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A CEEW-VILLGRO INITIATIVE

Energy-Efficient Silk Spinning and Reeling Machines: How Big is the Opportunity?

Image: Resham Sutra

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 textile industry is India's second-largest employer. At Powering Livelihoods, we focus on enterprises developing or deploying innovative appliances capable of improving productivity, reducing drudgery, and raising incomes. These include solar-based charkhas, sewing machines, looms, and silk reeling machines.

About this report

Who should read this report and why?

Powering Livelihoods market research reports aim to boost sectoral growth by helping entrepreneurs, investors, and policy-makers with value chain analysis, as well as market segmentation, policy, and competitor assessments.

This report attempts to answer the following questions:

1. What is the state of silk value chain in India?
2. How big is the market for energy-efficient machines across different silk value-chains?
3. Where can entrepreneurs sell their silk yarn?
4. How can machine manufacturing entrepreneurs navigate the sector in the next 3-5 years? Who are the competitors?
5. Which policies are relevant for entrepreneurs? Which ones are gender-inclusive?

Highlights

The **total addressable market (TAM)** for energy-efficient silk spinning and reeling machines is USD 51.1 million (INR 357.6 crore). Realising this opportunity could lead to the deployment of as many as **145,500 machines**. The **serviceable addressable market (SAM)** for these products is USD 25.9 million (INR 181.8 crore); **78,000 machines**.

SAM of energy-efficient machines across silk types:

- Mulberry: USD 6.4 million (INR 45.0 crore)
- Tasar: USD 10.4 million (INR 73.0 crore)
- Eri: USD 8.0 million (INR 56.3 crore)
- Muga: USD 1.1 million (INR 7.4 crore)

The serviceable available market will impact ~**81,500 livelihoods (~86.5 per cent women)** improving incomes and reducing drudgery.

Assam is one of the top producers of muga, eri and tasar silk fabric, while Andhra Pradesh and Tamil Nadu are leaders in mulberry silk fabric production. Unincorporated silk weaving enterprises are concentrated in Uttar Pradesh, Andhra Pradesh and Tamil Nadu. Silk yarn producers can sell to these **silk weaving clusters**.

The competitors of energy-efficient machines include traditional machines (*charkhas* and *taklis*) or practices (such as thigh reeling); small modern machines designed by CSTRI and local manufacturers; and large multi-end machines. **Entrepreneurs should tap into retail and distribution channels of traditional machine manufacturers, keeping in mind that clean solar energy can be a differentiating factor in regions with erratic electricity supply. Also, the existence of multiple operation modes in energy-efficient machines (such as manual, electric, and solar-powered) enhances ease of operation.**

State of silk value chain in India

Silk accounts for 0.2 per cent of world's total textile production.[1] It is a low volume high value product powering a labour-intensive and high-income industry. There are 4 major types of silk: mulberry, tasar, muga, and eri. In India, which produces all four varieties, non-mulberry silks are collectively known as vanya silk.

India produced **35,820 metric tonnes (MT)** of raw silk in 2019-20[2], accounting for a third of global production[1]

Questions answered in this section

- **What are the different steps in silk value chain?**
- **Which organisations support the Indian silk value chain?**
- **What is the extent of women's participation in different activities in the silk value chain?**

Silk production by type (2018-19)[3]

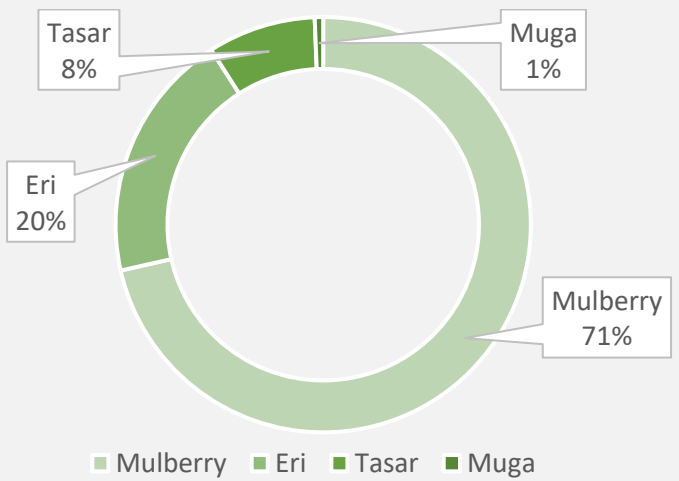

Image: iStock

[1] https://inserco.org/en/statistics; [2] http://csb.gov.in/wp-content/uploads/2020/09/Sericultural-Statistics.pdf; [3] http://csb.gov.in/wp-content/uploads/2020/03/csb-aar-18-19-english-low-res.pdf

Overview of the silk value chain[4]

Rearing:
Silkworms are either fed mulberry leaves plucked from bushes or allowed to feed on wild trees (in the case of non-mulberry and vanya silks).

Silk reeling and twisting:
Silkworm larvae envelop themselves in cocoons. These cocoons become the source of silk filaments. Reeling refers to the process of removing continuous filaments and winding them on a reel. Twisting is the process of imparting a twist to reeled yarn.

Spinning:
Cocoons with discontinuous silk filaments are used for spinning. Here, filaments from multiple cocoons are twisted together to form yarn.

Weaving:
Two types of yarn are produced through reeling, twisting, and spinning. The first, meant for use along the length of fabric, is called warp. The second, to be used breadthways, is called the weft. Weaving is the process of interlocking warp and weft in looms to produce fabric.

Fabric finishing:
Woven fabric is checked, altered (if required), folded and packed before it is sent to retailers.

Garmenting:
Garmenting is the process of stitching together different pieces of silk fabric on a sewing machine to produce clothes.


Image: iStock


Image: Resham Sutra


Image: iStock


Image: iStock


Image: iStock

[4] Authors' Analysis

Overview of the silk value chain

	Cultivation	Rearing	Reeling and twisting Spinning	Weaving	Cloth finishing and garmenting
Supporting organisations[5]	The Central Silk Board (CSB) is India's statutory body for silk production. The Indian Silk Export Promotion Council promotes silk exports.				
Employment[6]	The silk sector employs around 91 lakh people. One estimate suggests that 1 kg of raw silk production generates employment opportunities comparable to 11 workdays in on-farm and off-farm activities.				
Women participation[7] (in percentage)	Weeding: 100 Leaf harvesting: 91	Silk worm rearing: 60	Reeling: 50 Twisting: 60	Weaving: 63	Dyeing, printing, etc.: 60
Energy-efficient machines[5]			Reeling, re-reeling, twisting, and spinning machines	Solar looms	Solar sewing machines

Image: iStock

[5] Authors' Analysis, Central Silk Board (2019) Annual Report; [6] https://www.ibef.org/exports/indian-silk-industry.aspx; [7] Critical Analysis on Role of Women in Sericulture Industry, International Journal of Social Science Citation: IJSS: 6(3): 211-222, September 2017

How big is the market for energy-efficient machines across the silk value chain?

