



INCOME TRANSFORMATION THROUGH GOAT REARING: A PRE-POST IMPACT ASSESSMENT OF NATIONAL LIVESTOCK MISSION AND OTHER GOVERNMENT SPONSERED SCHEMES BENEFICIARIES IN REWA DISTRICT, MADHYA PRADESH, INDIA

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ABSTRACT

Purpose: Small-ruminant rearing is widely promoted as a pro-poor livelihood in rain-fed rural India, yet rigorous, effect-size-based evidence on the *magnitude* of household economic change under the National Livestock Mission (NLM) and other government schemes for goat rearing remains limited. This study quantifies the economic impact of NLM-supported goat rearing on beneficiary households during 2023-24 in Rewa district, Madhya Pradesh.

Design/methodology: A self-controlled, pre-post design was applied to a sample of 300 beneficiaries. Five household economic variables — annual goat income, annual expenditure, annual net income, total herd size, and household size — were compared between the pre-scheme and post-scheme states using paired-samples *t*-tests (*df* = 299). Practical significance was assessed with Cohen's *d* and 95% confidence intervals. **Findings:** All five variables changed significantly (*p* < 0.01). Mean annual net income rose from Rs. 17,497 to Rs. 60,998 — an approximately 3.5-fold increase (*t* = 48.849; *d* = 2.82). Annual goat income increased 4.4-fold (*t* = 56.614; *d* = 3.27), while expenditure rose in parallel (*t* = 72.258; *d* = 4.17), indicating productive rather than consumptive spending. Herd size grew modestly and heterogeneously (*t* = 6.124; *d* = 0.35), reflecting uneven expansion across households. **Originality/value:** By pairing significance testing with effect sizes and confidence intervals on a full 300-household sample, the study moves beyond “statistically significant” claims to establish the *scale* and *robustness* of income transformation, and identifies asset-count heterogeneity as a target for more inclusive program design.

KEYWORDS: goat rearing; National Livestock Mission; rural livelihoods; income impact; paired *t*-test; Madhya Pradesh.

INTRODUCTION

Livestock, and small ruminants in particular, occupy a strategic position in the livelihood portfolios of resource-poor rural households in India. Goats are low-cost to acquire, reproduce rapidly, tolerate marginal fodder conditions, and can be liquidated flexibly to meet household cash needs — properties that make them a classic “living bank” for smallholders, particularly the

landless and marginal farmers of less-favored, semi-arid environments.^[1, 2, 3] India holds the world's largest goat population — 148.88 million as per the 20th Livestock Census (2019) — of which Madhya Pradesh alone accounts for about 7.5 per cent.^[4] Recognizing this potential, the Government of India's National Livestock Mission (NLM) channels credit-linked capital subsidy toward the establishment of goat-rearing units, with the

explicit objective of raising household incomes, generating employment, and reducing rural poverty.^[5]

Despite substantial public investment, the evaluation literature on such schemes frequently stops at the level of statistical significance, reporting whether a difference exists but not *how large* it is. In large samples this is a serious limitation: with several hundred observations, even trivial differences attain significance, so significance alone cannot establish developmental importance.^[6] What programme designers and policymakers require is the **magnitude** of change and its **robustness** — information conveyed by effect sizes and confidence intervals rather than p-values alone.

This paper addresses that gap for NLM-supported goat rearing in Rewa district, Madhya Pradesh - a rain-fed, agriculturally marginal region of the Vindhya plateau where off-farm opportunities are limited. We ask: *To what extent, and how robustly, does NLM-supported goat rearing alter the economic position of beneficiary households?* We answer using a self-controlled pre-post design on 300 beneficiaries, reporting paired-samples *t*-tests together with Cohen's *d* and 95% confidence intervals for five economic variables.

The contribution is threefold. First, we quantify — rather than merely detect — income change, establishing an approximately 3.5-fold rise in net income, a finding consistent with, but larger in magnitude than, earlier assessments of goat-based livelihood interventions in central India.^[2,7] Second, by contrasting the very large effect sizes for income and expenditure with the modest, heterogeneous effect for herd size, we reveal that programme benefits flow primarily through economic flows and only unevenly through asset stocks. Third, we translate this into an equity-oriented design implication: targeting low-expansion households.

