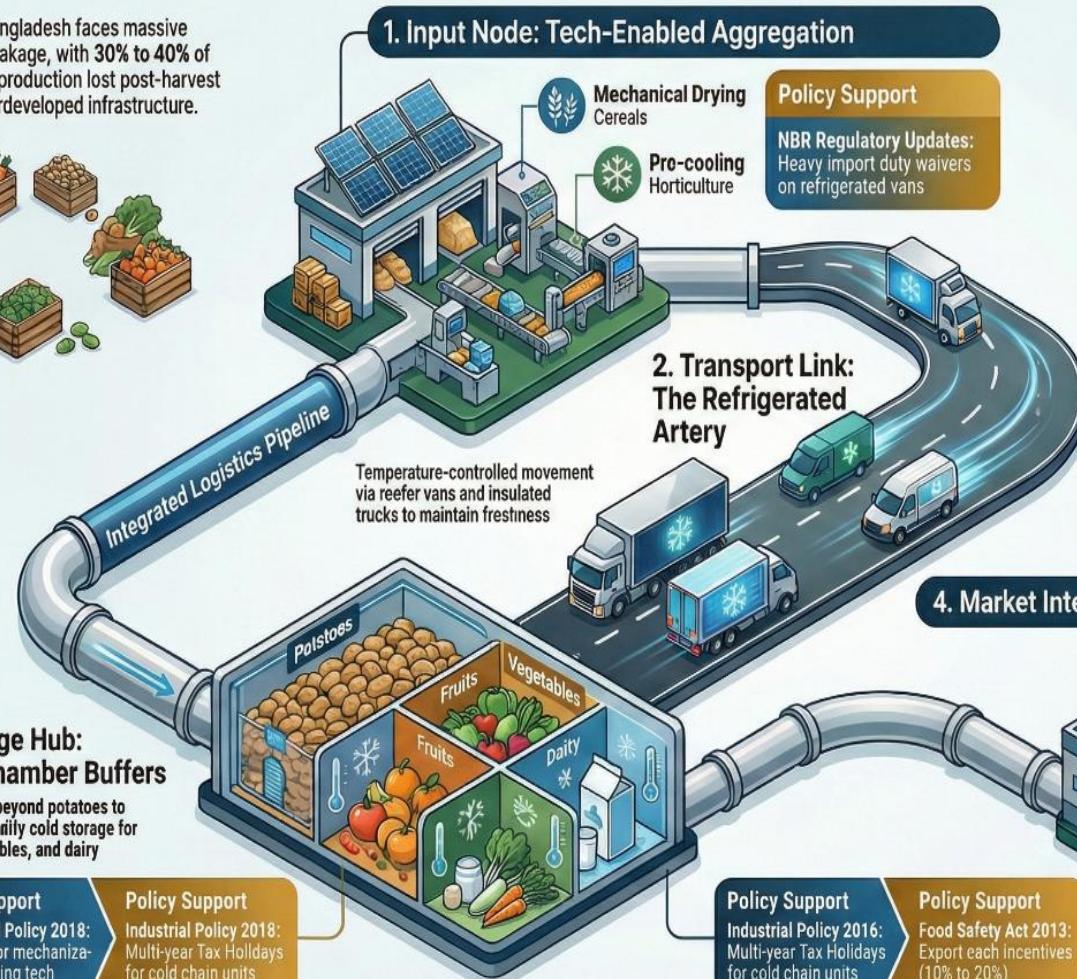
### **Phase 3: Bonded Warehousing for Non-RMG Sectors**

**Action:** Lobby for and utilize bonded warehouse facilities for agro-processing inputs (packaging materials, additives).

**Profit Model:** Currently, the bonded warehouse facility is dominated by the garment sector. Expanding this to agro-logistics allows duty-free import of packaging materials for re-export, significantly lowering operational costs.

# Integrated Agro-Logistics Investment Ecosystem: Modernizing Bangladesh's Food Value Chain

**Context:** Bangladesh faces massive economic leakage, with 30% to 40% of agricultural production lost post-harvest due to underdeveloped infrastructure.



