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A Study on Supply Chain Challenges and Solutions for Smallholders in Bangladesh's Agriculture

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Abstract

This study investigates the challenges faced by smallholder farmers in Bangladesh's agricultural supply chain, focusing on middleman dependency, inadequate infrastructure, limited market access, and insufficient storage facilities. The research utilizes qualitative methods, combining secondary data from reputable sources and primary data from interviews with farmers in the Rajshahi region. Findings reveal that over 85% of smallholders depend on intermediaries, transportation costs consume 15-20% of earnings, and inadequate storage leads to 15-20% losses for perishable goods.To address these challenges, the study explores the potential of cooperatives, regional marketplaces, and mobile market vans to reduce reliance on intermediaries. Technology integration, including digital platforms for real-time market data, blockchain for transparency, and IoT for monitoring storage and transport, emerges as transformative solutions. These interventions, complemented by investments in rural infrastructure and institutional support, can enhance supply chain efficiency, improve farmer incomes, and promote sustainable agricultural development. The paper concludes that adaptive strategies and continued investment are vital to creating an equitable and efficient agricultural system in Bangladesh.

Keywords:
Smallholder farmers, Supply chain challenges, Sustainable development, Infrastructure investment, Technology Integration

1. Introduction

Agriculture is a cornerstone of Bangladesh's economy, contributing 12.9% of GDP in 2022 and employing 40% of the workforce (World Bank 2023). It is vital for food security and rural livelihoods in a densely populated country of 165 million, often affected by natural disasters like floods and cyclones. Despite its importance, the sector faces persistent challenges, including supply chain inefficiencies, inadequate infrastructure, and middleman dependency, which disproportionately affect smallholder farmers. These issues lead to lower incomes, significant post-harvest losses, and limited opportunities for growth.

1.1. Objectives

This research aims to explore the challenges faced by smallholder farmers in Bangladesh within agricultural supply chains, focusing on the structural, logistical, and economic barriers that limit their income potential. The study seeks to analyse how reliance on intermediaries, inadequate infrastructure, and restricted market access

influence farmers' profitability and overall sustainability. By examining these barriers in-depth, this research aims to provide actionable insights for improving the supply chain system and supporting smallholder farmers' livelihoods.

1.2 Smallholder Farmers: Definition and Characteristics

Smallholder farmers are the backbone of Bangladesh's agriculture, accounting for 84% of the farming population and over 14 million households (FAO 2022; IFAD, 2023). Operating on plots under 2 hectares, they rely on family labour and often lack access to formal financial services, quality inputs, and modern technologies. These constraints result in low productivity, income instability, and economic vulnerability, with average annual incomes below $2,000 for most households (World Bank 2023). Socioeconomic challenges further complicate their situation. Over 50% of smallholders live below the poverty line, with women and older farmers increasingly managing farms amid limited resources and market access. Many smallholders rely on informal markets and intermediaries, who capture significant profit margins, leaving farmers with reduced earnings and little bargaining power (IFPRI 2022).

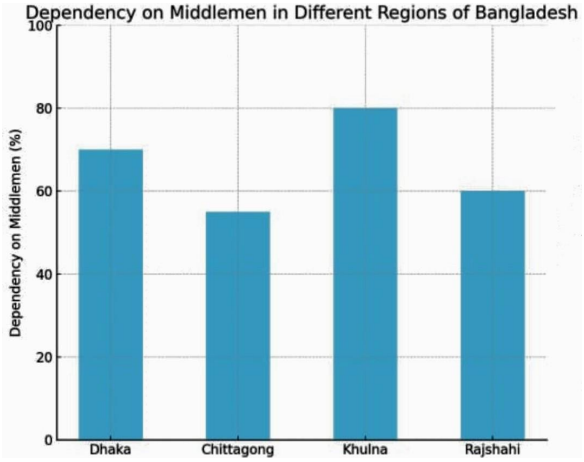

Figure 1. Dependency on Middleman in Different Regions

These farmers play a critical role in local food security and rural employment but face interconnected challenges, including inadequate infrastructure, high post-harvest losses, and volatile prices. Addressing these barriers is essential for improving income stability, fostering rural development, and promoting sustainable agricultural growth.