MATERIALS AND METHODS

Study area and population. The study was conducted in Rewa district, Madhya Pradesh, among households enrolled as beneficiaries of the goat-rearing component of the National Livestock Mission. Madhya Pradesh is among India's largest livestock-holding states, with a goat population of over 11 million (20th Livestock Census, 2019).^[4]

Sample. Beneficiary households were identified from the official NLM beneficiary records maintained by the district Animal Husbandry Department. A total of 300 beneficiary households (*n* = 300) that had completed at least one full production cycle under the scheme were selected by simple random sampling. Data were collected through a pre-tested structured interview schedule covering the pre-scheme and post-scheme (2023–24) reference periods.

Design. A self-controlled, pre-post (“before–after”) design was used, in which each household's post-scheme status is compared with its own pre-scheme status. This design controls for time-invariant household characteristics (caste, landholding, location, baseline aptitude), strengthening internal validity relative to a simple cross-section, though it does not control for secular time trends (see Limitations).

Variables. Five paired household economic variables were analyzed: (i) annual goat income (Rs.), (ii) annual expenditure (Rs.), (iii) annual net income (Rs.), (iv) total herd size (number of goats), and (v) household size (members).

Analysis. Because all five are quantitative (interval/ratio) variables measured on the same units before and after, the paired-samples *t*-test was the appropriate parametric procedure (*df* = *n* – 1 = 299). With *n* = 300, the Central Limit Theorem supports the normality of the sampling distributions of the means. For each pair, the test statistic is $t = \bar{D} / (SD / \sqrt{n})$, where $\bar{D}$ is the mean paired difference and *SD* its standard deviation. Two-tailed critical values were $t_{0.05} = 1.968$ and $t_{0.01} = 2.592$. Practical significance was assessed with Cohen's $d = |\bar{D}| / SD$ (benchmarks: 0.2 small, 0.5 medium, 0.8 large)^[6] and with 95% confidence intervals for the mean difference, computed as $\bar{D} \pm t_{0.05} \times (SD / \sqrt{n})$. Analyses were performed in IBM SPSS Statistics.

RESULTS

Table 1 summarizes the paired-samples results. All five economic variables recorded highly significant increases from the pre-scheme to the post-scheme state (all *p* < 0.01), and every 95% confidence interval excludes zero.

Table 1: Paired-samples *t*-test results for household economic variables (*n* = 300; *df* = 299).

Variable	Pre-scheme mean	Post-scheme mean	Mean difference	Standard Error	95% CI of difference	Paired t-test	Cohen's d	Significance
Annual goat income (Rs.)	21,467.50	95,262.50	73,795.00	1303.48	71,230 – 76,360	56.614	3.27	<i>p</i> < 0.01
Annual expenditure (Rs.)	3,970.42	34,264.17	30,293.75	419.25	29,469 – 31,119	72.258	4.17	<i>p</i> < 0.01
Annual net income (Rs.)	17,497.08	60,998.33	43,501.25	890.53	41,749 – 45,254	48.849	2.82	<i>p</i> < 0.01

Variable	Pre-scheme mean	Post-scheme mean	Mean difference	Standard Error	95% CI of difference	Paired t-test	Cohen's d	Significance
Total herd size (goats)	13.487	19.003	5.517	0.9008	3.74 – 7.29	6.124	0.35	$p < 0.01$
Household size (members)	4.92	5.08	0.16	0.0212	0.12 – 0.20	7.547	0.44	$p < 0.01$

Note: *t*-values are absolute; SPSS computes the before–after difference, hence the underlying sign is negative. Effect size $d = |\text{mean difference}| / \text{SD of the difference}$. CI = confidence interval of the mean paired difference.

Income. Annual goat income rose from Rs. 21,467.50 to Rs. 95,262.50, a mean increase of Rs. 73,795 (≈ 4.4 -fold), with an exceptionally large effect size ($d = 3.27$). Annual **net** income — the more policy-relevant measure — rose from Rs. 17,497.08 to Rs. 60,998.33, a mean increase of

Rs. 43,501.25 (≈ 3.5 -fold; $t = 48.849$; $d = 2.82$). The 95% confidence interval for the net-income difference (Rs. 41,749 – Rs. 45,254) excludes zero by a wide margin, confirming robustness (Figure 1).

