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Sustainability of gaushalas: do size and patronage matter?

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Abstract To be viable as an institution in the long term, gaushalas (cow shelters) must meet the needs of society by operating continually and sustainably. This study of 21 gaushalas in Haryana finds that donations constitute 74.19% of their total receipts and government grants 6.47%; sales generate only 20%. Sustainability is poor; to improve it, gaushalas should be made autonomous by increasing their sources of income from processing the by-products, distributing indigenous germplasm and products, and catering to social needs. The government promotes gaushalas, but grants should be based on standard animal units and distributed regularly.

Keywords Indigenous cow, Haryana, stray cattle, sustainability, composite sustainability index, animal welfare level

JEL codes Q10, Q56, R10

In India, the livelihood of people in rural areas depends on the cow. The cow is considered a holy animal, and there is a deep reverence for cows in the Indian psyche. Concerted efforts and social movements have been made to protect the cow; the Gaurakshini Sabha (Cow Protection Society), set up in Punjab in 1882, soon spread to the north of India and later to the entire country—hundreds of gaushalas (cow shelters) were opened in the next decade. A gaushala is a protective shelter, abode, or sanctuary for cows, set up to improve their health and life, sell pure milk and cow products, conserve germplasm, and stop animal cruelty, according to the Bureau of Indian Standards (BIS 1987). In 2014, India had about 3,030 gaushalas, of which 1,325 were run by the animal husbandry departments of states; 1,837 gaushalas were registered with the Animal Welfare Board of India.

The population of indigenous cattle has declined by 6% from the previous quinquennial census, however, according to the 20th livestock census in India (GoI 2019). Indigenous cattle are economically unviable; they are disowned to preserve feed and fodder for

productive animals and also because cow slaughter is banned. The population of indigenous cattle is approximately three times the population of crossbred cattle, which increased by 27% from the previous quinquennial census (GoI 2019). The disowned indigenous cattle live as strays in cities and villages alike, foraging in garbage dumps and on roadsides, and their population in the country is estimated at 52.88 lakh (GoI 2014). In recent years, the problem has blown up because illegal trade has been restricted, and most illegal abattoirs, especially in the northern and central states of India, have been closed. Hence, there is a strong need to find an alternative means to manage these animals and conserve the base of pure indigenous cattle, which has been decreasing.

Gaushalas (cow shelters) may be that means, provided they are sustainable and they serve the welfare of animals (Singh and Kamboj 2019). Many gaushalas serve their purpose well; some have developed in size and diversified, and they have become institutions in their own right. The management committees of some gaushalas render services selflessly, and the local

communities support them. But there are so many stray cattle that few gaushalas have the resources—money for operational expenses, workforce, and space for animals—to provide for their upkeep and sustenance. The central and state governments are now strengthening the existing gaushalas, and helping in setting up many more. Most gaushala managers are willing to adopt animal welfare practices, but their knowledge of the practices is poor (Sharma et al. 2020). Most gaushalas depend on voluntary donations (charity) (Bijla and Singh 2019; Singh et al. 2019; Sharma et al. 2020), but they need sources of funds that are regular and dependable. Gaushalas are constrained also by the low availability of feed and fodder, high cost of concentrates, insufficient and erratic government grants, high incidence of reproductive disorder, lack of space, and lack of adequate market information (Mandi 2018; Singh et al. 2019; Bijla et al. 2019).

The literature on gaushalas and their management is subjective, and it lacks in-depth economical and statistical analysis in quantitative terms. The main aim of setting up gaushalas was to provide for the welfare of abandoned cows, but there is no measure of welfare, and no information is available on this aspect. Against this backdrop, this paper studies the functioning of gaushalas and their organizational structure, works out their economics and factors affecting it in the study area, and assesses their prospects of achieving economic, social, and environmental sustainability, as well as animal welfare, in the long term.

Methodology

We explain the research problem through steps and procedures like area selection, sampling, and analytical framework.

Locale

We purposively selected Haryana because the state pioneered the establishment and maintenance of gaushalas; Swami Dayanand established the first gaushala at Rewari in 1879. Haryana has 18 lakh cattle, and its 578 gaushalas house about 3.99 lakh cattle (Government of Haryana 2019).

