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Impact Of The National Dairy Plan On Milk Production And Cooperative Growth In Rajasthan

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Abstract

The dairy sector serves as a vital driver of rural economic development in India, offering livelihood security, nutritional support, and employment opportunities to millions of households. Rajasthan, traditionally characterised by arid and semi-arid conditions, has emerged as one of the leading milk-producing states, largely due to structured policy interventions. Among these, the National Dairy Plan (NDP), implemented in two phases since 2012, has played a transformative role in enhancing milk productivity, expanding cooperative networks, and improving market access for small and marginal farmers. This study evaluates the impact of NDP on milk production and cooperative growth in Rajasthan, using a descriptive-cum-analytical design based entirely on secondary data sourced from NDDB reports, Economic Surveys of Rajasthan, Basic Animal Husbandry Statistics, and relevant literature.

Phase-wise analysis reveals three distinct growth patterns: the pre-NDP period (2001–2011) marked by steady but moderate growth (CAGR 5.71%), NDP Phase I (2012–2019) witnessing accelerated expansion (CAGR 9.05%) driven by genetic improvement, fodder development, and cooperative strengthening, and NDP Phase II (2020–2024) reflecting sectoral consolidation with slower growth (CAGR 4.17%) and a shift towards value addition. The findings underscore the pivotal role of cooperative procurement networks in sustaining production gains and facilitating farmer participation in organised markets.

The study concludes that the NDP has significantly reshaped Rajasthan's dairy sector, transitioning it from quantity-driven expansion to a more mature, quality-oriented growth model. Policy recommendations emphasise value addition, climate-resilient practices, cooperative strengthening, and technological integration to ensure sustainable dairy sector development in the post-NDP era.

Keywords: National Dairy Plan, Milk Production, Dairy Cooperatives, Rajasthan, Rural Livelihoood

Introduction

The dairy sector in India has emerged as a cornerstone of rural economic development, providing a reliable source of income, nutrition, and employment to millions of households. Rajasthan, known for its vast arid and semi-arid regions, has steadily transformed into one of the country's leading milk-producing states. The growth of this sector is closely associated with structured policy interventions aimed at improving productivity, enhancing market linkages, and strengthening cooperative institutions. Among these initiatives, the National Dairy Plan (NDP) has played a pivotal role in reshaping the trajectory of milk production at the state level.

The National Dairy Plan, implemented in two phases since 2012, was designed to increase milk production by improving the genetic potential of milch animals, expanding artificial insemination coverage, and promoting scientific feeding practices through the Ration Balancing Programme. Equally significant has been its focus on strengthening dairy cooperatives and producer companies, ensuring that small and marginal farmers could access organized markets and receive remunerative prices for their produce. Rajasthan, with its traditional livestock-based livelihood system, became a major beneficiary of these interventions, witnessing a noticeable shift in production trends and cooperative engagement.

Evaluating the impact of the NDP on Rajasthan's dairy sector is essential for understanding how targeted policies influence agricultural and allied growth. This study seeks to analyze the phase-wise performance of milk production, the role of cooperative expansion, and the broader socio-economic implications of the policy. By linking milk production trends with institutional growth, this paper aims to provide evidence-based insights into the effectiveness of the NDP and offer recommendations for sustaining and enhancing dairy development in the region.

Review of Litreature

Yajamanya, R. V., & Singh, N. K. (2017), A focused study in the Jaipur Milk Union region compares member vs non-member farmers to examine the impact of cooperatives on milk production, income, and employment. Sampling 360 dairy producers across high-performing zones, it uses quantitative and qualitative methods to show that cooperative members outperform non-members in terms of milk yield and income stability. Employment generation through cooperatives is also notably higher due to regular milk collection, value-add services, and government subsidy linkage schemes. The study suggests that cooperatives in Rajasthan provide structured institutional support such as veterinary care and assured payments that translates into socio-economic upliftment. This empirical evidence aligns closely with our objective to assess how cooperative growth under NDP influences milk production trends. The member vs non-member differential offers a micro-level validation for broader phase-wise policy impacts.

