

Reforming India's Public Distribution System (PDS): Operational Dynamics, Digital Interventions, and Strategic Pathways to Food Security

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Abstract

The Public Distribution System (PDS) is a central component of India's food-security architecture, providing subsidized food grains to vulnerable households through a nationwide network of procurement, storage, transportation, and Fair Price Shops (FPSs). Despite its scale and policy importance, the system has faced persistent operational challenges, including diversion of food grains, beneficiary identification errors, weak last-mile infrastructure, storage constraints, and uneven administrative capacity. This paper examines the contemporary operational dynamics of the Targeted Public Distribution System (TPDS) through the combined perspectives of public policy and supply chain management. Particular attention is given to digital interventions, including Aadhaar-enabled authentication, electronic Point of Sale (ePoS) systems, and the One Nation One Ration Card (ONORC) initiative. The paper uses secondary information from official administrative sources, audit material, and previously reported empirical studies to assess key stages of the distribution chain. The analysis suggests that digitalization can strengthen transaction-level traceability and reduce opportunities for duplicate or fictitious records, while portability can improve access for migrant households. At the same time, digital systems do not eliminate vulnerabilities in transportation, warehousing, connectivity, authentication, and retail-level incentives. The paper therefore argues for an integrated reform strategy that combines digital transparency with stronger logistics, decentralized procurement, improved storage, viable FPS economics, and reliable non-biometric fallback mechanisms. Such reforms can strengthen the PDS as a more transparent, resilient, and nutrition-sensitive instrument of food security.

Keywords: Public Distribution System (PDS); Food Security; Targeted PDS; Supply Chain Management; ePoS; Aadhaar; One Nation One Ration Card; Food Policy

1. Introduction

Food security is an essential component of inclusive economic development because reliable access to food affects household welfare, nutrition, productivity, and human-capital formation. In India, the Public Distribution System (PDS) is one of the principal institutional mechanisms used to support food access among vulnerable populations. The system operates through coordination between the central and state governments. The central institutional structure is responsible for major functions such as procurement,

storage, transportation, and allocation, while state administrations play an important role in beneficiary management and the operation and supervision of Fair Price Shops (FPSs).

The transition from a universal PDS to the Targeted Public Distribution System (TPDS) in 1997 and the subsequent enactment of the National Food Security Act (NFSA), 2013, represented important stages in the evolution of India's food-security policy. However, targeting also created an enduring policy challenge: the system must identify eligible households accurately while minimizing both exclusion of deserving beneficiaries and inclusion of ineligible households. Operational leakages and diversion of subsidized grain have further affected the effectiveness of the system.

Technological reforms have subsequently changed the way PDS transactions are recorded and monitored. Electronic Point of Sale (ePoS) devices, Aadhaar-enabled authentication, digitized beneficiary records, and ONORC portability have sought to strengthen transparency and make food entitlements more portable. These reforms, however, should be assessed as part of a wider supply chain rather than only at the retail transaction point. A transparent transaction at an FPS cannot by itself resolve weaknesses in procurement, storage, transportation, or local administration.

With this in mind, the paper focuses on two questions: (i) how far digital interventions can strengthen transparency and reduce opportunities for diversion and identity-related irregularities; and (ii) what structural and operational vulnerabilities continue to constrain the PDS's contribution to food security.

2. Objectives of the Study

- To examine the major operational challenges affecting the contemporary PDS in India.
- To assess the role of ePoS and Aadhaar-enabled authentication in improving transaction-level transparency.
- To examine the contribution of ONORC portability to food access for migrant beneficiaries.
- To identify supply-chain and retail-level vulnerabilities that remain despite digitalization.
- To propose policy measures for a more efficient, transparent, resilient, and nutrition-sensitive PDS.

3. Review of Literature

3.1 Targeting, Inclusion and Exclusion

An important strand of PDS research focuses on the difficulty of targeting benefits accurately. Errors of exclusion occur when eligible households fail to receive benefits, whereas errors of inclusion occur when benefits reach households that do not qualify. The literature cited in the source paper also highlights the particular difficulties faced by migrants and vulnerable rural households when access depends on documentation, residence-related requirements, or local administrative processes.

3.2 Diversion and Supply-Chain Leakages

Another major concern is the diversion of subsidized grain before it reaches intended beneficiaries. The economic difference between the cost of supplying food grains and the subsidized price creates incentives for diversion and arbitrage. Weak monitoring at storage and transportation stages can make accountability difficult. Earlier research cited in the paper identifies diversion as a longstanding issue within PDS operations.

3.3 Digitalization and Welfare Delivery

Digitalization has introduced a different set of opportunities and risks. ePoS systems can create electronic transaction records and improve stock reconciliation, while Aadhaar-enabled authentication can reduce duplication and identity-related irregularities. At the same time, biometric authentication may

fail because of fingerprint quality, connectivity problems, device failures, or other local infrastructure constraints. The literature therefore presents digitalization as a potentially important transparency mechanism, but not as a complete substitute for administrative capacity and inclusive delivery arrangements.

4. Analytical Framework and Methodology

The paper draws on secondary information and uses a qualitative analytical approach. The paper evaluates the PDS through two complementary perspectives. First, a Supply Chain Management (SCM) perspective is used to map the movement of food grains from procurement points through central and state storage facilities to Fair Price Shops and final beneficiaries. Second, a public-policy perspective is used to examine how technological and administrative reforms translate into beneficiary-level outcomes. The source paper identifies secondary information from official administrative dashboards, Ministry of Consumer Affairs, Food and Public Distribution material, Comptroller and Auditor General (CAG) reports, and existing peer-reviewed or independent field-evaluation literature. The analytical dimensions include procurement and distribution tracking, ePoS transaction performance, and ONORC portability. Because the available material is aggregated and secondary in nature, the study does not claim to estimate a causal effect of digitalization on food-security outcomes. Instead, it synthesizes operational evidence and identifies structural relationships and policy gaps.