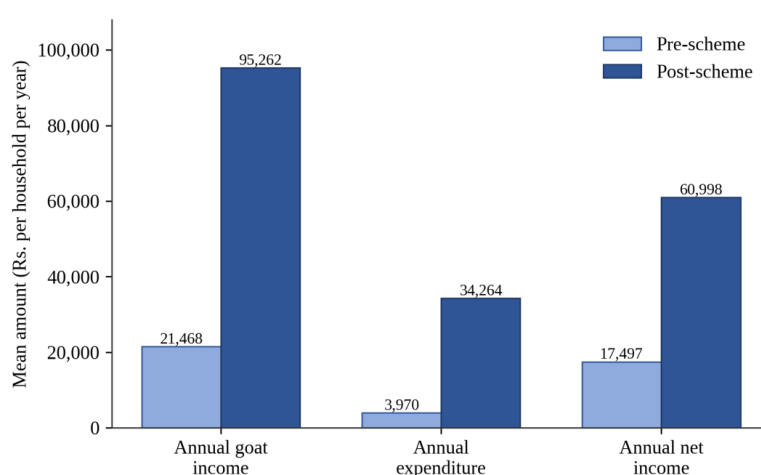


Figure 1: Mean annual goat income, expenditure and net income of beneficiary households before and after the scheme (n = 300).

Expenditure. Annual expenditure increased most steeply in relative terms (from Rs. 3,970 to Rs. 34,264; $t = 72.258$; $d = 4.17$). Because net income nonetheless rose 3.5-fold, this expenditure growth is best read as

productive investment (additional stock, fodder, animal health) rather than consumptive outlay. The pattern of effect sizes across all five variables is shown in Figure 2.

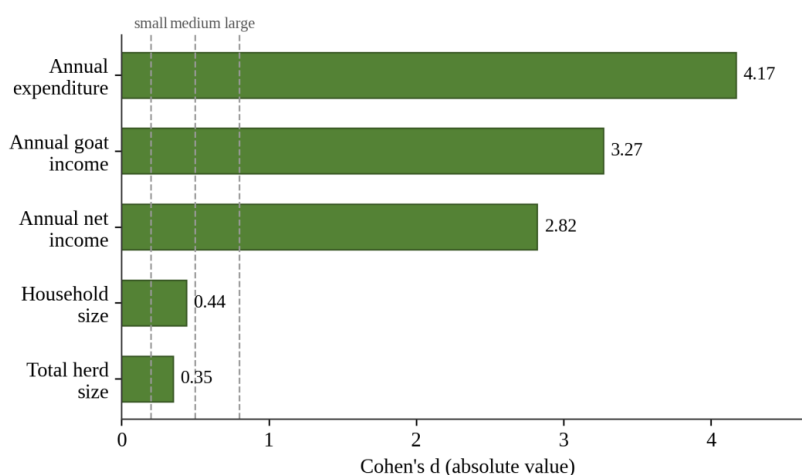


Figure 2: Cohen's d effect sizes for the five paired variables, against conventional benchmarks (0.2 small, 0.5 medium, 0.8 large).^[6]

Herd size and household size. Total herd size increased significantly but with only a small effect ($13.49 \rightarrow 19.00$; $d = 0.35$). The near-zero pre-post correlation underlying this pair ($r \approx 0.024$) indicates that herd expansion was highly heterogeneous across households, inflating the standard deviation of the difference and

moderating the t-value; this is visible in the wide confidence interval for the herd-size difference ($3.74 - 7.29$ goats) relative to its mean (5.52) in Figure 3. Household size rose slightly ($4.92 \rightarrow 5.08$; $t = 7.547$), a modest but significant demographic stabilization.