The state has enacted legislation for the conservation of indigenous species of cattle. The Gauvansh Sanrakshan and Gausamvardhan Act, 2015 aims to

conserve and develop indigenous breeds; establish institutes to maintain infirm, injured, stray, and uneconomical cows; and prohibit the slaughter of cows and their progeny. Moreover, the state has recently started establishing Gau Abhayaranyas (cow sanctuaries) by marking the reserve boundaries for the purpose, launched a new scheme for establishing gaushalas in prison premises, establishing Nandigrams specially for the bulls and Gau Chikitsalyas (cow hospitals) in select districts of Haryana (Gau Sewa Aayog 2019).

Sample

We selected one gaushala from each district of the state by conducting a preliminary survey of their functioning, structural base, performance, reputation, and impact on cattle welfare and on society—depending on the availability of data. Thus, we constructed a sample of 21 gaushalas. All were registered as a society or trust; 11 of the 21 gaushalas were set up at urban centres and 10 in rural areas.

We categorized the gaushalas by size (number of animals) and patronage. We used the cumulative square root frequency method to group the gaushalas by the number of animals into small (1,306), medium (3,003), and large (5,208). A gaushala has 2,535 animals on average. In the sample, 11 gaushalas were small, 6 gaushalas were of medium size, and 4 gaushalas were large. We grouped gaushalas by patronage using the variables financial backing, management responsibilities, and social base. A social activist, saint, or religious protagonist started almost all the gaushalas; only a very few were started through community action for the welfare of the cow.

Gaushalas have two major patronage types: khap or community gaushalas (Type A) and structured gaushalas (Type B). Type A gaushalas are set up primarily for animal welfare. These have no commercial interest, and these are supported by the village community, which contributes a fixed proportion of their produce or any other genuine receipts like sale proceeds.

Some gaushalas are supported by as many as 60 or 84 surrounding villages; their households contribute on occasions like births or marriages. The village households make up the major proportion of the donors and donations. Type B gaushalas have a structured body

as per the norms of the registration authority, and they aim to manage stray animals and discharge social obligations. Type B gaushalas depend mainly on government grants and public donations.

Construction of sustainability indices

For arriving at the composite sustainability index, we construct social sustainability index, economic sustainability index, and environmental sustainability index (Sabarathnam 2002; Waltrick 2003; Chand 2008; Rehman 2011), and then we combine the three.

Several variables are combined in developing any index, but these variables may vary in their units, measurement, and impacts. Therefore, we normalized these variables as per the method given below and constructed each individual index and, after normalization, assigned weights to the indices to develop the composite sustainability index.

$$L_{ij} = \frac{X_{ij} - \text{Min}X_{ij}}{\text{Max}X_{ij} - \text{Min}X_{ij}} \quad \dots(1)$$

$$L_{ij} = \frac{\text{Max} X_{ij} - X_{ij}}{\text{Max} X_{ij} - \text{Min} X_{ij}} \quad \dots(2)$$

where, $i = 1, 2, 3, \dots, n$ indicators

$j = 1, 2, 3$ dimension of sustainability

X_{ij} = Value of i^{th} indicator of j^{th} dimension

Equation 1 is for the indicators that have a positive effect on sustainability. Equation 2 is for the indicators that have a negative effect on sustainability. We involved experts from dairy economics, dairy extension, livestock production and management, animal physiology, and animal nutrition in the weighting of individual variables and indices.

After normalization, we calculated the three indices by aggregating the weighted normalized variables.

$$\text{ESI} = \sum_{i=0}^n W_i L_i / \sum W_i$$

$$\text{SSI} = \sum_{i=0}^n W_i L_i / \sum W_i$$

$$\text{EnSI} = \sum_{i=0}^n W_i L_i / \sum W_i$$

where,

ESI = economic sustainability index of each gaushala

SSI = social sustainability index

EnSI = environmental sustainability Index

w_i = weights assigned to the i^{th} indicator

L_i = normalized value of i^{th} indicator of respective index

n = number of indicators

We weighted and aggregated these three indices—economic, social, and environmental—to arrive at the composite sustainability index for each gaushala.

$$\text{CSI} = (w_1 * \text{ESI}_k + w_2 * \text{SSI}_k + w_3 * \text{EnSI}_k) / \sum W_i$$

where,

CSI = composite sustainability index of k^{th} gaushala and

W_i = weights assigned to individual index by expert opinion.