Table 1. Overview of Smallholder Farmers in Bangladesh

Aspect	Details
Proportion of Farmers	84% of farming population, over 14 million households
Landholding Size	Plots under 2 hectares, often less than 1 hectare.
Average Income	Below $2,000 annually; 50% below the poverty line.
Middlemen Dependency	Over 90% rely on intermediaries, reducing profits.
Education Levels	60% have primary education or less.
Key Challenges	Limited access to credit, inputs, markets, and storage.

1.3 Agricultural Supply Chain Management

Efficient agricultural supply chains are vital for smallholder farmers in Bangladesh to access profitable markets, sustain livelihoods, and support rural development. However, structural challenges such as middleman dependency, poor infrastructure, and limited market access severely impact their income and long-term sustainability. Over 85% of smallholders depend on intermediaries, who capture up to 40% of the final retail price, significantly reducing farmers' profitability (FAO 2022; World Bank 2023). Transportation barriers exacerbate the issue, with only 25% of rural roads in good condition, increasing costs and delays in delivering produce (BBS 2022).

Additionally, inadequate storage facilities lead to post-harvest losses of 15-20%, particularly for perishable crops, forcing farmers to sell immediately at low prices during market saturation periods (IFPRI, 2023). These limitations prevent farmers from accessing higher-value markets, storing goods for better pricing, or responding effectively to market demand. Addressing these supply chain challenges is essential to improving farmers' income, enhancing their market participation, and ensuring sustainable growth in Bangladesh's agricultural sector.

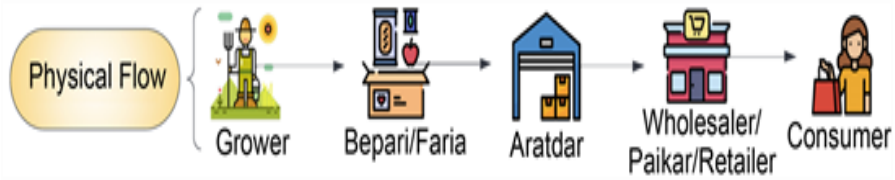

Figure 2. Physical flow of Agri-Food Supply Chain [Source: Hasan, I,2023]

2. Literature Review

Smallholder farmers globally face significant barriers to profitable markets due to limited infrastructure, high transaction costs, and restricted market access. In regions like sub-Saharan Africa and South Asia, fragmented supply chains and poor infrastructure result in unstable incomes, with transportation costs consuming up to 20% of the final price (Pingali & Rosegrant 2020). Similarly, in Bangladesh, smallholders lose up to 25-30% of potential income due to restricted market access and reliance on middlemen (IFPRI 2022). Comprising 84% of the agricultural workforce, Bangladeshi smallholders play a critical role in food security but remain economically vulnerable, earning under $2,000 annually (World Bank 2023).

Middlemen dominate supply chains, purchasing produce below market rates and reducing farmer incomes by up to 40% (Rahman & Parvin, 2022). Poor transportation infrastructure exacerbates challenges, with only 25% of rural roads paved, leading to high costs and post-harvest losses of up to 20% (BBS, 2022). Inadequate storage facilities further result in 15-20% spoilage, forcing farmers to sell at low prices post-harvest (Bangladesh Agricultural University, 2022). While initiatives like the Rural Infrastructure Development Project and NGO programs address supply chain gaps, resource limitations hinder their effectiveness. Expanding infrastructure, storage access, and direct market channels is essential for improving smallholder incomes and fostering sustainable agricultural growth. (Hasan, I. & Habib, et al., 2023)

Table 2. Supply Chain Challenges and Policy Interventions

Category	**Key Challenges**	**Impact**	**Interventions**	**References**
Market Access	I. Limited infrastructure and direct access to markets. II. Reliance on intermediaries (85% of farmers) reduces bargaining power.	I. Farmers lose up to 25-30% of potential income due to restricted access. II. Middlemen capture up to 40% of the retail price, lowering farmer income.	I. Regional marketplaces, cooperative models, and digital platforms for direct sales. II. Digital tools providing real-time market information (e.g., eNAM in India).	I.IFPRI (2022); ADB (2023)
Role of Middlemen	I. Essential for financing, transportation, and market connections. II. Farmers face "locked" dependencies when middlemen advance production loans.	I. Middlemen dominate pricing, exploiting lack of transparency. II. Financial exploitation and reduced income growth potential.	I. Encourage cooperatives to bypass middlemen and ensure fair price negotiations II. Public-private partnerships for financial access.	Rahman & Parvin (2022); FAO (2022). BBS (2022); ADB (2023)

