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Livestock Sector Dynamics and Rural Livelihood Sustainability: The Telangana Model

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Abstract:
Livestock has become the fastest-growing component of Telangana's agrarian economy since the state was formed in 2014. This paper examines the dynamics of the sector and their implications for rural livelihood sustainability through what policy-makers describe as the Telangana Model: targeted asset transfers, price incentives for dairy producers, doorstep veterinary services, and cooperative institutions. Using the 20th Livestock Census (2019), Basic Animal Husbandry Statistics, the Telangana Socio Economic Outlook 2023 and published studies, and interpreting the evidence through the sustainable livelihoods framework, the paper finds that the state's sheep population grew by 48.5 per cent between 2012 and 2019 and is now the largest in India; meat production nearly doubled between 2015-16 and 2021-22; egg production grew by 6.8 per cent a year; and livestock gross value added at current prices rose from Rs 29,282 crore in 2014-15 to Rs 1,03,895 crore in 2022-23. Livestock now generates almost half of agricultural and allied value added and supports about 25.8 lakh families. Sustainability remains conditional, however, on subsidy dependence, a caste-targeted design, fodder and grazing pressures, the erosion of backyard poultry, uneven implementation, and inconsistent data. The paper closes with recommendations to consolidate the gains.

Keywords: Telangana; livestock; rural livelihoods; sheep distribution scheme; dairy; sustainability; sustainable livelihoods framework

1. Introduction

Livestock occupies an unusual position in rural India. It is at once a source of daily cash flow, a store of wealth, a buffer against crop failure and a supplier of the animal-source foods on which household nutrition increasingly depends. Because livestock ownership is more evenly spread than land ownership, growth led by the sector tends to reach small and marginal households more directly than growth led by crops (Birthal & Negi, 2012). Livestock also plays an important role in the livelihoods of many of the rural poor and food security on a global scale, while also being a concern for resource use, emissions, and disease (Herrero et al., 2013; Thornton, 2010). But the sector cannot be simply enlarged; it needs to be transformed, FAO has stressed, if it is to meet the Sustainable Development Goals (SDGs) (FAO, 2018).
The case of Telangana is very instructive. The state was carved out on 2 June 2014, has a population of 350.04 lakh (Census 2011) and most of the land is rain fed in the Deccan Plateau, but agriculture and allied activities still provide jobs to 45.8 per cent of the state's workforce (Government of Telangana,

2023). The government has been actively promoting the allied sectors since 2014 with a clear objective to build up the allied sectors in tandem with irrigation and farmer income support. These measures, such as the sheep distribution scheme and support for livestock and fisheries, are responsible for increasing the agriculture and allied sectors' contribution to the gross state value added (GSVA) from 16.3 per cent in 2014-15 to 18.2 per cent in 2022-23 (Government of Telangana, 2023). Schemes when integrated are known as the Telangana Model in the official discourse.

The experience can be analysed through 3 features. The scale of the intervention is huge as more than 82 lakh sheep were distributed to approximately 3.93 lakh beneficiary families during 2017-2022 (Government of Telangana, 2023). Second, Telangana has the highest number of sheep in the country according to the 20th Livestock Census, which is unusual in a sector with a very slow turnover of numbers (DAHD, 2019). Third, the model is being touted as a model for other states, requiring independent and critical reading of evidence. There is a relative lack of available material, most of which is official or journalistic, and rather few studies have evaluated the model against a clear sustainability criterion.

This paper thus poses a straightforward one the question is how far have the recent dynamics of the animals rearing industry in Telangana reflected into sustainable rural livelihoods? Sustainability is defined in the livelihood's perspective of Chambers and Conway (1992): the ability to withstand and recover from stress and shocks, maintain or improve capacities and assets, and not damage the natural resource base. The rest of the paper reviews the literature relevant to the work reviewed in this paper (Section 2), describes the data and method (Section 3), documents the dynamics of the sector (Section 4), analyses the policy architecture (Section 5), assesses sustainability (Section 6), identifies challenges and recommendations (Section 7) and concludes (Section 8).

2. Conceptual Framework and Review of Literature

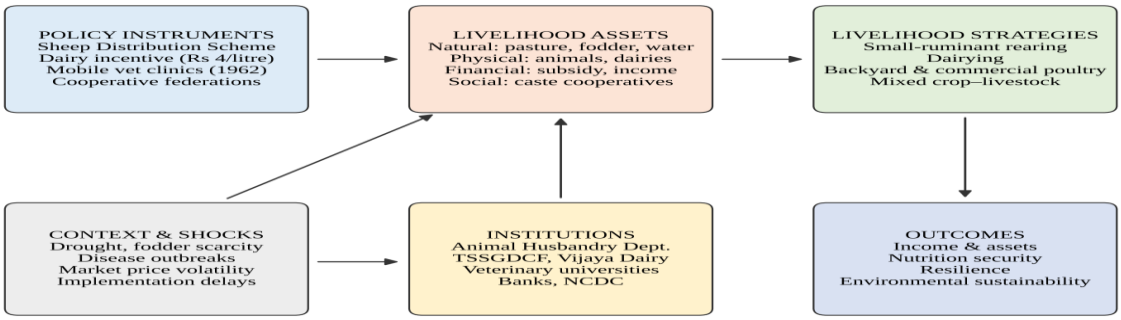
2.1 The sustainable livelihoods approach

