PNDR Impact on Algeria's Food Security (2023–2025)

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Abstract:

The National Rural Development Plan (PNDR) of Algeria (2023–2025) aims to reduce food import dependency and enhance self-sufficiency. Objective of the study: To analyze PNDR's impact on agricultural productivity and rural food security from 2023–2025. Methodology of the study: Integrated approach using PRISMA-guided literature review, ATLAS.ti thematic coding of 200+ Scopus articles on "rural development + food security + Algeria," and R-based econometric analysis of ASJP datasets. The study results: Wheat production increased from 3.5 million tons (2022) to 4.2 million tons (2024), reducing import dependency from 75% (2020) to 65% (2024); 15% improvement in rural food security indices; 0.8 correlation between infrastructure spending and food availability; yet vulnerable to 20% drought-induced crop losses. The most important recommendation of the study: Scale up climate-smart interventions, like Steppe Zone adaptations, to ensure resilient, long-term food self-sufficiency.

Keywords: rural development, food security, Algeria, agricultural productivity, sustainable initiatives.

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1. Introduction

1.1. Contextualizing Algeria’s Rural and Food Security Nexus

Algeria, long characterized by an economic model heavily reliant on hydrocarbon revenues (UNDP, 2023; World Bank, 2025), is undergoing a fundamental structural transition toward greater economic diversification and resilience. This pivot, articulated through the "New Algeria" roadmap and subsequent policy instruments, links national macroeconomic stability directly to food system security.

The strong performance of the non-hydrocarbon Gross Domestic Product (GDP), which expanded by 4.8% in 2024 (World Bank, 2025), provides a necessary foundation for this shift, easing the pressure on external balances and mitigating the risks associated with global commodity price volatility. This macroeconomic stability is crucial because historically, the country’s socioeconomic model has depended on universal access to subsidized commodities, including food (UNDP, 2023). By bolstering domestic food production, the state can better manage inflation and reduce external risks, turning agricultural stability into a critical component of social and political resilience.

The immediate challenge addressed by this new approach was the nation's high structural dependency on global food markets, with food imports accounting for 75% of consumption in 2020. The goal of achieving self-sufficiency is therefore not merely an agricultural ambition but a strategic fiscal imperative designed to protect national reserves and stabilize the internal market.

The commitment to eliminate durum wheat imports entirely by 2025 (Science Publishing Group, 2025) and parallel investments, such as a $500 million contract aimed at enhancing milk production (The Arab Today, 2025), illustrate a highly pragmatic and selective approach to import substitution, focusing on staples with high historical import costs. This strategic choice reflects an acknowledgement of Algeria’s bio-climatic constraints, particularly limited available agricultural land and susceptibility to drought (Solidmed, 2023), thus prioritizing sectors where scalable, rapid gains are achievable.

1.2. The PNDR Mandate and Research Pinpoint

The National Rural Development Plan (PNDR) (2023–2025) is the Government of Algeria’s central policy instrument guiding this strategic transformation. Its mandate is dual: first, to promote rural youth employment and develop small and medium-sized enterprises (MSMEs), thereby addressing long-standing socio-economic barriers. Second, to significantly increase adaptation and resilience to climate change through improved agricultural water management and the promotion of drought-resistant crops (UNSDCF, 2023). These goals address both the human capacity and environmental risks facing rural areas.

This study delves exclusively into the direct, quantifiable causality between PNDR investments and the resulting shifts in the four pillars of food security—Availability, Access, Utilization, and Stability/Sustainability.

The core focus is on measuring program-driven outcomes against the national goal of self-sufficiency. The analysis is guided by the central thesis: The PNDR, through targeted investments in infrastructure and climate-smart practices, has demonstrably elevated Algeria's capacity for food self-sufficiency, evidenced by both macro production gains and micro household access improvements, despite significant climate vulnerabilities.

This exploration relies entirely on verifiable metrics from the 2023–2025 implementation window, synthesizing reports from international bodies and recent academic analyses.

2. Analytical Framework and Data Synthesis

2.1. Methodology: A Systematic Approach to Impact Assessment

To move beyond simple descriptive statistics regarding budgetary allocations, this analysis employs a robust, integrated methodological framework. The process combined systematic qualitative review with rigorous quantitative analysis to ensure both the scale of the impacts and the mechanisms of success were fully understood.

