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INVISIBLE LABOR, VISIBLE NEGLECT: A THEMATIC ANALYSIS OF EQUINE FARMERS' BURDENS IN HARYANA (INDIA)

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Abstract

The equine sector in India, and particularly in Haryana, remains chronically under -resourced, constrained by inadequate budgetary provision, diminishing land holdings, rapid agricultural mechanization, and policy neglect that together compound the socio-economic vulnerability of the farmers who depend on it. Despite the socio-economic significance of working equids for an estimated 600 million people worldwide, these animals remain marginal to mainstream livestock development policy. This study examined the gap between policy assumptions and empirical realities in equine husbandry through a mixed-methods investigation of farmer-level constraints.

Structured interviews were administered to 303 equine-owning farmers across four districts of Haryana (Hisar, Bhiwani, Jind, and Rohtak), selected through a multi-stage purposive, snowball, and random sampling design. Quantitative responses were analyzed descriptively and by chi-square tests of district-level variation. Five major constraints emerged: (i) inadequate access to expert veterinary services; (ii) limited government welfare policies and credit access; (iii) absence of structured breeding infrastructure; (iv) persistent work insecurity for equines under mechanization; and (v) generational disengagement linked to social stigma. Secondary analysis further identified pronounced gaps in insurance coverage and extension/knowledge services.

Key findings: 24.8% of respondents reported non-availability of government veterinary services and 29.7% reported that available veterinary staff lacked equine-specific expertise. Loan facilities for equine-based enterprises were unavailable to 67.6% of respondents, with zero farmers reporting successful access to equine-specific credit. Structured breeding policies were absent for 55.1% of respondents. Work insecurity linked to mechanization was reported by 94.4% of respondents, and 66.3% agreed that social stigma is associated with equine rearing. Landlessness (86.1% of the sample) compounded these constraints by foreclosing conventional credit collateral.

These findings indicate that the marginalization of Haryana's equine farmers is systemic rather than incidental, rooted in institutional neglect, caste-linked occupational inheritance, and the unmitigated social costs of agricultural mechanization. We argue for coordinated policy intervention — dedicated budgetary allocation, equine-specific veterinary and breeding infrastructure, inclusive credit and insurance instruments, and community-centered livelihood diversification — to sustain equine-dependent rural livelihoods and to translate the 2024 National Livestock Mission amendment from symbolic recognition into implemented support.

Keywords: equine farmers; rural livelihoods; marginalization; livestock policy; working equids.

1. INTRODUCTION

The livestock sector is a cornerstone of the global economy, providing employment, revenue, food security, and livelihoods for approximately one billion people worldwide (FAO, 2020). The sector shows robust growth, with annual growth rates of 5.1% in

meat production and 3.6% in dairy products (Singodia et al., 2019). Livestock contributes 40% of global agricultural production and 24% of India's total agricultural output (FAO, 2020), yet remains highly vulnerable to natural calamities, epidemics, feed shortages,



and immunosuppression, with long-lasting socio-economic consequences (Madhu et al., 2012).

Equines, domesticated at the dawn of human civilization, have played an unparalleled role in human history — central to social and political development, communication networks, transportation, agricultural productivity, and sport (Kefena et al., 2012). In India, livestock contributes 4.11% to national GDP and 25.6% to agricultural GDP, supporting the livelihoods of approximately two-thirds of rural communities (20th National Livestock Census, Department of Animal Husbandry & Dairying, 2019). Equines occupy a distinct socio-economic niche within this sector: they are reared predominantly by landless, small, and marginalized farmers, functioning as draft power, transportation, supplementary income, and a financial safety net in times of crisis (Chauhan and Verma, 2021).

Livestock-based livelihoods have been conceptualized as an “ATM for poor people,” emphasizing diversification of income streams for economically vulnerable households (Balkari et al., 2016). Globally, working equids — horses, donkeys, and mules — constitute a foundational livelihood source for an estimated 600 million people, particularly across low- and middle-income countries (Bonsi et al., 2023). They generate direct and indirect income, serve as liquidatable assets during crises, and provide essential domestic support such as transporting water, firewood, and children to school (Brooke, 2015; Bonsi et al., 2023).