Infrastructure	I. Poor rural roads (only 25% are paved) hinder transportation and increase costs. II.-Limited transportation options restrict access to profitable urban markets.	I. High transport costs consume 10-20% of earnings; delays reduce product quality. II. post-harvest losses of up to 20% due to delays in transit.	I. Investments in rural road networks (e.g., PMGSY in India). II. Subsidized transport systems and community-managed logistics hubs.	Bangladesh Bureau of Statistics (2022); ADB (2023) Chowdhury & Mahmud (2021); FAO (2023)
Storage	I. Only 30% of smallholders have access to proper storage facilities. II. Immediate post-harvest sales result in lower prices during market saturation.	I. post-harvest losses of 15-20%, especially for perishables. II. Loss of income stability and reduced resilience to market volatility.	I. Expansion of community-based cold storage; tax incentives for private sector storage investment. II. Develop shared warehousing systems to reduce losses and allow strategic timing of sales.	IFAD (2023); FAO (2022) Rahman & Ahmed (2020); World Bank (2023)
Policy and Interventions	I. Limited rural infrastructure investments and slow government project implementation. II. Insufficient funding for scaling cold storage and digital tools.	I. Unequal access to programs, favouring certain regions. II. Smallholder exclusion from formal supply chains persists	I.BRAC-led training programs and the Rural Infrastructure Development Project improving rural connectivity.	Rahman & Ahmed (2020); World Bank (2023) IFAD (2022); FAO (2023); BRAC (2022)

3. Methodology

This research employs a qualitative methodology to examine the challenges faced by smallholder farmers within Bangladesh's agricultural supply chains, integrating both secondary and primary data for a comprehensive analysis. Secondary data was sourced from reputable organisations, including the Bangladesh Bureau of Statistics, IFAD, FAO, and the World Bank, providing insights into agricultural infrastructure, market access, and socio-economic conditions affecting smallholders.

Primary data collection involved semi-structured interviews and focus group discussions (FGDs) with 20 smallholder farmers from various villages in the Rajshahi region. This purposive sampling ensured diverse perspectives by including participants with varying levels of experience and crop types. Discussions focused on key supply chain challenges, including dependency on middlemen, transportation issues, and limited storage options. Generic identifiers were used in reporting the findings to maintain participant confidentiality while ensuring a focus on the challenges discussed.

Data analysis combined systematic reviews of secondary sources to identify structural barriers with thematic coding of primary data to highlight recurring patterns. This approach captured both macro-level issues and localized challenges faced by smallholders, offering a nuanced understanding of Bangladesh’s agricultural supply chains. The integration of diverse data sources provided a comprehensive framework for understanding the barriers to market access, profitability, and sustainability for smallholder farmers.

4. Findings

This study identifies critical challenges faced by smallholder farmers in Bangladesh's agricultural supply chains. Key issues include dependency on middlemen, inadequate transportation and storage facilities, limited market information, and insufficient government support. These constraints significantly reduce farmers' income potential and long-term sustainability.