Question answered in this section

- **What is the market potential of energy-efficient machines in mulberry, tasar, eri, and muga value chains?**

Image: Resham Sutra

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Mulberry silk production

Mulberry silk

Mulberry silk comes from domesticated, Bombyx mori L. silkworms, which feed on the leaves of the mulberry plant. Silkworms are of two main varieties: bivoltine (meaning that they produce two broods in a season) and cross-breeds. Over the years, the market for bivoltine silk has grown relatively faster.[8]

Mulberry (2018-19)	Bivoltine	Cross-breed
Cocoon production	46,400 MT[9] CAGR (2013-19) of 17.9%	139,100 MT[9] CAGR (2013-19) of 1.8%
Raw silk/ yarn production	7,000 MT[9] CAGR (2013-19) of 18.2%	18,300 MT[9] CAGR (2013-19) of 1.4%


Image: iStock

Yarn production

Mulberry silk is reeled using charkhas, cottage basins, multi-end reeling machines (MRM) or automatic reeling machines (ARM). The Central Silk Board and state departments are promoting bivoltine raw silk production and use of MRMs and ARMs to replace imports of high quality silk.[10]

But using MRMs and ARMs can be challenging. First, they require high initial capital investment. Second, they require regular and generous supply of high-quality cocoons, not to mention the labour needed to operate them efficiently. Significant fluctuations in cocoon production and prices in India makes this difficult.[11]

In many parts of India, manually operated charkha continues to be primary machine used for reeling. It is because they can reel low quality cocoons to produce cheaper silk which serves the price sensitive handloom market.[12]

Average cocoon price (INR/kg) in 2018-19[9]

347	300
Bivoltine	Crossbreed

Average raw silk price (INR/kg) in 2018-19[9]

2,770	3,130	3,310
Charkha	Cottage Basin	Multi-end

Regional landscape

Karnataka, Andhra Pradesh, West Bengal and Tamil Nadu together contributes **92 per cent** of total raw mulberry silk production.[9]

Northeast region
A textile promotion scheme in the north eastern states (except Manipur) is supporting the production of as many as 30 lakh mulberry disease-free layings across 4,000 acres of bivoltine plantation engaging over 9,000 women.[9]

Telangana
The Telangana government is promoting reeling using ARMs and MRMs by offering reelers INR 105 and INR 80 respectively for each kilogram of yarn produced.[9]

Other states
The Central Silk Board's (CSB) bivoltine cluster promotion programme promotes the cultivation of bivoltine silk in all states, except Gujarat, Rajasthan, Chhattisgarh, and Jharkhand.[9]

MRMs and ARMs provide best quality and productivity, but are unaffordable for microenterprises. Charkhas have lower productivity and yarn quality. This leaves a market gap that can be filled by small or medium energy-efficient spinning and reeling machines. They are affordable, need little space and produce high-quality yarn from both cross-breed and bivoltine cocoons.[11]

[8] http://csb.gov.in/silk-sericulture/silk/mulberry-silk; [9] Central Silk Board (2019) Annual Report; [10] Critical Analysis on Role of Women in Sericulture Industry, International Journal of Social Science Citation: IJSS: 6(3): 211-222, September 2017; [11] Authors' Analysis, Stakeholder Interviews; [12] https://tnsericulture.gov.in/sericultureNov12/Charka.htm; USD 1 = INR 70

Market potential for energy-efficient machines replacing charkhas

TAM

USD 21.0 million (INR 147.0 crore)

49,000 Traditional charkhas replaced[13]

SAM

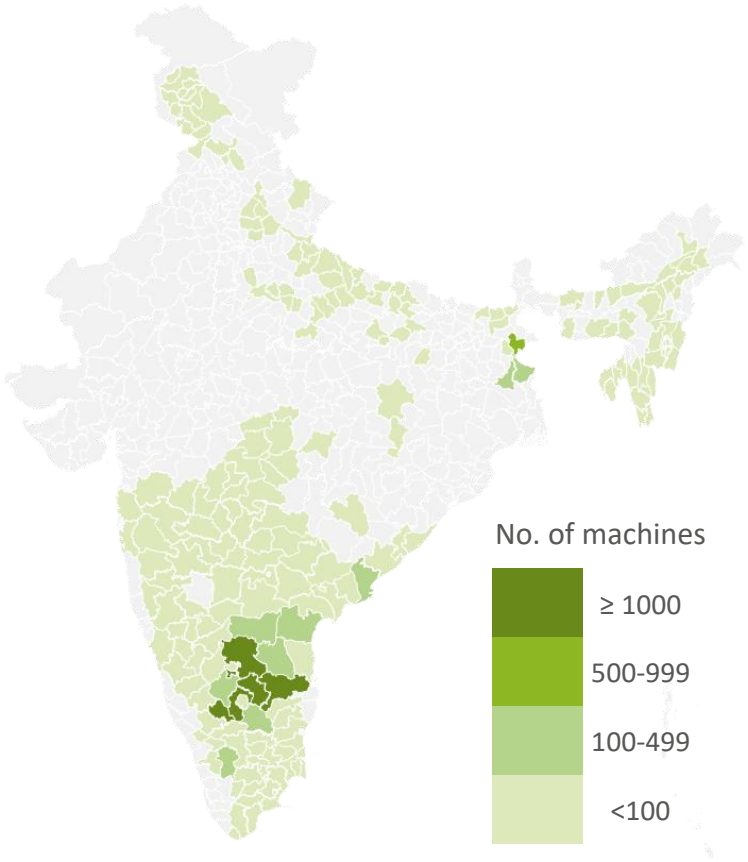
USD 6.4 million (INR 45.0 crore)

15,000 Traditional charkhas replaced[13]

Impact

Energy-efficient machines can impact the livelihoods of as many as **15,000 reelers (50 per cent women).**[13]

District wise potential number of energy-efficient machines[13] (SAM)



Top 15 districts for SAM [13]

State name	District name	Traditional charkhas which can be replaced
Andhra Pradesh	Anantpur	2,671
Andhra Pradesh	Chittoor	2,433
Karnataka	Mandya	1,454
Karnataka	Ramanagara	1,239
Karnataka	Chikkaballapur	997
West Bengal	Malda	971
Karnataka	Kolar	772
Karnataka	Bengaluru Rural	316
West Bengal	Murshidabad	310
Karnataka	Tumkur	236
Andhra Pradesh	Kurnool	184
Andhra Pradesh	Prakasham	177
West Bengal	Birbhum	149
Tamil Nadu	Krishnagiri	145
Andhra Pradesh	East Godavari	134

Complete list of districts is available here.