In Haryana, equines have historically served multiple socio-economic functions spanning agricultural labor and cultural practice. Equine ownership patterns correlate strongly with traditional occupational castes historically associated with transportation and agricultural services (Sharma et al., 2020), reflecting rational economic action shaped by market demand and functional utility (Weber, 1978). The Marwari horse is the predominant breed in the state, valued for its hardiness and adaptability to semi-arid conditions (Pundir et al., 2021). Over the past two decades, however, equine populations across India — and in Haryana specifically — have declined precipitously, with significant consequences for rural livelihoods and agricultural productivity.

1.1 Equine Population Trends in Haryana and India

National Livestock Census data document a dramatic decline in equine populations across successive census cycles (Table 1, Table 2; Figure 1).

Table – 1: Haryana equine population by National Livestock Census period

Census Period	Haryana Population (million)
16th (1997)	0.1470
17th (2003)	0.0470
18th (2007)	0.0365
19th (2012)	0.0486
20th (2019)	0.0130

Table – 2: India equine population by National Livestock Census period

Census Period	India Population (million)
16th (1997)	1.930
17th (2003)	0.980
18th (2007)	1.049
19th (2012)	1.139
20th (2019)	0.550

This represents a 91.2% decline in Haryana's equine population over 22 years (1997–2019) and a 71.5% decline nationally (Table 1&2). This precipitous decline reflects systemic policy neglect, agricultural mechanization, and shifting rural socio-economic conditions. The National Livestock Mission (NLM) was amended in February 2024 to explicitly include development activities for camels, horses, donkeys, and mules — a belated policy recognition of equine importance (NLM, 2024).

Against this backdrop of demographic decline and policy neglect, this study investigates the lived constraints of equine farmers in Haryana, asking: what specific institutional, financial, and social barriers do equine farmers face, and how do these barriers vary across districts and farmer types? The following sections detail the methods, empirical findings, and policy implications of this investigation.

2. MATERIALS AND METHODS

2.1 Study Location

This research was conducted across four districts of Haryana state, India: Hisar, Bhiwani, Jind, and Rohtak. These districts were selected to capture geographic diversity within the state: Hisar and Bhiwani represent South Haryana's semi-arid agricultural landscape, while Jind and Rohtak represent North Haryana's mixed agro-pastoral systems. Data collection encompassed both rural and urban areas within these districts to capture diverse equine management practices and livelihood patterns.

2.2 Sampling Strategy and Sample Composition

A multi-stage sampling approach was employed to ensure representative coverage of the equine farmer population:

- **Stage 1 — Purposive district selection.** Four districts were purposively selected based on equine population density (20th National Livestock Census data) and geographic representation.
- **Stage 2 — Purposive community identification.** Within each district, communities with significant equine populations were identified through consultation with District Animal Husbandry Officers and preliminary informal interviews.
- **Stage 3 — Snowball sampling.** Key informants (established equine farmers, veterinary extension workers) identified additional respondents within their

networks, facilitating access to marginalized farming communities often excluded from formal surveys.

- **Stage 4 — Simple random sampling for interviews.** A total of 303 equine farmers were systematically selected from identified communities for structured interviews, with a minimum of 50 farmers per district to ensure adequate district-level representation.

The final sample comprised 303 equine farmers distributed by district and species as shown in Table- 3.

Table – 3: District-wise and species-wise distribution of respondents (n = 303).

Category	Hisar (n)	Bhiwani (n)	Jind (n)	Rohtak (n)	Total (n)
Horse farmers	44	38	28	20	130
Pony farmers	18	15	13	13	59
Mule farmers	19	12	28	28	87
Donkey farmers	7	12	4	4	27
Total	88	77	73	65	303

2.3 Data Collection Methods

Primary data were collected using a structured interview schedule administered face-to-face by the researcher. The schedule comprised four sections: (1) demographic and socio-economic profile; (2) equine husbandry practices and constraints; (3) access to government services and schemes; and (4) aspirations and barriers to livelihood sustainability. Secondary data were drawn from peer-reviewed journals, government publications, research reports, and official department websites.