**USD \$440 Million Market Opportunity**

Projected value of the temperature-controlled logistics market in Bangladesh by 2031



**40% Storage Shortfall**

Current 2.7M MT capacity is 95% dedicated to potatoes, leaving massive gaps



**Strategic Policy Incentives**

Includes NBR import duty waivers on reefer vehicles and 20% export cash incentives

*Figure 16: The Profitable Agro-Logistics Ecosystem*

Therefore, by aligning investment strategies with the "missing middle" of the supply chain, specifically in multipurpose cold storage, reefer transport, and first-mile aggregation, and leveraging the fiscal incentives provided by the National Logistics Policy and Industrial Policy, investors can unlock high returns while solving Bangladesh's critical food security challenges.

## 10. Conclusion

The transition of Bangladesh from a subsistence farming model to a commercialized agribusiness ecosystem is inevitable but currently stalled by structural inefficiencies. The report concludes that the current investment in the sector is not just insufficient but fundamentally misaligned. Billions are locked in potato storage, while high-value sectors like dairy and mangoes suffer from a total lack of cooling facilities.

To bridge the \$2.4 billion loss gap, the report advocates for a shift toward 'logistics-centric' investments. The most viable path forward is the adoption of Two-Step Loans (TSL), which combine donor-backed low-interest funds with technical assistance to de-risk investments for SMEs. By focusing on multi-commodity hubs and refrigerated transport, Bangladesh can reclaim lost value, ensure food security for its projected 170 million citizens, and meet international safety standards for export.

Alongside physical infrastructure and financing, effective agro-logistics reform requires clear coordination among market actors and reliable public regulation. Quality preservation must be treated as an investment in value rather than an added cost, supported by enforceable grading standards, functional producer organizations, and digital platforms that link supply with demand. Consistent rules on food safety and contract enforcement will give private investors the confidence to commit long-term capital. With these institutional foundations in place, efficiency gains can translate directly into higher rural incomes and more stable, affordable food for consumers.

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## Appendix

**Table 15: Commodity-Wise Market Surplus Calculation (FY 2023-24)**

Subsector Category	Specific Commodity	Annual Production Amount (Million Metric Tons / Units) ( $V_i$ )	Family Consumption $C_f$ (%)	Seed Requirement $S_r$ (%)	Feed for Livestock /Poultry $F_a$ (%)	Post-Harvest Losses $W_p$ (%)	Payments in Kind $K$ (%)	$C_f = (Vi \times Cf\%)$ (MMT)	$S_r = (Vi \times Sf\%)$ (MMT)	$F_a = (Vi \times Fa\%)$ (MMT)	$W_p = (Vi \times Wp\%)$ (MMT)	$K = (Vi \times K)$ (MMT)	Marketable Surplus (MMT)
Cereals	Rice	40.27	50.00%	6.00%	10.00%	13.00%	7.50%	20.135	2.4162	4.027	5.2351	3.02025	5.43645
	Maize	5.2	3.50%	1.00%	75.00%	9.00%	Negligible	0.182	0.052	3.9	0.468	0	0.598
	Wheat	1.17	17.50%	9.00%	7.50%	11.00%	2.50%	0.20475	0.1053	0.08775	0.1287	0.02925	0.61425
Vegetables	Vegetables (General) (excluding Potato)	17.09	25.00%	1.50%	5.00%	30.00%	1.50%	4.2725	0.25635	0.8545	5.127	0.25635	6.3233
	Potato	11.57	12.50%	22.50%	3.00%	25.00%	3.00%	1.44625	2.60325	0.3471	2.8925	0.3471	3.9338
Fruits	Total Fruits	5.5	30.00%		5.00%	30%	3.00%	1.65	0	0.275	1.65	0.165	1.76
	Mango	3	17.50%		2.00%	35.00%	5.00%	0.525	0	0.06	1.05	0.15	1.215
Fisheries	Total Fish	5.02	12.50%	2.00%	Negligible	18.50%	1.50%	0.6275	0.1004	0	0.9287	0.0753	3.2881
Livestock	Meat (Total) (Includes poultry meat)	9.23	7.50%			5.00%	Negligible	0.69225	0	0	0.4615	0	8.07625
	Milk	15.04	35.00%		15.00%	12.00%	Negligible	5.264	0	2.256	1.8048	0	5.7152
Poultry	Eggs (Billion Units)	23.75	20.00%			12.50%	Negligible	4.75	0	0	2.96875	0	16.03125