Economic variables estimated for each gaushala

We estimated the economic variables for each gaushala to determine their returns and expenses and calculate the economic sustainability index (ESI). Sales (SL) comprise the income from the sale of milk, dung/compost, urine and its products, and animals. Miscellaneous income (MI) consists of rent, equipment hire charges, bull service, processing charges, sale of scrap, and the sale of a product or service not included above. Together, SL and MI make up gross returns (GR), and GR and donations and grants (DOGR) make up the total receipts (TR).

The expenditure on feed and fodder, fixed expenses, labour cost, and veterinary and other charges were variable expenses. Annual interest on owned and borrowed capital, and depreciation on fixed assets other than animals—like buildings and equipment—constitute the fixed expenses. Variable and fixed expenses make up the total expenses (TE).

The information was collected from the balance sheets of gaushalas. The summary parameters calculated using above mentioned variables were

net receipts = total receipts – total expenses;

returns over variable costs (ROVC) = total receipts (TR) – variable costs;

autonomy of a gaushala = proportion of sales revenue and MI in total receipts (a gaushala's dependency is the inverse of its autonomy); and

operating ratio (OR) = operating expenses (variable costs) / total receipts (TR).

Results and discussion

We summarize the findings and interpretations of the study into four heads: functioning of the gaushalas; receipts and expenditure; sustainability assessment; and factors affecting sustainability.

Functioning of gaushalas

The executive committee of a gaushala makes all the decisions. Elected once every three to five years, the executive committee must have a president, vice-president, secretary, joint secretary, and treasurer (Figure 1).

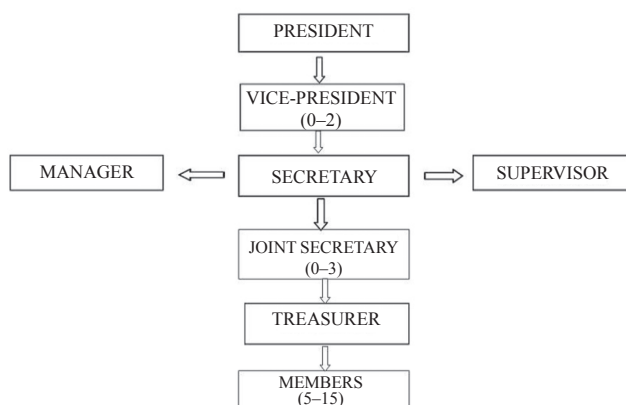


Figure 1 Structure of gaushala executive committee

Source gaushalas records

The election of the office bearers, especially that of the president, is largely unanimous. The executive committee may have up to three vice-presidents and up to three joint secretaries, and it must have a minimum of five members. The secretary performs the gaushala's day-to-day duties and plays a key role in its planning activities, and they are supported by one manager and one supervisor. The division of duties is clear.

Each gaushala has the resources to serve only a limited number of animals, but the number exceeds that limit

Table 1 Space available in gaushalas per standard animal unit (SAU, 2018)

	Covered area (square metre)	Open area (square metre)	Total area (square metre)
Patronage type			
A	4.22	10.55	14.78
B	3.89	7.77	11.66
Size			
Small	3.50	7.80	11.30
Medium	4.39	10.68	15.07
Large	5.24	9.60	14.85
All	4.11	8.21	12.32

Source Estimated by authors

at most gaushalas, because the state government often, and unexpectedly, entrusts stray animals to their care. About 75.8% of the herd size at gaushalas is composed of the major indigenous breeds (Hariana, Tharparkar, Rathi, Kankrej, Gir, and Sahiwal); crossbred animals make up only 24.2% of the herd.

Practices followed in gaushalas

The animal management practices practised at gaushalas influence animal welfare greatly; we studied the practices to establish interventions that would improve sustainability overall.

Housing practices

The space—covered and open—available per animal, the most important indicator of the environment sustainability index, is fixed by the BIS at 9.75 sq m, or 105 sq ft, per standard animal unit (SAU) (Table 1). At most gaushalas, however, the animals have much less space.

The housing system comprises a covered area and an adjacent loafing, or resting, area with common feeding and watering arrangements. The roofing of the sheds is made of flat or sloping asbestos, or reinforced cement concrete or, in some cases, galvanized iron sheeting at around 15 ft above the ground. But if we consider only the covered area, the space per SAU was less than half the BIS recommendation.

