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Powering Livelihoods
A CEEW-VILLGRO INITIATIVE

Enhancing India's milk and meat production: Is hydroponics green fodder the answer?

Market Opportunity Analysis

Powering Livelihoods

Powering Livelihoods, a USD 3 million (INR 21 crore) initiative by CEEW and Villgro, is mainstreaming clean energy-based solutions in the rural economy. It provides capital, technical, and sectoral growth support to help social enterprises deploy a large number of clean energy-based livelihood solutions in a gender-inclusive manner.

The agriculture and allied services industry is India's largest employer. At Powering Livelihoods, we focus on enterprises developing or deploying innovative appliances to improve productivity, reduce drudgery and raise incomes. Examples include micro food processing, hydroponics-based fodder grow units, solar pumps, cold storages, dryers etc.

About this report

Powering Livelihoods market research reports aim to boost sectoral growth by helping entrepreneurs, investors, and policymakers with value chain analysis, market segmentation, policy, and comparative analysis.

This report explores:

1. Milk and meat yields in India
2. Is small-scale hydroponic fodder unit a potential sustainable and low-cost solution to the prevailing fodder scarcity?
3. What is the potential market size for small-scale hydroponic fodder units?
4. What major market segments and geographies can the entrepreneurs promoting small-scale hydroponic fodder target?
5. Which policies are relevant for such entrepreneurs? Which ones are gender-inclusive ?
6. What business strategies can vertical fodder grow unit manufacturers/entrepreneurs adopt?

Highlights

India's national fodder and feed deficits are driving down its livestock's milk and meat yields. In this context, fodder grown through hydroponics-based vertical farming offers farmers a low-cost and sustainable alternative.

The total available market for small-scale hydroponic fodder (SSHF) units is **USD 3.2 billion (INR 23,905 crore)**. The total annual market for green fodder is **USD 4.2 billion (INR 31,555 crore)**.

The serviceable available market (SAM) is **USD 2.1 billion (INR 15,965 crore)**. More than 4.6 million small-scale hydroponic fodder units could operate across India, impacting the lives of as many as 16 million livestock farmers. The serviceable annual market for green fodder is **USD 2.8 billion (INR 21,071 crore)**.

The SAM has two parts

USD 1.7 billion (INR 12, 532 crore) market for more than 3.6 million SSHF units with the potential to **improve milk yields**

USD 457.7 million (INR 3,433 crore) market for over 1 million SSHF units with the potential to **boost meat yields**.

Uttar Pradesh, Rajasthan, Gujarat, Maharashtra, Karnataka, Andhra Pradesh, Tamil Nadu, Madhya Pradesh, Telangana and Bihar account for 82.3 per cent of the serviceable available market**.**

Large scale hydroponic fodder units (or bulk deployment of SSHF units) can help create employment opportunities, along with plugging fodder deficit. Entrepreneurs **can target women self-help groups (SHG) and dairy cooperatives** and other local livelihood groups to deploy these units.

Entrepreneurs can deploy SSHF units using two business models: **direct sales or fodder-as-a-service**. Asset financing partnerships and targeted vernacular sales efforts are critical to scale up direct sales.

Fodder-as-a-service model requires capital investment, as well as a dedicated team to run the manufacturing facility and carry out marketing activities.

Milk and meat yields

This section covers

1. Milk and meat yields in India

Image: iStock

Image: iStock

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Milk and meat yields in India

At 537 million, India has 15% of the global livestock population, while its share of land area is only 2.2% [1]

Cattle **36%***

Buffalo **20.5%***

Sheep **13.8%***

Goat **27.7%***

Milk

India's milk production in 2018 was **188 million tonnes**, the highest in the world.[1]

Meat

India's meat production in 2019 was **8 million tonnes,** or **~2.4%** global production.[2]

Low milk and meat yield

The average annual milk yield of cattle in India is **50% lower** than the global average.[3]

Meat yield for most of the species is **20-60% lower** than global average.[3]

Livestock feed and fodder deficit is a critical reason for India's low milk and meat yields.

India has **green fodder deficit of 32%,** dry fodder deficit of **23%** and concentrate feed deficit of **36%.**[4] Major reasons are:

Households that depend on livestock farming hold **~ 0.5** hectare of land on an average.[5]

Only 4.2% of total land in India is used for livestock farming and fodder cultivation.[5]

The number of census towns **tripled** between 2001 and 2011.[6] This rapid urbanisation is reducing India's pastures.

Rising livestock populations, low availability of conventional animal feed/fodder, and limited land resources are creating an opportunity for sustainable fodder alternatives.[7]

1 Ministry of fisheries, Animal Husbandry & Dairying(2019), 20th Livestock Census All India Report; 2https://knoema.com/atlas/topics/Agriculture/Total-production-of-meat; 3 Role of livestocks in doubling farmers income,2018; 4 Ministry of Agriculture and farmers welfare (2016-17), 24th Standing committee report on Agriculture 5 Key Indicators of Land and Livestocks Holding, NSSO 70th Round (2013); 6 Ministry of Urban Development,Handbook of Urban Statistics 2019; 7 Author's Analysis; *Percentage share of India's total livestock population

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Bridging India’s green fodder gap sustainably

This section covers

1. What alternatives can sustainably bridge India’s green fodder deficit?
2. What are the different types of vertical farming to grow green fodder?
3. Can small-scale hydroponic fodder units meet the fodder deficit?

Image: Hydrogreens Agro Tech

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What alternatives can sustainably bridge India's green fodder deficit?

Comparison of major fodder and feed solutions

Desirable characteristic

	Pastures [8]	Fodder crops [9]	Food waste / crop residue [10]	Customised feed [11]	Hydroponics based vertical farming* [12]
Capacity	As per land availability	25-40 tonnes per hectare annually	As per crop and food waste availability	Feed bags available in packages of 10 -100 kgs	Small scale units: 25-100 kgs/day Large scale units: 100-10,000 kgs/day
Fodder grow cycle	Dependent on rainfall	Two months	Crop harvest cycle or amount of food waste	Available throughout the year	7-8 days
Costs	Production cost: NIL Farmer purchase price: NIL	Production cost: INR 3-4 per kg Farmer purchase price: INR 5-10 per kg	Production cost: NIL Farmer purchase price: INR 3-5 per kg	Farmer purchase price: INR 20-100 per kg	Production cost: INR 3-5 per kg Farmer purchase price: INR 6-8 per kg Equipment cost: INR 35,000 - 3,30,000
Crop types	Grass	Maize, millet, sorghum bajra, azolla, guinea	Wheat straws, maize stovers, sorghum stovers, fibrous parts of other crops, and food waste	Silage, oil cakes, food waste-based concentrate feed, laxative feed, and grains/cereal mix	Maize, wheat, barley and other fodder crops; herbs and other microgreens
Land requirement	High	High	Moderate	Low	Low
Water requirement	High	High	Low	Moderate	Low
Milk / meat yield	High	High	Moderate	High	High (10-15% higher than conventional) [13]
Scalability	Low	Low	Moderate	Moderate	High
Fodder as a source of livelihoods	Low	Moderate	Low	Moderate	High

Hydroponics-based vertical farming could be a scalable and sustainable solution to India's green fodder deficit. Other vertical farming technologies include aeroponics (which use air as a growth medium, along with water sprinklers) and fogponics (similar to aeroponics but with micro water particle sprinklers).