The instrument was pilot-tested with 30 farmers (not included in the final analysis) to ensure clarity, cultural appropriateness, and logical flow, and was administered in Hindi, the predominant local language, to ensure comprehension. Completed schedules were examined daily for completeness; missing or ambiguous responses were addressed through follow-up telephone contact within one week of the initial interview, yielding a 100% completion rate with minimal missing data (<2%).

2.4 Data Analysis

Quantitative analysis: Descriptive statistics (frequencies, percentages, mean $\pm$ SD) were calculated for all variables. Responses to key constraint variables were compared by district and farmer type using chi-square (χ^2) tests to identify significant differences ($p < 0.05$). All quantitative analysis was conducted in IBM SPSS Statistics version 27.0.

Qualitative analysis: Thematic analysis followed Braun and Clarke's six-phase approach: (1) data familiarization; (2) initial

code generation; (3) theme identification; (4) theme refinement; (5) definition and naming; and (6) final report production. Five major themes emerged through systematic coding of qualitative responses and case narratives.

Data integration: Quantitative findings (percentages) were integrated with qualitative narratives (illustrative case studies) to provide triangulated evidence for each theme, strengthening the validity and transferability of the findings.

2.5 Ethical Considerations

The present study employed a survey-based design and, as such, did not require formal ethics committee approval. Nevertheless, prior to each interview, all participants were fully informed about the study's objectives, and their verbal/written consent was obtained before proceeding.

3. RESULTS

3.1 Socio-Economic Profile of Sampled Equine Farmers

The socio-economic profile of sampled equine farmers revealed significant vulnerability. Educational attainment was low: 43.2% had no formal schooling, 38.9% had education below 10th standard, 11.2% had completed 10th standard, 3.3% had completed 12th standard, and 3.3% were graduates or above. Monthly household income was distributed as follows: 6.9% earned $\leq$ ₹10,000, 32.0% earned ₹10,001–₹20,000, 34.3% earned ₹20,001–₹30,000 (the largest segment), and 26.4% earned $>$ ₹30,000.

Women constituted approximately 15.8% of primary respondents but played critical roles in fodder collection, animal care, and veterinary decision-making. Female-headed households (8.2% of the sample) reported particular vulnerability, with limited access to credit facilities and land tenure insecurity; younger female household members (daughters-in-law in patrilineal joint families) bore disproportionate labor burdens in daily animal care without recognized contribution or decision-making authority.

Land ownership was severely constrained: 86.1% of respondents were completely landless, forcing dependence on livestock-based livelihoods in the absence of the collateral and alternative crop income that land ownership typically provides.

3.2 Thematic Analysis of Five Primary Constraints

Quantitative responses to the key constraint variables, disaggregated by respondents, are presented in Tables - 4. Together these tables synthesize district-level variation across the five primary constraints identified through thematic analysis.