Inside the covered area, the floors are concrete or brick-on-edge; the floors in the open area are brick-on-edge or earthen (sand/soil-bedded) with a plantation of shady

Table 2 Feedstuff available at gaushalas (kg per day per animal)

	Green fodder	Dry fodder mixture	Concentrate
Patronage type			
A	4.92 ^a (0.925)	3.89 (0.903)	0.25 (2.199)
B	3.59 ^b (0.619)	3.31 (0.891)	0.39 (10.663)
Size			
Small	2.95 (0.507)	5.17 ^a (0.920)	0.60 ^a (11.085)
Medium	5.62 (0.886)	4.65 ^a (0.943)	0.29 ^b (2.462)
Large	3.64 (1.041)	1.88 ^b (0.115)	0.18 ^c (1.428)
Overall	3.78 (0.692)	3.62 (0.870)	0.33 (9.940)

Source Estimated by authors

Figures in parentheses represent respective standard errors

The values with different superscripts indicate the significant difference at $P < 0.05$

trees. Most large gaushalas, and about half the small and medium gaushalas, have ceiling fans to protect the cows from heat stress during the summer.

Type A and large gaushalas were better than others at provisions for separate housing of sick and injured animals and treatment yard; higher floor, feeding and watering space availability; and better summer protection measures.

Feeding practices

Green fodder comprises seasonal crops—sorghum, maize, and napier in the summer and berseem, oats, and lucerne in the winter. Dry fodder comprises wheat straw and, in some cases, paddy straw and other crop residue. The concentrate is made of a mixture of grains and oilcake. Some gaushalas have cropland; they use it to cultivate some green fodder to meet part of their requirement, and they receive the rest as donation or purchase.

Gaushalas in all categories fed the animals much less green fodder, dry fodder, and concentrate than the minimum they need for nutrition and sustenance (Table 2). On average, per day, each adult animal requires 20–25 kg of green fodder, but they were fed only 3.78 kg; they require 5–6 kg of dry fodder, but they are fed only 3.62 kg; and 2–3 kg of concentrate mixture, but fed only 0.33 kg.

The availability of dry fodder was better at small gaushalas (5.17 kg) and medium-size gaushalas

(4.65 kg, $P < 0.05$) than at large gaushalas (1.88 kg). The availability of concentrate mixture was also better at small gaushalas (0.60 kg; $P < 0.01$) than at medium-size gaushalas (0.29 kg) and large gaushalas (0.18 kg).

In gaushalas that have large herds of animals in loose houses and that practise common feeding, the dominant animals—higher up the social hierarchy in the herd—eat more than their fair share of feed and fodder, and the weaker or subordinate animals have to make do with smaller amounts (Soltysiak and Nogalski 2010). That is why all the animals cannot have their due share of feed and fodder even though both are available in sufficient amounts. So, enough manger space is required so that weaker animals who stand lower in the social hierarchy can also eat their share. If the manger is partitioned—by erecting a fence-line barrier at 60–75 cm intervals (BIS 1987)—the dominant animals can be prevented from bullying the weaker animals.

Receipts and expenditure

We estimated the total receipts and expenses of gaushalas (Table 3): grants and donations made up about 81% of the total receipts, and sales and miscellaneous activities generated only 19%. Variable expenses made up about 78% of total expenses and fixed expenses 22%.

Type A gaushalas received INR 9,810 per SAU, and spent INR 9,240; therefore, their net receipts per year per SAU was INR 570 only. Type B gaushalas' annual receipts were INR 8,840 against an expenditure of INR 8,560; they received only INR 280 per SAU per year, just half the net receipts of Type A gaushalas, because their expenses, especially on labour and veterinary services, are higher.

Small gaushalas receive INR 8,910 and spend INR 8,730 per SAU on average. Large gaushalas receive INR 9,510 per SAU; they have higher fixed expenses, and they spend INR 8,890. The net receipts of large gaushalas are INR 620 and INR 180 only per SAU for small gaushalas.