Source: Bangladesh Bureau of Statistics (BBS). (2024). Yearbook of agricultural statistics-2023. Statistics and Informatics Division, Ministry of Planning; Food and Agriculture Organization (FAO). (2024). Bangladesh at a glance: Food loss and waste in key value chains. FAO Regional Office for Asia and the Pacific; Hassan, M. K., et al. (2022). Postharvest loss assessment of fruits and vegetables in Bangladesh. Bangladesh Agricultural Research Council (BARC); World Bank. (2020). Promoting agri-food sector transformation in Bangladesh: Policy and investment priorities. World Bank Group.

Note: For the convenience of calculation, the average of the percentage range of Household Consumption, Seed Requirements, Feed for Livestock/Poultry, Post-Harvest Losses, and Payments in Kind is considered for calculation.

**Table 16: Commodity-Wise Volume of the Marketable Surplus that Enters Storage Facilities Calculation (FY 2023-24)**

Subsector Category	Specific Commodity	Marketable Surplus (MMT)	Percentage (%) of Surplus Stored in Formal Facilities	Volume of the Stored Marketable Surplus (MMT) ( $V_{Stored}$ )
Cereals	Rice	5.43645	15.00%	0.8154675
	Maize	0.598	50.00%	0.299
	Wheat	0.61425	17.50%	0.10749375
Vegetables	Vegetables (General) (excluding Potato)	6.3233	Negligible (direct market access)	~
	Potato	3.9338	45.00%	1.77021
Fruits	Total Fruits	1.76	Negligible (direct market access)	~
	Mango	1.215	Negligible (direct market access)	~
Fisheries	Total Fish	3.2881	Negligible (direct market access)	~
Livestock	Meat (Total) (Includes poultry meat)	8.07625	3.00%	0.2422875
	Milk	5.7152	Negligible (direct market access)	~
Poultry	Eggs (Billion Units)	16.03125	1.50%	0.24046875

Source: Bangladesh Bureau of Statistics (BBS). (2024). Yearbook of Agricultural Statistics 2023. Statistics and Informatics Division; Department of Agricultural Marketing (DAM). (2025). Marketable Surplus and Marketing Cost of Agricultural Commodities. Ministry of Agriculture; Food and Agriculture Organization (FAO). (2024). Food Loss and Waste in Bangladesh: A Value Chain Perspective; World Bank. (2023). Bangladesh: Moving towards a Modern Food System

Note: For the convenience of calculation, the average of the percentage range of marketable surplus stored in formal facilities is considered for calculation.

**Table 17: Commodity-Wise Value Added Services (VAS) Calculation (FY 2023-24)**

Subsector Category	Specific Commodity	Marketable Surplus (MMT)	Unit	Estimated VAS Cost (BDT)	Value Added Services (VAS) BDT Million	Value Added Services (VAS) BDT Billion
Cereals	Rice	5.43645	ton	7,500	40,773.375	40.77
	Maize	0.598	ton	5,000	2,990.000	2.99
	Wheat	0.61425	ton	6,500	3,992.625	3.99
Vegetables	Vegetables (General) (excluding Potato)	6.3233	ton	7,000	44,263.100	44.26
	Potato	3.9338	ton	8,500	33,437.300	33.44
Fruits	Total Fruits	1.76	ton	12,500	22,000.000	22.00
	Mango	1.215	ton	15,000	18,225.000	18.23
Fisheries	Total Fish	3.2881	ton	20,000	65,762.000	65.76
Livestock	Meat (Total) (Includes poultry meat)	8.07625	ton	50,000	403,812.500	403.81
	Milk	5.7152	liter	21,000	120,019.200	120.02
Poultry	Eggs (Billion Units)	16.03125	dozen	10,000	160,312.500	160.31