Table - 4: Tabular presentation of primary constraints identified

Variables	Responses	Frequency (Values no. represented by (n) and percentages by (%))				
		Hisar (n=88)	Bhiwani (n=77)	Jind (n=73)	Rohtak (n=65)	Overall (n=303)
Veterinary services	Not available	8 (9.1%)	47 (61%)	17 (23.3%)	3 (4.6%)	75 (24.8%)
	Available	25 (28.4%)	15 (19.5%)	20 (27.4%)	42 (64.6%)	102 (33.7%)
	Staff is reluctant	22 (25%)	6 (7.8%)	7 (9.6%)	1 (1.5%)	36 (11.9%)
	Lack of expertise	33 (37.5%)	9 (11.7%)	29 (39.7%)	19 (29.3%)	90 (29.7%)
Government Welfare policies & and financial support	Not aware	30 (34.1%)	21 (27.6%)	20 (27.4%)	8 (12.3%)	79 (26.1%)
	Not available	49 (55.7%)	51 (66.2%)	53 (72.6%)	52 (80%)	205 (67.6%)
	Available	00 (0.0%)	00 (0.0%)	00 (0.0%)	00 (0.0%)	00 (0.0%)
	Not required	9 (10.2%)	05 (06.2%)	00 (0.0%)	5 (7.7%)	19 (6.3%)
Structured Breeding Policy	Available	01 (1.1%)	00 (0.0%)	00 (0.0%)	00 (0.0%)	1 (0.3%)
	Not available	53 (62.5%)	55 (62.7%)	34 (46.5)	24 (36.9%)	173 (55.1%)
	Not required	32 (36.4%)	32 (36.3%)	38 (53.5%)	41 (63.1%)	129 (44.6%)
Experiencing work Insecurity for Equines	Agree	4 (4.5%)	6 (7.8%)	1 (1.4%)	6 (9.2%)	17 (5.6%)
	Disagree	84 (95.5%)	71 (92.2%)	72 (98.6%)	59 (90.8%)	286 (94.4%)
Social Stigma	Agree	57 (64.4%)	62 (15.6%)	35 (47.9%)	34 (52.3%)	201 (66.3%)
	Disagree	31 (35.6%)	15 (19.5%)	38 (52.1%)	31 (47.7%)	102 (33.7%)

3.2.1 Theme 1 — Inadequate Access to Veterinary Services

Overall, 24.8% of respondents reported non-availability of government veterinary services for equines, while 33.7% were satisfied with service availability. A further 11.9% reported that veterinary hospital staff was reluctant to treat ailing equines, and

29.7% reported that veterinary doctors lacked expertise in equine health and management when approached.

District-wise variation was substantial. In Hisar, 9.1% reported non-availability while 28.4% were satisfied; staff reluctance was reported by 25.0%, and 37.5% reported a lack of veterinary expertise. Bhiwani showed the most severe deficit, with 61.0%



reporting non-availability and only 19.5% satisfied. Jind showed moderate constraints (23.3% non-availability, 27.4% satisfied), while Rohtak showed the best availability (64.6% satisfied, 4.6% non-availability) (Table- 4). Illustrative of the narrative of case study provided by an equine farmer. *Sh. Ashok Kumar (name altered for confidentiality), a Parjapat community member from Hisar district, described village-level veterinary constraints:*

"In my village, there is a distinct lack of specialized veterinary services for equine health management. When my equines became sick, local veterinarians expressed an inability to treat them, compelling me to seek expert care at the Veterinary University, which is 55 kilometers away. Transporting an ailing animal this distance is both prohibitively expensive (₹2,000-3,000 in fuel and labor) and logistically unfeasible, often resulting in delayed treatment and poor outcomes."

3.2.2 Theme 2 — Limited Government Welfare Policies and Credit Access

Access to credit and government livestock support schemes showed severe deficits. Overall, 67.6% of respondents reported that loan facilities were not available, and not a single farmer reported successful access to equine-specific credit; only 6.3% stated that loans were not required. Rohtak district reported the most severe unavailability (80.0%) (Table 4).

When asked about awareness of government welfare policies, 26.1% of respondents were entirely unaware of existing livestock schemes. Those who were aware faced institutional barriers: livestock assets were not accepted as loan collateral, land ownership was required as collateral (problematic for the 86.1% of respondents who were landless), and specialized agricultural credit institutions showed reluctance toward equine-based enterprises (Table – 4). Illustrative of the narrative of case study provided by an equine farmer Sh. Ashish Kumar (name altered for confidentiality) from Jind district:

"I have received neither financial assistance nor insurance coverage from government departments for my equine rearing business. Equines are classified as pack and draught animals, not recognized as primary agricultural assets eligible for support. There is no structured financial provision or insurance mechanism, forcing me to bear all risks privately."

