Ecosystem Landscape Study:

Eri Silk Value Chain in Assam & Meghalaya

January 2024

SELCO Foundation

Eri silk contributes significantly to the country's silk production landscape, representing 20.87% of the total production.

This study delves into the intricate ecosystem of the Eri Silk Value Chain in Assam and Meghalaya, unravelling its complexities and identifying key stakeholders and their roles.

By examining the dynamics of this value chain, the study pinpoints crucial areas for innovation and intervention.

NEDFi, 2020

Objectives

- Analyse the Eri silk value chain in Assam and Meghalaya, covering various stages from production to market.
- Identify critical sectors and stages within the Eri silk value chain.
- Assess the impact of climate risks, regional variations and resource constraints on Eri silk production.
- Evaluate the potential of DRE technologies to enhance productivity and sustainability within the value chain.
- Formulate recommendations for improving income generation, reducing drudgery and fostering economic development.

Eri Silk in India

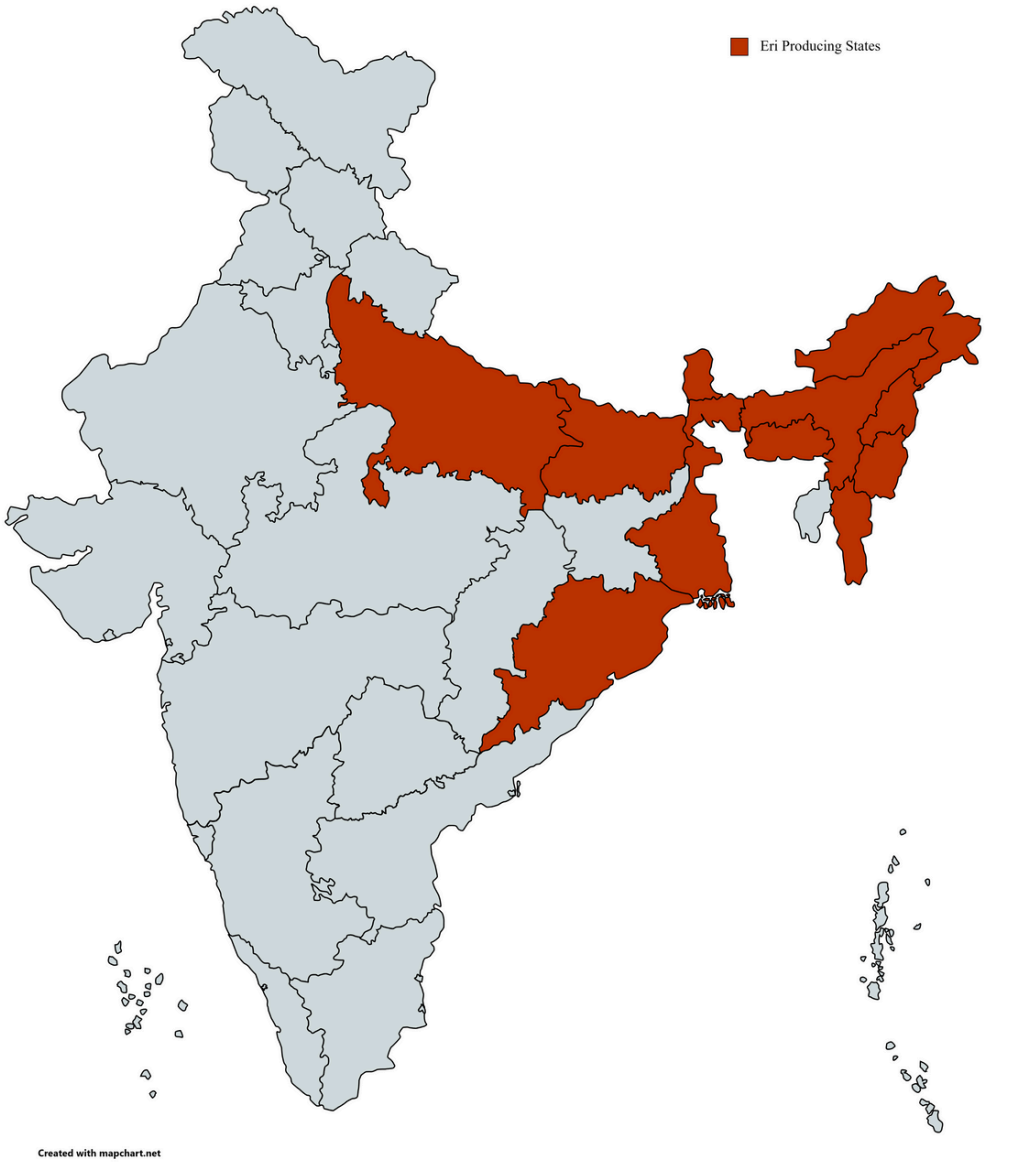
Eri silk is the **second largest silk produced** in India after mulberry.