Source: Bangladesh Bureau of Statistics (BBS). (2024). Report on Agriculture and Household Survey 2023. Ministry of Planning; Centre for Policy Dialogue (CPD). (2024). State of the Bangladesh Economy in FY2023-24: Third Interim Review; Department of Agricultural Marketing (DAM). (2024). Commodity-wise Marketing Margin and Cost Analysis. Ministry of Agriculture; Metropolitan Chamber of Commerce & Industry (MCCI). (2024). Bangladesh's Economy During FY2023-24 (FY24); World Bank. (2023). Bangladesh: Moving towards a Modern Food System

## Agro-Logistics Market Size Calculation (FY 2023-24)

Agro-Logistics Market Size Estimation for Cereal:

**Step 1: Transportation Market Calculation ( $C_{Trans, Cereals}$ )**

$$MS_{Cereals} = (MS_{Rice} + MS_{Maize} + MS_{Wheat})$$

$$= (5.43645 + 0.598 + 0.61425) \text{ MMT}$$

$$= 6.6487 \text{ MMT}$$

$$TKM_{(Cereals)} = (MS_{Cereals} \times D_{Cereals})$$

$$= (6.6487 \times 250) \text{ Billion ton-km}$$

$$= 1.662175 \text{ Billion ton-km}$$

$$C_{Trans, Cereals} = (TKM_{Cereals} \times AFR_{Cereals})$$

$$= 1.662175 \text{ Bn} \times 9 \text{ BDT}$$

$$= \text{BDT } 14.96 \text{ Billion}$$

**Step 2: Storage Market Calculation ( $C_{Store, Cereals}$ )**

**Formula:**

$$C_{Store, Cereals} = (V_{Stored, Cereals} \times T_{Duration, Cereals} \times ASC_{Cereals})$$

$$V_{Stored, Cereals} = (V_{Stored, Rice} + V_{Stored, Maize} + V_{Stored, Wheat})$$

$$= (0.8154675 + 0.299 + 0.10749375) \text{ MMT}$$

$$= 1.22196 \text{ MMT}$$

$$C_{Store, Cereals} = (1.22196 \times 5 \times 240) \text{ BDT Billion}$$

$$= \text{BDT } 1.47 \text{ Billion}$$

**Step 3: Value-Added Services Calculation ( $CVAS_{Cereals}$ )**

**Formula:**

$$\begin{aligned}
CVAS_{Cereals} &= (CVAS_{Rice} + CVAS_{Maize} + CVAS_{Wheat}) \\
&= (40.77 + 2.99 + 3.99) \text{ BDT Billion} \\
&= 47.75 \text{ BDT Billion}
\end{aligned}$$

#### **Step 4: Total Agro-Logistics Market Size of Cereals**

$$\begin{aligned}
M_{Cereals} &= (C_{Trans,Cereals} + C_{Store,Cereals} + CVAS_{Cereals}) \\
&= (14.96 + 1.47 + 47.75) \text{ BDT Billion} \\
&= 64.18 \text{ BDT Billion} \\
&= \text{USD } 524.86 \text{ Million} \\
&= \text{USD } 0.52486 \text{ Billion}
\end{aligned}$$

#### **Agro-Logistics Market Size Estimation for Vegetables:**

**Vegetables (general, excluding potato):**

##### **Step 1: Transportation Market Calculation ( $C_{Trans, vegetables}$ )**

$$MS_{vegetables} = 6.3233 \text{ MMT}$$

$$\begin{aligned}
TKM_{(vegetables)} &= (MS_{vegetables} \times D_{vegetables}) \\
&= (6.3233 \times 194) \text{ Billion ton-km} \\
&= 1.22672 \text{ Billion ton-km}
\end{aligned}$$

$$\begin{aligned}
C_{Trans, vegetables} &= (TKM_{vegetables} \times AFR_{vegetables}) \\
&= (1.22672 \times 18) \text{ BDT Billion} \\
&= 22.081 \text{ BDT Billion}
\end{aligned}$$

##### **Step 2: Storage Market Calculation ( $C_{Store, vegetables}$ )**

- **Vegetables Storage:** Negligible (direct market access).