[8] Author's Analysis; [9] Author's Analysis; Rathod P and Dixit S,Green fodder production: A manual for field functionaries,2019; [10] Author's Analysis [11] Author's Analysis; TNAU Agritech Portal, Livestock Feed Management; [12] Author's Analysis; NABARD, Hydroponics Fodder Production: An Alternative Technology for Sustainable Dairying; [13] Shit N (2019) Hydroponic fodder production: an alternative technology for sustainable livestock production in India. *Hydroponics based vertical farming uses water(instead of soil) as a medium to grow fodder

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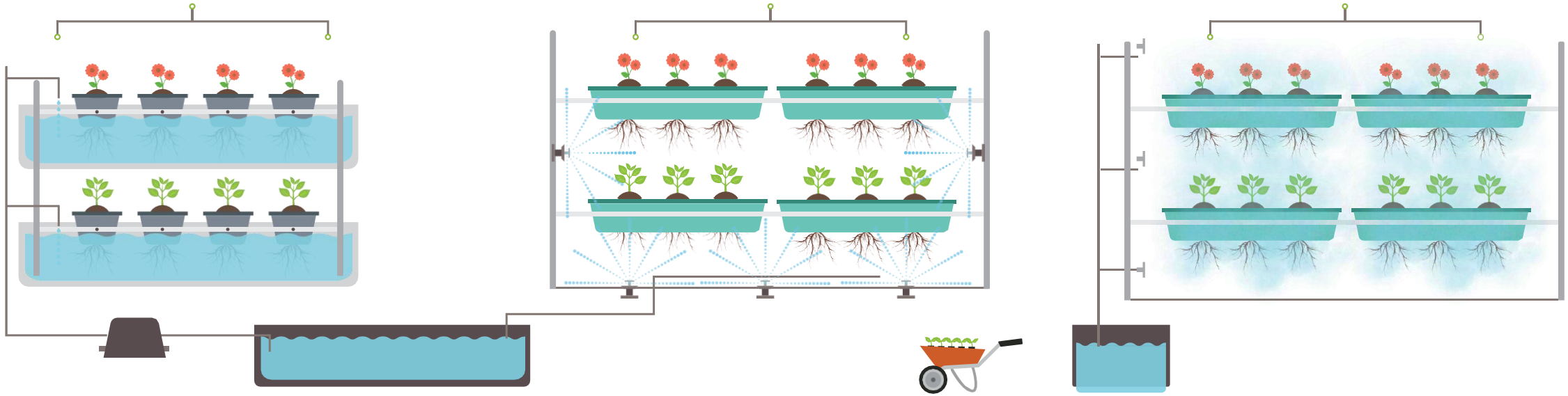
What are the different types of vertical farming to grow green fodder?

In vertical farming, plants grow not in soil, but in controlled or semi-controlled environments using water or air as growing media. The emergence of hydroponics as a farming practice later followed by green, cost-effective innovations such as aeroponics and fogponics.[14] Here is a quick overview of these three practices.



Hydroponics Stations

(Water as a medium)[15]

- Plant roots are submerged in water for nutrient absorption.
- Suitable for a variety of crops, including green fodder.

Aeroponics Stations

(Air as a medium with water sprinkler)[16]

- Controlled nutrients supply and light exposure help control the size and shape of plants.
- Suitable for select crops like citrus plants.

Fogponics Stations

(Water as a medium with micro water sprinklers)[16]

- Humidity and temperature are regulated using a smart motor/timer to optimise plant growth.
- Suitable for crops like mushroom, green fodder and leafy microgreens.

Fast growth
(7-8 days)

Growth of fodder round the year
(even in drought prone regions)

Land and water savings

Climate friendly

[14] https://www.sourcetrace.com/blog/aeroponics-hydroponics-growing-plants-without-soil/; [15] https://actascientific.com/ hydroponic technique for fodder production; [16] https://aerofarms.com/technology/, [17] Author's Analysis

Can small-scale hydroponic fodder units meet the fodder deficit? [18]

At present, hydroponic fodder units are available in two categories: a) Small-scale fodder units b) Large-scale fodder units

Small-scale hydroponic fodder (SSHF) units can help livestock farmers grow their own fodder, reducing their dependence on market availability of fodder. Farmers can club multiple individual units together (bulk deployment) to increase production capacity as required.

Large-scale hydroponic fodder (LSHF) units can help create employment, as they can be owned and operated by self-help groups (SHGs), dairy cooperatives, civil society organisations, large livestock farmers or local entrepreneurs with access to land and finance.

	Small-scale hydroponic fodder (SSHF) unit	Large-scale hydroponic fodder (LSHF) unit
Benefits	• Minimum capacity of 25 kg fodder per day. Each unit can feed 5 cattle/buffalos or 11 sheep/goats daily. • Pre-fabricated easy to assemble units that are easily scalable • Suitable for all end-users: small, medium and large entrepreneurs or farmers.	• Capacity ranges between 100 kg to 10 tonnes of fodder per day, enabling production at scale in a short duration. • Suitable for large-scale entrepreneurs, or collective/community ownership. • Ensures fodder availability at scale.
Challenges	• Needs awareness campaigns in vernacular languages and sales efforts to ensure adoption	• High initial capital cost • Relatively large area required for setup

Livestock farming in India is largely carried out at the household level. Small-scale hydroponic fodder unit have a high deployment potential since they require little space and water. Although each individual unit has a low capacity, farmers or entrepreneurs can club multiple units together to meet higher fodder requirements.

Growing fodder through small-scale fodder grow units could help minimise the fodder deficit. These products are relatively less capital-intensive and can be deployed in a decentralised manner; they can be easily accessed and adopted. Also, during months when fodder requirements are low, livestock farmers can use them to grow small leafy plants like coriander, mushrooms, stevia and other leafy greens.

- A fogponics vertical farming unit manufacturer

Small-scale hydroponic fodder unit (bulk deployment)

Image: Hydrogreens Agro Tech

[18] Author's Analysis

Market segmentation

The potential market for small scale hydroponic fodder units is studied under two broad categories: 1) Enhancement of milk yields - cattle and buffaloes and 2) Enhancement of meat yields - sheep and goat. The customers for such units include livestock farmers, individuals, entrepreneurs and bulk buyers such as Self Help Groups (SHGs) and dairy cooperatives. This section also evaluates such bulk sale locations.