A livelihood is defined as the means of living and consists of capabilities, assets and activities, and it is sustainable if it does not lead to the depletion of its resources when exposed to shocks (Chambers & Conway, 1992). Scoones (1998) elaborated on this idea with the development of an analytical framework that connects five types of capital (natural, physical, financial, human and social) to livelihood strategies and livelihood outcomes, through institutions and organisational processes, and influenced by context and shocks. A similar pentagon of assets was popularised by the UK Department for International Development (1999) in its guidance sheets, and Ellis (2000) demonstrated that rural households in developing countries tend to diversify their assets across activities because of risk management, with livestock being among the most common assets of the asset portfolio.

The two reasons why the Telangana Model is suitable for the study is as follows.The suitability of the Telangana Model to the study is as follows. It views policy instruments as instruments that alter the asset stock of the household sector, and not as policy goals, and it holds that policy effectiveness needs to be evaluated on resilience and resource sustainability as well as on income. The framework is adapted to the present case in Figure 1. Policy instruments work on livelihood assets, livelihood assets support livelihood strategies, livelihood strategies produce livelihood outcomes, and the system is supported by livelihood contextual shocks and through livelihood institutions.

Figure 1

Sustainable livelihoods framework adapted to the Telangana livestock model



Source: Author's adaptation of Chambers and Conway (1992), Scoones (1998) and DFID (1999).

2.2 Livestock and rural development in India

Livestock are a growth driver for the poor, as consistently identified in Indian literature. Birthal and Negi (2012) demonstrate that livestock production has been expanding at a faster rate than crop output over the last few decades; the sector is more inclusive – a higher share of animals belong to smallholders, and the sector is less volatile than the crop sector. Demand is the motivating factor. Delgado et al. (1999) anticipated a global shift towards animal-source foods as incomes rise and populations urbanise, and Indian household expenditure patterns have moved in the same direction. At the national level, milk output reached 221.06 million tonnes in 2021-22, with per capita availability of 444 grams per day, while per capita egg availability was 95 and meat availability 6.82 kilograms per year (DAHD, 2023).

The same literature warns of supply-side constraints. Dikshit and Birthal (2010) projected a substantial gap between the demand for and supply of feed and fodder in India, and subsequent work has repeatedly identified fodder, animal health services and market access as the binding constraints on smallholder livestock production. Herrero et al. (2013) add that livestock's contribution to livelihoods is strongest where production systems remain integrated with crop farming and local grazing resources, and weakest where intensification disconnects animals from the land base.

2.3 Evidence from Telangana

Region-specific studies are fewer. Kuchimanchi et al. (2021) traced farming system transitions in a region of Telangana between 1997 and 2015 and found that subsistence mixed farming systems shifted rapidly to market-oriented specialised systems. Some households intensified production while others were marginalised; the role of livestock in farming changed, and lower-caste groups and women gained ownership of large ruminants and access to technologies, although women's workloads also increased. Siripurapu (2023) examined traditional sheep penning on the Deccan Plateau and noted that the expansion of irrigated farmland alters the relationship between farmers and pastoralists, since sheep flocks avoid damp and inundated fields. At the household scale, Pankaj et al. (2019) introduced low-input sheep rearing with improved forage among six small farmers in Vikarabad district and reported that the energy deficiency in family diets was eliminated and protein intake rose above requirement, especially for children, after the intervention. The sample is small, but the result shows the nutritional pathway the aim of the livelihood-oriented livestock programmes is seeking to open up.

2.4 Research gap

The Telangana Model has been elaborated in official documents and in the media, but it has rarely been considered as part of a policy framework for sustainability. This paper makes this integrated reading, and points to differences and shortcomings in the evidence base that a policy audience should be aware of in the design of the main schemes.

3. Objectives, Data and Methodology

The study aims at the following objectives: (a) To document the changes in livestock population and production in Telangana since 2012, (b) To measure the contribution of livestock sector to the agricultural economy of Telangana as per Telangana Model, (c) To document the policy architecture that constitutes the Telangana Model, (d) To assess the sustainability of the livelihoods being supported by the Telangana Model and to suggest improvements.

The study is descriptive, analytical, and based solely on secondary data. The population figures are derived from Telangana at a Glance 2022 and national livestock summary 2019 (DAHD, 2019; Directorate of Economics and Statistics, 2022). Data for production of meat, eggs and milk are obtained from Basic Animal Husbandry Statistics (DAHD, 2023) and state government publications. Value added data and scheme parameters, and employment data are taken from the Telangana Socio-Economic Outlook 2023 and press reports of its release. The design and outcomes of the scheme have been verified with the information provided in the Telangana Today, The Hans India, etc. newspapers which serve as the originals of the official statements and are not independent verifications.

Compound annual growth rates (CAGR) have been computed as (end value/start value)1/n - 1. The shares and ratios were derived from the published data. All value-added data include real growth and price change, and are presented at current prices. Sustainability is measured qualitatively on four dimensions (economic, social, ecological and institutional) defined in the framework of livelihoods and the strength of the evidence available for each of these dimensions is rated. Two restrictions are highlighted here. First, the paper does not utilize primary household data, and consequently claims concerning household income are based on official aggregates and illustrative cases. Secondly, the numbers reported by official indicators are not altogether different. Where this is the case, the deviation is mentioned, and the series is taken from the national statistical publication.