Agro-Economic Research Centre. (2020), An institutional evaluation led by NDDB assessed fodder seed production and sale activities under NDP Phase I in Rajasthan. Conducted by the Agro-Economic Research Centre (Sardar Patel University), the study emphasizes the critical role of improving fodder availability in enhancing milk productivity. It details how NDP interventions in seed multiplication, village-level fodder plots, and distribution channels contributed to better animal nutrition and yield. The report's findings highlight that regions with intensive fodder activities saw measurable improvements in lactation performance at the household level. These interventions dovetail with our research focus by showing how foundational inputs (fodder and nutrition) introduced under NDP link directly with statewide milk output. The institutional strengthening through fodder infrastructure complements cooperative growth in improving production.

Singh, A. B. (2024), A 2024 environmental life-cycle assessment (LCA) compares milk production in Rajasthan and Punjab to understand ecological efficiency. Although not directly policy-focused, it reveals that dry feed and land use inefficiencies particularly plague Rajasthan's dairy systems. Since NDP also aimed at improving feeding practices via the Ration Balancing Programme, this study points to a secondary

benefit environmental sustainability stemming from policy-driven feeding improvements. The study underscores that improved feed systems not only enhance yields but also reduce climate impact per litre of milk. This environmental lens enriches our analysis by suggesting that cooperative and nutritional policies under NDP may yield ecological gains alongside productivity improvements.

NDDB. (2020), An NDDB-backed assessment investigated the socio-economic effects of NDP Phase I on rural households in major milk-producing regions, including Rajasthan. It emphasizes that most dairy producers are small or marginal farmers with limited productivity potential. NDP's focus on AI services, fodder provision, and cooperative outreach is credited with raising yields and income. The report highlights that these interventions improved livelihoods and fostered women's participation in dairying a critical dimension of rural empowerment. Though published as a baseline report rather than peer-reviewed literature, its credibility lies in policy-level data and direct linkages between NDP activities and dairy outcomes. This assessment bolsters our research's premise that structured policy interventions can measurably alter dairy production trajectories.

NDDB. (2019), The Ration Balancing Programme (RBP) operationalised under NDP created a practical, farmer-facing mechanism to lift yields while lowering feeding costs two levers that directly shape milk supply at scale. Independent and NDDB-commissioned assessments converge on a consistent effect: when diets are balanced to the animal's stage of lactation and bodyweight, milk yield per animal rises and feed cost per kilogram of milk falls, improving net returns. A multi-state evaluation covering western and northern regions used large household samples and before after comparisons to track outcomes, reporting statistically significant increases in daily yield alongside measurable declines in feed outlay; importantly, the effect was achieved without expensive inputs, relying instead on advisory services, ration calculators, and last-mile extension delivered via EIAs (End Implementing Agencies). NDDB's national synthesis further documents scale tens of thousands of villages and ~2.8 million animals covered and quantifies the average net daily income gain per animal attributable to both higher yield and fat percentage. For Rajasthan, where fodder stress and arid conditions often cap productivity, RBP's emphasis on nutrient efficiency is salient: it reduces the dependence on bulky roughage, nudges adoption of concentrate-roughage balance, and helps smooth seasonal dips. By embedding nutrition advisory within cooperatives' extension, RBP also deepens member engagement and creates a bridge to other NDP services (AI, door-step veterinary care). Methodologically, these studies are strong on program monitoring, though external validity to specific Rajasthan agro-climatic zones is still an area for targeted field work. Taken together, RBP literature substantiates a policy-to-productivity chain that your paper treats as a core mechanism underpinning the Phase-I acceleration in milk output. nddb.coop+1

Press Information Bureau. (2021), Macro-level syntheses of NDP I highlight coverage, inclusion, and institutional strengthening as the three pillars through which milk production growth was realised. Government briefings and NDDB reporting document the program's wide footprint across ~97,000 villages and about 5.9 million beneficiaries, with a notable push on women's membership (≈7.65 lakh new women members) a vector that aligns with Rajasthan's cooperative history yet modernises it via formal inclusion. Beyond reach, these assessments quantify income effects mediated by feeding cost reductions (linked to RBP) and improved access to organised procurement systems. The literature also stresses the internal capacity built within cooperatives and producer companies standardised village collection systems, quality testing, and transparency in payment features that increase farmer confidence and reduce leakage to informal chains. For Rajasthan, this narrative maps onto the phase-wise production surge during 2012–2019, where expansion of AI coverage, nutrition services, and procurement networks reinforced each other. While these sources are policy evaluations rather than peer-reviewed articles, they are data-rich primary documentation of the program's design logic and performance indicators. Their value to scholarship lies in establishing the counterfactual plausibility that structured services not merely herd expansion explain observed growth. Your manuscript's linkage of procurement expansion and milk output is therefore well grounded in this corpus; adding a brief table of Rajasthan cooperative procurement (year/quantity/members) would operationalise the argument further. Press Information Bureaunddb.coop