Top 15 districts represent ~82 per cent of the serviceable market.

Andhra Pradesh, Karnataka, West Bengal, and Tamil Nadu are India's top mulberry producing states. Machine manufacturing entrepreneurs should target these states, as well as those that have achieved high growth in raw mulberry silk production in recent years, such as **Tripura, Maharashtra, Uttar Pradesh, and Telangana**.[13]

Methodology

While estimating the total available market (TAM), based on literature, we considered that as much as 50 per cent of mulberry silk is currently produced on charkhas, and that a single charkha produces 1 kg of yarn daily for 300 days in a year.[14]

We calculated the serviceable available market (SAM) by considering factors such as:

- A state's total mulberry silk production
- The production growth rate between 2015-19
- Industrialisation
- State level policy interventions to promote decentralised production
- Solar irradiance and grid electricity availability

We considered that existing reelers would move to the energy-efficient machines for evaluation of Impact.

[13] Authors' Analysis; Critical Analysis on Role of Women in Sericulture Industry, International Journal of Social Science Citation: IJSS: 6(3): 211-222, September 2017; [14] https://tnsericulture.gov.in/sericultureNov12/Charka.htm; USD 1 = INR 70; TAM = Total Available Market; SAM = Serviceable Available Market

Tasar silk production

Tasar silk

Tasar silk is coarse and has a copperish colour. It comes in two varieties: oak tasar and tropical tasar. The silkworm used in oak tasar's production (*Antheraea proyeli J.*) feeds on natural oak food plants. The one used in tropical tasar's production (*Antheraea mylitta*) feeds on Asan and Arjun food plants.[15]

Tasar (2018-19)	
Cocoon production	2,300 million[16] CAGR (2013-19) of 1.1%
Raw silk / yarn production	3,000 MT[16] CAGR (2013-19) of 2.2%

Yarn production

Tasar yarn is produced using modern machines and traditional thigh reeling. Thigh reeling constitutes 30 per cent of total production[17] and produces low-denier, low-twist yarn, which is in demand.[18]

Indian tasar yarn is mainly used as weft along with imported warp tasar. Weft spun yarn is used in furnishing and shirts as it improves fabric texture. Replacing imported warp is difficult because it is of better quality, available in large quantities, and easier to use.[19] Other major challenges for reelers and spinners are high price of cocoons, working capital issues in cocoon procurement, and a lack of market access.[18]

Average cocoon price (INR/1000 cocoon) in 2018-19[16]

4,000-5,000 Raily*	3,000-3,450 Daba*

Average raw silk price (INR/kg) in 2018-19[16]

3,200-3,500 Reeled	1,800-2,100 Ghicha*

Average cocoon to reeled yarn yield: 1 kg yarn/ 1,250 cocoons[20]

Thigh reeling of tasar silk

Image: Resham Sutra

*Raily: Wild variety of cocoon, Daba: Semi-domesticated variety of cocoon, Ghicha: Yarn variety handmade out of multiple unreelable cocoons.

[15] http://csb.gov.in/silk-sericulture/silk/tasar-silk; [16] Central Silk Board (2019) Annual Report; [17] https://pib.gov.in/newsite/PrintRelease.aspx?relid=158964; [18] Tasar Value Chain Analysis Jharkhand, CSB & PRADAN (2017); [19] Reel of Fortune, PRADAN (2015); [20] Author's Analysis

Tasar raw silk yarn production in India

Tasar raw silk yarn production across states in India (in MT) [21,22,23,24]

≥ 1000 MT

Jharkhand

- **Production in 2018-19:** 2372 MT
- **Predominant tasar type:** Tropical
- **Tasar weaving cluster(s):** Bhagaiya, Raksa, Kharsawan

100-1000 MT

Chhattisgarh

- 340 MT
- Tropical tasar
- Champa, Raigarh clusters

Odisha

- 123 MT
- Tropical tasar
- Gopalpur, Nuwapatna, and Barpali clusters

0.01-100 MT

Bihar

- 38 MT
- Tropical tasar
- Bhagalpur, Nawadah, Nalanda, and Gaya clusters

West Bengal

- 25 MT
- Tropical tasar
- Fulia, Sonamukhi, Raghunathpur, and Tantipura clusters

Maharashtra

- 23 MT
- Tropical tasar
- Bhandara cluster

Uttar Pradesh

- 22 MT
- Oak tasar
- Varanasi cluster

Madhya Pradesh

- 18 MT
- Tropical tasar

Telangana

- 10 MT
- Tropical tasar

Andhra Pradesh

- 05 MT
- Tropical tasar

Uttarakhand

- 0.04 MT
- Oak tasar

Created by Oleksandr Panasovskyi from Noun Project

[21] http://csb.gov.in/silk-sericulture/silk/tasar-silk; [22] Central Silk Board (2019) Annual Report; [23] Reel of Fortune, PRADAN (2015); [24] Tasar Value Chain Analysis Chhattisgarh, CSB & PRADAN (2017)

Market potential for energy-efficient machines in tasar value chain

TAM

USD 15.1 million (INR 106.0 crore)

53,000 machines[25]

SAM

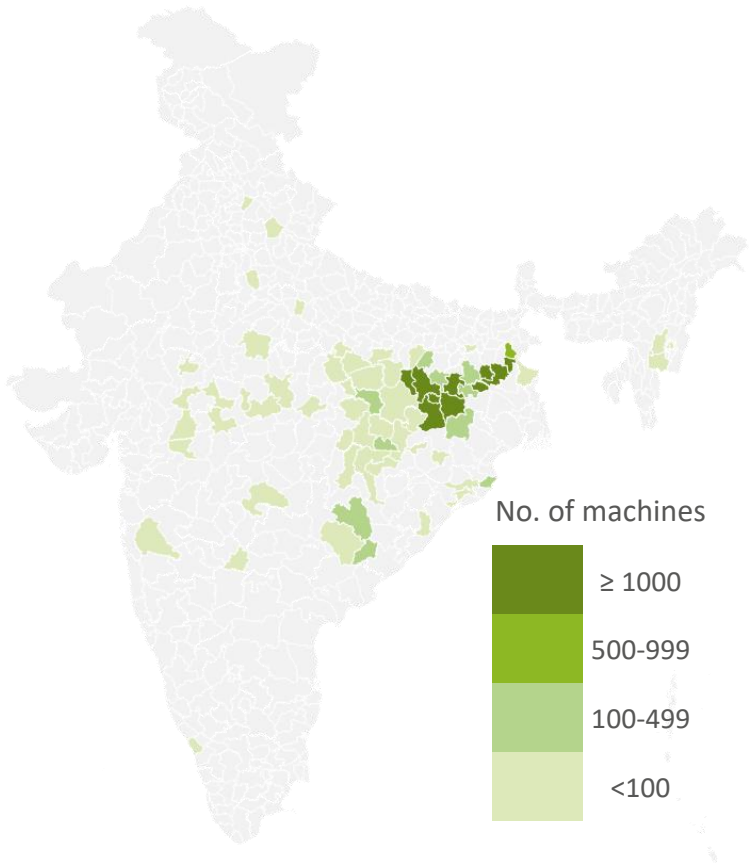
USD 10.4 million (INR 73.0 crore)