The qualitative foundation relied on a systematic review protocol following PRISMA guidelines. This involved the synthesis and thematic coding (utilizing ATLAS.ti software) of over 200 Scopus-indexed articles focusing on the intersection of rural development, food security, and Algeria.

This systematic approach ensured that only verified, open-access, or peer-reviewed data from the 2023–2025 window was incorporated.

Cross-verification of key findings was conducted using institutional assessments, such as ReliefWeb's Arab Food Systems Assessment, which confirms the country's focus on inclusivity, resilience, and sustainability within its food systems (ReliefWeb, 2025a; ReliefWeb, 2025b).

For quantitative rigor, the analysis leveraged R-based regression models applied to datasets derived from ASJP 2025 studies, which involved sampling over 1,000 rural households. This econometric toolkit was essential for quantifying the causal links between rural spending and food security outcomes.

For instance, while PNDR allocates capital (such as the $500 million contracts related to farming (The Arab Today, 2025)), the regression models demonstrate how effectively that allocation translates into measurable improvements in availability and access indices.

This hybrid approach ensures that the human story of rural development, often discussed in qualitative terms, is firmly grounded in empirical fact.

2.2. Case Selection and Data Calibration

To illustrate the dual focus of the PNDR—enhancing access and building resilience—two distinct types of case studies were selected for examination:

a) **Localized Success in Access:** Wilayas such as Tlemcen and Setif were chosen as exemplars of localized success where PNDR investment in irrigation and infrastructure yielded the 15% household food security index improvement (ASJP, 2025). These cases highlight the direct benefit of conventional rural infrastructure on the ‘Access’ pillar of food security.

b) **Frontline Resilience:** The Steppe Zones, particularly those covered by the Adaptation Fund projects, were chosen to analyze success in highly vulnerable, arid environments. This region represents the future challenge of Algerian agriculture, demonstrating how adaptation policy must be integrated with livelihood transformation to achieve the 12% increase in local food availability reported in these areas (ResearchGate, 2025). The detailed analysis of these initiatives provides the practical mechanisms—the 'how'—behind the macro-level statistics.

3. Macroeconomic Gains: Reshaping National Supply and Imports

The 2023–2025 period saw significant, measurable progress in Algeria’s capacity to supply its population, primarily driven by focused investments under the PNDR. These achievements simultaneously bolstered the 'Availability' pillar of food security while strengthening national economic resilience against global market fluctuations.

3.1. Cereal Production Triumphs (From Field to Silo)

The most compelling evidence of the PNDR’s immediate impact on food availability is the sharp rise in national cereal production. Aggregate wheat output increased substantially, rising from a baseline of 3.5 million tons in 2022 to 4.2 million tons in 2024 (FAO, 2025). This 20% growth rate in a critical staple sector serves as the primary indicator of the national self-sufficiency agenda’s efficacy, even amidst limited rainfall noted in 2024 (World Bank, 2025). Furthermore, targeted PNDR regions reported even higher rates of success, with localized agricultural output boosting by 18% (FAO, 2025).

This success is intrinsically linked to simultaneous strategic investment in storage infrastructure. Recognizing that increased production must be supported by adequate preservation capacity to mitigate post-harvest losses and stabilize market prices, the government established a program to construct 30 silos and 350 storage centers (Science Publishing Group, 2025). This investment ensures that the hard-won gains, such as the 4.2 million tons of wheat, are securely managed, mitigating price volatility and strengthening the ‘Stability’ pillar of food security.

The strategic alignment between production growth and storage capacity expansion suggests that policymakers successfully anticipated and addressed a structural bottleneck in the national supply chain.

Table 1: National Cereal Production and Import Dependency Shifts (2022–2024)

Metric	Baseline (2022)	Outcome (2024)	Structural Impact
National Wheat Production (Million Tons)	3.5	4.2	+20% output increase, improved Availability
Food Import Dependency Rate (%)	75% (2020)	65%	10-point reduction, enhanced Resilience
Targeted Regional Agricultural Output Growth (%)	N/A	18%	Localized PNDR efficiency and adoption rates

Source: Established by the researcher based on FAO Algeria Country Report (2025) and World Bank Algeria Economic Update (2025).

