
Market Access and Supply Chain Barriers in Crop Diversification in Haryana: A Current Economic Study

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Abstract:

This paper examines how market access and supply chain constraints shape farmers' decisions to diversify crop production in Haryana beyond the dominant wheat-rice system. Crop diversification into pulses, oilseeds, maize, vegetables, fruits, and other high-value crops offers potential gains in farm income, groundwater conservation, and nutritional outcomes. However, the transition remains constrained by inadequate market infrastructure, limited cold storage and transport facilities, weak quality control systems, and the absence of reliable buyers for non-cereal crops. The study situates these challenges within the economic logic of agricultural decision-making and traces the historical evolution of Haryana's agricultural policy regime that has reinforced cereal dominance. It identifies key market and supply chain barriers inhibiting diversification and reviews existing government interventions aimed at improving market linkages. Drawing on selected international experiences, the paper highlights policy-relevant lessons for overcoming structural bottlenecks. The study concludes with evidence-based recommendations to strengthen market access and supply chains in ways that make crop diversification economically viable and environmentally sustainable in Haryana.

Keywords: Cold chain infrastructure, Crop diversification, Market access, Supply chain barriers, Sustainable agriculture

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INTRODUCTION:

In Haryana's agricultural economy, market access and supply chain constraints are closely intertwined, creating a structural bottleneck that reinforces the dominance of the water-intensive wheat-rice system and inhibits crop diversification. Inadequate cold storage and transport infrastructure result in post-harvest losses of 20–40 per cent for perishable commodities such as fruits and vegetables, substantially reducing their profitability (CLASP, 2023).

From an economic perspective, farmers function as risk-averse profit-maximising agents who allocate land, capital, labour, and water based on expected returns, risk-adjusted costs, and transaction efficiencies. Weak market access distorts these calculations by generating price volatility through information asymmetries, increasing transaction costs due to poor grading, packaging, and contract enforcement, and elevating production and marketing risks. As a result, the net present value of high-value crops—such as pulses, oilseeds, maize, and horticulture—often remains lower than that of government-procured staples supported by assured minimum support prices. Existing research further demonstrates that prolonged rice-wheat monocropping threatens soil health, groundwater sustainability, and long-term market viability. Although diversification has the potential to raise farm incomes and productivity, smallholders with fragmented landholdings face weak bargaining power and limited access to credit, locking them into a low-diversification equilibrium amid accelerating groundwater depletion (Boora et al., 2025; Rawat & Bala, 2021).

Agricultural market failures significantly intensify the challenges associated with crop diversification. These failures manifest in the form of information asymmetries, high transaction costs, weak bargaining power among smallholder farmers, limited access to institutional credit, and fragmented landholdings. Such constraints disproportionately affect crops that require timely grading, cold storage, and rapid transportation, thereby raising marketing risks and post-harvest costs. In the absence of reliable supply chain infrastructure and predictable price signals, farmers rationally prefer staple crops with lower risk and assured procurement, despite their declining environmental and economic sustainability. Consequently, improving market access and reducing supply chain inefficiencies are central to making crop diversification economically viable and sustainable in Haryana. Strengthening market linkages, infrastructure, price discovery mechanisms, and institutional support systems is therefore essential to enable farmers to move beyond the entrenched wheat-rice production system.

HISTORICAL BACKGROUND: POLICY REGIMES AND THEIR IMPACT

Haryana's agricultural sector experienced rapid growth following the Green Revolution of the 1960s, driven by policy support for high-yielding variety (HYV) seeds, a major expansion of irrigation infrastructure, and assured procurement of wheat and rice at minimum support prices (MSP). Irrigation coverage increased from approximately 21 per cent in 1960–61 to over 90 per cent by the early 2000s, while wheat production rose from 0.74 million tonnes in 1966 to more than 12 million tonnes by the 2020s, transforming the state into a major food surplus region. This

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policy framework contributed significantly to national food security and rural income growth, with agricultural gross state domestic product (GSDP) expanding at an average annual rate of 4–5 per cent during the initial decades. At the same time, it entrenched a narrow wheat–rice cropping system, which accounted for over 80 per cent of the cropped area by the 1990s. Risk-reducing incentives arising from guaranteed MSP procurement and electricity subsidies lowered the effective cost of cultivating water-intensive paddy, reinforcing farmer dependence on cereals (Singh, 2000; Bhupal, 2012). Over time, this mono-cropping pattern locked in land-use practices, intensified groundwater extraction in several regions, and strengthened supply chain efficiencies for cereals. These dynamics economically favoured staples with high benefit–cost ratios over riskier alternative crops, even as soil fertility declined and input costs continued to rise.