7364 MT of eri silk was **produced** in India in 2022.

It is known for its **all-weather properties**, being cool in summer and warm in winter.

Common Eri products: shawl, stole, mekhla chaddar (traditional Assamese outfit), jensem (traditional Khasi outfit), running fabric

Central silk board, 2023



State Profile | Assam

- **Conducive terrain** and **temperature** for the entire life cycle of Eri silkworm rearing.
- Considered **one of the most climate-vulnerable** states - 4 districts have experienced an exponential increase in flood frequency (CEEW, 2021).

Terrain

Fertile Plains

Hilly Region

Climate Vulnerabilities

Landslide

Extreme Weather

Major livelihoods

Agriculture

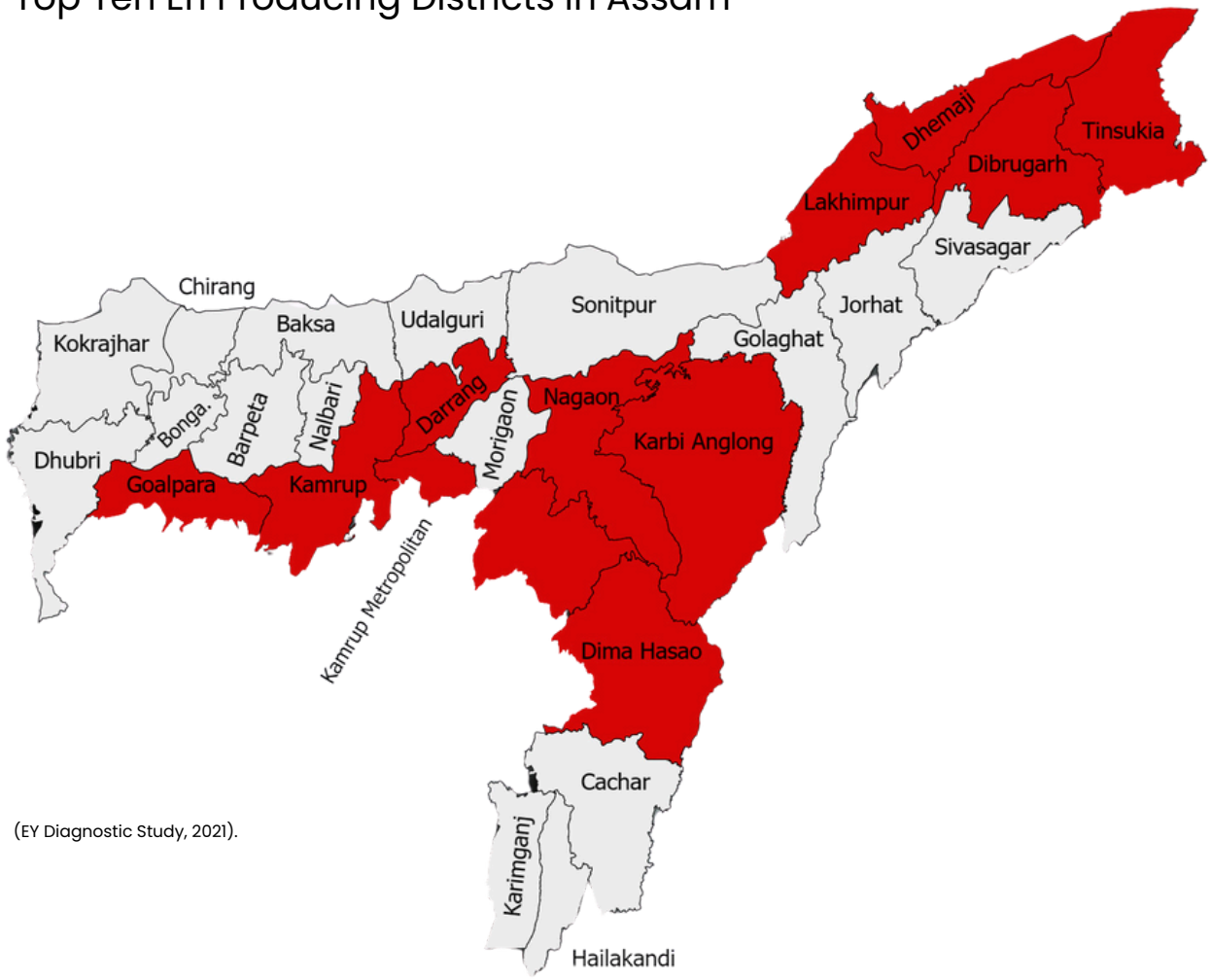
Livestock

NTFP

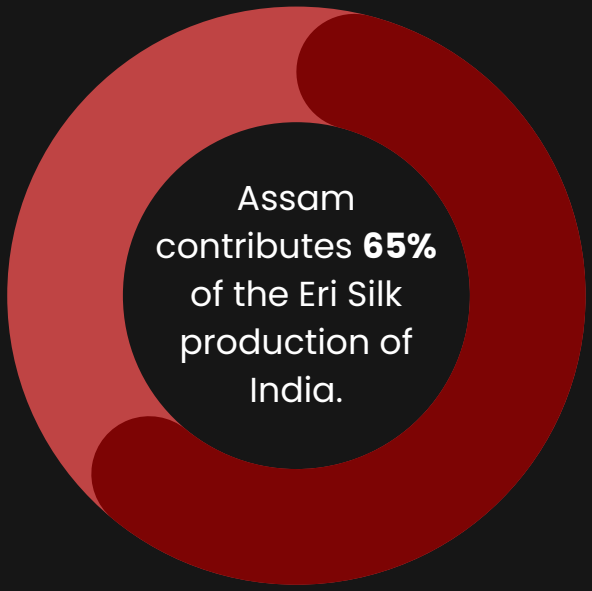
Handloom

Sector Profile | Assam

Top Ten Eri Producing Districts in Assam



(EY Diagnostic Study, 2021).



Production of Eri Cocoons: 67,69,000 kg

Production of Eri Raw Silk: 54,20,000 Kg

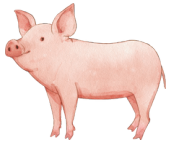
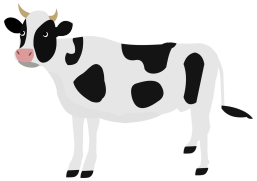