36,500 machines[25]

Impact

Energy-efficient machines can impact the livelihoods of as many as **36,500 reelers (all women).**[25]

District wise potential number of energy-efficient machines[25] (SAM)



Top 15 districts for SAM[25]

State name	District name	Estimated number of machines
Jharkhand	Dumka	9,539
Jharkhand	Ranchi	6,667
Jharkhand	West Singhbhum	5,557
Jharkhand	Dhanbad	3,279
Jharkhand	Giridih	1,773
Jharkhand	Palamu	1,210
Jharkhand	Hazaribagh	1,132
Jharkhand	Garhwa	1,102
Jharkhand	Pakur	1,058
Jharkhand	Sahebganj	1,042
Jharkhand	Saraikela Kharsawan	578
Jharkhand	Deoghar	429
Jharkhand	Chatra	350
Jharkhand	Godda	326
Odisha	Mayurbhanj	201

Complete list of districts is available here.

Top 15 districts cover ~ 93 per cent of serviceable market. [25]

Reelers see value in energy-efficient machines with batteries as these can operate after sunset. The main adoption barrier is the high initial cost.

Methodology

For TAM calculations, based on literature, we consider that 80-90 per cent of tasar silk is produced by traditional machines (non-efficient) and methods, and a single reeler produces 200 grams of yarn daily for 300 days in a year.[26]

To calculate the serviceable available market (SAM), we considered factors such as:

- Total tasar silk production in a state
- Production growth rate between 2015-19
- State level policy interventions to promote decentralised production
- Solar irradiance and grid electricity availability

We considered that existing reelers would move to the energy-efficient machines for evaluation of Impact. Limitation - Tasar silk is imported in significant quantity due to the availability of low-cost and high-quality alternatives. However, due to the lack of availability of reliable estimates, this is not factored into the analysis.

[25] Authors' Analysis; http://www.uniindia.com/~/women-empowerment-schemes-of-textiles-ministry/Business%20Economy/news/1522136.html; [26] Authors' Analysis , Stakeholder consultation, Tasar Value Chain Analysis Jharkhand, CSB & PRADAN (2017); USD 1 = INR 70; TAM = Total Available Market; SAM = Serviceable Available Market

Eri silk landscape

Eri silk

Eri silk, also known as Endi or Errandi, is a multivoltine silk spun from open ended cocoons. It comes from domesticated silkworm, *Philosamia Ricini*, which feeds on castor leaves. It is used indigenously for making bed sheets.[27]

Eri (2018-19)	
Cocoon production	9,100 MT[28] CAGR (2013-19) of 8.9%
Raw silk / yarn production	6,900 MT[28] CAGR (2013-19) of 8.5%

Image: iStock

Yarn production

Eri silk is spun on taklis or machines produced by the Central Silk Technological Research Institute (CSTRI) or by local manufacturers.[29] The government has also set up eri spun silk mills to increase production.[30]

Takli, a traditional hand tool for processing Eri silk, is **economical and easy to use. But it has low productivity and yarn production is uneven. When used as weft with mulberry warp,** eri spun yarn brings a coarse and dense texture to the fabric.[29]

Takli spinners face major challenges. They suffer from a lack of working capital and quality standards, and are unable to meet peak demand. The young generation is showing interest in using machines for better productivity.[31]

Average cocoon price (INR/ kg) in 2018-19[28]

700-900 for cut cocoons

Average raw silk price (INR/ kg) in 2018-19[28]

2,250-2,800 for spun yarn

Regional landscape

Eri culture is mainly practiced in north eastern states. But it is also prevalent in **Bihar, Uttar Pradesh, West Bengal and Odisha**. In 2018-19, **Assam and Meghalaya** were the leading producers of eri silk, accounting for 69 per cent and 16 per cent of total production.[27]

Assam and Manipur

The Central Silk Board (CSB) is opening eri spun silk mills in Assam and Manipur and an eri seed unit in Assam under the North East Region Textile Promotion Scheme.[28]

Energy-efficient spinning and reeling machines can replace existing practices to improve productivity and provide consistent outputs. This will help end-users to maintain quality standards and meet peak demands.[32]

[27] http://csb.gov.in/silk-sericulture/silk/eri-silk; [28] Central Silk Board (2018-19) Annual Report; [29] Contemporary breakthrough in Ahimsa silk spinning; Indian Journal of Traditional Knowledge, Vol. 7(1), January 2008, pp. 178-181; [30] https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1565170; [31] Supply Chain Linkages and Constraints in Natural Silk Sector of Assam: A study of Muga and Eri Silk, International Journal of Multidisciplinary Management Studies, Vol 1, Issue 3, December 2011 ; [32] Authors' Analysis; USD 1 = INR 70

Market potential of energy-efficient machines replacing taklis

TAM

USD 13.1 million (INR 91.8 crore)

37,500 machines[33]

SAM

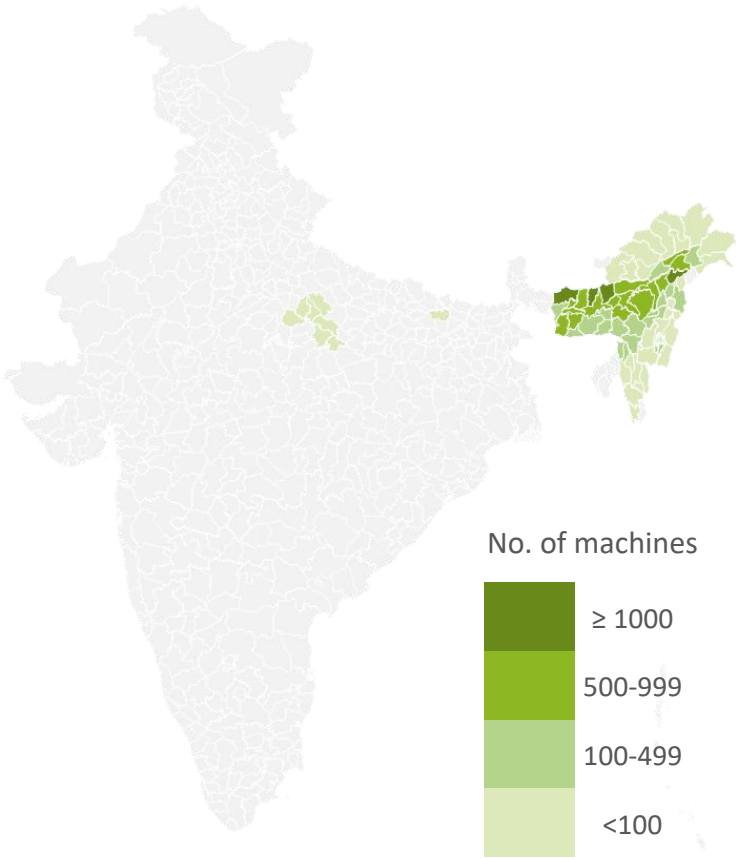
USD 8.0 million (INR 56.3 crore)