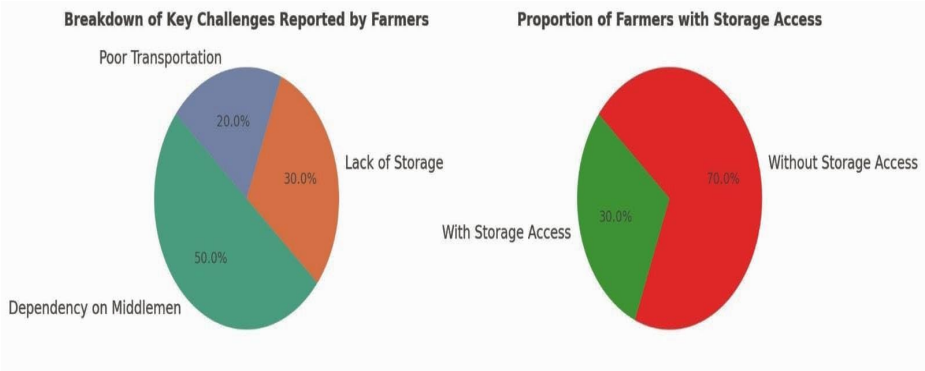

Figure 3. Key Challenges reported by farmers

Over 85% of smallholders depend on middlemen to access markets, with intermediaries often capturing up to 40% of the final sale price (IFPRI, 2023). For instance, a rice farmer, Mr. A reported selling his produce at 20-30% below urban market rates due to middlemen's control over pricing. Similarly, Mr. B highlighted additional transportation fees imposed by intermediaries, further eroding profits. While some farmers acknowledged the logistical support and credit provided by middlemen, these benefits often come at the cost of reduced bargaining power and financial independence.

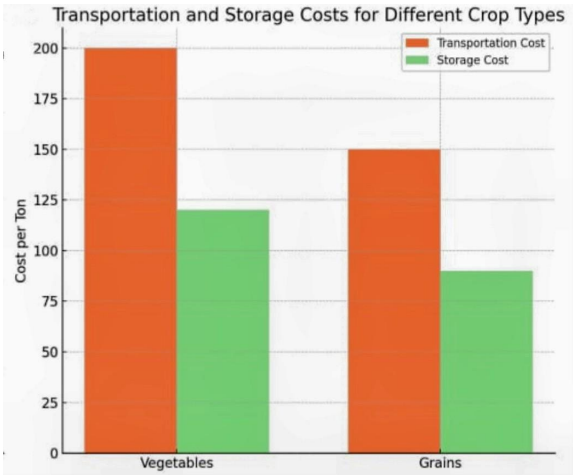

Figure 4. Comparison of Transportation -Storage Costs difference

Transportation challenges are another critical barrier. Approximately 25% of rural roads in Bangladesh are unpaved, making market access difficult, particularly during monsoons (BBS, 2022). Farmers like Mr. C shared that poor road conditions delay delivery and compromise the quality of perishable goods. Transport costs, which can constitute 15-20% of total expenses (ADB 2023), often force farmers to sell locally at reduced prices.

Figure 5. Seasonal Fluctuations in Market Prices

Inadequate storage facilities exacerbate income instability. Post-harvest losses for perishables are estimated at 15-20% due to insufficient storage infrastructure (FAO 2022). Mr. D, a vegetable farmer, noted losing 20% of his harvest annually to spoilage, while others, like Mr. E, emphasized that immediate post-harvest sales at low prices are unavoidable without cold storage. Access to storage could potentially increase smallholder income by 10-15%, as farmers could delay sales until market prices improve.

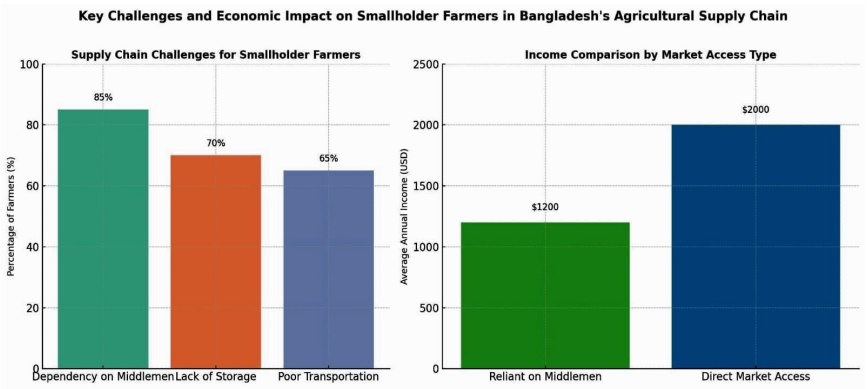

Figure 6. Key Challenges and Economic Impact on Smallholder Farmers

Market information is another major gap, with 70% of farmers relying on informal and often inaccurate sources for pricing and demand data (IFAD 2022). This lack of reliable information prevents farmers from negotiating fair prices or making informed production decisions. Meanwhile, government programs, such as subsidies and financial aid, remain inaccessible to many farmers due to bureaucratic hurdles and limited outreach. Currently, fewer than 20% of smallholders benefit from government agricultural initiatives (World Bank 2023).