3.1 Study area

Telangana is an area of 1,12,077 km², the eleventh largest state in India, and is located on the Deccan Plateau with the majority of its rivers draining into the Godavari and Krishna rivers. The number of districts has been reduced from 10 to 33 and gram panchayats have increased from 8,368 to 12,769 since 2016 (Government of Telangana, 2023). Despite an overall average of Rs 3.17 lakh, the per capita income at current prices in 2022-23 is far less than that of India (Rs 1.71 lakh), and this figure masks the situation of the rural households that rely on rainfed agriculture and wage employment. In that context, livestock is desirable because it demands less land and can be started on a small unit of animals and be a source of income in the months in which crops can't. Reading this analysis below in the context of the combination of high aggregate prosperity and ongoing rural vulnerability.

4. Dynamics of Livestock Sector in Telangana

4.1 Population

According to Livestock Census-20 (2019), Telangana has maximum sheep population in India, accounting for 190.63 lakh or 25.67 per cent of the country's sheep population of 742.61 lakh (Directorate of Economics and Statistics, 2022). About 128 lakh sheep were recorded in the census of 2012, which means that the sheep population has increased by approximately 48.5 per cent in the last seven years and by around 62 lakh animals. National sheep numbers grew by only 14.1 per cent over the same period, from 65.07 to 74.26 million (DAHD, 2019). Telangana's share of the national flock therefore rose from about 19.7 per cent to 25.7 per cent. Goat numbers grew modestly, from about 45.8 lakh to 49.4 lakh (7.8 per cent), slightly less than the national increase of 10.1 per cent. Table 1 summarises the comparison.

Table 1

Sheep and goat populations, Telangana and India, 2012 and 2019

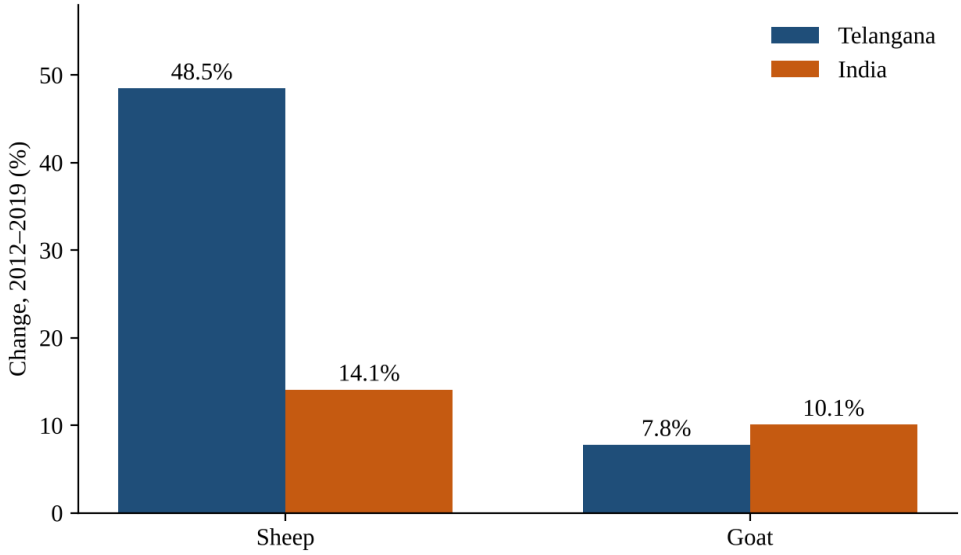
Species / Region	2012	2019	Change (%)
Sheep: Telangana (lakh)	128.4	190.6	48.5
Sheep: India (million)	65.07	74.26	14.1
Telangana share of India's sheep (%)	19.7	25.7	+6.0 points
Goat: Telangana (lakh)	45.8	49.4	7.8
Goat: India (million)	135.17	148.88	10.1

Source: DAHD (2019); Directorate of Economics and Statistics (2022); Government of Telangana releases reported in Press Trust of India (2022). Telangana 2012 sheep and goat figures and shares are derived from census growth rates and the 2019 totals; they are approximate.

Growth rates of the two species are compared in Figure 2. This is quite remarkable as the sheep population cannot be expanded quickly through the natural breeding program. The growth is said to be due to the sheep distribution programme in which sheep were imported from other states and allocated to the families of the beneficiaries and also because of the increase in the numbers of sheep distributed in the families

(Telangana Today, 2022d). The census does not distinguish between scheme-based and organic growth, so attribution should be considered as a possibility rather than a certainty.

Figure 2
Sheep and goat population percentage change from 2012-2019



Source: Computed from DAHD (2019) and Directorate of Economics and Statistics (2022).

The national census reported that the number of exotic and crossbred cattle increased by 26.9 per cent while the number of indigenous cattle decreased by 6 per cent and livestock decreased by 4.6 per cent from the previous census to reach 535.78 million (DAHD, 2019). The national trend of creeping up of crossbreeding and changing in species composition sets the background for Telangana's shift towards small ruminants and poultry.