In recent years, in response to growing environmental and economic sustainability concerns, the Haryana government – alongside centrally sponsored schemes – has increasingly pivoted towards promoting crop diversification. Initiatives such as the *Mera Pani Meri Virasat* (MPMV) scheme, introduced in 2020 and subsequently expanded, provide direct cash incentives of up to ₹8,000 per acre to encourage farmers to shift from paddy cultivation to less water-intensive crops, including cotton, pulses, maize, and oilseeds. The programme has set a target of covering approximately one lakh acres during the Kharif 2025 season and has contributed to a cumulative reduction in paddy area (Global Agriculture, 2025; Tribune India, 2025).

Complementary policy measures include substantial subsidies for micro-irrigation systems under the *Per Drop More Crop* initiative, institutional support for Farmer Producer Organizations (FPOs) to strengthen aggregation and market access, and horticulture promotion through the National Horticulture Mission. Collectively, these interventions reflect a gradual policy shift from output-centric growth towards a sustainability-oriented framework that emphasises water conservation, income diversification, and reduced fiscal stress arising from cereal procurement.

Despite these efforts, the structural dominance of the wheat–rice system remains largely intact. Established mandi networks, long-standing minimum support price incentives, and sizeable electricity subsidies continue to favour paddy cultivation, limiting the economic competitiveness of alternative crops. This persistence underscores the need for deeper market and supply chain reforms to ensure that diversification becomes a viable and enduring choice for farmers rather than a policy-induced deviation.

GOVERNMENT SCHEMES AND MEASURES CURRENTLY UNDERWAY

A number of schemes at the state and central levels aim to address some of the above challenges:

1. **Mera Pani Meri Virasat (Haryana):**

The *Mera Pani Meri Virasat* scheme incentivises farmers to replace paddy cultivation with less water-intensive crops such as cotton, pulses, maize, bajra, and horticultural crops. Under the scheme, farmers receive financial assistance of up to ₹8,000 per acre for diversifying at least 50 per cent of their earlier paddy area. The programme targets approximately one lakh acres during the Kharif 2025 season, with a focus on water-stressed blocks, and also contributes indirectly to

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soil health improvement through reduced residue burning (Department of Agriculture and Farmers Welfare, Haryana, n.d.; Haryana Chief Minister's Office, 2025).

2. Micro-Irrigation under PMKSY:

Subsidies provided under the *Pradhan Mantri Krishi Sinchai Yojana* (PMKSY) cover a substantial share of the cost of drip and sprinkler irrigation systems, ranging between 70 and 90 per cent. These interventions have been shown to reduce water consumption by 30–50 per cent and enhance the feasibility of horticulture and diversified cropping on smallholdings. By 2024, micro-irrigation systems had been implemented over more than 1.5 lakh hectares in Haryana, with recent policy targets seeking to promote diversification over approximately one lakh acres in water-stressed regions during Kharif 2025 (Government of Haryana, n.d.; Tribune India, 2025).

3. FPO Promotion and Capacity Building:

NABARD and state-led initiatives have facilitated the formation of more than 500 Farmer Producer Organizations (FPOs) in Haryana by 2025. These institutions play a key role in improving aggregation, access to institutional credit, and farmers' bargaining power in markets. Empirical assessments indicate that FPO members have experienced income gains in the range of 15–25 per cent through improved supply chain integration and collective marketing, supported by credit disbursements amounting to approximately ₹5,000 crore (Social Studies Journal, 2024).