This section covers

1. **What is the total and serviceable available market for small-scale hydroponic fodder units?**
2. **Which districts show high sales potential of small-scale hydroponic fodder units?**
3. **Which districts are priority market for green fodder for cattle, buffaloes, sheep, and goat?**
4. **Which are the priority regions for bulk sales through dairy cooperatives?**

Image: iStock

What is the total available market for small-scale hydroponic fodder units?

Total available market (TAM)[19] = **USD 3.2 billion (INR 23,905 crore)** → **6.8 million SSHF units**

The total available market comprises:
milking cattle – USD 1.4 billion (10,641 crore), milking buffaloes – USD 1 billion (7754 crore), non-migratory sheeps – USD 0.3 billion (2242 crore), and male goat – USD 0.4 billion (3267 crore)

Methodology

Total milking cattle and buffaloes, non-migratory young sheeps, and male goats at district level × Daily green fodder requirement (which can be met with hydroponic fodder) × % National level green fodder deficit = Estimated amount of hydroponic green fodder required to plug the deficit → SSHF units* required

Estimated daily requirement of hydroponic green fodder for key livestock in regions with low green fodder availability

Annual green fodder market (total available market) = **USD 4.2 billion (INR 31,555 crore)**

Assumptions

- Hydroponic green fodder can supplement fodder deficits for cattle, buffalo, sheep, and goats in regions with low green fodder availability. In such regions, the amount of supplementary green fodder needed is 5 kg per day [20] for milking cattle/buffaloes and 2.5 kg per day[21] for sheep/goats.
- On an average each SSHF produces 27.5 kg[22] of green fodder daily.
- The national green fodder deficit in 2020 was 32%, according to an estimate by the National Institute of Animal Nutrition and Physiology (NIANP).[23]
- Meat (goat and sheep): We considered male goats (kids and adult) and young sheep for our calculations, since they are primarily reared for meat.
- Sheep: We only considered non-migratory sheep for our calculations, since a fraction of sheep rearers tend to migrate.[24]
- We considered that the SSHF units are utilised for eight months (annually), and hydroponic green fodder is sold at INR 7 per kg to estimate the annual green fodder market.

Limitations

- Green fodder deficit data is available at the national level and not at the district level. However, this does not affect the TAM estimate as we are evaluating overall market size.
- Hydroponics fodder can only supplement a fraction of daily feed requirements (up to 5 kg). Farmers need to use it in combination with other kinds of fodder (like roughage and concentrate) for optimal results.
- There is lack of evidence on improvement in sheep wool production and goat milk production, therefore, we have not considered this as a potential market.
- Due to lack of gender disaggregated data we could not estimate the livelihood impact on women.

[19] Author's Analysis; [20] ICAR-NIANP Feed chart; [21] Stakeholder consultation; https://www.merckvetmanual.com/management-and-nutrition/nutrition-sheep/feeding-practices-in-sheep; [22] Stakeholder consultation; [23] Modeling and Forecasting Livestock Feed Resources in India Using Climate Variables; https://www.animbiosci.org/upload/pdf/25-60.pdf; [24] http://dahd.nic.in/sites/default/filess/NAP%20on%20Sheep.pdf

***SSHF units : Small Scale Hydroponic Fodder units**

What is the serviceable available market for small-scale hydroponic fodder units?

Serviceable available market (SAM)[25] = **USD 2.1 billion (INR 15,965 crore)** → **4.6 million SSHF units**

Methodology

Total milking cattle and buffaloes, non-migratory young sheeps, and male goats at district level × Daily green fodder requirement (which can be met with hydroponic fodder) = Estimated daily requirement of hydroponic green fodder for target livestock in regions with low green fodder availability

Estimated daily requirement of hydroponic green fodder for target livestock in regions with low green fodder availability × Priority region fodder deficit multiplier* = Estimated amount of hydroponic green fodder required to plug the deficit → SSHF units required

Annual green fodder market (serviceable available market) = **USD 2.8 billion (INR 21,073 crore)**

Livelihood Impact | 16 million livestock farmers/owners

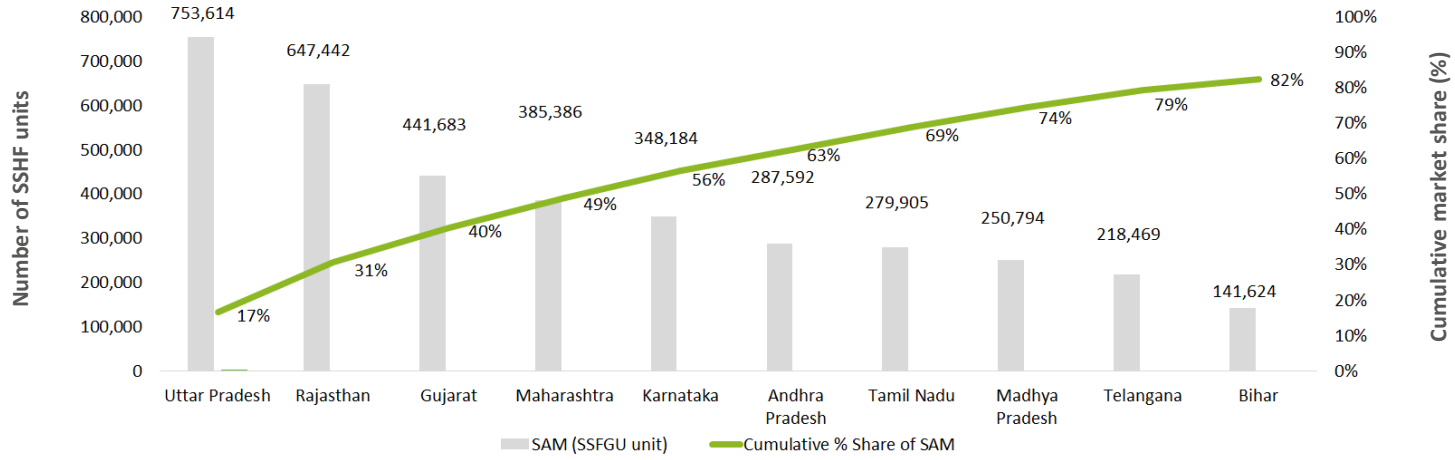
More than 60% of labours are women in different animal rearing practices

***Priority region fodder deficit multiplier**

To identify priority regions, we considered the following factors:

- District-level distribution of households purchasing green fodder as per NSSO round 70 [26]
- District-level mean annual rainfall.[27]
- Districts prone to extreme drought events. [28]
- For milking cattle and milking buffaloes, we preferred states where milk yields can be improved.[29]
- For goats and sheep, we preferred states where meat yields can be improved.[29]

State level distribution of SAM



The top 10 states represent 82.3 per cent of the total serviceable market.

[25] Authors' Analysis; [26] Situation Assessment Survey of Agricultural Households, NSSO 70th Round (2013); [27] IMD, Observed rainfall variability and changes over different state; [28]https://www.ceew.in/publications/preparing-india-extreme-climate-events; [29] Ministry of fisheries, Animal Husbandry & Dairying(2019), Basic Animal Husbandry Statistics,

Which districts are priority market for small-scale hydroponic fodder units?