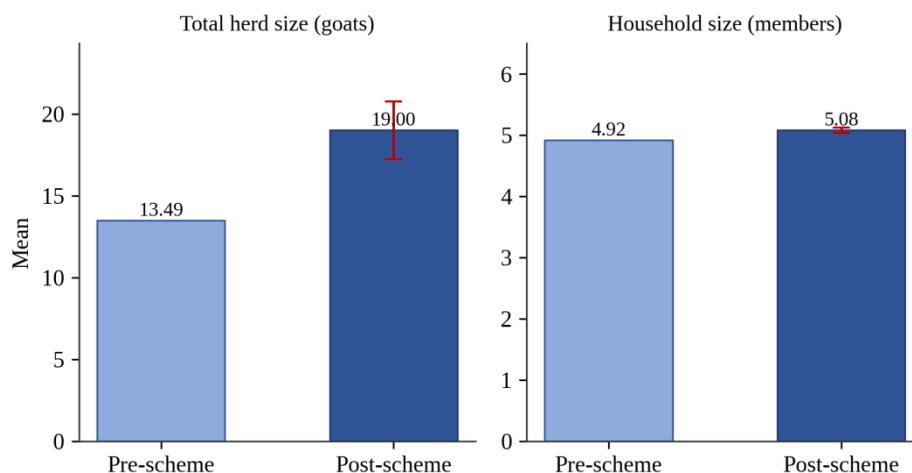


Figure 3: Mean total herd size and household size before and after the scheme; error bar shows the 95% confidence interval of the paired difference.

DISCUSSION

The results establish that NLM-supported goat rearing produced not merely a *detectable* but a *substantial* economic transformation. The effect sizes for the monetary variables ($d = 2.8-4.2$) are extraordinary by conventional standards, where $d > 0.8$ already denotes a large effect.^[6] Two interpretive points follow.

First, the **structure of change is investment-led**. The simultaneous rise in income and expenditure, with net income still more than tripling, indicates that beneficiaries reinvested in their enterprises rather than diverting gains to consumption. This is a favourable signature for sustainability: enterprises that reinvest tend to compound. Placed against wage-based safety nets, goat income is additionally *asset-based* — generated from a self-reproducing herd rather than from labour-days — which lends it greater durability and scope for organic growth, consistent with the wider evidence that goats can materially raise smallholder incomes in India.^[2,7]

Second, the **contrast between flows and stocks is developmentally informative**. Income and expenditure (flows) show very large, uniform effects, whereas herd size (a stock) shows a small, heterogeneous effect. The near-zero pre-post correlation for herd size implies that a household's baseline holding did not predict its expansion: some beneficiaries scaled up sharply while others did not. This heterogeneity is the key equity finding — the program's full economic potential is not yet uniformly realized, and targeting low-expansion households could raise aggregate and distributional outcomes simultaneously.

Aggregated across the sample, the mean net-income gain implies roughly Rs. 1.3 crore of additional annual income for 300 households, a sum that also seeds a local multiplier through spending on fodder, veterinary services, and transport. A note of caution is warranted: because income is concentrated in a single livestock activity, households remain exposed to covariate shocks (disease outbreaks, price collapse), which motivates insurance and income-diversification measures.^[1]

CONCLUSION

NLM-supported goat rearing significantly and substantially improved the economic position of beneficiary households in Rewa district, with net income rising approximately 3.5-fold and effect sizes far exceeding conventional thresholds. The change is investment-led and, in aggregate, large enough to shift households across meaningful economic thresholds. Three implications follow: (i) **protect the gains** through low-premium livestock insurance and encourage diversification, given single-activity concentration; (ii) **broaden the base** by targeting the heterogeneous, low-expansion households identified by the weak herd-size effect; and (iii) **link savings** to the formal financial system so that raised net incomes translate into durable asset accumulation.

LIMITATIONS

The pre-post design does not include a non-beneficiary control group, so secular trends cannot be fully separated from program effects. Pre-scheme values rely partly on recall, introducing possible recall bias. Findings are specific to Rewa district and should be generalized cautiously.

DECLARATIONS

Funding: None. **Conflicts of interest:** The authors declare no conflict of interest. **Ethics approval and consent:** Approval was obtained from Awadhesh Pratap Singh University, Rewa, Madhya Pradesh, India; informed consent was obtained from all respondents. **Data availability:** All data generated or analyzed during this study are included in this published article.

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