4. Cold Chain Development:

Infrastructure support through schemes such as the *Agriculture Infrastructure Fund* has promoted investments in packhouses, cold storage facilities, and refrigerated transport, with national allocations amounting to nearly ₹20,000 crore. Despite these initiatives, Haryana continues to experience post-harvest losses of 30–40 per cent for perishable commodities due to last-mile infrastructure gaps. Public-private partnership models are therefore being pursued to augment cold storage capacity by an estimated 50,000 metric tonnes by 2026 (CLASP, 2023).

5. Residue Management and Crop Diversification Incentives:

The Haryana government has promoted the adoption of stubble management machinery and custom hiring centres, deploying over 5,000 machines by 2025. These measures have contributed to a substantial reduction in farm fires in identified hotspot villages and lowered residue management costs by approximately ₹2,000–3,000 per acre. While primarily aimed at environmental management, these interventions indirectly support crop diversification by reducing cultivation costs and enabling alternative cropping practices (Times of India, 2025). Collectively, these schemes represent important policy efforts to encourage diversification. However, their effectiveness depends on closer integration with market development initiatives to ensure that farmers adopting alternative crops have reliable buyers, logistics support, and opportunities to realise higher value.

CURRENT CHALLENGES AND SUPPLY CHAIN BARRIERS

Current market and supply chain constraints pose significant obstacles for farmers in Haryana seeking to diversify away from the traditional wheat-rice system. The continued

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dominance of paddy and wheat cultivation has contributed to environmental stress in the form of soil degradation, groundwater depletion, and rising input externalities, prompting policy efforts to encourage diversification into pulses, oilseeds, maize, vegetables, fruits, and other horticultural crops. However, this transition remains constrained by persistent structural and market failures. Farmers face inadequate market infrastructure, including limited access to cold storage and transportation, the absence of efficient grading and packaging facilities, and weak linkages with organised buyers. Small and marginal farmers are further constrained by information asymmetries, high transaction costs, fragmented landholdings, and limited access to institutional credit, which collectively reduce their capacity to invest in perishable and high-value crops. These constraints are exacerbated by price volatility and the absence of assured market returns for diversified produce, encouraging risk-averse farmers to continue cultivating cereals supported by government procurement mechanisms. Addressing these supply chain weaknesses is therefore central to making crop diversification both economically viable and environmentally sustainable in Haryana. The key barriers are discussed below.

i. Weak Market Linkages for High-Value Crops

Limited and unreliable market linkages significantly restrict farmers' participation in high-value crop markets. A large proportion of small and marginal farmers continue to sell their produce through traditional wholesale mandis, where price volatility is high and buyer commitment is uncertain. In the absence of assured institutional buyers or formal contracts, farmers face substantial marketing risks, which discourages investment in diversified crops and reinforces dependence on wheat and rice with predictable demand and procurement support. Empirical studies on contract farming indicate that assured purchase arrangements, standardized quality requirements, and reduced-price uncertainty can substantially improve farm incomes and incentivize adoption of high-value crops. Dependable buyers and enforceable contractual arrangements therefore play a critical role in enabling farmers to invest in improved inputs, grading, and post-harvest handling practices, thereby enhancing product quality and market participation.

ii. Insufficient Cold Chain and Storage Infrastructure

Fruits and vegetables are highly perishable commodities that require reliable cold chain infrastructure to maintain quality and extend market reach. At the national level, India operates approximately 8,600 cold storage facilities with an aggregate capacity of nearly 40 million metric tonnes, concentrated primarily in a few states such as Uttar Pradesh, West Bengal, and Gujarat. Despite this expansion, cold chain infrastructure remains unevenly distributed and insufficient to meet the needs of perishable crop diversification, resulting in substantial post-harvest losses and constrained market access for farmers.