Large gaushalas received about 85% of the grants and donations; overall, the share was 81%. In absolute terms, the average net receipts of Type A gaushalas were higher (INR 20.48 lakh) than for Type B gaushalas (INR 4.11 lakh). The scale of operations of an enterprise determines its cost and income advantages. The net

Table 3 Receipts and expenses of gaushalas (INR per year per standard animal unit (SAU), 2018)

Variable	Patronage type		Overall	Size		
	A	B		Small	Medium	Large
Receipts						
a. Donations	7.47 ^a	6.37 ^b	6.87 (74.19)	6.46 ^b	6.85 ^a	6.97 ^a
b. Grants	0.56	0.65	0.59 (6.37)	0.62	0.60	0.75
c. Gross income (d+e)	1.78 ^b	1.82 ^a	1.80 (19.44)	1.83	1.79	1.79
d. Sales	1.34	1.39	1.37 (14.79)	1.40	1.36	1.36
e. Miscellaneous income	0.44	0.43	0.44 (4.75)	0.43	0.43	0.44
Total Receipts	9.81	8.84	9.26 (100.00)	8.91	9.24	9.51
Expenditure						
Feeding cost	4.22	4.26	4.41 (49.77)	4.62 ^a	4.23	5.01 ^b
Veterinary and other expenditure	1.01 ^b	1.38 ^a	1.20 (13.54)	1.35 ^a	1.15	0.99 ^b
Labour cost	0.96 ^b	1.47 ^a	1.28 (14.45)	1.38 ^a	1.22 ^a	0.88 ^b
Total variable expenses	6.18 ^b	7.11 ^a	6.89 (77.76)	7.36 ^a	6.61	6.88 ^b
Total fixed expenses	2.36 ^a	1.67 ^b	1.97 (22.23)	1.85	2.01	2.01
Total expenses	9.24	8.56	8.86 (100.00)	8.73	8.90	8.89
Net receipts	0.57	0.28	0.40	0.18	0.34	0.62

Source Estimated by authors

The figures in parentheses are the percentage of the total

The values with different superscripts indicate the significant difference at P<0.05

Table 4 Components of sales at gaushalas (INR per SAU per year)

Variable	Patronage type		Overall	Size		
	Type A	Type B		Small	Medium	Large
Sales (SL)	1340	1390	1370 (100.00%)	1400	1360	1360
Milk	746	870	824 (60.14%)	867	818	807
Dung and compost	241	207	214 (15.62%)	211	213	223
Urine and its products	05	18	12 (0.87%)	14	12	05
Other sales (calves, animals, etc.)	348	295	320 (23.36%)	308	317	325

receipts were INR 133.05 lakh (large gaushalas), INR 8.02 lakh (medium-size gaushalas), and INR 1.79 lakh (small gaushalas). Gaushalas spend between INR 179.15 lakh and INR 173.53 lakh on operations.

Sales

A gaushala sells milk, dung / compost, urine and its products, and animals; the income it generates from these sales reduces its dependence on external receipts and is an important parameter of sustainability. The income was around 15% of the total receipts (Table 4). Table 4 shows the percentage share of each component of sales.

Gaushalas earn 60.14% of their income from selling milk; 23.36% from the sale of heifers, cows, dead animals, and grains (other sales); and 15.62% from selling dung and compost. On average, 8.09% of the total animals produced milk.

If we consider productivity to be the sales of milk per SAU per year, Type B and small gaushalas were more productive than others. The cows at gaushalas are mostly indigenous, and their milk is considered to be pure, and it fetched a higher price: INR 40.5 per litre of buffalo milk and INR 32.8 per litre of cow milk. In some cases, cow milk was given away to be used as medicine, and that milk is not considered as sales.

This also indicates that community gaushalas—Type A gaushalas and large gaushalas—aim to house stray, unwanted, and unproductive cows and keep a larger proportion of them. This is the reason that some gaushalas have grown in size and got immense social backing.

The share of income from cow urine and its products is negligible (0.87%), but it is in great demand, due to its medicinal properties and rising people's orientation

towards natural products (Mohanty et al. 2014). Some medicines formulated by gaushalas were a blend of milk, urine, and ghee. The cow urine and other products used to prepare medicines vary in quality, and the method of preparation varies by medicine; therefore, the prices vary by medicine.