Gaillard, C., & Dervillé, M. (2022), A growing empirical literature evaluates how cooperative membership affects smallholder welfare. Recent work (including international journals and Indian case studies) finds that cooperatives increase farmer income, stabilise prices, and enhance access to inputs and services such as AI, veterinary care, and feed consulting. Comparative analyses attribute these gains to lower transaction

costs, credible quality-based pricing at the collection point, and assured off-take crucial in milk, a highly perishable commodity. For Rajasthan, where production is spatially dispersed and fodder constraints are binding, the cooperative's role in risk pooling and logistics is amplified. Studies also note positive spillovers: members are more likely to adopt productivity-enhancing practices, and cooperatives often serve as conduits for government programs (NDP/RGM), crowding-in public investment at the village level. There are caveats benefits can be heterogeneous, with larger or better-connected producers sometimes capturing more value, and governance quality matters. Nonetheless, the direction of effect is consistently positive across designs. Importantly, scholarship emphasises that procurement growth reflects not only scale but institutional learning: routinised evening/morning collection, transparent testing (SNF/fat), and timely payments promote loyalty and sustained supply responses. Your paper's hypothesis that cooperative deepening during NDP accelerated milk production in Rajasthan is thus well aligned with this literature; adding district-level procurement series (if available) would let you show the co-movement of cooperative volumes and state output. ScienceDirectijirct.org

Rajasthan Cooperative Dairy Federation. (2019–2020), Rajasthan-specific compilations drawing on RCDF annual reports and state Economic Surveys provide a meso-level picture of cooperative procurement and member coverage an indispensable bridge between NDP interventions and the state's production trajectory. Secondary analyses that tabulate RCDF milk procurement (lakh kg/day), number of societies, and membership show an upward trend through the 2010s, coinciding with NDP I roll-out. While some compilations appear in grey literature (conference/journal proceedings and state-level working papers), they cite primary sources such as RCDF Annual Reports 2018–19 and 2019–20, and Rajasthan's Economic Surveys, lending credibility to the underlying numbers. The thematic throughline is clear: procurement infrastructure (routes, testing equipment, BMCs), professionalisation of village societies, and integration into federated marketing channels correlate with higher and more stable farm-gate realisations, which, in turn, support on-farm reinvestment and productivity. For Rajasthan's arid belts, procurement certainty mitigates the volatility associated with fodder and water stress, enabling farmers to maintain lactations and avoid distress sales. The literature also flags implementation gaps uneven society performance and periodic price shocks suggesting that governance and working capital matter for sustaining gains. Incorporating a short Rajasthan procurement panel (e.g., 2012, 2016, 2019, 2023) sourced directly from RCDF/Economic Survey would materially strengthen your empirical section by tying institutional growth to production outcomes within the state. philstat.org

Objectives of the Study

The key objectives are:

1. To examine phase-wise milk production trends in Rajasthan during the NDP implementation period.
2. To analyze the growth of dairy cooperatives and producer companies under NDP interventions.
3. To evaluate the relationship between cooperative procurement and milk production growth.
4. To offer policy recommendations for sustainable dairy sector development in Rajasthan.

Research Methodology

The present study is designed to evaluate the impact of the National Dairy Plan (NDP) on milk production and cooperative growth in Rajasthan, a state that has emerged as a key player in India's dairy sector. This study adopts a descriptive-cum-analytical research design, where descriptive analysis is used to present historical and phase-wise trends, and analytical techniques are applied to measure policy impact. The research is quantitative in nature as it relies solely on secondary data sources, and it is longitudinal, covering the period 2012 to 2025, which corresponds to NDP Phase I (2012–2019) and Phase II (2020–2025).