In contrast to leading states, Haryana has a comparatively limited cold storage base, with fewer than 300 facilities, restricting farmers' ability to store, aggregate, and time the sale of fruits and vegetables. This infrastructural gap compels producers to engage in distress sales

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immediately after harvest, often at unfavourable prices, thereby discouraging diversification into horticulture and other high-value crops that depend on effective cold chain support for profitability and waste reduction (CLASP, 2023).

iii. Low Scale and Fragmented Supply

Small and fragmented landholdings significantly constrain farmers' ability to achieve the scale required by processors, organised retailers, and exporters. At the national level, small and marginal farmers constitute the majority of agricultural producers, with an average operational holding size of just over one hectare, limiting uniform production and consistent volume supply. Haryana exhibits a similar structural pattern, with a large proportion of farmers operating holdings below two hectares, which complicates aggregation for high-value crops. Although Farmer Producer Organizations (FPOs) and cooperative models have been promoted to address scale-related constraints, a substantial share of FPOs struggle to function at an economically efficient scale due to managerial limitations, inadequate capitalisation, and weak market integration. Strengthening aggregation mechanisms through professional management, financial support, and digital coordination can reduce per-unit transaction costs and enhance farmers' access to high-value markets (Social Studies Journal, 2024).

iv. Quality Standards and Traceability Requirements

Modern domestic and international markets increasingly demand stringent quality standards, uniform grading, and robust traceability systems. However, smallholder farmers often lack access to the technical expertise, infrastructure, and certification support necessary to comply with these requirements. A limited share of India's horticultural output meets export-grade standards, primarily due to inconsistent post-harvest handling practices and the absence of standardised quality protocols. International experience demonstrates that the adoption of traceability frameworks enhances food safety, origin assurance, and buyer confidence, enabling producers to access premium markets. While some Indian commodity clusters – such as grapes, spices, and basmati rice – have adopted traceability systems, broader uptake remains limited. Expanding certification services, training programmes, and digital traceability infrastructure is therefore essential for enabling farmers in Haryana to integrate into high-value domestic and export supply chains (International Journal of Economics, Business and Management Research, 2023).

v. Transportation, Logistics, and Financial Constraints

Inadequate transportation and logistics infrastructure further constrain crop diversification, particularly for perishable commodities. A significant proportion of rural settlements lack all-weather road connectivity, delaying the movement of produce and increasing spoilage risks. In addition, the availability of refrigerated transport remains far below estimated requirements, resulting in high post-harvest losses for fruits and vegetables during transit. These inefficiencies reduce farm-gate prices and diminish incentives for farmers to shift away from cereals toward high-value crops (CLASP, 2023). Diversification into fruits, vegetables,

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flowers, and spices also requires higher working capital for quality inputs, skilled labour, irrigation, packaging, and rapid post-harvest movement. However, access to affordable institutional credit remains limited for many small and marginal farmers, who continue to rely on informal sources with higher borrowing costs. In the absence of tailored financial products, such as short-term working capital loans and warehouse receipt financing, farmers rationally prefer wheat and rice, which involve lower financial risk and assured procurement. Strengthening targeted credit instruments, interest subvention mechanisms, and FPO-linked lending is therefore critical to overcoming financial barriers to diversification.

vi. Knowledge and Extension Gaps

Knowledge and training gaps play a critical role in shaping farmers' adoption of high-value crops. A relatively small proportion of Indian farmers receive regular and structured agricultural extension support, leaving many without access to updated information on improved crop varieties, pest and disease management, post-harvest handling, grading, packaging, and evolving market standards. As a result, farmers often lack the technical and managerial capacity required to meet the quality expectations of organised domestic and export markets. In Haryana, despite comparatively stronger extension networks than in many other states, awareness of export standards, certification requirements, and quality protocols remains uneven across regions and farm sizes. These gaps constrain farmers' ability to engage with modern value chains and reduce buyer confidence. Strengthening extension systems through digital advisory platforms, Farmer Producer Organization (FPO)-based training, and public-private partnerships is therefore essential for building farmer capabilities, reducing information asymmetries, and enhancing trust between producers and market actors.