The top ten districts of the overall SAM (as represented below) account for 12.6 per cent of the serviceable market, i.e. USD 267 million (INR 2,005 crore). [30]

Rajasthan, Karnataka, and Maharashtra are among the top states for all four types of livestock: milking cattle, milking buffaloes, male goats and non-migratory sheep.

85 per cent of the overall SAM is in arid and semi-arid regions.

In areas where there is low to no rainfall, SSHF units can be used to grow animal feed throughout the year. In regions with high rainfall, they can be used to grow other plants during the rainy season.

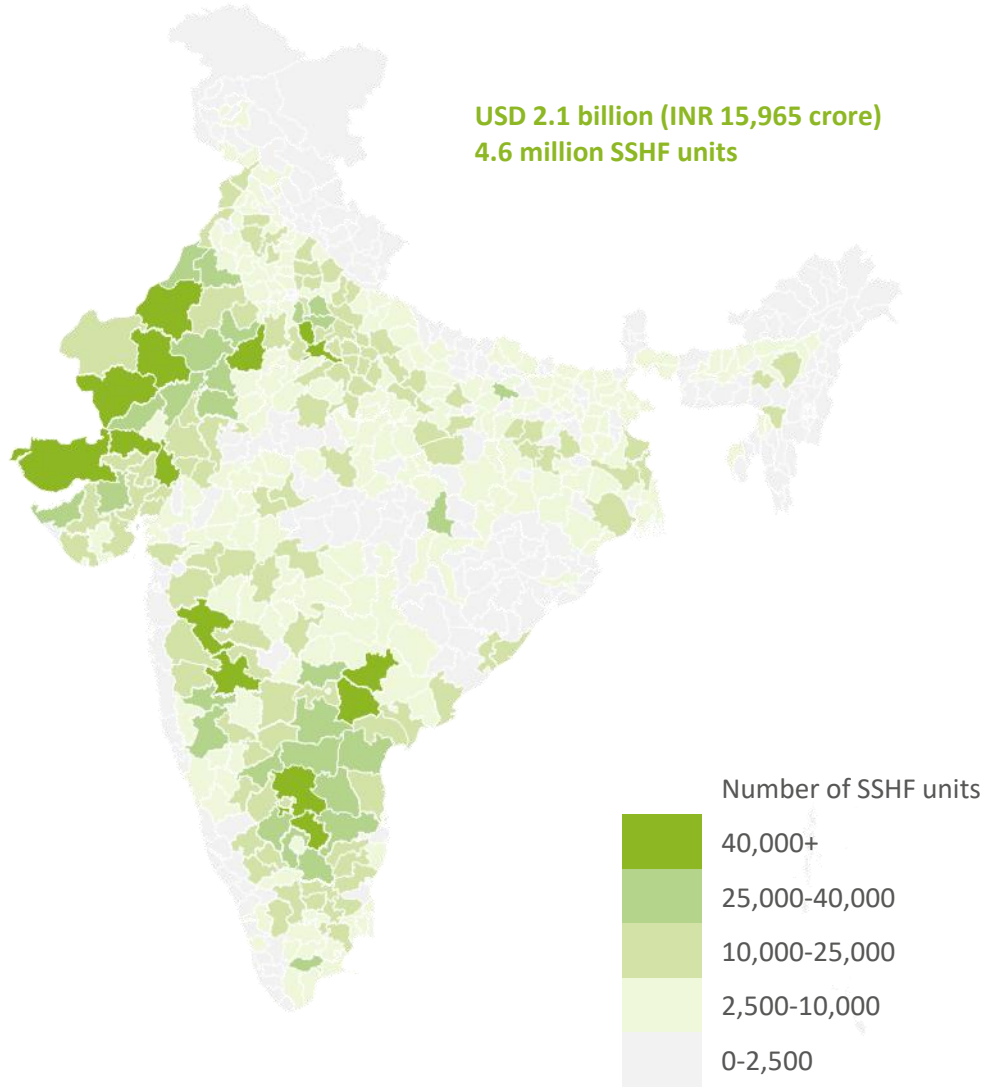
Top 10 Districts

State	District	SSHF units	Mean annual rainfall*	Number of SHGs
Andhra Pradesh	Anantapur	72,292	Low	56,477
Gujarat	Kachchh	70,425	Low	10,523
Maharashtra	Ahmednagar	68,718	Low	13,043
Rajasthan	Jodhpur	58,279	Low	4,481
Gujarat	Banaskantha	57,324	Low	11,020
Maharashtra	Solapur	53,771	Low	21,192
Uttar Pradesh	Agra	52,573	Low	10,623
Rajasthan	Jaipur	49,123	Low	3,814
Uttar Pradesh	Mathura	45,791	Low	1,991
Rajasthan	Barmer	44,668	Low	5,702

A complete list of districts with market potential estimates is available here [30]

*Low: 0mm - 800mm, Moderate: 800mm - 1500mm, Heavy: 1500mm and above.

District wise distribution of serviceable available market

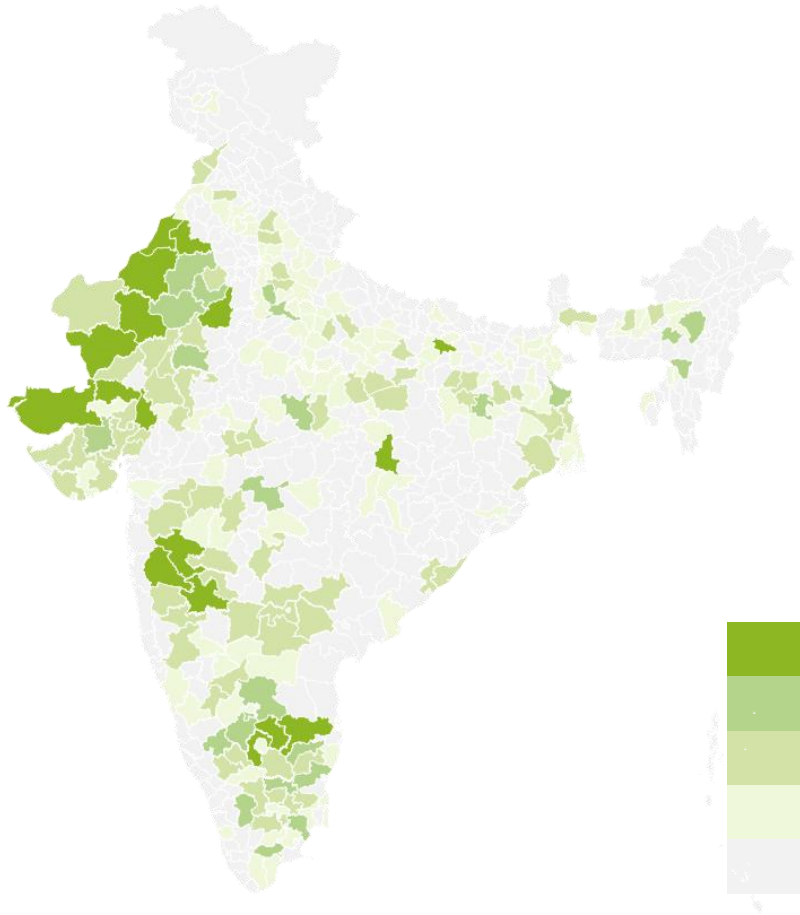


[30] Author's Analysis

Cattle | Buffalo | Sheep | Goat

Which districts are priority market for green fodder for cattle?