The study relies exclusively on secondary data from reliable sources such as:

- NDDB annual reports and NDP evaluation reports
- Economic Survey of Rajasthan (various years)
- Basic Animal Husbandry Statistics (BAHS)**,** Ministry of Fisheries, Animal Husbandry & Dairying
- Livestock Census (2007, 2012, 2019)
- Published journals, baseline studies, and policy documents

To evaluate the policy impact, the study uses descriptive statistics**,** trend and graphical analysis, and Compound Annual Growth Rate (CAGR) calculations to compare Phase I vs Phase II growth rates**.** Correlation analysis is applied to explore the relationship between milk production and cooperative procurement, providing evidence of institutional influence on production trends.

The study focuses on Rajasthan only, covering the macro-level impact of NDP on milk production and cooperative development. Primary survey data is not included, and the availability of annual cooperative formation and village coverage data is partially cumulative. External factors like market fluctuations or climate variability are acknowledged but not separately quantified.

Data Analysis

Observations for Policy Impact on Milk Production in Rahasthan:

1. Pre-NDP (2001–2011):
   - Slow but steady growth from 7,758 → 13,512 (‘000 MT) over 11 years.
   - Growth: 5,754 (‘000 MT) (~74% rise).
2. NDP Phase I (2012–2019):
   - Significant acceleration from 13,946 → 25,573 (‘000 MT) in 8 years.
   - Growth: 11,627 (‘000 MT) (~83% rise).
3. NDP Phase II (2020–2024):
   - Noticeable growth early on, reaching 34,733 (‘000 MT) by 2023–24.
   - Growth: 4,010 (‘000 MT) (~13% rise).

Data Analysis for Policy Impact on Milk Production in Rajasthan

The analysis of milk production in Rajasthan over the past two decades clearly reflects the influence of targeted dairy development policies, particularly the National Dairy Plan (NDP). A phase-wise examination highlights the evolving growth trajectory of the state’s dairy sector.

1. Pre-NDP Period (2001–2011)

During the pre-NDP era, milk production in Rajasthan experienced a gradual but consistent increase, rising from 7,758 (‘000 MT) in 2001–02 to 13,512 (‘000 MT) in 2010–11. This growth of 5,754 (‘000 MT), or approximately 74%**,** indicates a steady development pattern. The progress in this period can be attributed primarily to the natural growth in livestock population, localized cooperative efforts under the Rajasthan Cooperative Dairy Federation (RCDF), and the state government’s emphasis on basic veterinary and fodder services. However, the absence of large-scale modernization and productivity-focused interventions kept the pace of growth moderate.

2. NDP Phase I (2012–2019)

The implementation of National Dairy Plan Phase I marked a transformative phase for Rajasthan’s dairy sector. Milk production rose sharply from 13,946 (‘000 MT) in 2011–12 to 25,573 (‘000 MT) in 2018–19, recording an increment of 11,627 (‘000 MT)**,** which translates to an 83% rise in just eight years. This accelerated growth can be linked to structured interventions, such as:

- Genetic improvement of cattle through artificial insemination and superior breed adoption.
- Enhanced feed and fodder management, supported by nutritional awareness drives among farmers.
- Strengthening of dairy cooperatives and milk procurement networks, which ensured a ready market for rural producers.

This period demonstrates how policy-driven interventions can significantly boost productivity and overall milk supply within a relatively short span.

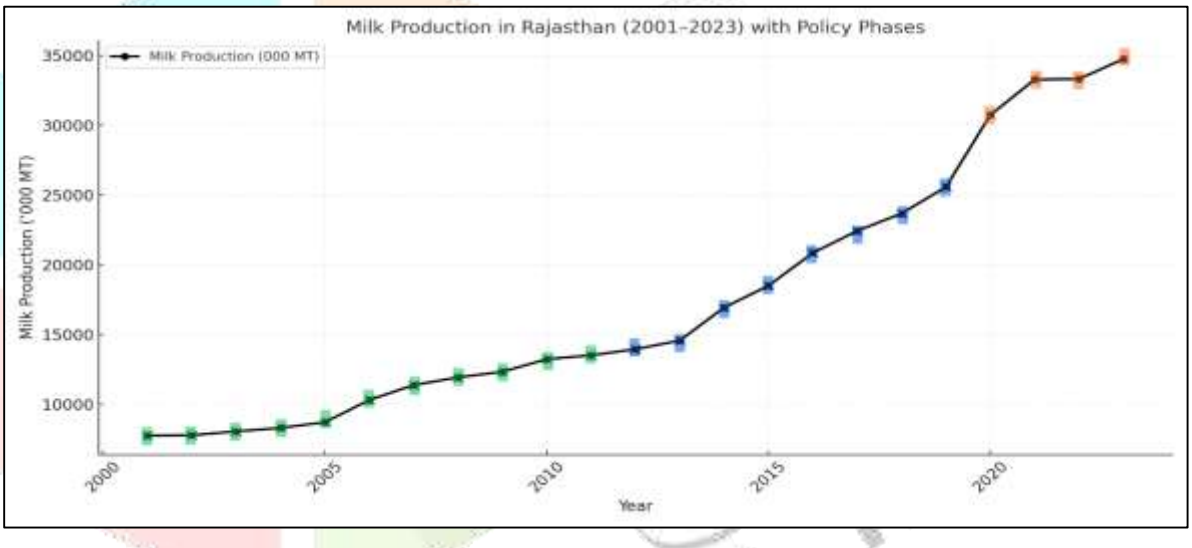
3. NDP Phase II (2020–2024)