SUGGESTIONS IN INDIAN LANDSCAPE

Addressing market access and supply chain barriers to crop diversification in Haryana requires a multi-pronged strategy aligned with national agricultural priorities and state-specific institutional capacities. Such an approach must combine investments in physical infrastructure with market reforms, institutional strengthening, and digital integration. Strengthening cold chain logistics through public-private partnerships can reduce post-harvest losses in perishable crops, while expanded use of the National Agriculture Market (e-NAM) platform can improve price discovery and facilitate inter-state trade. The following policy directions outline practical interventions that can enhance the economic viability of crop diversification in Haryana.

i. Strengthening FPOs and Aggregation

Promoting the formation and capacity building of Farmer Producer Organizations (FPOs) through targeted grants for governance, infrastructure, and business planning can enhance aggregation and bargaining power among smallholders. By 2025, more than 500 FPOs had been established in Haryana, enabling small farmers to collectively meet buyer volume requirements and improve access to institutional credit. Empirical assessments indicate that participation in FPOs has been associated with income gains of 15–25 per cent for member farmers through

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improved supply chain integration and access to organised markets (Social Studies Journal, 2024; Global Agriculture, 2025).

ii. Investment in Last-Mile Cold Chain and Packhouses

Expanding last-mile cold chain infrastructure, including packhouses and decentralized cold storage facilities near production clusters, is critical for reducing post-harvest losses in horticultural crops. National-level initiatives have allocated substantial resources for agricultural infrastructure development, with a focus on augmenting cold storage capacity through public-private partnerships. In Haryana, such investments have the potential to address post-harvest losses estimated at 30–40 per cent for perishable commodities and support the development of high-value crop clusters (CLASP, 2023).

iii. Market Linkage Schemes and Contract Farming Support

Facilitating structured linkages between FPOs, processors, and exporters through standardized contract farming frameworks and accessible dispute-resolution mechanisms can reduce price uncertainty and market risk. Pilot initiatives in Haryana suggest that risk-sharing arrangements and improved buyer-producer coordination for crops such as maize and oilseeds can enhance market participation. Integration with digital trading platforms, including e-NAM, has further contributed to higher inter-state trade volumes by improving transparency and price signals (International Journal of Economics, Business and Management Research, 2025).

iv. Quality Assurance and Traceability Programmes

Supporting certification services, shared testing facilities, and digital traceability systems is essential for enabling farmers to meet the quality standards required by organised domestic and export markets. Training initiatives focusing on post-harvest handling, grading, and compliance with retailer specifications have reduced rejection rates for fruits and vegetables and strengthened buyer confidence. Scaling such programs can help farmers in Haryana access higher-value markets and sustain diversification efforts (International Journal of Economics, Business and Management Research, 2025).

v. Targeted Finance and Working Capital Support

Crop diversification into high-value commodities requires greater working capital for inputs, packaging, and rapid market delivery. Designing tailored credit products, including warehouse receipt financing and FPO-linked lending, can ease liquidity constraints for smallholders. Haryana's agricultural credit planning for 2025–26 places increased emphasis on risk-mitigation instruments, including crop insurance coverage under the Pradhan Mantri Fasal Bima Yojana, to support diversification into pulses and other non-cereal crops (Social Studies Journal, 2024).

GLOBAL BEST PRACTICES

Below are five examples of countries that addressed market and supply chain barriers to help farmers diversify and reach higher value markets.

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i. The Netherlands - High-Value Horticulture and Integrated Cold Chains

The Netherlands has emerged as one of the world's leading exporters of horticultural products despite its limited land area. This success is underpinned by an integrated agri-food system characterized by advanced greenhouse technologies, efficient cold chain infrastructure, and coordinated market institutions. Centralized auction platforms, cooperative structures, and specialized logistics networks ensure transparency, price discovery, and rapid market access, enabling perishable produce to reach European markets within short timeframes. These institutional arrangements demonstrate how investments in logistics, quality control, and coordinated marketing can support high-value exports and sustain farmer incomes in land-constrained contexts (Wageningen University & Research, 2022).

ii. Israel - Irrigation and Technology-Led Diversification

Israel has successfully transformed severe water scarcity into an opportunity for high-value agricultural diversification through innovations in micro-irrigation, wastewater recycling, and protected cultivation. A substantial share of cultivated land operates under precision irrigation systems, allowing efficient production of fruits, vegetables, flowers, and herbs. Strong extension services, close linkages between farmers and agri-technology firms, and vertically integrated supply chains connect producers directly to domestic retailers and export markets. Israel's experience illustrates how technology-driven resource efficiency and institutional support can enable diversification even under extreme ecological constraints (Wageningen University & Research, 2021).