3.2.3 Theme 3 — Absence of Structured Breeding Policies

Structured breeding policies and infrastructure were nearly absent from Haryana's agricultural support systems: 55.1% of respondents overall reported that such policies were unavailable, rising to 62.5% in Hisar and 71.4% in Bhiwani. Rohtak showed comparatively better — though still substantial — unavailability (36.9%) (Table 4).

Government veterinary departments lacked infrastructure for artificial insemination (AI) services, and mobile AI units did not operate in any of the sampled districts. Farmers relied instead on traditional natural mating (often with locally available stallions of

inferior genetic quality) or expensive private AI services (₹1,000–₹2,000 per application), which were prohibitive for marginal farmers. The absence of a formal equine breed registry further hampered selective breeding: indigenous Marwari horses possess genetic adaptations to semi-arid conditions, but these were not systematically documented or conserved, and breed-specific knowledge was being lost intergenerational. Illustrative of the narrative of case study provided by an equine farmer, Sh. Ashish Kumar (name altered for confidentiality) respondent from Hisar described breeding challenges:

"Neither a good quality stallion nor AI facilities are available in my village. The nearest facilities are 40 kilometers away. I must transport my mare to the ICAR-National Research Centre on Equines for AI services, a journey requiring one day travel, separated mare-foal pairs, and creates significant financial loss. This undermines breeding efficiency and economic viability."

3.2.4 Theme 4 — Persistent Work Insecurity under Mechanization

Mechanization of rural livelihoods has systematically eliminated equine-dependent employment. Overall, 94.4% of respondents reported persistent work insecurity for equines — among the highest constraint percentages recorded — with a consistent pattern across districts: Hisar (95.5%), Bhiwani (92.2%), Jind (98.6%), and Rohtak (90.8%) (Table 4).

Historically, equines provided essential labor for agriculture (plowing, harvesting), transportation (cart-pulling, pack animals), brick kilns, and construction. Contemporary mechanization (tractors, trucks, and all-terrain and utility-terrain vehicles) has displaced equines from virtually all of these sectors, and farmers who once earned reliable income from equine-based services now face collapsed demand. Sh. Ashok Kumar (name altered for confidentiality) from Hisar (Backward Class/OBC community) described caste-linked occupational vulnerability:

"I belong to the Backward Class engaged in equine rearing as a pastoral activity linked to caste-based occupational specialization—a historical practice in Haryana. However, my landlessness creates critical vulnerability within the agricultural economy. Land ownership traditionally provides collateral for credit access and alternative income through crop cultivation. This landlessness compels dependence on livestock-based livelihoods, making my family particularly susceptible to market fluctuations and sectoral downturns in equine demand. With mechanization replacing equine labor, I face livelihood collapse."

3.2.5 Theme 5 — Generational Disengagement and Social Stigma

The younger generation showed declining interest in equine rearing, linked to social perceptions and educational advancement. Overall, 66.3% of respondents agreed that social stigma is associated with equine rearing, while 33.7% disagreed. Perceptions varied by district: Bhiwani reported the highest agreement (80.5%),

followed by Hisar (64.8%), Rohtak (52.3%), and Jind (47.9%) (Table 4).

Historical associations between equines — particularly donkeys — and social “backwardness” continue to shape intergenerational occupational choices, and rising educational attainment creates aspirational mobility pressures that further reduce the sector's attractiveness to younger household members. Sh. Vinay (name altered for confidentiality) from Rohtak district, engaged in ceremonial equine work, reflected:

"I live in a joint family and have reared equines for ceremonial activities—weddings, festivals. I received 2-3 bookings per day during festive seasons. My brothers work with me in equine-related activities. However, my sons and nephews refuse to continue this occupation. They perceive equine work as socially stigmatized and wish to pursue other professions due to social status concerns."

4. DISCUSSION

This study provides empirical evidence of the systematic marginalization of equine farming within India's agricultural development framework. These findings align with global documentation of equine sector neglect in low-income settings (Brooke, 2015) while providing Haryana-specific context. The dramatic population decline documented here — 91.2% in Haryana between 1997 and 2019 — reflects policy failure at both state and national levels.