Donations and grants

Donations make up 74.2% of gaushalas' funds. This finding is in line with Sharma et al. (2020), a study conducted on 54 cow shelters of India. Around 6.5% of the funds come in the form of grants from the Animal Welfare Board of India and Nagar Nigams (municipal committees and corporations) (Table 5).

The Haryana Gau Sewa Aayog provides grants for fodder, and it provides special grants for erecting animal sheds and structures for stray cattle, purchasing ambulances, and meeting expenses incurred due to natural calamities. The Aayog provides special grants also for celebrating *gaupashtmi*, a festival dedicated to Lord Krishna and cows, and for making products and Ayurvedic medicines based on *panchgavya* (a mixture of cow dung, cow urine, milk, curd, and ghee, in a certain ratio). The chairman of the Aayog may exercise their discretion case by case. These grants were not comprehensive or regular, and these were disbursed only after much effort and perseverance.

Sustainability assessment

A gaushala's ability to operate and meet the needs of society sustainably and continually determines its viability as an institution. Sustainability is considered to have three dimensions: economic, social, and environmental (Sabarathnam 2002; Waltrick 2003; Chand 2008; Rehman and Khan 2012). We used these dimensions to estimate the CSI of each gaushala. We

Table 5 Grants received by gaushalas

Major grants/ agencies	Description
Animal Welfare Board of India (AWBI)	The AWBI provides recognized and registered animal welfare organizations (AWOs) regular grants and specific grants (shelter, birth control, ambulance, and natural calamity relief) on successful application.
Nagar Nigam Grant	The municipalities catch stray animals and send them to gaushalas; they provide INR 50–100 per cow for maintenance. Sometimes, environmental considerations form the basis of their grants.
Haryana Gausewa Aayog	The Aayog provides grants for fodder and <i>gaupashtmi</i> ; they also provide special grants.

Table 6 Economic indicators by gaushala type and herd size, 2018

Indicator	Weight	Patronage type		Overall	Size		
		Type A	Type B		Small	Medium	Large
Net receipts/SAU (INR per year)	30	570.24	279.13	405.05	175.00	342.00	618.00
ROVC/SAU (INR per year)	15	−5105.00	−5066.00	−5081.60	−5056.97	−5093.59	−5091.38
Operating ratio	5	70.17	77.93	75.99	77.28	74.53	56.56
Productive animals (%)	10	4.44	10.87	8.09	12.00	7.74	5.69
Employment generation (person-days)	10	44.6	16.18	22.95	9.27	23.33	60.00
Autonomy (%)	20	18.13	20.58	19.89	20.51	19.39	14.73
Dependency (%)	10	81.86	79.41	80.11	79.49	80.61	85.27

describe the indicators of each index in the following sections.

Indicators of economic sustainability index (ESI)

We weighted the economic indicators and used these to analyse the sustainability of gaushalas (Table 6). The major indicator of a gaushala's economic sustainability is its net receipts; we calculated it based on the SAU per annum and assigned it the maximum weight of 30% (Table 4). The other indicators of economic sustainability are returns over variable cost (ROVC) per SAU (ROVC/SAU), autonomy, percentage of productive animals, dependency, and operating ratio.

Type A and large gaushalas had higher net receipts per SAU per annum but a smaller proportion of productive animals. Employment generation was in proportion to their size of operation and job volume. Type B and smaller gaushalas had greater autonomy, an important variable for sustainability, with 20% weightage.

Indicators of social sustainability index (SSI)

We weighted and analysed several social indicators (Table 7) and assigned the highest weightage (35%) to cattle protection. Type A gaushalas had a higher proportion of cow protection, training programmes conducted, number of persons getting training, and number of donors than Type B gaushalas. The values of all the indicators of herd size were higher for large gaushalas than medium-size and small gaushalas.

Farmers leave cattle at gaushalas, and some cattle are saved from butchers and other illegal confinements. Indigenous cattle are sustained by community relations and the access to resources (Singh 2013; Singh and Kamboj 2019; Sharma et al. 2020) and by community services—training programmes, miscellaneous services, and social participation (van Calster et al. 2005; Waltrick 2003; Singh et al. 2007).