4.2 Production of meat, eggs and milk

Production of animal-source foods has grown faster than the population of animals, which indicates rising off-take and productivity. Table 2 reports the series published in Basic Animal Husbandry Statistics. Meat production rose from 542 thousand tonnes in 2015-16 to 1,005 thousand tonnes in 2021-22, an 85 per cent increase equal to a CAGR of 10.8 per cent (Figure 3). Telangana's share of national meat production rose from 7.72 to 10.82 per cent, and per capita meat availability rose from 14.99 to 26.64 kilograms per year, almost four times the national figure of 6.82 kilograms (DAHD, 2023). State government sources have different figures for the total for 2021-22 ranging from 9.75 to 10.15 lakh tonnes, though Telangana remains in the fifth position among states (Telangana Today, 2022b; Kumar, 2023). The volume of chicken meat is growing, from 262 thousand tonnes in 2013 to 445 thousand tonnes in 2018, and the other volume is primarily composed of sheep and goat meat.

Table 2

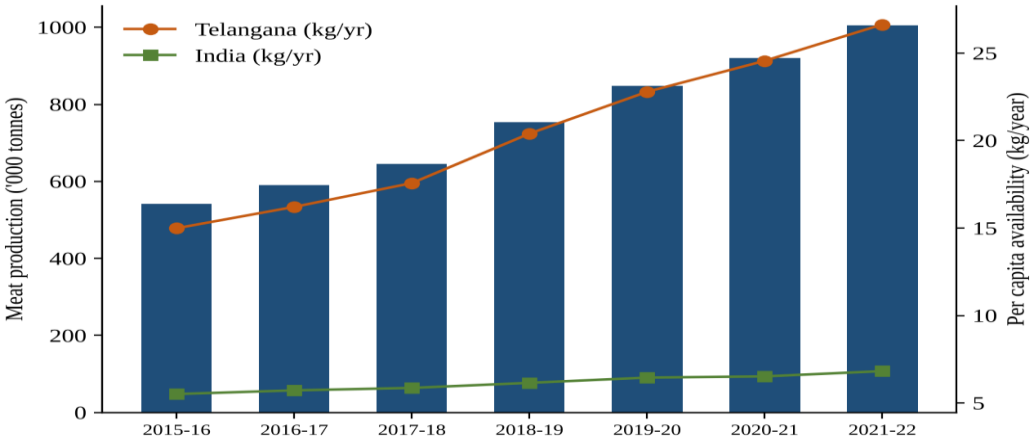
Meat and egg production in Telangana, 2015-16 to 2021-22

Year	Meat ('000 t)	Meat per capita, Telangana (kg)	Meat per capita, India (kg)	Eggs (billion)	Eggs per capita (no.)
2015-16	542.05	14.99	5.51	11.21	310
2016-17	591.04	16.21	5.72	11.82	324
2017-18	645.03	17.57	5.86	12.67	345
2018-19	754.06	20.40	6.15	13.69	370
2019-20	848.16	22.79	6.45	14.81	398
2020-21	920.25	24.56	6.52	15.85	423
2021-22	1,004.99	26.64	6.82	16.67	442
CAGR (%)	10.8	10.1	3.6	6.8	6.1

Source: Basic Animal Husbandry Statistics (DAHD, 2023). CAGR computed by the author for 2015-16 to 2021-22.

Figure 3

Meat production and per capita availability, Telangana and India

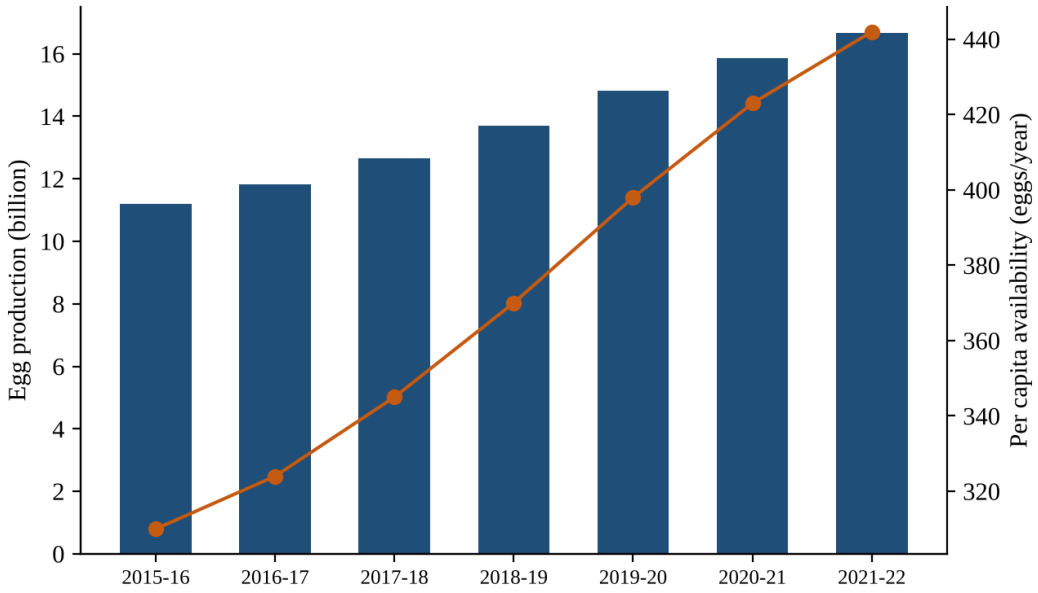


Source: Basic Animal Husbandry Statistics (DAHD, 2023); author's plot.