23,000 machines[33]

Impact

Energy-efficient machines can impact the livelihoods of as many as **23,000 spinners (97 per cent women).**[33]

District wise potential number of energy-efficient machines[33] (SAM)



Top 15 districts for SAM[33]

State name	District name	Estimated number of machines
Assam	Sivasagar	4,757
Assam	Udalguri	1,774
Assam	Kokrajhar	1,020
Assam	Baksa	1,020
Assam	Nagaon	874
Assam	Sonitpur	726
Assam	Jorhat	699
Assam	Golaghat	655
Assam	Karbi Anglong	640
Assam	Chirang	621
Assam	Kamrup & Kamrup (Metro)	588
Assam	Goalpara	583
Assam	Dibrugarh	564
Assam	Dhemaji	543
Assam	Morigaon	543

Complete list of districts is available here.

Top 15 districts cover ~94 per cent of serviceable market[33]

Assam is the top state, with 15 districts capturing 94 per cent of serviceable market.[33]

Entrepreneurs manufacturing machines for this market should focus on asset financing to enable adoption.

Methodology

Based on literature, we consider that 57 per cent of eri silk spinners use taklis, and that a single spinner produces 300 grams of yarn daily for 300 days in a year.[34]

To calculate the serviceable available market (SAM), we considered factors such as:

- A state's total eri silk production
- Production growth rate between 2015-19
- State level policy interventions to promote decentralised production
- Solar irradiance and grid electricity availability

We considered that existing reelers would move to the energy-efficient machines for evaluation of Impact.

[33] Authors' Analysis; Monimala Saikia and Kumud Ghosh, Involvement and contribution of women in eri culture activities in Jorhat district of Assam; [34] https://sericulture.assam.gov.in/portlet-innerpage/spinning; USD 1 = INR 70; TAM = Total Available Market; SAM = Serviceable Available Market

Muga silk landscape

Muga silk

Muga silk comes from the semi-domesticated multivoltine silkworm, *Antheraea assamensis*. It is reared on the aromatic leaves of Som and Soalu plants.[35] It is used to make mekhalas*, bed sheets, and sarees, among other products.[36]

Muga (2018-19)	
Cocoon production	1,170 million[37] CAGR (2013-19)[21] of 8.5 %
Raw silk / yarn production	230 MT[37] CAGR (2013-19) of 7.9 %


Image: iStock

Yarn production

Muga is reeled on '*bhir*' devices or on machines developed by the Central Silk Technological Research Institute (CSTRI) or by local manufacturers. **Bhir devices have quality and productivity issues but are essential for meeting the demand for untwisted weft yarn.** So there is a demand of machines with better productivity capable of yielding yarn of uniform quality. Another use case is for spinning machines which can spin the remnants of reeled cocoons.[38]

There are two major challenges in Muga value chain. First, the usage of insecticides and pesticides in nearby tea plantations makes rearing of Muga silk worm difficult. Second, there is competition from multiple look-alikes in the market, such as the muga-eri blend and dyed eri.[39]

Average cocoon price (INR/ 1000 cocoons) in 2018-19[37]

4,000-5,000
reeling cocoon

Average raw silk price (INR/ kg) in 2018-19[37]

18,000-25,000 for warp yarn

16,500-20,000 for weft yarn

Average cocoon to yarn yield[38]
1 kg yarn/ 4,500-6,000 cocoons

Regional landscape

Muga production is limited to the north eastern states. The leading producers, Assam and Meghalaya, contribute 82 per cent and 15 per cent of total output, respectively.

The Central Silk Board (CSB) is working to improve quality of muga silk under its North East Region Textile Promotion Scheme. The natural habitat in which production occurs lies in protected areas like the Upper Doigrung wild life area, the Kuklung reserve forest, the Mebo reserve forest and the Bagmara reserve forest.[37]

The relatively high average muga cocoon price increases the working capital required for production.

This market is supply constrained, making muga silk a high value product.

Considering these two points, entrepreneurs should prefer value chain approach by providing energy-efficient machines, raw material, and job work to skilled artisans.[40]

*Mekhala is a traditional Assamese attire.

[35] http://csb.gov.in/silk sericulture/silk/muga-silk; [36] Central Silk Board (2019) Seri-states of India; [37] Central Silk Board (2018-19) Annual Report; [38] https://sericulture.assam.gov.in/portlets/silk-reeling-and-spinning; [39] https://medium.com/smaclab/the-story-of-golden-thread-paradox-of-muga-silk-in-assam-5b8f43b1a0e2; [40] Author's Analysis; USD 1 = INR 70

Market potential of energy-efficient machines replacing bhir

TAM

USD 1.8 million (INR 12.8 crore)

6,000 bhir devices can be replaced[41]