$$C_{Store, vegetables} = N/A$$

### **Step 3: Value-Added Services Calculation ( $CVAS_{vegetables}$ )**

$$CVAS_{vegetables} = 44.26 \text{ BDT Billion}$$

### **Step 4: Total Agro-Logistics Market Size of Vegetables (general, excluding potato)**

$$M_{vegetables} = (C_{Trans, vegetables} + C_{Store, vegetables} + CVAS_{vegetables})$$

$$= (22.081 + N/A + 44.26) \text{ BDT Billion}$$

$$= 66.341 \text{ BDT Billion}$$

$$= 542.53 \text{ Million USD}$$

**Potato:**

### **Step 1: Transportation Market Calculation ( $C_{Trans, potato}$ )**

$$MS_{vegetables} = 3.9338 \text{ MMT}$$

$$TKM_{(potato)} = (MS_{potato} \times D_{potato})$$

$$= (3.9338 \times 210)$$

$$= 0.8261 \text{ Billion ton-km}$$

$$C_{Trans, potato} = (TKM_{potato} \times AFR_{potato})$$

$$= (0.8261 \times 12) \text{ BDT Billion}$$

$$= 9.9132 \text{ BDT Billion}$$

### **Step 2: Storage Market Calculation ( $C_{Store, potato}$ )**

**Formula:**

$$C_{Store, potato} = (V_{Stored, potato} \times T_{Duration, potato} \times ASC_{potato})$$

$$C_{Store, potato} = (1.77021 \times 9 \times 8,000) \text{ BDT Billion}$$

$$= \text{BDT } 127.455 \text{ Billion}$$

### **Step 3: Value-Added Services Calculation ( $CVAS_{potato}$ )**

$$CVAS_{potato} = \text{BDT } 33.44 \text{ Billion}$$

#### **Step 4: Total Agro-Logistics Market Size of Potato**

$$M_{potato} = (C_{Trans,potato} + C_{Store,potato} + CVAS_{potato})$$

$$= (9.9132 + 127.455 + 33.44) \text{ BDT Billion}$$

$$= 170.81 \text{ BDT Billion}$$

$$= \text{Approx. } 1.4 \text{ Billion USD}$$

#### **Total Agro-Logistics Market Size of Vegetables Subsector**

$$M_{vegetables} = (M_{potato} + M_{other})$$

$$= (66.341 + 170.81) \text{ BDT Billion}$$

$$= 237.15 \text{ BDT Billion}$$

$$= \text{Approx. } 1.94 \text{ Billion USD}$$

#### **Agro-Logistics Market Size Estimation for Fruits:**

##### **Total Fruits (excluding mango):**

##### **Step 1: Transportation Market Calculation ( $C_{Trans,fruits}$ )**

$$MS_{fruits\ total} = 1.76 \text{ MMT}$$

$$TKM_{(fruits\ total)} = (MS_{fruits\ total} \times D_{fruits\ total})$$

$$= (1.76 \times 180) \text{ Billion-ton}$$

$$= 0.3168 \text{ Billion-ton}$$

$$C_{Trans,fruits\ total} = (TKM_{fruits\ total} \times AFR_{fruits\ total})$$

$$= (0.3168 \times 19) \text{ BDT Billion}$$

$$= 6.0192 \text{ BDT Billion}$$

##### **Step 2: Storage Market Calculation ( $C_{Store,fruits\ total}$ )**

- **Fruits Storage:** Negligible (direct market access).

$$C_{Store, fruits\ total} = N/A$$

### **Step 3: Value-Added Services Calculation ( $CVAS_{fruits}$ )**

$$CVAS_{fruits\ total} = 22 \text{ BDT Billion}$$

### **Step 4: Total Agro-Logistics Market Size of Total Fruits (excluding mango)**

$$M_{fruits\ total} = (C_{Trans, fruits\ total} + C_{Store, fruits\ total} + CVAS_{fruits\ total})$$

$$= (6.0192 + N/A + 22) \text{ BDT Billion}$$

$$= 28.02 \text{ BDT Billion}$$

$$= 229.15 \text{ Million USD}$$

### **Mango:**

#### **Step 1: Transportation Market Calculation ( $C_{Trans, mango}$ )**

$$MS_{mango} = 1.215 \text{ MMT}$$

$$TKM_{(mango)} = (MS_{mango} \times D_{mango})$$

$$= (1.215 \times 280) \text{ Billion-ton}$$

$$= 0.3402 \text{ Billion-ton}$$

$$C_{Trans, mango} = (TKM_{mango} \times AFR_{mango})$$

$$= (0.3402 \times 20) \text{ BDT Billion}$$

$$= 6.8040 \text{ BDT Billion}$$

#### **Step 2: Storage Market Calculation ( $C_{Store, mango}$ )**

- **Mango Storage:** Negligible (direct market access).