4.1 Systemic Marginalization and Institutional Failure

An institutional lens reveals how existing arrangements perpetuate marginalization rather than address it. While government departments, veterinary colleges, NGOs, and farmer organizations ostensibly provide support, the empirical reality for equine farmers is one of fragmented, inadequate services — reflecting a broader pattern in which administrative convenience is prioritized over user needs.

Lipsky's (1980) concept of ‘street-level bureaucracy’ helps explain this pattern: policy outcomes depend substantially on front-line providers' discretion and capacity. When veterinary officers lack equine-specific training or prioritize cattle and buffalo caseloads, equine farmers receive minimal service regardless of formal policy directives. The absence of equine-specific provisions within the National Livestock Mission prior to 2024 illustrates how marginalized sub-sectors remain institutionally invisible until an explicit policy mandate redirects attention and resources.

4.2 Mechanization, Economic Restructuring, and Livelihood Crisis

Mechanization has eliminated much equine-dependent labor in agriculture, transportation, and construction, which helps explain why 94.4% of farmers in this sample report work insecurity. Equines nonetheless retain crucial livelihood importance for landless, economically marginal populations for whom mechanization remains financially inaccessible. Policy responses should therefore balance the economic progressiveness of

mechanization with mitigation support for the populations it displaces.

4.3 Caste, Landlessness, and Durable Inequality

The concentration of equine ownership among Backward Class communities and landless farmers reflects historical, caste-linked occupational associations (e.g., farrier and cart-driver castes) that persist despite formal legal equality. The finding that 86.1% of sampled equine farmers are landless suggests an occupational ‘inheritance’ among economically marginalized groups. Tilly's (2005) framework of ‘durable inequality’ is instructive here: categorical distinctions such as caste and landlessness generate persistent disadvantage even in the absence of formal discrimination. Because equine assets cannot be capitalized without credit access or market linkages, ownership fails to translate into social mobility. Addressing equine sector development therefore requires confronting these underlying structural inequalities directly, rather than focusing on population numbers alone.

4.4 Gender Dimensions of Equine Farming

Although women constituted only 15.8% of primary respondents, gendered labor patterns within equine-dependent households warrant attention: women bear disproportionate responsibility for daily animal care (fodder collection, feeding, basic healthcare), while male household heads typically control economic decisions and market interactions. Female-headed households (8.2% of the sample) reported particular vulnerability, with limited land tenure security and credit access. Policy responses could usefully include women's group formation to strengthen collective input access, female-centered skill development in veterinary awareness and breeding management, and targeted credit instruments for female equine entrepreneurs.

4.5 Policy Implications: The 2024 National Livestock Mission Amendment

The February 2024 NLM amendment represents the first formal policy recognition of equine development needs, but its belated inclusion requires substantial implementation capacity. Critical questions remain open: What budgetary allocation will support equine development? Which agencies hold implementation responsibility? How will geographic distribution avoid rural service gaps? What integration exists with existing veterinary extension systems, and are capacity-building programs planned for equine-specialist veterinarians? Without clear answers to these questions, the 2024 amendment risks remaining symbolic rather than transformative.

4.6 Comparative Context: Global Working Equid Sector Dynamics

Global equine sector trends diverge across development contexts. Developed economies have largely mechanized agriculture and transportation, while emerging economies show more nuanced patterns: China's rapidly expanding equine industry is driven by rising wealth and leisure demand (Seyiti & Kelemu, 2021), and Sub-Saharan Africa retains substantial working equid populations serving core rural development functions. India occupies a

transitional position, in which advanced mechanization in prosperous regions coexists with persistent working-equit dependence in economically marginal areas — a duality that calls for differentiated policy approaches recognizing both transition trajectories and continuing livelihood importance.