These findings underscore the interconnected nature of supply chain challenges. The reliance on middlemen is compounded by poor transportation infrastructure, inadequate storage, and limited access to market information. These barriers collectively restrict farmers' ability to engage in profitable, sustainable agricultural practices and highlight the urgent need for comprehensive policy interventions.

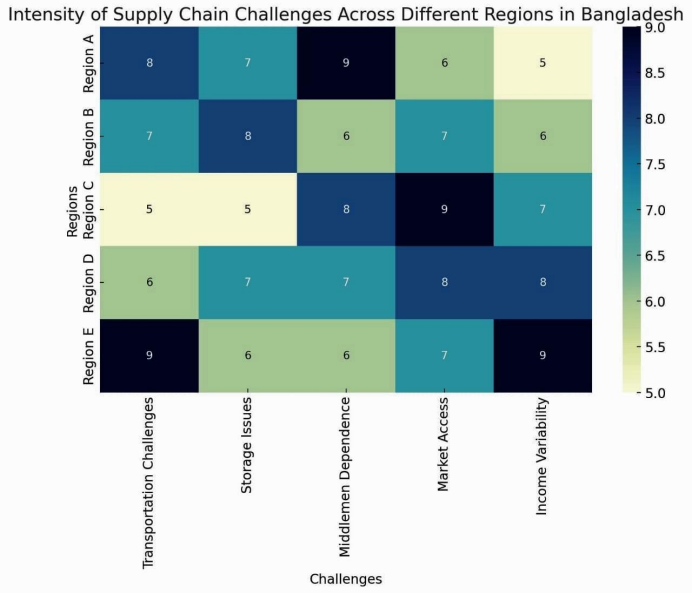

Figure 7. Supply Chain Challenges across different regions

5.Discussion

Smallholder farmers in Bangladesh face challenges in agricultural supply chains, including limited market access, poor infrastructure, and dependency on middlemen. Targeted solutions can address these issues by improving market access through cooperatives, regional marketplaces, and mobile market vans, enabling farmers to sell directly to buyers and reduce transaction costs.Technology integration can revolutionize supply chains. Digital platforms offering real-time market data and price transparency can connect farmers directly with buyers. Mobile apps and SMS-based services provide critical market insights, while e-marketplaces like India's eNAM serve as effective models. Advanced technologies such as blockchain ensure transparency and traceability, boosting trust in transactions, while IoT devices monitor storage, transportation, and product quality, reducing spoilage and improving standards. QR code systems can further enhance consumer confidence by providing product origin details. Institutional support for digital adoption, simplified access to government programs, and capacity building in digital literacy and cooperative management are essential. By combining these technological and structural interventions, Bangladesh can create an efficient agricultural supply chain, empowering smallholders and fostering sustainable rural development.

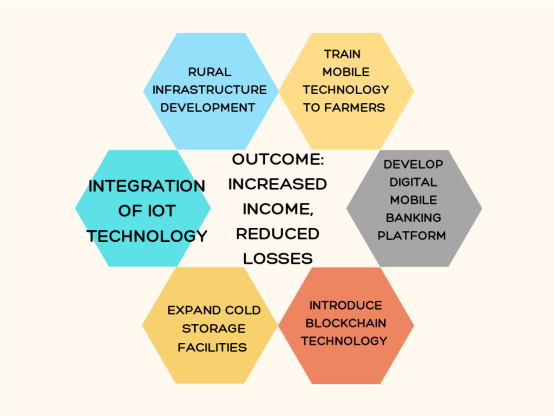

Figure 8. Improved Agriculture Supply Chain Model

6. Conclusion

This research highlights key challenges in Bangladesh's agricultural supply chain for smallholder farmers, including middleman dependency, poor transportation, inadequate storage, and limited market information. Middlemen reduce farmgate prices by 30-40%, while poor rural infrastructure and storage limitations force farmers to sell immediately after harvest, lowering income stability. Solutions include cooperatives, digital platforms, and infrastructure investments to improve market access and reduce post-harvest losses. Technologies

like blockchain and IoT can enhance transparency and efficiency, while QR codes build consumer trust. Improving supply chain efficiency will boost smallholder incomes, productivity, and sustainability while contributing to food security and rural development. Adaptive strategies and continued investment are essential to ensure accessibility and long-term growth.

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