Environmental indicators

We used environment-related variables to define

Table 7 Social indicators by gaushala type and herd size, 2018

Indicator	Weight	Patronage type		Overall	Size		
		Type A	Type B		Small	Medium	Large
Cattle protection	35	55.37	38.29	45.68	38.66	39.05	56.25
No. of training programmes conducted in a year	15	14.80	7.75	9.43	5.27	12.67	16.00
No. of other programmes conducted in a year	5	222.80	110.25	2.00	0.91	2.67	4.00
No. of persons getting training in Gaushala	10	222.80	110.25	137.05	77.00	189.16	224.00
No. of persons giving donations or rendering charity services	15	1034.60	367.50	526.33	312.91	680.00	882.75
No. of celebrations/ fairs organized in a year	10	2.00	1.125	1.33	1.00	1.33	2.25
No. of persons treated at gaushala	10	12.40	34.38	29.14	25.00	18.67	56.25

Source Estimated by authors

Table 8 Environmental indicators by gaushala type and herd size, 2018

Indicator	Weight	Patronage types		Overall	Size categories		
		Type A	Type B		Small	Medium	Large
Housing space available (m ²)	10	14.78	11.66	13.05	11.30	15.07	14.85
Grazing (hrs/wk)	5	4.80	3.00	3.43	1.45	6.67	4.00
Biopesticides production (q/month)	10	0.00	0.31	0.24	0.00	0.00	1.25
Vermicompost production (q/month)	10	10.00	3.13	4.76	1.82	4.17	13.75
Dung proportion used as biofuel (%)	15	33.80	36.37	35.76	35.18	32.83	41.75
Electricity production (KW)	10	0.00	0.94	0.71	0.00	0.00	3.75
Sewage used in irrigation (%)	20	0.00	0.62	0.48	0.00	1.67	0.00
Dead animals disposal (% burial)	20	92.00	70.00	75.10	67.73	79.17	90.00

Source Estimated by authors

Table 9 Sustainability of gaushalas over size groups, 2018

Gaushala category	ESI	SSI	EnSI	CSI
Patronage Types				
Type A	0.38	0.52	0.34	0.42
Type B	0.42	0.34	0.24	0.35
Overall	0.41	0.38	0.26	0.37
Size Categories				
Small	0.39	0.29	0.19	0.31
Medium	0.41	0.44	0.30	0.40
Large	0.47	0.55	0.41	0.48

ESI – Economic Sustainability Index

EnSI – Environmental Sustainability Index

SSI – Social Sustainability Index

CSI – Composite Sustainability Index

Source Estimated by authors

sustainability (Table 8). We assigned a weight of 20% each to the sewage used in irrigation and to the safe disposal of dead animals, and we used these indicators to calculate the environmental sustainability index. The other indicators used were the proportion of dung used in biofuel, housing space available, biopesticides, and electricity production.

Type B gaushalas use 36.37% of dung as fuel, more than Type A gaushalas (33.8%). Type A gaushalas performed better on the other indicators—housing area per SAU (15.23 sq m), the number of dead animals buried (92%), and vermin-compost production (10.0 quintal per month)—because land is more plentifully available in rural areas. Large gaushalas performed better on some environmental indicators, like

biopesticides, vermin-compost production, and the utilization of dung. No definite trend was seen in the case of other variables.

Composite sustainability index (CSI) of gaushalas

We used the economic, social, and environmental sustainability indices to develop the composite sustainability index (Table 9): its value, 0.37—less than half the range of the index—reveals that, overall, the sustainability of gaushalas is very low. The values of the other indices were 0.41 (economic sustainability index), 0.38 (social sustainability index), and 0.26 (environmental sustainability index).

Among patronage type, the CSI was the highest (0.42) for Type A gaushalas; in the size category, it was the highest for large gaushalas (0.48).

Economically, large gaushalas were more sustainable (0.47) than medium-size gaushalas (0.41) and small gaushalas (0.39). The pattern of social sustainability was similar.

Larger gaushalas outperformed the other gaushalas on the EnSI value because they had greater resources for operations.

It can be concluded on the basis of the CSI and SSI results that large and Type A gaushalas, backed by village communities and social support, were better managed and more sustainable, than the other types of gaushala. Applying cumulative square root frequency method on the CSI values, we categorized gaushalas by sustainability into low (<0.31 CSI), medium (0.31–0.52 CSI), and high (>0.52 CSI); sustainability is low for 62% of the gaushalas, medium for 24%, and high for only 14%.