$$C_{Store, mango} = N/A$$

#### **Step 3: Value-Added Services Calculation ( $CVAS_{mango}$ )**

$$CVAS_{mango} = 18.23 \text{ BDT Billion}$$

#### **Step 4: Total Agro-Logistics Market Size of Mango**

$$M_{mango} = (C_{Trans,mango} + C_{Store,mango} + CVAS_{mango})$$

$$= (6.8040 + N/A + 18.23) \text{ BDT Billion}$$

$$= 25.034 \text{ BDT Billion}$$

$$= 204.43 \text{ million USD}$$

#### **Total Agro-Logistics Market Size of Fruits Subsector**

$$M_{fruits} = (M_{fruits\ total} + M_{mango})$$

$$= (28.02 + 25.034) \text{ BDT Billion}$$

$$= 53.054 \text{ BDT Billion}$$

$$= 433.31 \text{ million USD}$$

$$= 0.43331 \text{ billion USD}$$

#### **Agro-Logistics Market Size Estimation for Fisheries:**

##### **Step 1: Transportation Market Calculation ( $C_{Trans,fisheries}$ )**

$$MS_{fisheries} = 3.2881 \text{ MMT}$$

$$TKM_{(fisheries)} = (MS_{fisheries} \times D_{fisheries})$$

$$= (3.2881 \times 400) \text{ Billion-ton}$$

$$= 1.31524 \text{ Billion-ton}$$

$$C_{Trans,fisheries} = (TKM_{fisheries} \times AFR_{fisheries})$$

$$= (1.31524 \times 30) \text{ BDT Billion}$$

$$= 39.4572 \text{ BDT Billion}$$

##### **Step 2: Storage Market Calculation ( $C_{Store,fisheries}$ )**

- **Fisheries Storage:** Negligible (direct market access).

$$C_{Store,fisheries} = N/A$$

#### **Step 3: Value-Added Services Calculation ( $CVAS_{fisheries}$ )**

$$CVAS_{fisheries} = 65.76 \text{ BDT Billion}$$

#### **Step 4: Total Agro-Logistics Market Size of Fisheries**

$$M_{fisheries} = (C_{Trans,fisheries} + C_{Store,fisheries} + CVAS_{fisheries})$$

$$= (39.4572 + N/A + 65.76) \text{ BDT Billion}$$

$$= 105.2172 \text{ BDT Billion}$$

$$= \text{Approx. } 860.67 \text{ million USD}$$

$$= \text{Approx. } 0.86067 \text{ billion USD}$$

#### **Agro-Logistics Market Size Estimation for Livestock (including poultry meat and milk):**

##### **Livestock (red meat + poultry meat):**

#### **Step 1: Transportation Market Calculation ( $C_{Trans,livestock\ meat}$ )**

$$MS_{livestock\ meat} = 8.07625 \text{ MMT}$$

$$TKM_{(livestock,\ meat)} = (MS_{livestock,\ meat} \times D_{livestock,\ meat})$$

$$= (8.07625 \times 260) \text{ Billion-ton}$$

$$= 2.099825 \text{ Billion-ton}$$

$$C_{Trans,livestock,\ meat} = (TKM_{livestock,\ meat} \times AFR_{livestock,\ meat})$$

$$= (2.099825 \times 20) \text{ BDT Billion}$$

$$= 41.9965 \text{ BDT Billion}$$

#### **Step 2: Storage Market Calculation ( $C_{Store,livestock,\ meat}$ )**

**Formula:**

$$C_{Store,livestock,meat} = (V_{Stored,livestock,meat} \times T_{Duration,livestock,meat} \times ASC_{livestock,meat})$$

$$C_{Store,livestock,meat} = (0.2422875 \times 9 \times 200) \text{ BDT Billion}$$