SAM

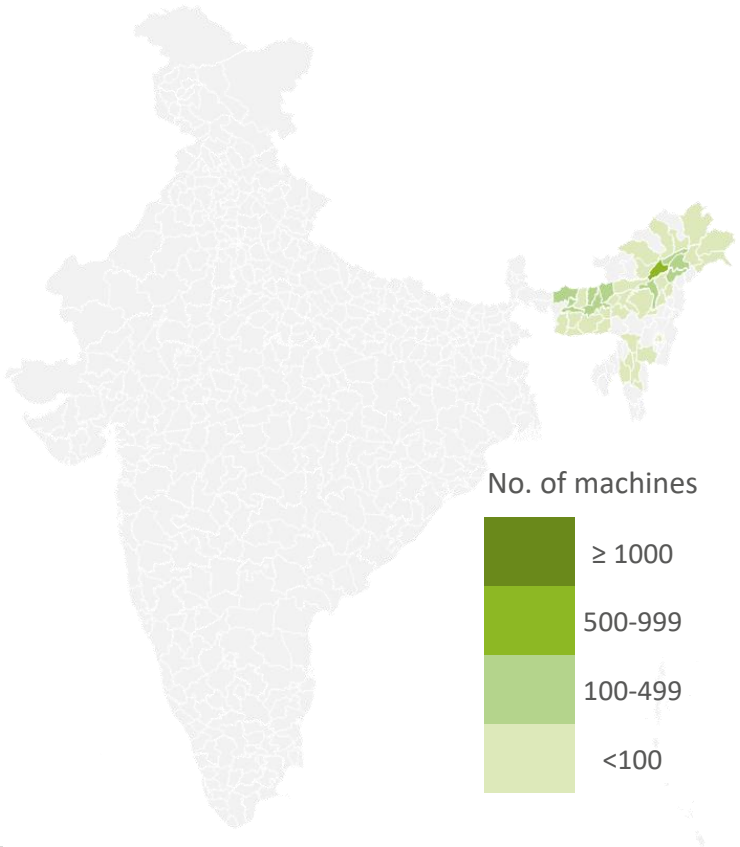
USD 1.1 million (INR 7.4 crore)

3,500 bhir devices can be replaced[41]

Impact

Energy-efficient machines can impact the livelihoods of as many as **7,000 reelers (60 per cent women).**[41]

District wise potential number of energy-efficient machines[41] (SAM)



Top 15 districts for SAM[41]

State name	District name	Estimated number of replaceable bhirs
Assam	Lakhimpur	550
Assam	Sivasagar	337
Assam	Dhemaji	332
Assam	Goalpara	314
Assam	Kamrup & Kamrup (Metro)	263
Assam	Udalguri	232
Assam	Dibrugarh	213
Assam	Kokrajhar	187
Assam	Baksa	173
Assam	Golaghat	172
Assam	Chirang	129
Assam	Darrang	124
Meghalaya	South Garo Hills	75
Meghalaya	East Khasi Hills	73
Meghalaya	West Garo Hills	42

Complete list of districts is available here.

Top 15 districts cover ~92 per cent of serviceable market[41]

Assam and Meghalaya are major contributors, with shares of 82 per cent & 15 per cent, respectively.

The target customers are rearers and reelers working in groups under master reelers, weavers and traders in and around cocoon producing areas and weaving centres.

Methodology

Based on literature, we consider that 56 per cent of muga silk is reeled using bhir devices, and that one device produces 80 grams of yarn daily for 300 days in a year.[42]

To calculate the serviceable available market (SAM), we considered factors such as:

- A state's total muga silk production
- The production growth rate between 2015-19
- State level policy interventions to promote decentralised production
- Solar irradiance and grid electricity availability

We considered that existing reelers would move to the energy-efficient machines for evaluation of Impact.

[41] Authors' Analysis; https://sericulture.assam.gov.in/frontimpotentdata/role-of-women-in-sericulture-industry; [42] https://sericulture.assam.gov.in/portlets/silk-reeling-and-spinning; USD 1 = INR 70;
TAM = Total Available Market; SAM = Serviceable Available Market

Which are the priority areas for silk-related weaving in India?

Question answered in this section

- Where can entrepreneurs sell their silk yarn?

Image: iStock

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Where can entrepreneurs sell their silk yarn?

Entrepreneurs can sell their silk yarn to weaving households, weaving enterprises and powerloom industry. We define weaving households as homes with at least one weaver. By enterprises, we mean unincorporated non-agricultural enterprises involved in silk weaving.

The table shows states in decreasing order of total number of weaving households. Assam (33 per cent). Manipur (18 per cent), West Bengal (10 per cent), Tamil Nadu (10 per cent), Andhra Pradesh (8 per cent) are top five states with highest number of weaving households. Muga, eri and tasar weaving households are concentrated in north eastern and eastern states while mulberry silk weaving households are concentrated in southern India. [43] Silk weaving enterprises are concentrated in Andhra Pradesh, Uttar Pradesh, and Bihar.[44]

Silk consumption by weaving households is concentrated near raw silk production centres.

Muga silk weaving is concentrated in Assam and Manipur, eri silk weaving is concentrated in Assam, mulberry silk weaving is concentrated in Tamil Nadu and Andhra Pradesh, and tasar silk weaving in Assam, Jharkhand, and West Bengal.

This proximity in value chain operations can help entrepreneurs looking to establish farm-to-fabric models.[43]

High  Low

State wise number of weaving households (WH)[43], weaving enterprises (WE)[44] and clusters[45,46]

State	Muga WH	Eri WH	Mulberry WH	Tasar WH	Looms at WE	Silk weaving clusters in India
Assam	54,003	43,155	5,357	7,241	0	Bijaynaga, Palashbari, Hajo, Rampur (Eri); Sualkucchi-Bamundi (Muga)
Manipur	45,244	7,080	4,517	1,437	7,905	-
West Bengal	16,291	3,399	4,483	8,749	2,516	Murshidabad, Baluchari, Fulia (Tasar)
Tamil Nadu	9,352	4,904	17,195	924	0	Kanchipuram, Arni, Thirubuvanam
Andhra Pradesh	1,055	4,255	19,764	99	39,487	Dharmavaram, Pochampalli, Venkatagiri
Uttar Pradesh	10,701	1,389	6,725	1,165	10,560	Varanasi, Mubarakpur
Jharkhand	2,448	2,553	1,633	4,591	0	Bhagaiya, Raksa, Kharsawan
Meghalaya	3,207	3,175	266	271	0	Umden
Telangana	351	55	6,195	282	1,816	-
Nagaland	1,728	1,971	1,864	582	58	-
Bihar	1,443	1,508	1,591	1,557	11,480	Bhagalpur (Tasar)
Karnataka	18	44	3,880	15	1,358	Banglore, Mysore, Kollegal, Illekal, Moolakalmooru
Odisha	134	656	879	1,469	0	Naupatna
Mizoram	1,081	306	176	836	0	-
Madhya Pradesh	16	576	819	127	0	Maheshwari and Chanderi
Gujarat	179	105	779	71	0	Patola
Tripura	421	139	128	235	0	-
Maharashtra	18	3	658	103	0	Paithan, Bhandara, and Yeola
Chhattisgarh	322	12	1	291	0	Champa, Raigarh (Tasar)
Arunachal Pradesh	162	398	17	1	0	-
Jammu and Kashmir	110	75	72	88	929	Srinagar
Rajasthan	33	29	50	161	0	-
Uttarakhand	1	11	15	39	0	-
Others	5	7	11	2	0	-

[43] Author's Analysis; Fourth All India Handloom Survey (2020) [44] NSSO Round 73, Unincorporated non-agricultural enterprises; [45] Supply Chain Linkages And Constraints In Natural Silk Sector of Assam: A Study of Muga And Eri Silk; [46] http://www.silkmarkindia.com/blog/?p=149

Competitor analysis and policy landscape

Questions answered in this section

- Who are the major competitors and what is the way forward for entrepreneurs?
- What are the relevant government policies for silk entrepreneurs?