Egg production grew more steadily, from 11.21 billion in 2015-16 to 16.67 billion in 2021-22 (6.8 per cent a year; Figure 4), and per capita availability rose from 310 to 442 eggs per year against a national average of 95 (DAHD, 2023). Telangana is a leading commercial poultry state. The pattern is not uniformly positive for smallholders, however. Backyard layer numbers fell from 89.08 lakh in 2016-17 to 54.29 lakh in 2021-22, the number of indigenous birds roughly halved, and the backyard share of egg production fell from 6.1 to 2.7 per cent (DAHD, 2023). Growth has therefore been concentrated in the commercial segment, which is capital intensive and offers less direct livelihood support to women and poor households than backyard production.

Figure 4

Egg production and per capita availability in Telangana, 2015-16 to 2021-22



Source: Basic Animal Husbandry Statistics (DAHD, 2023); author's plot.

Milk production grew more slowly. State releases report an increase from 42.07 lakh tonnes in 2013-14 to 60.99 lakh tonnes in 2021-22 (Press Trust of India, 2022), while a later press account of the Socio-Economic Outlook puts 2021-22 output at 58.07 lakh tonnes, ranking thirteenth among states (Kumar, 2023). Using the lower figure, the CAGR is 4.1 per cent, below the national growth of 5.29 per cent recorded in 2021-22 (DAHD, 2023). In March 2022, the minister reported daily milk production of 162.86 lakh litres (FullHyderabad, 2022). Telangana is thus a leader in meat and eggs but a mid-ranking state in milk, which is precisely the commodity that provides the regular cash flow that small producers need.

4.3 Economic contribution

Livestock is now a major contributor to the agrarian economy. According to the Socio Economic Outlook 2023, livestock gross value added at current prices rose from Rs 29,282 crore in 2014-15 to Rs 1,03,895 crore in 2022-23, and about 25.82 lakh families are engaged in rearing livestock or related activities (Kumar, 2023). Over the same period, GSVA of agriculture and allied sectors rose from Rs 76,123 crore to Rs 2,17,877 crore, a CAGR of 14.05 per cent (Government of Telangana, 2023). Table 3 and Figure 5 show that livestock grew at a nominal CAGR of 17.2 per cent, faster than the broader sector, and that its share in agricultural and allied value added rose from 38.5 to 47.7 per cent.

Table 3

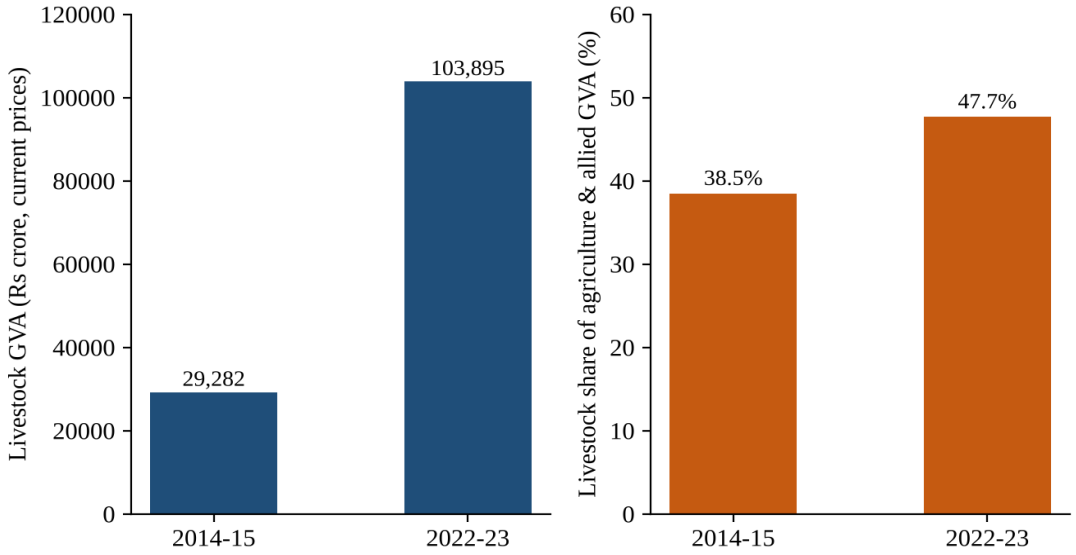
Livestock in the agricultural economy of Telangana, 2014-15 and 2022-23

Indicator	2014-15	2022-23	Change
GVA of agriculture and allied sectors (Rs crore)	76,123	2,17,877	CAGR 14.1%

Indicator	2014-15	2022-23	Change
GVA of livestock (Rs crore)	29,282	1,03,895	CAGR 17.2%
Livestock share of agri. and allied GVA (%)	38.5	47.7	+9.2 points
Agri. and allied share of total GSVA (%)	16.3	18.2	+1.9 points
Families engaged in livestock (lakh)	n.a.	25.82	n.a.