5. PDS Supply Chain and Operational Challenges

5.1 Procurement Concentration and Storage Constraints

The PDS depends substantially on public procurement associated with Minimum Support Price (MSP) operations. When procurement is geographically concentrated, substantial quantities of grain must be transported from surplus areas to deficit regions. This can increase pressure on national transport networks and storage capacity. Storage limitations can also affect grain quality, particularly where open-air storage is used under conditions that expose stocks to moisture, pests, and weather-related risks.

5.2 Vulnerabilities at Fair Price Shops

Fair Price Shops represent the final operational link between the public distribution network and households. At the retail end, dealers work within regulated commission arrangements while still having to meet routine costs such as rent and electricity. Where retail economics are weak, incentives for underweighting or diversion may arise. Strengthening the economic viability and accountability of FPSs is therefore important for improving last-mile delivery.

5.3 Authentication and Connectivity Constraints

Digital authentication requires functional devices, reliable connectivity, and successful beneficiary verification. Connectivity failures can interrupt transactions, particularly in remote locations. Biometric mismatch can also create difficulties for elderly beneficiaries and manual workers. A well-designed digital PDS therefore requires an accessible fallback mechanism so that technological failure does not become food-access failure.

6. Digital Interventions and Their Implications

6.1 Aadhaar-Enabled Authentication and ePoS

The movement from paper-based records toward ePoS-based transactions can improve the visibility of retail transactions. Electronic records make it more difficult to maintain entirely fictitious transaction

logs and can facilitate stock reconciliation. Aadhaar-enabled authentication can further support beneficiary verification and reduce duplication. However, these benefits depend on functioning infrastructure and appropriate safeguards against exclusion.

6.2 One Nation One Ration Card (ONORC)

ONORC represents an important shift from geographically fixed access toward portability of food entitlements. For migrant workers and households whose members move across locations for employment, portability can reduce the dependence of food access on a single local ration shop. The initiative therefore has particular relevance for labour mobility and urban food security. Its effectiveness, however, depends on interoperable systems, awareness, functioning authentication, and availability of stocks at participating outlets.

7. Integrated Assessment

The analysis points to a fairly clear conclusion: digitalization can address some PDS problems, but not all of them. Digital tools are strongest at the point where a beneficiary transaction is recorded. They are less capable of independently resolving upstream problems such as procurement concentration, storage losses, transport diversion, grain-quality management, and weak retail incentives. The PDS should therefore be understood as an end-to-end supply chain in which accountability must exist at every stage. A second finding is that efficiency and inclusion must be pursued together. A system that records transactions accurately but prevents a legitimate beneficiary from completing a transaction because of connectivity or authentication failure cannot be considered fully effective. Digital accountability should consequently be combined with human oversight and accessible fallback mechanisms.

8. Policy Recommendations

1. **End-to-end transport monitoring:** Introduce GPS-based fleet monitoring and geofencing for PDS transportation, with appropriate audit trails and monitoring of unauthorized stops.
2. **Strengthen storage infrastructure:** Expand and modernize storage capacity and strengthen quality-management systems to reduce exposure to moisture, pests, and weather-related deterioration.
3. **Diversify procurement:** Encourage procurement from a wider geographical base where economically and institutionally feasible, reducing excessive concentration and transport pressure.
4. **Diversify the PDS basket:** Where policy and fiscal conditions permit, broaden the food basket beyond wheat and rice to include locally appropriate millets, pulses, and other nutritionally valuable commodities.
5. **Improve FPS viability:** Review dealer commissions and operating incentives so that legitimate retail operations are financially sustainable while maintaining strong monitoring and accountability.
6. **Create reliable authentication fallback:** Standardize secure, auditable alternatives for cases of biometric failure or network disruption so that eligible beneficiaries are not denied food because of technical problems.
7. **Strengthen grievance redressal:** Improve beneficiary-facing complaint mechanisms, transaction records, and local oversight so that errors can be identified and corrected quickly.

9. Limitations of the Study

This paper relies on secondary and aggregated information available in the material reviewed. It does not present a primary household survey, experimental design, or state-level econometric estimation.

Consequently, the paper should be interpreted as an analytical assessment of operational dynamics rather than a causal impact evaluation. Future research could strengthen the evidence base through household-level surveys, state-wise panel data, FPS-level transaction data, and comparative empirical analysis of digital and non-digital delivery outcomes.

10. Conclusion

India's PDS has evolved substantially through institutional and technological reforms. The introduction of digital transaction systems, Aadhaar-enabled authentication, and ONORC portability has strengthened the potential for transparency, beneficiary verification, and portability of entitlements. Nevertheless, the analysis demonstrates that technology alone cannot resolve the deeper operational constraints of a nationwide food-distribution network.

A stronger PDS will therefore require reforms that work together rather than isolated technological fixes. Procurement, storage, transportation, FPS economics, digital infrastructure, authentication, grievance redressal, and beneficiary inclusion must operate as interdependent components of one food-security system. Strengthening these links can reduce operational leakages, improve reliability, and make food entitlements more accessible to vulnerable and mobile households. Such reforms can enhance the contribution of the PDS to food security and support India's broader commitment to reducing hunger and improving social protection.

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