District wise distribution of serviceable available market for milking cattle



Potential market
USD 933 million (INR 6,998 crore)
2 million SSHF units

Livelihood impact
7.7 million cattle rearers

Annual green fodder market
USD 1.2 billion (INR 9,237 crore)

Top 10 Districts for milking cattle

State	District	SSHF units	Mean annual rainfall
Maharashtra	Ahmednagar	53,044	Low
Rajasthan	Jodhpur	29,606	Low
Maharashtra	Solapur	29,231	Low
Gujarat	Banaskantha	27,320	Low
Gujarat	Kachchh	26,228	Low
Rajasthan	Bikaner	25,551	Low
Rajasthan	Barmer	19,936	Low
Rajasthan	Ganganagar	19,565	Low
Andhra Pradesh	Chittoor	18,267	Moderate
Uttar Pradesh	Ballia	16,705	Low

A complete list of districts with market potential estimates is available here[31]

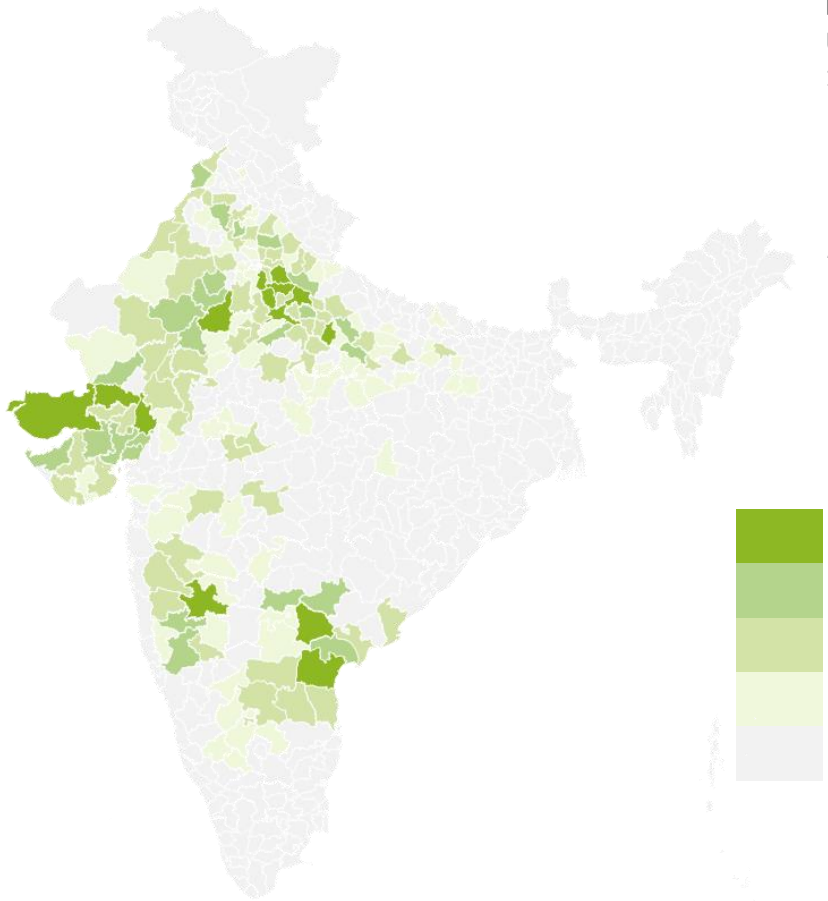
Rajasthan, Uttar Pradesh, Maharashtra, Gujarat, Tamil Nadu, Karnataka, Madhya Pradesh, Bihar, West Bengal, and Assam account for ~81 per cent of the serviceable market for milking cattle. [31]

[31] Author's Analysis

Cattle | **Buffalo** | Sheep | Goat

Which districts are priority market for green fodder for buffaloes?

District wise distribution of serviceable available market for milking buffalo



Potential market
USD 737.9 million (INR 5,535 crore)
1.6 million SSHF units

Livelihood Impact
5.6 million buffalo rearers

Annual green fodder market
USD 1 billion (INR 7,306 crore)

Top 10 Districts for milking buffalos

State	District	SSHF units	Mean annual rainfall
Uttar Pradesh	Agra	40,080	Low
Uttar Pradesh	Mathura	32,397	Low
Uttar Pradesh	Bulandshahr	28,350	Low
Gujarat	Banaskantha	27,367	Low
Rajasthan	Jaipur	26,637	Low
Gujarat	Kachchh	24,935	Low
Uttar Pradesh	Aligarh	24,659	Low
Maharashtra	Solapur	18,958	Low
Uttar Pradesh	Etah	15,649	Low
Andhra Pradesh	Prakasam	15,510	Moderate

A complete list of districts with market potential estimates is available here[31]

Uttar Pradesh, Rajasthan, Gujarat, Maharashtra, Madhya Pradesh, Haryana, Andhra Pradesh, Punjab, Karnataka, and Telangana account for ~95 per cent of the serviceable market for milking buffaloes. [31]