Source: Government of Telangana (2023); Kumar (2023); shares and CAGR computed by the author. Values are at current prices and therefore include price effects; 2022-23 are advance estimates.

Figure 5- *Livestock gross value added and its share in agriculture and allied GVA*



Source: Kumar (2023) and Government of Telangana (2023); shares computed by the author.

The figures are to be taken with a pinch of salt. They are nominal prices, and a significant proportion of the rise is due to price rises for livestock products, while the 2022-23 prices are based on advance estimates. Despite this, the importance of livestock is evident and undeniable across independent sources of livestock population, output, and value data, with livestock becoming a near half of the allied economy.

5. The Telangana Model: Policy Architecture

5.1 Sheep Distribution Scheme

The model focuses on the Sheep Distribution Scheme. It has been created to enhance the livelihood of Yadava (Golla) and Kuruma communities who traditionally raise sheep, and the primary sheep breeders' co-operative societies (PSBCS) do the same. A 20-ewe unit and a ram is distributed to each beneficiary. During the first phase, the unit cost was Rs 1.25 lakh, with the beneficiary covering 25 per cent and the

government 75 per cent, and sheep were bought from other states (Telangana Today, 2022d). The most important parameters are summarised in Table 4.

Table 4

Profile of the Sheep Distribution Scheme

Parameter	Phase I (2017 to 2022)	Phase II (2021-22 onwards)
Unit	20 ewes + 1 ram, with feed and medicines	Same
Unit cost	Rs 1.25 lakh	Rs 1.75 lakh
Subsidy share	75% (Rs 3,751 crore, per SEO 2023)	75% (State share Rs 4,594 crore)
Beneficiaries	3.93 lakh families; 82.64 lakh sheep	Target 3.5 lakh families
Total outlay	Rs 4,980 crore (State plus beneficiary share)	Rs 6,125 crore
Reported outcomes	About 1.30 crore lambs born; assets valued at Rs 6,500 crore	Direct bank transfer of Rs 1.58 lakh piloted for 4,699 beneficiaries

Source: Government of Telangana (2023); Telangana Today (2022d) and Dileep (2023). Minor differences between press and SEO figures reflect the dates of reporting.

The reported outcomes are substantial. By mid-2022, the government reported that 1.30 crore lambs had been born and that the assets created were worth Rs 6,500 crore, and PSBCS membership had grown to 8,109 societies with 7.61 lakh members (Telangana Today, 2022d). The state also became the third largest wool producer in the country, with 3.96 lakh kilograms in 2019-20 (Telangana Today, 2022d). Illustrative cases published by the press describe households whose annual income from sheep rose to between Rs 2.25 lakh and Rs 9.6 lakh (Dileep, 2023; Telangana Today, 2022d). These are individual success stories that have been chosen by the implementing agency and cannot be viewed as generalisation, but do show the potential of the scheme where animals are surviving, and veterinary advice has been provided.

The scheme has also had its problems. A bigger effort is required for Phase II, and Phase II is not as well underway. In November 2022, the second phase was reported to have been temporarily halted following a complaint to the Election Commission and was expected to resume (Telangana Today, 2022a). The government has, meanwhile, tried the direct transfer of subsidy money into beneficiaries' bank accounts, allowing them to purchase the animals (Dileep, 2023), which would streamline the process, but would put the onus on the beneficiaries to secure good-quality animals. The cost of this scheme is not negligible, with an average subsidy of around Rs 0.95 lakh per beneficiary family or Rs 3,751 crore divided by 3.93 lakh. It is therefore necessary to assess its returns against other ways of using public funds.

5.2 Dairy incentives and cooperative institutions

The dairy strategy is hinged on price support and rejuvenation of the institutions. The Telangana State Dairy Development Cooperative Federation (Vijaya Dairy) paid an incentive of Rs 4 per litre on milk

supplied by farmers, and this was extended to the farmers supplying other cooperative dairies; about Rs 343 crore was spent on incentives by February 2022 (Telangana Today, 2022c).

In September 2017 the Chief Minister announced a 'Ksheera Viplavam' (milk revolution) combining incentives with the distribution of buffaloes (The Hans India, 2017), and in 2018 the government cleared Rs 800 crore for subsidised buffalo distribution (Pashu Sandesh, 2018). Procurement prices were raised in February 2022 to Rs 41.64 per litre for buffalo milk and Rs 32.64 for cow milk, and the dairy, which was reported to be loss-making before 2014, reached a turnover of about Rs 700 crore (Telangana Today, 2022c).

Implementation delays have undermined the incentive. As early as February 2018, farmers in Bhadradri Kothagudem district complained that the promised incentive had not reached them three months after its announcement (The Hans India, 2018). Dairy income depends on the regularity of payments, so such delays reduce the financial capital effect of the scheme at the very point where it should be strongest.

5.3 Animal health services

Animal health is the least visible but possibly the most important component. Since 15 September 2017, Telangana has operated 100 mobile veterinary clinics at the assembly constituency level, supported by a 1962 toll-free call centre, each staffed by a veterinarian and a paravet and equipped with medicines and diagnostic tools (DAHD, n.d.). Services are outsourced to a private operator. Independent evaluations of their coverage, response time and effect on mortality were not found in the public record. For small-ruminant keepers, whose flocks are exposed to seasonal disease, rapid access to treatment is a precondition for the survival rates on which the scheme's returns depend.