iii. Kenya - Smallholder-Based Horticulture for Export Markets

Kenya represents a prominent example of successful smallholder integration into global horticulture value chains. Vegetables, fruits, and floriculture constitute a significant share of agricultural output and export earnings, supported by contract farming arrangements, strict quality standards, and compliance with international certification requirements. Investments in village-level collection centres, cold storage facilities, and traceability systems have strengthened Kenya's access to European markets and reduced marketing risks for small farmers. This case highlights the importance of quality assurance, buyer-producer coordination, and logistics infrastructure in enabling smallholders to participate in high-value export markets (Journal of Development Studies, 2020).

iv. Vietnam - Fruit Export Expansion through Value Chain Upgrading

Vietnam has rapidly expanded exports of fruits such as dragon fruit, lychee, and mango by strengthening value chain coordination, quality standards, and post-harvest infrastructure. Public-private collaboration has improved grading, hygiene, phyto-sanitary compliance, and cold storage capacity, enabling access to premium markets in East and Southeast Asia. Export earnings from fruits increased substantially over the past decade, reflecting the effectiveness of targeted investments in farmer aggregation, certification systems, and logistics. Vietnam's experience demonstrates how emerging economies can scale horticultural exports through

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coordinated value chain development (Journal of Asian Economics, 2023).

v. **India – FPO-Led Domestic Successes in High-Value Crops**

Within India, Farmer Producer Organizations (FPOs) have enabled smallholders to benefit from crop diversification by facilitating aggregation, collective marketing, and compliance with quality standards. In states such as Odisha, Maharashtra, and Andhra Pradesh, FPOs have successfully marketed mangoes, grapes, and vegetables through shared grading, packaging, and direct linkages with organized buyers. In some cases, coordinated training and institutional support have enabled FPOs to access export markets. These domestic experiences illustrate that global best practices in aggregation, quality control, and market integration can be adapted effectively within the Indian context. Collectively, these case studies underline several common lessons: the centrality of cold chain and logistics infrastructure, the importance of quality assurance and traceability systems, the role of aggregation institutions such as cooperatives and FPOs, and the value of targeted technological and extension support. These insights offer relevant guidance for designing market-led crop diversification strategies in Haryana (CLASP, 2023).

CONCLUSION

This study demonstrates that technological interventions alone are insufficient to sustain crop diversification in the absence of well-functioning markets and supply chains capable of absorbing high-value agricultural produce such as pulses, oilseeds, vegetables, and fruits. In Haryana, moving away from the entrenched wheat-rice production system requires integrated policymaking that combines direct diversification incentives with sustained investments in market infrastructure, institutional capacity, and risk-mitigation mechanisms. Initiatives such as the *Mera Pani Meri Virasat* scheme, alongside efforts to strengthen Farmer Producer Organizations, expand cold chain capacity, promote quality assurance and traceability systems, and improve access to tailored agricultural finance, illustrate an emerging policy recognition of these interdependencies (CLASP, 2023).

Comparative international experiences—from smallholder-led horticultural exports in Kenya to value chain upgrading in Vietnam—together with domestic evidence on reduced post-harvest losses and improved market participation, underscore that coordinated alignment among buyers, logistics providers, digital platforms, and producer institutions is critical for sustainable diversification outcomes (Journal of Development Studies, 2020; Journal of Asian Economics, 2023). Haryana can draw on these lessons by piloting district-specific integrated value chains for selected crops, systematically monitoring outcomes such as farm incomes, market access, and groundwater use, and scaling successful models through public-private partnerships. If pursued consistently, such an approach can support the emergence of high-value production clusters, reduce post-harvest losses, ease the fiscal burden associated with cereal procurement, and strengthen rural livelihoods under increasing water stress. The framework outlined in this study therefore offers evidence-based guidance for policymakers, development agencies, and private

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investors seeking to advance economically viable and environmentally sustainable crop diversification in Haryana.

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