3.2. The Shifting Trade Balance: Reducing the Dependency Footprint

The PNDR's influence is perhaps best demonstrated by the structural shift in Algeria's external trade balance for food. The reduction in food import dependency from 75% to 65% (World Bank, 2025) is a direct consequence of the strategic approach to import substitution, which is highlighted by specific national commitments and capital expenditure.

Table 2: Strategic PNDR Investments and Fiscal Goals (2023–2025)

Investment Goal	PNDR Mechanism/Allocation	Quantifiable Target
Reduce Durum Import Dependency	Policy to cease importation of durum wheat	0% imports by 2025
Enhance Domestic Dairy Production	$500 million contracts for farming project	Increased domestic milk output capacity
Stabilize Cereal Supply	Construct 30 silos and 350 storage centers	9 MMT state storage capacity post-completion

Source: Established by the researcher based on Science Publishing Group (2025) and The Arab Today (2025).

While this success is noteworthy, it must be acknowledged that it was achieved despite challenging environmental conditions. The reduction in imports, while significant, could have been even greater had it not been necessary to counteract the substantial crop yield losses due to drought, which are estimated at 20% for the 2023–2024 period (Adaptation Fund, 2025). This environmental fragility underscores that current achievements are hard-won and require aggressive, scaled-up resilience strategies to maintain momentum.

4. Micro-Level Transformation: Access, Livelihoods, and Resilience

While macroeconomic shifts confirm the PNDR's efficacy at the national level, the most tangible benefits are observed in the localized transformations impacting rural communities, specifically regarding improved access and the adoption of climate-resilient livelihoods.

4.1. Quantifying Improved Household Food Access

The PNDR's success in bolstering the ‘Access’ pillar of food security is quantified by empirical data from specific wilayas. Studies reveal that rural household food security indices improved by a notable 15% in regions like Tlemcen and Setif (ASJP, 2025).

This improvement is not simply a secondary effect of increased food production but a direct consequence of targeted infrastructure projects, such as irrigation expansions, which stabilize local supply and reduce the economic friction associated with obtaining food.

The 15% rise in access strongly validates the core policy assumption that investments in rural infrastructure serve as a crucial multiplier. By providing reliable water and transport links, the PNDR ensures that food reaches consumers efficiently and at an affordable price, thereby mitigating rural poverty and promoting social cohesion—a key mandate of the PNDR that addresses the socio-economic barriers facing rural populations (UNSDCF, 2023). This link between physical infrastructure and economic accessibility is further cemented by econometric findings discussed in Section 5.2.

4.2. Steppe Adaptations: Climate-Smart Livelihoods in Arid Zones

To counter the pervasive threat of drought and desertification (Solidmed, 2023), the PNDR supported intensive adaptation efforts in the critical Steppe Zones, transforming climate policy into economic opportunity. These projects, which supported 10,000 livelihoods, provide a robust model for integrating climate-smart agriculture with resilient economic activities.

The Adaptation Fund project details reveal a comprehensive approach (Adaptation Fund, 2025):

a) **Water Management and Access:** The foundation of resilience was water. The initiative rehabilitated 20 surface water collection systems, directly benefitting 1,000 households, or approximately 6,000 people, ensuring equitable resource distribution with 50% women beneficiaries (Adaptation Fund, 2025).

b) **Capacity Building:** The program trained 2,000 agropastoralist households (12,000 people) in agroecology and climate-resilient practices (Adaptation Fund, 2025).

c) **Livelihood Transformation:** The project supported 1,000 local MSMEs and focused on climate-resilient economic activities like the development of Halfah and Medicinal, Aromatic, and Perfume (MAP) plants (Adaptation Fund, 2025).

The efficacy of this integrated approach is clear: 80% of targeted households reported increased incomes through the adoption of new climate-resilient economic activities (Adaptation Fund, 2025). Crucially, these interventions resulted in a 12% increase in local food availability within the Steppe Zones (ResearchGate, 2025).

Table 3: Regional Impact of PNDR on Household Food Security Indices and Livelihoods (2024)

Indicator/Wilaya	Intervention Mechanism	Quantified Outcome
Household Food Security Index (Tlemcen/Setif)	Irrigation projects, rural infrastructure	15% improvement in access scores
Steppe Zone Livelihoods	Water collection systems and training	10,000 livelihoods supported
Local Food Availability (Steppe)	Climate-smart practices	12% increase in local food provision
Economic Resilience (Steppe HH)	MSME support & value chain development	80% of targeted households reported increased incomes

Source: Established by the researcher based on ASJP Determinants of Food Security (2025), Adaptation Fund Proposal for Algeria (2025), and ResearchGate Study (2025).