Image: Resham Sutra

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Who are the major competitors and what is the way forward for entrepreneurs?[47]

	Traditional machines	Small size modern machines	Multi-end machines
Machine type	Bhir, takli, traditional charkha, thigh reeling, etc.	Small (1-10 ends) machines for reeling, twisting, and spinning of all types of silk.	Multi-end cottage basin reeling machines, re-reeling machines, automatic reeling machines, multi-end reeling machines, etc. These are more popular in mulberry value chain.
Cost	Very low as they are locally manufactured	INR 8,000 – 40,000	> INR 20 lakhs
Productivity	Bhir, takli, thigh reeling: 40-150 g/day; traditional charkha: 1,000 g/day	250-350 g/day	9-90 kg/day
Mechanisation	Manual (no mechanisation)	Both manual and mechanised variants available	Mechanised
Yarn quality	Non-uniform	Uniform	Uniform
Power source	Manual power	Manual power, grid, diesel, renewable energy	Grid, diesel
Manufacturers	NA	These machines are designed by CSTRI and manufacturers like Das & Kumars, R K Industries, Resham Sutra Pvt Ltd, Pragjyothika Enterprise, etc.	These machines are manufactured by large manufacturers like Sri Gajalakshmi Engineering Works, Sri M V R Industries, etc.

Due to their low productivity and non-uniform yarn quality, traditional machines present ideal case for replacement by energy-efficient machines. Though silk yarn production is an independent activity, reelers and spinners generally work in groups with master reelers, spinners, weavers, and traders. Entrepreneurs can target these groups for better reach. They can also tap into retail and distribution channels of traditional machine manufacturers.

Small, modern machines designed by CSTRI and small manufacturers offer the strongest competition to energy-efficient solar-powered machines. But clean solar energy can be a differentiating factor in regions with erratic electricity supply. Further, the existence of multiple operation modes in energy-efficient machines enhances ease of operation.

Multi-end machines are good for locations with high aggregate demand and supply. Though they do not provide any direct competition to energy-efficient machines but they affect demand-supply balance in the region. These machines are used in the mulberry value chain in Karnataka. Energy-efficient machine manufacturers should prioritise other regions for mulberry silk reeling machines.

[47] Author's Analysis - India mart, silks.csb.gov.in, cmerti.res.in, sericulture.assam.gov.in

Which policies are relevant for entrepreneurs?

Scheme	Silk type	Beneficiaries	Target geographies	Main provisions	Scheme value
Capacity Building					
Integrated Basin Development Livelihood Project (IBDLP)[48]	All	Silk value chain players like farmers, reelers, spinners **(Gender agnostic)**	Meghalaya	Developing complete value chain through supporting rearing, reeling, spinning, weaving, and marketing activities. Promoting new technologies for reeling and spinning.	NA
Chief Minister's Indigenous Textile Promotion Scheme[49]	All	Weavers **(Gender agnostic)**	Arunachal Pradesh	Distributing improved frame loom/acrylic yarn/ fine cotton yarn/ eri silk yarn to poor handloom weavers, free of cost.	NA
Uttar Pradesh Textile Policy 2017[50]	All	Silk reeling entrepreneurs (SC and ST) and weavers **(Gender targeted)**	Uttar Pradesh	Supporting SC and ST entrepreneurs through the central government's Standup India scheme. Forming self help groups (SHGs) of women weavers who adopt modern looms and market their products. Setting up a mission to increase silk koya and hemp fibre production in UP.	NA
Bivoltine Cluster Promotion programme - Central Silk Board[51]	Mulberry	Mulberry silk farmers and rearers **(Gender agnostic)**	All states except Gujarat, Rajasthan, Jharkhand and Chhattisgarh	Promoting bivoltine silk production between 2017-20.	NA
North East Region Textile Promotion Scheme - Central Silk Board[51]	All	Silk ecosystem **(Gender agnostic)**	Northeastern states	38 sericulture projects under four broad categories: Integrated Sericulture Development Project (ISDP), and Intensive Bivoltine Sericulture Development Project (IBSDP), Eri Spun Silk Mill, and Aspirational Districts.	NA
Scheduled Caste Sub Plan (SCSP) - Central Silk Board[51]	All	SC and ST families across the silk value chain **(Gender agnostic)**	Andhra Pradesh, Telangana, Himachal Pradesh, Uttar Pradesh, Tamil Nadu, Uttarakhand, Chattisgarh, Jharkhand, Maharashtra, Madhya Pradesh, and Odisha	Providing families with various kinds of assistance, including support for machine purchases, silkworm rearing, and skill upgradation.	USD 5.7 million (INR 40 crore)

[48] http://megseriloom.gov.in/schemes.html; [49] http://textiles.arunachal.gov.in/chief-minstrers-indigenous-textile-promotion-scheme/; [50] UP Textile Policy 2017; [51] Central Silk Board (2018-19) Annual Report
Gender Targeted: Policies which have either some women focused clause or where major beneficiaries are women; Gender Agnostic: No special focus on women; NA = Not available.

Which policies are relevant for entrepreneurs?

Scheme	Silk type	Beneficiaries	Target geographies	Main provisions	Scheme value
Capacity Building					
Mukhyamantri Tasar Vikas Pariyojna[52]	Tasar	Reelers **(Gender targeted)**	Bihar	Forming 135 SHGs to encourage yarn production through a Common Facility Centre (CFC).	NA
Tasar Sericulture Development and Extension[53]	Tasar	Rearers and reelers **(Gender agnostic)**	Madhya Pradesh	Subsidising rearing equipment, rearing house construction, irrigation and establishing reeling units. Cost break-up: 25% to be born by state, 25% by beneficiaries, and 50% by the Central Silk Board.	NA
Integrated 'Soil to Silk' Tasar Project - Central Silk Board[54]	Tasar	Farmers, graineurs, reelers, and others **(Gender agnostic)**	Chhattisgarh (Janjgir-Champa district)	Development of new plantations with an area of 2,500 hectares and maintenance of existing plantations in 1,240 hectares; building forward and backward linkages for ensuring crop productivity, cocoon storage facilities, reelers collectives, cocoon bank and marketing support.	USD 9.79 million (INR 68.53 crore) (2016-19)
Mahila Kisan Sashaktikaran Pariyojana for Tasar Development - Central Silk Board[54]	Tasar	Female farmers **(Gender targeted)**	Jharkhand, Odisha, West Bengal, Chhattisgarh, Maharashtra, Bihar	Promoting tasar-based livelihoods since 2013. Covering 36,000 beneficiaries in 23 districts, most of which are affected by Left-Wing Extremism (LWE).	USD 10.2 million (INR 71.6 crore)
Vanya Cluster Promotion Programme - Central Silk Board[54]	Tasar, eri, muga	Vanya rearers, reelers and spinners **(Gender agnostic)**	India	Improving productivity, enabling transfer of improved technologies, strengthening forward and backward linkages, etc.	USD 1.9 million (INR 13.40 crore)
Oak Tasar Development Project in Uttarakhand - Central Silk Board[54]	Tasar	Tribal people living in hilly areas **(Gender agnostic)**	Uttarakhand	Developing infrastructure for seed production and commercial crop rearing, reeling/spinning; forward integration to increase oak tasar silk production and create sustainable livelihoods.	USD 4 million (INR 28.36 crore)