5.4 Poultry and the private sector

Poultry growth has been driven mainly by private commercial enterprise, with research support from public institutions such as the Directorate of Poultry Research and the state veterinary university. Public programmes for backyard production exist at the national level but have not offset the decline in backyard layers noted earlier (DAHD, 2023). The model is thus a mixed one – the direct investment in ruminant-based livelihoods and indirect facilitation for private poultry expansion.

5.5 Complementary public investments

The livestock strategy is not a stand-alone approach. Livestock promotion along with investment support to farmers (Rythu Bandhu), 24-hour free power for agriculture, the Mission Kakatiya tank restoration programme and large irrigation projects, and the government spending Rs 1.61 lakh crore on irrigation between 2014-15 and 2022-23 are listed under the Socio-Economic Outlook 2023, while reports indicate that there are 300 lakh tonnes of unutilised groundwater in the state. Group life insurance (Rythu Bima) for farmers augments household financial security, which has increased from Rs 3,738.67 crore in 2014-15 to Rs 12,684.59 crore till January 2023. Bank-linked SHG lending has also improved household financial security, increasing from Rs 4,486.05 crore in 2014-15 to Rs 8,866.41 crore till January 2023. These measures are of interest in the present analysis in two respects. They increase the capacity of rural households to buy animal-source foods, which has implications for demand for animal-source foods, and they hinder the ability to attribute observed positive livelihood changes to livestock policy alone. Any assessment of the Telangana Model needs to then differentiate the impact of livestock schemes from that of irrigation and income transfers.

6. Evaluation of the sustainability of livelihoods

The table 5 matches the main policy instruments and their evidence to the livelihood capitals that they address. The assessment is based on the livelihood framework (Figure 1) and is based on the principle of multi-dimensionality of sustainable livelihoods.

Table 5

Sustainability assessment of the Telangana livestock model

Dimension	Positive evidence	Risks and gaps	Evidence strength
Economic	Livestock GVA up 3.5 times; meat and egg output growing; asset creation through sheep units	Nominal values; subsidy dependence; price volatility; payment delays	Moderate
Social	Targets Golla/Kuruma households; cooperative membership 7.6 lakh; women and lower castes gain ownership of large ruminants (Kuchimanchi et al., 2021)	Caste-based eligibility; women's workload; backyard poultry decline	Moderate to weak
Ecological	Small ruminants suited to dryland; integration with crops	Fodder and grazing pressure; irrigation-led land use change; disease risk	Weak
Institutional	Cooperative federation; mobile clinics; dairy revival	Delays, interrupted phases, no independent evaluation, inconsistent data	Weak

Source: Author's assessment based on sources cited in Sections 4 and 5.

6.1 Economic sustainability

The economic case rests on the high returns to small-ruminant rearing at low input cost, on rising demand for meat, and on the diversification of income away from rainfed crops. The growth of livestock value added and the doubling of meat output support the proposition that the sector can raise incomes. Three concerns qualify it. First, the scheme's fiscal cost is high, and most of the evidence on returns is based on selected cases. Second, expanding supply faster than demand could depress prices, and meat demand in Telangana is already high by national standards (the per capita availability of 26.64 kilograms is almost four times the Indian average). Third, income from dairying is vulnerable to feed costs and to the regularity of incentive payments. Whether households can sustain returns once subsidy ends is therefore unproven.

6.2 Social sustainability

Social sustainability concerns who gains and whether gains are secure. The sheep scheme targets communities with a traditional livelihood and an existing cooperative structure, which increases the chance that animals are well managed and that markets are accessible. It also means that other poor

households, including landless labourers outside these communities, are excluded, and that caste identity is made a condition of access. Evidence from a Telangana region indicates that structural change in farming can include lower-caste groups and women in ownership of large ruminants, although it also increases women's workload (Kuchimanchi et al., 2021). The decline of backyard poultry, a female-managed enterprise, points in the opposite direction. Nutrition outcomes could be a major social benefit, as the small Vikarabad study suggests (Pankaj et al., 2019), but no state-level evidence on dietary effects of the scheme was found.

6.3 Ecological sustainability

Telangana's agro-ecology has changed rapidly. Gross irrigated area rose by 117 per cent between 2014-15 and 2021-22, from 62.48 to 135 lakh acres, and paddy production rose from 45.71 lakh tonnes in 2015-16 to 202 lakh tonnes in 2021-22 (Government of Telangana, 2023). They bring about changes in the feed available for use, as well as changes to grazing land and the movements of flocks, as sheep do not like wet fields (Siripurapu, 2023). Further, a national feed and fodder deficit limits growth (Dikshit & Birthal, 2010). Overgrazing and spread of diseases are more likely to occur in larger flocks on the same amount of pasture and in cases of heavy concentration of the poultry industry, issues of biosecurity and waste management are likely (Herrero et al., 2013). Ecological sustainability cannot be demonstrated using available data, as there is no reporting of the sector's fodder balance or rangeland condition or emissions in the state's policy documents.