5. Policy Challenges and Econometric Validation

While the PNDR demonstrates clear successes in boosting production and access, the long-term sustainability of these gains is critically threatened by environmental and structural barriers. The role of econometric analysis is vital here, moving beyond descriptive results to pinpoint the most effective policy levers for future investment.

5.1. The Shadow of Climate Change and Structural Vulnerabilities

The most immediate and severe threat to Algeria's agricultural self-sufficiency is climate change. Despite the national success in increasing wheat production to 4.2 million tons, this figure is already substantially diminished by the estimated 20% crop yield losses incurred due to severe drought conditions during the 2023–2024 period (Adaptation Fund, 2025).

Compounding this immediate threat is the long-term risk of water scarcity. Projections indicate a likely 20% decrease in water discharge and runoff across the region by 2040 (Adaptation Fund, 2025). This environmental reality necessitates that water management remains the single highest priority for PNDR resource allocation.

Furthermore, persistent socio-economic barriers, such as high structural unemployment among rural youth and ongoing rural-urban migration, continue to challenge the PNDR's objective of enhancing socio-economic conditions (UNSDCF, 2023).

5.2. Econometric Evidence: Infrastructure as a Determinant of Availability

The effectiveness of PNDR spending in mitigating these challenges is validated by robust statistical evidence. Econometric models using R-based regressions on ASJP datasets reveal a highly significant, strong positive correlation coefficient ($R = 0.8$) between rural infrastructure spending and measured food availability scores (Psychology and Education Journal, 2025).

This 0.8 correlation signifies that infrastructure investment acts as a necessary multiplier for agricultural success. It underscores the critical finding that the limiting factor in Algerian food security is often not raw yield per hectare, but the ability to aggregate, store, and reliably move the harvest from the farm to the market.

Infrastructure, including irrigation networks, storage facilities (such as the new 9 MMT capacity (Science Publishing Group, 2025)), and rural roads, translates farming potential into stable food availability and economic access for consumers. This empirical finding provides clear guidance for future policy: PNDR allocations must strategically prioritize infrastructure maintenance and expansion to secure and amplify the current production gains.

Table 4: Econometric Determinants and Policy Implications (2023-2025)

Determinant Variable	Measured Correlation (R)	Policy Implication
Rural Infrastructure Spending (PNDR)	0.8 (Strong positive)	Infrastructure acts as a multiplier; sustained investment required for Availability.
Agricultural Output (Domestic Production)	N/A (Implicit link)	Reduction in Import Dependency (75% to 65%); achieved 4.2M tons wheat.
Climate Adaptation Investments	N/A (Implicit link)	Critical for mitigating major yield losses (20%); secures future stability.
Rural Household Income/Livelihoods	N/A (Implicit link)	Direct link to improved Access (15% rise) and social cohesion.

Source: Established by the researcher based on Psychology and Education Journal Components of Food Security (2025), World Bank Economic Update (2025), FAO Country Report (2025), Adaptation Fund Proposal (2025), ASJP (2025), and ResearchGate (2025).

Table 5 delivers a comprehensive PESTLE framework that maps the multidimensional ecosystem in which Algeria's National Rural Development Plan (PNDR) operates, exposing both synergistic drivers of success and systemic fault lines that threaten sustained food security gains.

The PESTLE matrix reveals PNDR as a high-stakes balancing act—political resolve and economic tailwinds propel measurable gains, yet environmental fragility and socio-technological inertia form a precarious underbelly. The 0.8 correlation between infrastructure spend and food availability (cited earlier) is contingent on neutralizing drought risk and accelerating technology transfer.

Without urgent, cross-cutting reforms—streamlining land rights, insulating budgets from oil shocks, and scaling climate-resilient extension services—the hard-won 10-percentage-point drop in import dependency risks reversal. The table thus functions as a strategic dashboard, signaling that resilience, not just growth, must anchor Algeria's rural transformation agenda.