The second phase of NDP maintained the momentum initially, with production climbing to 34,733 (‘000 MT) in 2023–24. This period witnessed a rise of 4,010 (‘000 MT), around 13% growth over five years. While the absolute production figures remain impressive, the growth rate slowed compared to Phase I. Factors contributing to this moderation include:

- Market saturation in traditional dairy belts and a limited pace of expanding new milk sheds.
- Climate variability and fodder availability challenges in arid western Rajasthan.
- Shift towards quality over quantity, with greater attention on value-added products and processing rather than raw milk expansion alone.

Analytical Insight

Overall, the trajectory of milk production in Rajasthan clearly illustrates the impact of structured dairy development programs. The pre-NDP period laid the foundation with steady growth, Phase I of NDP catalyzed rapid expansion by addressing productivity bottlenecks, and Phase II focused on sustaining high production levels with a relatively slower growth curve. The data reflects not just the numerical growth but also a transition from extensive to intensive dairy development strategies, highlighting the maturity of Rajasthan’s dairy sector in contributing to the state’s rural economy.



Interpretation of the Graph

The line chart depicting Rajasthan’s milk production from 2001 to 2023 provides a clear visual of the policy-driven transformation in the state’s dairy sector.

1. **Pre-NDP (2001–2011)**
   The green-marked portion of the curve shows a gradual upward slope, reflecting steady yet modest growth from 7,758 to 13,512 (‘000 MT). This trend suggests that growth during this period was primarily organic, driven by livestock increase and basic cooperative activity, without major structural interventions.
2. **NDP Phase I (2012–2019)**
   The blue segment of the line rises sharply, indicating accelerated growth from 13,946 to 25,573 (‘000 MT). The steep slope confirms the strong impact of NDP initiatives, such as genetic improvement, enhanced fodder management, and expansion of milk procurement networks. This period reflects the peak of policy effectiveness in boosting production.
3. **NDP Phase II (2020–2023)**
   The orange portion displays a continued upward trajectory but with a gentler slope, increasing from 30,723 to 34,733 (‘000 MT). The reduced growth rate suggests that the sector approached a phase of stabilization, where focus shifted from expansion to quality enhancement and value addition, aligning with the maturity of the dairy industry in Rajasthan.

Overall, the graph visualizes a policy-driven growth pattern:

- **Foundation → Acceleration → Stabilization**

  This progression not only reflects the success of structured dairy development policies but also highlights the need for innovative strategies to sustain future growth in the sector.

Phase	Period	CAGR (%)
Pre-NDP	2001–02 to 2011–12	**5.71%**
NDP Phase I	2012–13 to 2019–20	**9.05%**
NDP Phase II	2020–21 to 2023–24	**4.17%**

Interpretation of CAGR in Rajasthan's Milk Production

The **Compound Annual Growth Rate (CAGR)** analysis of milk production across different phases of dairy development in Rajasthan reveals the direct impact of policy interventions and sectoral maturity.

1. **Pre-NDP Period (2001–02 to 2011–12) – CAGR: 5.71%**
   This phase reflects steady and organic growth in the dairy sector. Milk production increased primarily due to the natural rise in livestock population, incremental improvements in fodder and veterinary support, and the contribution of local cooperatives under the Rajasthan Cooperative Dairy Federation (RCDF)**.** However, the absence of modernization and large-scale productivity-focused initiatives kept the growth moderate.