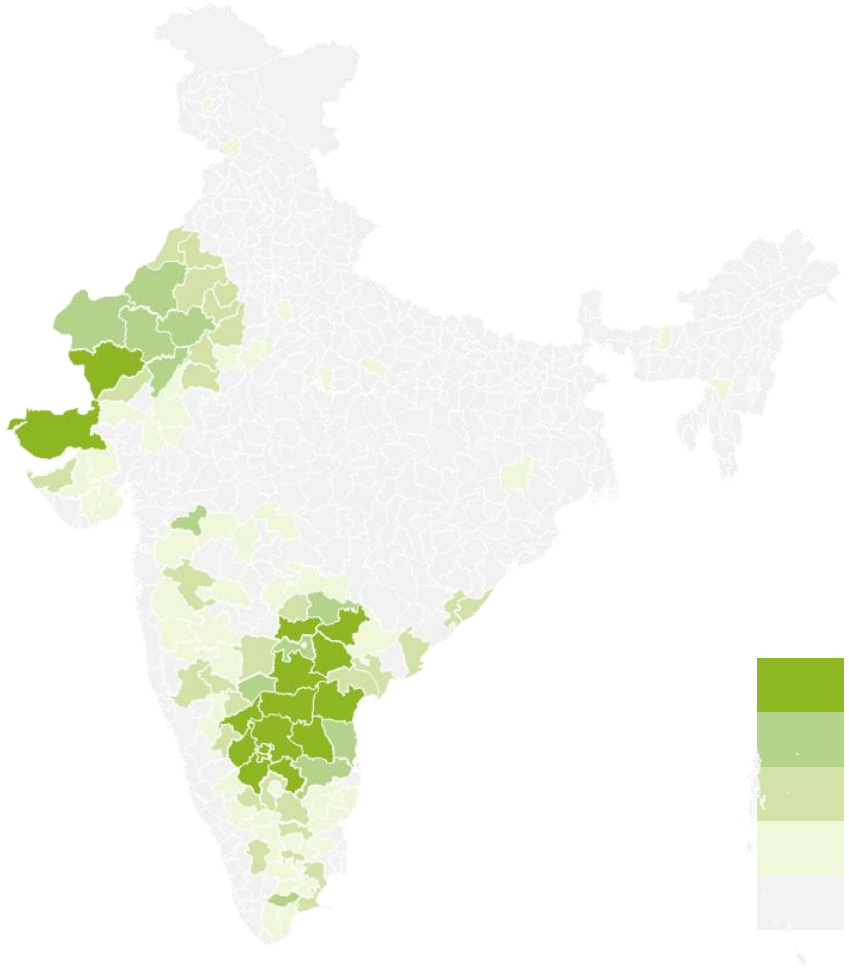
*Hydroponics green fodder units for cattle and buffalo is **a USD 1.7 billion (INR 12,532 crore)** market with the potential to deploy **3.6 million SSHF units** to improve milk yields. Livestock rearers and value chain players in low and moderate rainfall areas are actively looking for alternate fodder, therefore, entrepreneurs can prioritse these areas for sale of hydroponic fodder units.*

[31] Author's Analysis

Cattle | Buffalo | **Sheep** | Goat

Which districts are priority market for green fodder for sheep?

District wise distribution of serviceable available market for sheep



Potential market
USD 245 million (INR 1,838 crore)
525 thousand SSHF units

Livelihood Impact
1.4 million sheep rearers

Annual green fodder market
USD 0.3 billion (INR 2,426 crore)

Top 10 Districts for sheep

State	District	SSHF units	Mean annual rainfall
Andhra Pradesh	Anantapur	46,817	Low
Andhra Pradesh	Kurnool	15,626	Low
Gujarat	Kachchh	15,089	Low
Telangana	Mahbubnagar	15,053	Low
Karnataka	Bellary	14,030	Low
Andhra Pradesh	Y.S.R.	13,954	Low
Andhra Pradesh	Prakasam	13,674	Moderate
Telangana	Nalgonda	12,857	Low
Rajasthan	Barmer	11,520	Low
Karnataka	Tumkur	10,938	Low

A complete list of districts with market potential estimates is available here[32]

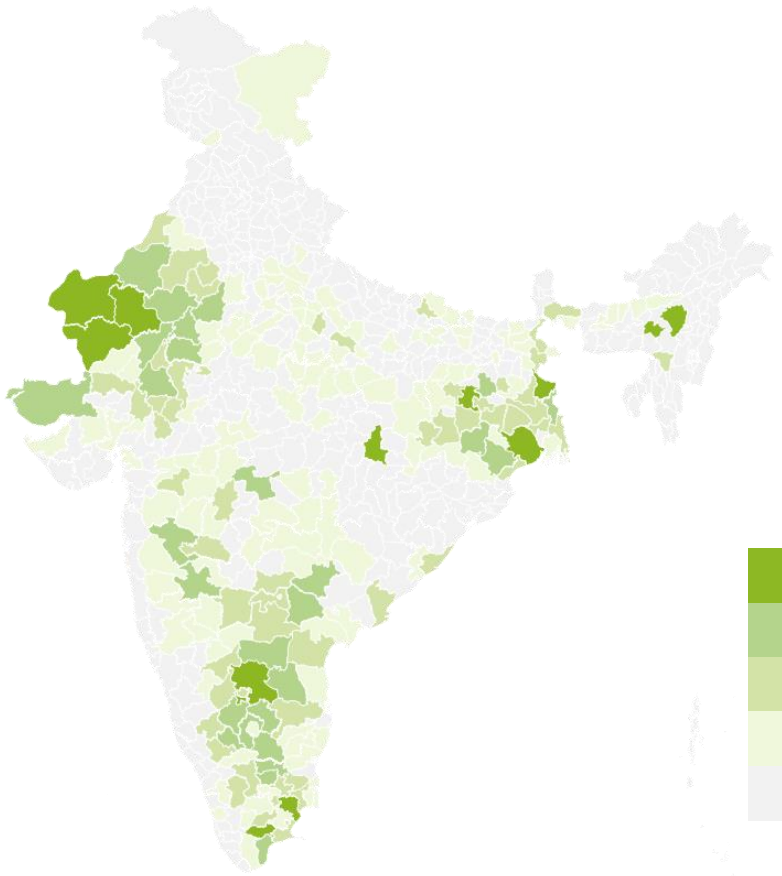
Andhra Pradesh, Telangana, Karnataka, Rajasthan, Tamil Nadu, Gujarat, and Maharashtra account for ~95 per cent of the serviceable market for sheep.[32]

[32] Author's Analysis

Cattle | Buffalo | Sheep | **Goat**

Which districts are priority market for green fodder for goats?

District wise distribution of serviceable available market for male goat



Potential market
USD 212.7 million (INR 1,595 crore)
455.7 thousand SSHF units

Livelihood Impact
1.3 million goat rearers

Annual green fodder market
USD 0.3 billion (INR 2,105 crore)

Top 10 Districts for male goat

State	District	SSHF units	Mean annual rainfall
Tamil Nadu	Virudhunagar	10,516	Low
Rajasthan	Jodhpur	10,495	Low
West Bengal	Murshidabad	9,432	Moderate
Rajasthan	Barmer	8,354	Low
Jharkhand	Hazaribagh	7,252	Moderate
Andhra Pradesh	Anantapur	6,175	Low
Tamil Nadu	Pudukkottai	6,030	Low
Rajasthan	Jaisalmer	5,945	Low
Assam	Karbi Anglong	4,705	Moderate
Andhra Pradesh	Y.S.R.	4,515	Low

A complete list of districts with market potential estimates is available here[32]

Rajasthan, Tamil Nadu, West Bengal, Karnataka, Maharashtra, Jharkhand, Uttar Pradesh and Andhra Pradesh account for ~73 per cent of the serviceable market for male goats.[32]

*Hydroponics green fodder units for sheep and goats is a **USD 457.7 million (INR 3,433 crore)** market with the potential to deploy **1 million SSHF units** to improve meat yields. Sector stakeholder and small ruminant (goat and sheep) rearers acknowledge low productivity of meat due to scarcity of feed, fodder, and availability of productive breeds. However, more emphasis is on procuring productive breeds to increase the number of livestock and hence meat quantity. The entrepreneurs should focus on creating awareness by partnering with local champions such as pashu sakhis to capture the market.*

[33] Author's Analysis

Cattle | Buffalo | Sheep | Goat

Which are the priority regions for bulk sales through dairy cooperatives?