[52] Sericulture schemes in Bihar; [53] http://mpgramodyogglobal.gov.in/RuralIndu/DEP202/Schemes.aspx; [54] Central Silk Board (2018-19) Annual Report
Gender Targeted: Policies which have either some women focused clause or where major beneficiaries are women; Gender Agnostic: No special focus on women; NA = Not available.

Which policies are relevant for entrepreneurs?

Scheme	Silk type	Beneficiaries	Target geographies	Main provisions	Scheme value
Financial Support					
Kaimagga Vikasa Yojane[55]	All	Weavers **(Gender agnostic)**	Karnataka	Providing beneficiaries with financial assistance of 50 per cent for purchases of cotton/silk/woolen handlooms. Handloom co-operative societies receive assistance worth 75% of purchase costs .	NA
Integrated Handlooms Development Scheme - Group approach for development of Handlooms[56]	All	Weavers **(Gender agnostic)**	Tamil Nadu	Providing financial assistance to the tune of USD 0.85 million (INR 60 lakh) (for a period of 3 years) for skill development; purchases of new looms and accessories; building dyeing units, common facility centers and showrooms; and organising exhibitions/fairs.	NA
State Plan Scheme (Odisha)[57]	All	Silk reelers, spinners, weavers, etc **(Gender agnostic)**	Odisha	Financial assistance for establishment of private entrepreneurs in post cocoon activities such as reeling, spinning, twisting, dyeing and weaving for developing infrastructure.	NA
Working Capital Assistance for Tasar Reeling Units (Buniyaad Machinery)[58]	Tasar	Reelers **(Gender agnostic)**	Andhra Pradesh	Providing reelers with financial assistance up to 90% of the unit cost - USD 714 (INR 0.50 lakhs) - of Tasar reeling units.	NA
Manipur Textile Policy[59]	All	Small and medium enterprises **(Gender agnostic)**	Manipur	Providing tax reimbursements on purchase of raw material, machinery/accessories/equipment, end products/intermediate products in the value chain.	NA
Maharashtra Textile Policy[60]	All	Entrepreneurs, weavers and weavers' groups **(Gender agnostic)**	Maharashtra	Providing credit-linked capital subsidies to silk entrepreneurs, weavers and weavers' groups for dyeing/processing/weaving machinery.	NA

[55] http://www.karnatakadht.org/english/pdf/kaimagga-vikasa-yojane.pdf; [56] https://www .tn.gov.in/scheme/department_wise/10?page=1; [57] https://handloom.odisha.gov.in/sites/default/files/2020-02/POSI_Guideline.pdf; [58] http://www.sericulture.ap.gov.in/sub_schemes.php?id=17; [59] Manipur Textile Policy 2019; [60] Maharashtra State Textile Policy 2018-23

Gender Targeted: Policies which have either some women focused clause or where major beneficiaries are women; Gender Agnostic: No special focus on women; NA = Not available.

Which policies are relevant for entrepreneurs?

Scheme	Silk type	Beneficiaries	Target geographies	Main provisions	Scheme value
Market Development					
State development scheme[61]	Mulberry	Reelers **(Gender agnostic)**	Andhra Pradesh	Providing reelers with INR 130/- per kilogram for 1A grade and above quality silk and INR 35/- per kilogram of raw silk produced on charkhas.	NA
Telangana Sericulture Support Programme[62]	Mulberry, tasar	Reelers, tasar weaving societies **(Gender agnostic)**	Telangana	Providing reelers with INR 80 per kilogram of MERU (Multi-End Reeling Unit) silk produced, and INR 105 per kilogram of ARM (Automatic Reeling Machine) silk produced. Establishing crop colonies for both mulberry and tasar silks. Providing tasar weavers' societies with a 50% subsidy on reeling cocoons.	NA
Yarn Support Price to Silk Handloom Weavers[63]	All	Weavers **(Gender agnostic)**	Andhra Pradesh	Providing each beneficiary with INR 1000 per month for the purchase of four kilograms of silk yarn (at INR 250 per kg).	NA
Vanya Silk Market Promotion Cell - Central Silk Board[64]	Tasar, eri, muga	Manufacturers, traders, exporters, and designers in vanya silk value chain **(Gender agnostic)**	India	Generic, brand and market promotion of vanya silk through silk expos, workshops, meets, and commercialisation programmes. Product development through collaborative projects.	NA
Weaver support program[65]	All	Weavers **(Gender agnostic)**	Meghalaya	Encouraging the weavers to shift from acrylic yarn to natural filament yarn. The goal is to raise incomes and make use of locally available silk yarn fibre.	NA
New Textile and Garment Policy 2019-24[66]	All	Entrepreneurs, weavers and weavers' groups **(Gender agnostic)**	Karnataka	Providing capital subsidy support to silk entrepreneurs, weavers and weavers' groups for silk dyeing/processing/weaving machinery. Encouraging clustering of reeling and weaving activities. Strengthening linkages between producers and the industry. Creating market hubs and organising regular events to provide backward and forward linkages.	NA

[61] http://www.sericulture.ap.gov.in/sub_schemes.php?id=11; [62] Brief note on Horticulture and Sericulture, Government of Telangana; [63] http://www.sericulture.ap.gov.in/sub_schemes.php?id=13; [64] Central Silk Board (2018-19) Annual Report; [65] http://megseriloom.gov.in/schemes.html; [66] Karnataka New Textile and Garment Policy 2019-24

Gender Targeted: Policies which have either some women focused clause or where major beneficiaries are women; Gender Agnostic: No special focus on women; NA = Not available.

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Thank You

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