6.4 Institutional sustainability

The institutions of the model are expanded, but some of them are performing unevenly (cooperative federations, the Animal Husbandry Department, Vijaya Dairy, veterinary university). When the incentive payment is delayed (The Hans India, 2018), Phase II is interrupted (Telangana Today, 2022a) and relying on outsourced services is a sign of administrative strain. As well, the quality of information is important. The paper had some different official figures in different sources like production of meat in 2021-22 was provided as 9.75 lakh tonnes, 10.05 lakh tonnes and 10.15 lakh tonnes and milk production as 58.07 lakh tonnes and 60.99 lakh tonnes. Sustained learning and accountability are not easy if there is no consistent reporting and independent evaluation.

6.5 A livelihoods synthesis

The model has been the strongest in the spheres of physical and financial assets, as shown by the 5 capitals. Animals, dairy infrastructure and cash incentives are tangible, can be counted, and are directly attributable to public programmes. Social capital has also expanded via cooperative societies, but with small numbers of members in specific communities. Human capital is the least available in documentation. Whether an animal is a productive asset after it is transferred depends on veterinary extension, paravet training, and entrepreneurial skills, but the public record provides little information about training coverage and quality. Natural capital is the most vulnerable, as it is limited and is being reshaped by the intensification through irrigation.

The framework of livelihoods also focuses on the issue of vulnerability. If households have only one type of asset (e.g., a flock of one species bought at one time), they face disease, price fluctuations and drought in a manner different from diversified households (Ellis, 2000). A sustainable livelihood for livestock in Telangana would be the integration of small ruminants with dairy farming, poultry, and crop farming

supplemented by insurance and veterinary care. So far, the design of the model has focused on the first element and the second element to a lesser degree, and the diversification dimension is not very clearly expressed.

7. Challenges and Policy Recommendations

The above analysis indicates that Telangana has made a significant progress in livestock population, production, and value addition and the emerging challenge is to translate the livestock growth into sustainable and equitable livelihoods. Six recommendations follow.

The first step is for the state to fund an independent assessment of the Sheep Distribution Scheme at the household level, which tracks sheep mortality, sheep population growth, the income generated, the repayment of the share of the sheep and the consumption and nutrition outcomes. Success stories published in the media should not be considered a representative sample. Second, a gradual change from asset transfer to support of production is recommended: Breed improvement, lamb survival, marketing in cooperatives, processing, so that the returns are not dependent on continued subsidy. The pilot of direct bank transfers should be carefully considered for quality of purchase and for fraud risk.

Third, the need to make the security of fodder and grazing an explicit goal. This implies identification of common grazing areas, cultivation of fodder crops in irrigated fields, incorporation of paddy residue in the structured feeding systems, and establishment of fodder reserves for droughts. Fourth, the dairy component must be assured of payment, there should be a fixed schedule for the dairy incentive to be paid, and some attempt to increase productivity as milk is the commodity that will generate steady income. Fifth, backyard poultry and goat enterprises should be supported in the form of improved rural chicken varieties, chick supply and market linkages for the model to be inclusive, especially for the households outside Golla and Kuruma communities who are manning chicken and goat enterprises. Sixth, the state should enhance the quality of data: provide a consistent annual series, cross-check data from different departments and the national data set, and report on fodder availability, diseases, and environmental conditions, in addition to production.

7.1 Limitations and directions for further research

Some limitations affect the conclusions drawn from this paper, which should be applied. It is based on secondary information, such as official statements reported in the press, and these are invariably in the best interests of the programmes they report. There were inconsistencies in reporting of several indicators, and figures for 2012 were approximate where they were based on census growth rates. Value-added series are presented in current prices, which means that the real rates of growth are lower. Finally, the impact of the sheep scheme cannot be disentangled from that of other government investments and market conditions. Household panel data on a representative, stratified sample of beneficiary and non-beneficiary households, supplemented by remote-sensing measures of grazing land availability and fodder supplies, and gendered division of labour in livestock enterprises should be explored in future research. Comparative studies with the neighbouring states with similar agro-ecology and different livestock policies would help to determine the extent to which the results of Telangana can be attributed to policy design.

8. Conclusion

The Telangana Model is evidence that an energetic approach of asset transfer, price support and service delivery can transform the rural economy structure in just a few years. Between 2012 and 2019 the total sheep population increased by nearly 48.5 per cent, and the production of sheep meat almost doubled from 2015-16 to 2021-22, as increased by nearly 6.8 per cent per year, and livestock value added nearly increased by 40 per cent and almost 48 per cent of the agriculture and allied value added during 2012-19 and 2015-16 to 2021-22, respectively. From a sustainable livelihoods perspective, the economic and asset benefits are tangible, but the social, ecological and institutional results are less certain and sometimes negative.

The main result is thus conditional. The model has grown its asset base and value of its sector but it is still to be determined if its subsidies can be translated into productivity improvements that deliver resilience, if the benefits are limited to specifically targeted communities, and if its fodder, health and markets keep up with the growth in animal numbers. Household panel studies and rangeland assessments are best suited to answer these questions and facilitate further primary research. The experience of Telangana can be instructive to policy-makers who are interested in such schemes elsewhere, as it illustrates both the potential for success and the importance of effective implementation, evaluation and ecological management for ensuring long-term benefits.

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