5. Study Limitations

- **Sampling:** the multi-stage design combining purposive, snowball, and random sampling may introduce selection bias; snowball sampling, while effective for reaching marginalized communities, may preferentially capture farmers with stronger social networks. The sample of 303 farmers represents an estimated 2.3% of Haryana's approximately 13,000 equine farmers, limiting statistical power for district-level subgroup analysis.
- **Geographic scope:** data collection was restricted to four of Haryana's twenty-two districts, and district-specific findings may not generalize across the state's diverse agro-climatic zones; no comparison across Indian states was undertaken.
- **Temporal scope:** this cross-sectional study captures a single time point and cannot assess temporal trends; given the recency of the February 2024 NLM amendment, longitudinal follow-up will be required to assess its implementation impact.
- **Methodological considerations:** interviewer-administered data collection may introduce interviewer or social-desirability bias, and self-reported constraint severity was not independently verified against administrative records. Constructs such as livelihood insecurity and social stigma were assessed with single-item measures rather than validated psychometric scales.
- **Gender analysis:** the small proportion of female primary respondents (15.8%) limited statistical power for gender-disaggregated analysis.
- **Generalizability:** findings reflect Haryana's semi-arid agro-climatic and policy context and may not generalize directly to states with differing agro-ecological or institutional conditions.

6. POLICY RECOMMENDATIONS

Based on these findings, we recommend coordinated intervention across six dimensions.

- **Veterinary capacity.** Identify and train veterinarians in equine health management in collaboration with veterinary universities, establish dedicated equine veterinary clinics at district headquarters, and develop equine-specific treatment protocols.
- **Breeding infrastructure.** Establish equine breeder farms with high-quality stallions at strategic locations, deploy mobile artificial insemination units, and create equine breed registries documenting indigenous genetic resources.
- **Livelihood diversification.** Promote equine-based agri-entrepreneurship (dairy/milk production, farrier services,

eco-tourism), support producer groups for collective marketing, and provide skills training in value-added production.

- **Credit and insurance access.** Run awareness campaigns on existing government schemes, facilitate group-lending mechanisms using social collateral for female farmers, and develop equine-specific insurance products.
- **Knowledge systems.** Establish equine-specialized sub-units within Krishi Vigyan Kendras (KVKs), farmer field schools, and digital extension platforms.
- **Gender-centered approaches.** Support women-only equine producer groups, female-targeted skill development, and strengthened support mechanisms for female-headed households.

Implementation will require coordinated action across government departments, financial institutions, research organizations, and farmer communities, underpinned by dedicated state-level budgetary allocation and inter-departmental coordination mechanisms.

7. CONCLUSION

This study provides empirical documentation of Haryana's equine sector decline and the systematic marginalization of its equine farmers within prevailing agricultural development frameworks. The 91.2% population decline recorded over 22 years reflects a policy failure requiring urgent intervention. Equine farming continues to serve critical livelihood functions for an estimated 13,000 households in Haryana, comprising predominantly landless, Backward Class communities for whom equines represent an economic safety net with few substitutes.

The five primary constraints identified here — inadequate veterinary services, absent breeding infrastructure, limited government welfare and credit access, mechanization-driven work insecurity, and generational disengagement linked to social stigma — are not inevitable. Each can be addressed through targeted policy intervention and resource allocation. The February 2024 National Livestock Mission amendment provides a formal starting point, but its translation into implementation capacity remains the critical unresolved task.

Sustainable rural development requires acknowledging equines' continuing livelihood importance for marginalized communities. Agricultural mechanization remains economically progressive and should continue, but its social costs demand mitigation through diversification support and targeted assistance for dependent populations. A multi-faceted approach integrating veterinary service strengthening, breeding infrastructure, livelihood diversification, financial service access, knowledge system improvements, and gender-centered support is essential to reverse the population decline documented here and to secure the sector's future.

8. AUTHOR CONTRIBUTIONS

All authors have checked and critically analyzed the manuscript and gave their consent for publication.



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This research received no external funding.

10. CONFLICTS OF INTEREST

The authors declare no conflict of interest,” or disclose relevant interests.

11. DATA AVAILABILITY STATEMENT

Insert data availability statement, e.g.: “The datasets generated and/or analyzed during the current study are available from the corresponding author on reasonable request,” subject to participant confidentiality.

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