$$= 0.4361175 \text{ BDT Billion}$$

### **Step 3: Value-Added Services Calculation ( $CVAS_{livestock,meat}$ )**

$$CVAS_{livestock,meat} = 403.81 \text{ BDT Billion}$$

### **Step 4: Total Agro-Logistics Market Size of Livestock (meat)**

$$M_{livestock,meat} = (C_{Trans,livestock,meat} + C_{Stored,livestock,meat} + CVAS_{livestock,meat})$$

$$= (41.9965 + 0.4361175 + 403.81) \text{ BDT Billion}$$

$$= 446.24262 \text{ BDT Billion}$$

$$= 3.65 \text{ Billion USD}$$

### **Dairy (Milk):**

#### **Step 1: Transportation Market Calculation ( $C_{Trans,dairy}$ )**

$$MS_{dairy} = 5.7152 \text{ Million Liters}$$

$$TKM_{(dairy)} = (MS_{dairy} \times D_{dairy})$$

$$= (5.7152 \times 143) \text{ million-liters}$$

$$= 0.81727 \text{ Billion-liters}$$

$$C_{Trans,dairy} = (TKM_{dairy} \times AFR_{dairy})$$

$$= (0.81727 \times 25) \text{ Billion-liters}$$

$$= 20.43175 \text{ Billion-liters}$$

#### **Step 2: Storage Market Calculation ( $C_{Store,dairy}$ )**

- **Dairy (milk) Storage:** Negligible (direct market access).

$$C_{Store,dairy} = N/A$$

### **Step 3: Value-Added Services ( $CVAS_{dairy}$ )**

$CVAS_{dairy} = 120.02$  BDT Billion

### **Step 4: Total Agro-Logistics Market Size of Dairy**

$$M_{dairy} = (C_{Trans,dairy} + C_{Stored,dairy} + CVAS_{dairy})$$

$$= (20.43175 + N/A + 120.02) \text{ BDT Billion}$$

$$= 140.4518 \text{ BDT Billion}$$

$$= 1.15 \text{ billion USD}$$

### **Total Agro-Logistics Market Size of Livestock (meat+dairy) Subsector**

$$M_{livestock} = (M_{livestock,meat} + M_{dairy})$$

$$= (446.24262 + 140.4518) \text{ BDT Billion}$$

$$= 586.69 \text{ BDT Billion}$$

$$= 4.8 \text{ billion USD}$$

### **Agro-Logistics Market Size Estimation for Poultry (Eggs)**

#### **Step 1: Transportation Market Calculation ( $C_{Trans,poultry\ eggs}$ )**

$MS_{poultry\ eggs} = 16.03125$  Million dozens

$$TKM_{(poultry\ eggs)} = (MS_{poultry\ eggs} \times D_{poultry\ eggs})$$

$$= (16.03125 \times 125) \text{ Billion dozens}$$

$$= 2.00391 \text{ Billion dozens}$$

$$C_{Trans,poultry\ eggs} = (TKM_{poultry\ eggs} \times AFR_{poultry\ eggs})$$

$$= (2.00391 \times 25) \text{ Billion BDT}$$

$$= 50.09775 \text{ Billion BDT}$$

#### **Step 2: Storage Market Calculation ( $C_{Store,poultry\ eggs}$ )**

**Formula:**

$$C_{Store,poultry\ eggs} = (V_{Stored,poultry\ eggs} \times T_{Duration,poultry\ eggs} \times ASC_{poultry\ eggs})$$

$$C_{Store,poultry\ eggs} = (0.24046875 \times 3 \times 18) \text{ BDT Billion}$$

$$= 0.01299 \text{ BDT Billion}$$

**Step 3: Value-Added Services ( $CVAS_{poultry\ eggs}$ )**

$$CVAS_{poultry\ eggs} = 160.31 \text{ BDT Billion}$$

**Step 4: Total Agro-Logistics Market Size of Poultry (Eggs)**

$$M_{poultry\ eggs} = (C_{Trans,poultry\ eggs} + C_{Stored,poultry\ eggs} + CVAS_{poultry\ eggs})$$

$$= (50.09775 + 0.01299 + 160.31) \text{ BDT Billion}$$

$$= 210.421 \text{ BDT Billion}$$

$$= \text{Approx. } 1.72 \text{ billion USD}$$