Dairy cooperatives and self-help groups (SHGs) are the priority targets for bulk deployment of SSHF units.
Manufacturers/enterprises can engage with local institutions, NGOs and other civil society organisations to unlock this market segment.

For dairy cooperatives, enterprises need to take into account factors such as milk procurement through dairy co-operatives [33], milk yields[34] and aridity.[35]

The table (right) shows the number of dairy cooperatives in major milk-producing states and the percentage of milk procurement through these cooperatives.

Milk procurement through dairy cooperatives is high in Gujarat and Karnataka. Dairy cooperatives are potential bulk customers for SSHF units in these states.

Even though Uttar Pradesh has a large number of cooperatives, they contribute little to milk procurement (0.48%). Here, entrepreneurs should target SHGs or livestock rearers directly.

High  Low

Top states for dairy cooperatives segment

State*	SAM (Cattle & Buffaloes)	Number of Dairy Cooperatives	% Milk Procurement through Cooperatives	Milk Productivity (Cattle) (in kgs)	Milk Productivity (Buffaloes) (in kgs)	Arid/ Semi - Arid region
Gujarat	398,473	19,853	57.7	6.1	5.2	Yes
Karnataka	221,867	16,021	34.5	4.7	3.2	Yes
Tamil Nadu	178,041	10,677	14.8	6.4	4	Yes
Maharashtra	330,001	20,652	12.5	5.7	5	Yes
Bihar	125,525	22,261	7	4.6	4.4	No
Telangana	95,410	5,189	5	3.6	5.2	Yes
Punjab	134,676	7,353	4.8	12.5	8.4	Yes
Rajasthan	485,906	14,822	4.3	5.8	6.9	Yes
Andhra Pradesh	139,438	3,308	3	6.3	7.5	Yes
Madhya Pradesh	229,769	9,151	2.3	3.5	4.6	Yes
Haryana	127,947	7,264	1.5	8	9.1	Yes
West Bengal	85,546	4,117	1.5	3.7	4.8	No
Uttar Pradesh	717,095	31,754	0.5	4	4.5	Yes

[33] NDDB (2019), Annual Report; [34] Ministry of fisheries, Animal Husbandry & Dairying(2019), Basic Animal Husbandry Statistics; [35] Observed aridity changes over the semi arid regions of India; Centre for Climate Change Research, Indian Institute of Tropical Meteorology.
*Major milk producing states (Top 13), as per National Dairy Development Board

Policy landscape

Policy landscape

1. Policies relevant for entrepreneurs
2. Which are the women-focused policies?

Image: iStock

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What are the relevant policies for entrepreneurs?

Schemes	Beneficiaries	Objective	Intervention	Scheme Value
Holistic Development				
Fodder and Feed Development Scheme [36]	Livestock Farmers **(Gender agnostic)**	To assist and train state government and dairy farmers in feed and fodder development	Providing subsidies for fodder and feed making units and promote improved variation of fodders	USD 18.9 million (INR 141.4 crore)
Supporting dairy cooperatives and farmer producer organisations engaged in dairy activities by MAFD[37]	Livestock Farmers **(Gender agnostic)**	To provide a stable market platform by creating the necessary infrastructure for milk producers and distributors to gain access to organised milk sectors	Providing soft loans for working capital to cooperatives and FPOs in dairy activities, and stable market access to dairy farmers	USD 40 million (INR 300 crore)
Animal Husbandry Infrastructure Development Fund. [38]	MSMEs, individual entrepreneurs, FPOs, private companies, Section 8 companies	To incentivise investments for establishing: (i) The dairy processing and value addition infrastructure (ii) Meat processing and value addition infrastructure (iii) Animal feed plants	Providing loans for up to 90 % of the product cost.	USD 2 billion (INR 15,000 crore)
Dairy Entrepreneurship Development Scheme by Ministry of Fisheries, Animal Husbandry and Dairy (MFAD) [39]	Livestock farmers, entrepreneurs, SHGs, dairy cooperatives, district milk unions **(Gender agnostic)**	To provide financial support to entrepreneurs to start dairy or allied businesses	Assisting commercially bankable projects with loans from commercial, cooperatives, urban and rural banks of up to 40 % of total outlay.	No budgetary allocation for 2020-21
Quality Mark for Dairy and Dairy Products by NDDB, MAFD[40]	Dairy cooperatives, dairy units of educational institutes or government **(Gender agnostic)**	To help enhance the safety, quality and hygiene of milk and milk products manufactured by dairy cooperatives.	Units satisfying Quality Mark criteria will be allowed to use the logo on milk and milk product packaging	NA*
Marketing & Other Support				
Formation and promotion of 10,000 FPOs by MA&FW.[41]	Small and marginal farmers (SMFs) with <1 hectare of land holding **(Gender agnostic)**	To provide a supportive ecosystem for the formation of 10,000 new FPOs and the development of sustainable, income-oriented farming.	Supporting FPOs in various ways to make them economically viable and self-sustaining beyond the period of government support	USD 915.5 million (INR 6,866 crore) (Till 2027-28)
Marketing Promotion Scheme by Ministry of MSME [42]	All micro, small and medium Enterprises (MSMEs) **(Gender agnostic)**	To organise exhibitions abroad and participate in international exhibitions/ trade fairs, buyer-seller meets, intensive campaigns, and marketing promotion events	Providing financial assistance of up to 95% of the entrepreneurs' airfare and space rent. Assistance is based on the size and type of the enterprise.	NA*

Gender targeted: Policies which either have a women-focused clause or whose major beneficiaries are women; Gender agnostic: No special focus on women. *NA = Not Available

[36] https://www.nddb.org/sites/default/files/pdfs/Fodder-Feed.pdf; [37]https://dahd.nic.in/sdcfpo; [38] http://dahd.gov.in/sites/default/filess/Implementation%20Guidelines-AHIDF.pdf; [39]https://dadf.gov.in/sites/default/filess/Dairy%20Entrepreneurship%20Development%20Scheme%20(DEDS).pdf; [40] https://www.nddb.coop/sites/default/files/Quality-Mark-Guidelines-Version6-27062018-low.pdf;[41]http://agricoop.nic.in/sites/default/files/English%20FPO%20Scheme%20Guidelines%20FINAL_0.pdf; [42]https://msme.gov.in/4-marketing-promotion-schemes.

What are the relevant policies for entrepreneurs?