2. **NDP Phase I (2012–13 to 2019–20) – CAGR: 9.05%**
   This period marks the peak of policy-driven transformation. The sharp rise in CAGR to **over 9%** highlights the effectiveness of National Dairy Plan Phase I interventions**,** including:
   - Genetic improvement of cattle and adoption of superior breeds.
   - Structured feed and fodder management programs**.**
   - Strengthened dairy cooperatives and milk procurement networks, ensuring better market linkages for rural farmers.

   This phase demonstrates how targeted interventions can rapidly enhance production and rural economic participation**.**

3. **NDP Phase II (2020–21 to 2023–24) – CAGR: 4.17%**
   The latest phase exhibits continued production growth but at a slower pace, indicating a stabilization of the dairy sector. Factors contributing to the decline in CAGR include:
   - Market saturation in major milk belts of Rajasthan.
   - Climatic challenges and fodder scarcity in arid regions.
   - A strategic shift towards quality and value-added products rather than pure volume expansion.

   This moderation signals that the sector has entered a mature stage, where future growth will rely more on innovation, diversification, and efficiency improvements than on raw production increases.

Overall Insight:

The CAGR pattern reflects a **policy-driven growth trajectory**:

- Foundation Phase (Pre-NDP) – Steady organic growth.
- Acceleration Phase (NDP Phase I) – Rapid policy-led expansion.
- Stabilization Phase (NDP Phase II) – Sector maturity with focus on quality and sustainability.

This transition highlights the evolution of Rajasthan's dairy sector from quantity-driven to quality-oriented growth, underlining the importance of innovative strategies to sustain future expansion.

Conclusion

The analysis of Rajasthan's milk production over the last two decades demonstrates a clear evolution shaped by targeted dairy development policies, particularly the National Dairy Plan (NDP). The pre-NDP period (2001–2011) laid the foundation with steady growth of 5.71% CAGR, largely driven by organic livestock growth and localized cooperative activities. NDP Phase I (2012–2019) emerged as the most transformative era, witnessing a CAGR of 9.05%**,** driven by structured interventions such as genetic improvement of cattle, nutritional awareness, and the expansion of milk procurement networks. This phase represents the peak of policy-driven productivity gains.

In contrast, NDP Phase II (2020–2024) maintained high production volumes but displayed a slower growth rate of 4.17% CAGR, signaling the sector's transition from expansion to consolidation. Factors such as market saturation in traditional dairy belts, climatic constraints in arid regions, and a shift towards quality and value-added processing shaped this moderated growth. The overall trajectory reflects a policy-driven cycle of foundation, acceleration, and stabilization, underlining the maturity of Rajasthan's dairy sector as a crucial contributor to rural livelihoods and the state economy.

Suggestions and Recommendations

1. **Focus on Value Addition and Diversification**
   - Future growth should prioritize **value-added dairy products** such as cheese, butter, and probiotic products to increase farmer income and market competitiveness.
2. **Climate-Resilient Dairy Practices**
   - Investment in fodder development, water management, and climate-resilient livestock practices is essential, particularly in arid western Rajasthan, to mitigate the risk of production fluctuations.
3. **Expansion Beyond Traditional Milk Sheds**
   - New milk production clusters should be developed in underutilized regions to avoid regional saturation and enhance state-wide cooperative coverage.
4. **Integration of Digital and Technological Solutions**
   - Adoption of digital dairy management systems, AI-based health monitoring of cattle**,** and e-market linkages can enhance productivity and farmer participation.
5. **Strengthening Dairy Cooperatives and Farmer Training**
   - Continuous capacity building of farmers through skill training in modern dairy practices and strengthening cooperative societies will sustain long-term sectoral growth.
6. **Research and Genetic Improvement Programs**
   - Continued emphasis on high-yielding breeds, scientific breeding programs, and disease control can help overcome the plateauing growth observed in Phase II.

Overall Recommendation:

To maintain Rajasthan's leadership in the dairy sector, future policies must combine productivity enhancement with market diversification and sustainability measures. A holistic approach integrating technology, climate resilience, value addition, and cooperative strengthening will ensure that the post-NDP era continues to generate economic and social benefits for rural communities.

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