Table 5: PESTLE Analysis of Rural Development Linkages to Food Security

Component	Positive Linkage	Negative/Vulnerability
Political/Policy	Strong PNDR commitment; strategic self-sufficiency goals (durum wheat stop 2025).	Institutional coordination challenges; risk of public spending consolidation.
Economic	Reduced import dependency (65%); GDP growth (4.8%) easing inflation.	High sensitivity to global oil and gas prices; subsidy reform necessity.
Socio-Cultural	Improved household access (15% rise); 10,000 livelihoods supported; youth employment focus.	Rural-urban migration; high structural unemployment among rural youth.
Technological	Promotion of climate-smart agriculture; training 2,000 HH in agroecology.	Lagging adoption rates; reliance on traditional farming methods.
Legal	Alignment with UNSDCF 2023-2027 (UNDP, 2023); framework for green jobs.	Complexity of land tenure/water rights; need for strong public-private partnerships.
Environmental	Steppe restoration; water conservation (20 rehabilitated systems).	Drought impacts (20% yield loss); long-term risk of 20% water decline by 2040.

Source: Established by the researcher based on World Bank Economic Update (2025), Science Publishing Group (2025), UNDP (2023), UNSDCF (2023), ASJP (2025), and Adaptation Fund Proposal (2025).

6. Conclusion: Resilience, Refinements, and the Way Forward

6.1. Recapping Quantifiable Progress and PNDR Efficacy

The analysis confirms that the National Rural Development Plan (PNDR) has been an effective policy instrument in initiating Algeria's crucial pivot toward food self-sufficiency during the 2023–2025 period. The plan’s efficacy is evidenced by concrete, quantifiable gains across both the macro- and micro-levels of food security.

Macroeconomically, the nation successfully boosted wheat production from 3.5 million to 4.2 million tons (FAO, 2025) and achieved a critical 10-point reduction in food import dependency, settling at 65% (World Bank, 2025). At the community level, the tangible benefits include a 15% improvement in household food security indices in targeted wilayas (ASJP, 2025) and the successful transformation of livelihoods for 10,000 people in fragile Steppe Zones through climate-smart practices (Adaptation Fund, 2025).

Crucially, the PNDR model demonstrated that success relies on a dual investment strategy: dedicating resources to physical infrastructure (which exhibits a strong 0.8 correlation with food availability (Psychology and Education Journal, 2025)) while simultaneously investing in soft infrastructure, such as capacity building and local MSME support (which drove an 80% reported income increase in specific project zones (Adaptation Fund, 2025)). This integrated approach is essential for turning fragile success into structural resilience.

6.2. Strategic Refinements for Greater Resilience

Despite these accomplishments, the structural vulnerability revealed by the 20% crop yield loss due to drought presents an urgent mandate for refinement (Adaptation Fund, 2025). Future PNDR phases must prioritize and scale adaptation initiatives.

First, policy must guarantee sustained and increasing funding for high-correlation infrastructure components—specifically, irrigation systems, water management, and the expansion of the new 9 MMT storage capacity (Science Publishing Group, 2025). This investment is necessary not only to maximize output but to secure the supply chain against post-harvest losses and climate unpredictability.

Second, the successful, integrated model developed for the Steppe Zones must be replicated and expanded to other vulnerable regions. This model, which combines physical interventions (rehabilitated water systems) with economic support (MSME development for climate-resilient value chains), provides the long-term buffer required to mitigate the fiscal impact of climate shocks.

Finally, policy makers must reinforce the link between rural development and social cohesion. By sustaining improvements in household food access (the 15% index rise), the PNDR contributes directly to enhanced social stability, making food security a strategic policy objective that extends beyond the agricultural sector.

6.3. Gaps in Data and Future Research

While the analysis is robust, data granularity presents limitations. The comprehensive improvement in household food security indices (15% increase) is based on representative samples from wilayas like Tlemcen and Setif (ASJP, 2025).

Future research requires the systematic collection of standardized food security indices across all wilayas to address regional disparities and fully assess the equity of the PNDR's impact.

Furthermore, future research should move beyond the 'Availability' and 'Access' dimensions to rigorously evaluate 'Utilization'—the nutritional quality and diversity of the domestic food supply, especially in light of the renewed focus on strategic import substitution like milk production (The Arab Today, 2025).

A detailed assessment of long-term income sustainability, tracking the 80% reported income increase in steppe households beyond the initial project lifespan, is also essential to ensure that economic resilience is truly structural.

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