Table 10 Factors affecting composite sustainability of a gaushala in the study area, 2018

Variables	Variables' description	Coefficients (with dummy of size)	Coefficients (with dummy of patronage type)
Intercept	Intercept term	0.7354** (0.1599)	0.4277 (0.4992)
Medium size dummy	Base small size gaushala	0.0314 (0.0141)	—
Large size dummy	Base small size gaushala	0.0957* (0.0224)	—
Type A dummy	Base Type B gaushala	—	−0.0116 (0.0424)
Operating ratio	Operating Ratio	−0.7403* (0.1619)	−0.4228 (0.4849)
Productive animals	Proportion of productive animals (%)	0.0007 (0.0006)	0.0008 (0.0008)
Autonomy	Level (percent) of autonomy (%)	0.0049* (0.0009)	0.0025 (0.0017)
Protection	Proportion of animals protected out of total animals (%)	−0.0014* (0.0004)	−0.0003 (0.0015)
Training conducted	Number of training and other programmes conducted (No.)	0.0092* (0.0020)	0.0077 (0.0045)
Trained persons	Number of persons getting training from the Gaushalas (No.)	−0.0003 (0.0002)	0.0000 (0.0003)
Getting treatment	Number of persons getting treatment from the Gaushalas (No.)	0.0001 (0.0001)	0.0000 (0.0003)
Space	Open and shed area (m ² / SAU)	0.0015 (0.0009)	0.0011 (0.0016)
Biopesticides production	Biopesticides production (q/ month)	0.0006 (0.0004)	0.0021 (0.0008)
Dung used as biofuel	Proportion of dung used as biofuel (%)	0.0000 (0.0003)	0.0002 (0.0010)
Electricity generated	Electricity generated (KiloWatt)	0.0025 (0.0023)	0.0089 (0.0042)
Sewage water used	Proportion of sewage used in irrigation	−0.0132 (0.0049)	−0.0004 (0.0127)
Dead animals disposal	Dead animals' disposal rate (%)	−0.0014 (0.0006)	0.0004 (0.0018)

***=p<.001, **=p<.01 and *=p<.05

Source Estimated by authors

Factors affecting sustainability

A gaushala's sustainability is affected by both its size and type; to calculate the effect of each separately, we ran two regressions—one with the dummy of herd size and the other with the dummy of patronage type. The

dependent variable was a gaushala's composite sustainability index.

Large gaushalas were 0.0957 times more sustainable than small gaushalas (Table 10). Autonomy has a positive and significant effect on sustainability; if

autonomy increases by 1, sustainability increases by 0.005. Gaushalas conduct training programmes; these show a similar positive and significant effect.

Sustainability is negatively and significantly affected by the operating ratio (−0.7403) and the proportion of protected animals (−0.0014); an increase in the values of these variables negatively affects sustainability. Gaushalas should control their working expenses to maintain their sustainability.

In the case of the second regression, where the dummy of the types of gaushalas was taken, the type of gaushala alone does not much affect the sustainability index; the individual variables—specifically, the economic variables—have more of an effect on the sustainability of gaushalas. The individual variables—and, specifically, the economic variables—affect sustainability more than the type of gaushala alone.

Conclusions and policy implications

Gaushalas depend on donations for 74.19% of their total receipts, and their sustainability is very low—the value of the composite sustainability index of 62% of the gaushalas is less than 0.31. Sales, or own income—important for economic sustainability—was only about 20% of the total receipts. The grants by government and government-owned organizations make up 6.47% of their total receipts, but all the categories of gaushala had positive net receipts. Large gaushalas had the highest net receipts (INR 3,000 per SAU).

Type A gaushalas, backed by village communities and run on cultural lines, performed better on economic and sustainability indicators. Size makes a difference, as large gaushalas harness economies of scale and cater to the social and environment needs.

To improve sustainability, gaushalas should be made autonomous by increasing their sources of income from processing by-products, distributing indigenous germplasm, and catering to social needs. Conducting community development and training programmes, and religious and cultural programmes, can give gaushalas a professional orientation and help them run more efficiently.

The government is promoting gaushalas, but the disbursal of grants does not reflect that intent. The grants should be based per SAU and distributed regularly so that gaushalas can protect the indigenous

cattle of the country and mitigate the menace of stray cattle.

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