Schemes	Beneficiaries	Objective	Intervention	Scheme Value
Financial Support				
Credit Guarantee Scheme by GOI & SIDBI [43]	Existing and new MSMEs **(Gender targeted)**	To support collateral and third party guarantee-free credit for MSMEs.	Providing collateral-free loans up to a limit of INR 20 million for eligible MSMEs. The guarantee cover available under the scheme is between 50 - 85%. The extent of guarantee cover is 80% for MSMEs operated and/or owned by women.	Information not available
Credit Linked Capital Subsidy Scheme for Technology Upgradation [44]	Sole proprietorships, partnerships, cooperative societies, and private/public limited companies in the SSI sector **(Gender targeted)**	To provide upfront a subsidy of 15% on institutional credit (up to INR 10 million) for specified MSMEs in 51 sub-sectors.		Information not available (Scheme is under revision)
Bank Credit Facilitation Scheme by National Small Industries Corporation Limited (NSIC) [45]	MSME Entrepreneurs **(Gender agnostic)**	To help MSME meet their credit requirements	Arranging credit support (free of cost) for MSMEs through their partner banks	NA*
Venture capital scheme for agribusiness development by Small Farmers' Agriculture- Business Consortium (SFAC) [46]	Individuals, Farmers, producer groups, SHGs, agripreneurs **(Gender agnostic)**	To catalyse private investment in agribusiness projects and provide producers with an assured market for increasing rural income and employment.	Providing interest free venture capital in from of soft loans (up to INR 5 million) to projects in agriculture and allied sector (including dairy).	Information not available

Gender targeted: Policies which either have a women-focused clause or whose major beneficiaries are women; Gender agnostic: No special focus on women. *NA = Not Available

[43] https://www.cgtmse.in/Home/VS/3, [44]https://clcss.dcmsme.gov.in/; [45] https://www.nsic.co.in/schemes/Credit-Facilitation-Through-Bank.aspx; [46]http://sfacindia.com/UploadFile/Statistics/1265_VCA%20Brochure_07-12-17%20(2).pdf

Key Business Strategies

Business Strategies

1. What business models can be used to scale up adoption of hydroponics fodder units?
2. What are the key element of business for hydroponic fodder units?

Image: Hydrogreens Agro Tech

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What business models can help scale the adoption of hydroponics fodder units?

		Technology manufacturers	SSHF Users
Direct equipment sales *Individual units sale to end-users*	Benefits	Helps understand customer needs and wants better to customise and improve the product.	• Continuous availability of green fodder. • Income enhancement.
	Challenges	Innovative and vernacular training tools and sales approaches are required to scale up product adoption.	Access to capital is a barrier for small livestock farmers or entrepreneurs.

		Technology manufacturers	SSHF Users	Fodder users
Fodder as a service *local entrepreneur supplying green fodder to livestock farmers* ***a) Subscription model:*** *Livestock farmers subscribe (fixed purchase) to a fodder supply service provided by a local entrepreneur* ***b) Pay-as-you-go model:*** *Livestock farmers purchase fodder as and when required*	Benefits	Opportunity to deploy large or multiple units to cater to multiple livestock farmers.	• Local livelihood generation and enhancement • Better understanding of the local community and their needs. • Subscription model - assured revenues. • Pay-as-you-go model - able to tap into end-users who can not afford purchasing hydroponic fodder units.	• No capital investment. • Availability of affordable green fodder. • Income enhancement. • Subscription model: reliable fodder supply. • Pay-as-you-go model: No lock-in or fixed outlay.
	Challenges	Lead generation and conversion may require more time investment.	• Land requirement to set up manufacturing. • Asset utilisation during good monsoons. • Subscription model: Risk of under-subscription. • Pay-as-you-go model: Risk of unsold fodder with no fixed buyers.	• Distance to the fodder service facility may be large for some of the potential fodder users. Lack of transportation may be a deterrant for such users. • Subscription model: may seem as a wasteful expense on days when fodder is not required due to unforeseen circumstances. • Pay-as-you-go model: users may face ocasional unavailability.

- *Asset financing partnerships and targeted vernacular sales efforts are required to scale up direct sales.*
- *Technology manufacturers may consider fodder-as-a-service as a business line. This will require capital investment and a dedicated team to run the fodder manufacturing facility and carry out marketing activities. They may also consider a franchise-model to share capital costs and profits.*
- *A customised subscription model governed by local factors is vital to the success of fodder-as-a-service. A quarterly subscription or a subscription for the weaning period may be more successful in locations with medium rainfall, whereas a semi-annual or annual subscription may be successful in those with low rainfall. There may be an initial pay-as-you-go or gestation period for fodder users to become adopters. Local entrepreneurs may consider fodder home delivery to increase their user base.*

[47] Author's Analysis

What are the key element of business for hydroponic fodder units?

Here is a summary of key business elements for hydroponic fodder units.

Value Proposition

- Enhancement of milk and meat yields resulting in increased income
- Low land requirement
- Low water requirement (suitable for regions with water scarcity)
- Short production cycle (one week)
- Significant decrease in time between the day of harvest and the day of consumption (better retention of nutrition in fodder)
- Fodder production independent of local climate
- Low recurring costs (seeds/grains and power)
- Solar-powered variants at affordable prices

Revenue Stream

- Direct Sales
- Fodder-as-a-service

Key Partners / Stakeholders

Policy Makers
- Ministry of Animal Husbandry and Dairying
- Ministry of Micro, Small & Medium Enterprises
- Ministry of Rural Development
- Ministry of Agriculture and Farmers' Welfare.
- National Rural Livelihoods mission

Investors and Financiers
- **Enterprises:** Venture capitalists, small and medium scale enterprise (SME) exchanges, angel investors, private equity and debt.
- **End users:** Regional rural banks, small finance banks, non-banking financial companies (NBFCs)

Research Institutions
- Agriculture research institutions
- Animal nutrition research institutions

Ecosystem Supporters
- Think-tanks
- Impact or social enterprise incubators
- NGOs driving/proposing policy changes

Others
- Raw material suppliers
- Distributors / retailers / e-commerce platforms

Customer Segments

Direct Sales
- Livestock farmers
- Village-level entrepreneurs (especially from arid/semi-arid regions)
- Self help groups

Fodder-as-a-service
- Self help groups and farmers producers organisations (FPOs) in regions with high animal husbandry activities.
- Non-governmental organisations (NGOs) working on economic empowerment through animal husbandry related activities.
- Dairy cooperatives
- Grass/fodder/animal feed traders
- Livestock traders
- Regional joint livelihoods groups (formal or informal)

Sales channels

Direct Sales
- Customer enquiry through website
- Sales agents

Distributors
- Online (IndiaMart, BigHaat)
- Offline distributors and retailers

Exhibitions or Fairs
- Entrepreneur Summits
- Krishi Melas

[48] Author's Analysis

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Publications team: Alina Sen (CEEW) and Ganesh Radha Udayakumar.

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Council on Energy, Environment and Water
Sanskrit Bhawan, A-10 Qutab Institutional Area, Aruna Asaf Ali Marg, New Delhi - 110067, India

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Thank You

Authors:
Wase Khalid (wase.khalid@ceew.in)
Shruti Jindal (shruti.jindal@ceew.in)
Abhishek Jain (abhishek.jain@ceew.in)
Richa Ahuja

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