Segment Profile | Assam

Rural and tribal women who traditionally cultivate and weave silk

**Families Engaged in Eri Sericulture (in Nos.): 239,810.
3.27% of total households***

Most practice diversified livelihoods, allowing individuals to adapt to seasonal demands.

Seasonal Calendar

Livelihoods	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Eri Rearing												
Agriculture												
Animal Husbandry & Other Livelihoods												

*Based on population projection for 2024, with assumption of 4.9 as the average household size.

State Profile | Meghalaya

- **Conducive terrain** and **temperature** for the entire life cycle of Eri silkworm rearing.
- Meghalaya has a **high forest cover**, but there has been a significant reduction in forest cover due to industrial activities like timber logging, coal mining and sand mining (Climate Group, 2023).

Terrain

Fertile Valleys & Plains

Hilly Region

Climate Vulnerabilities

Landslide Prone

High Rainfall/
Severe Lightning

Major livelihoods

Agriculture

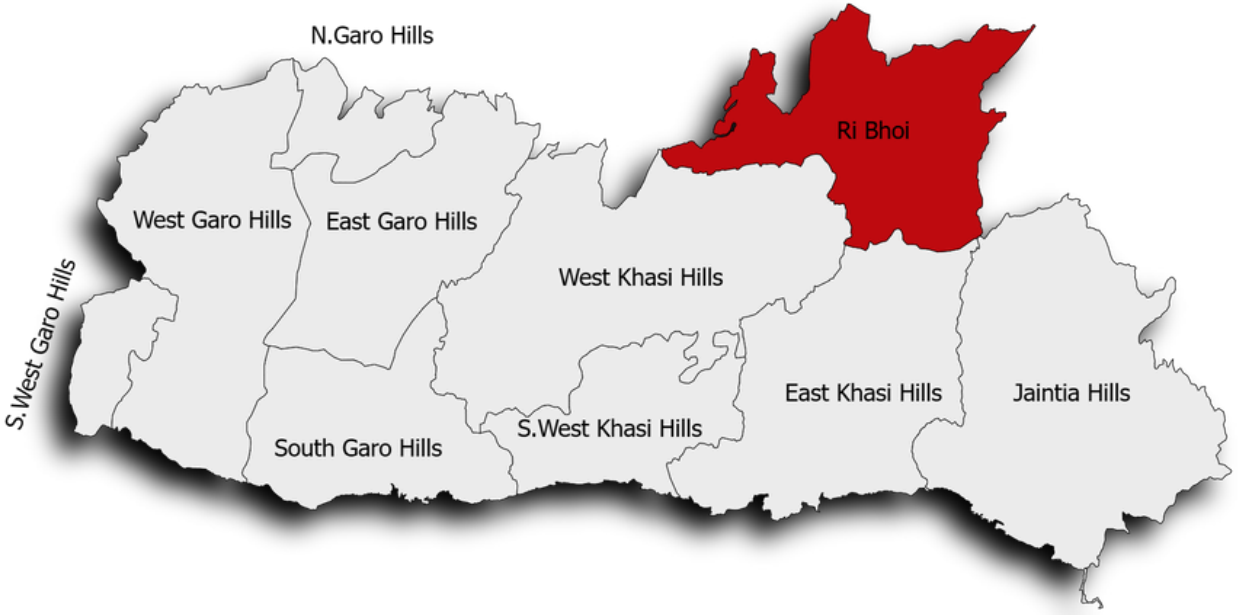
Mining

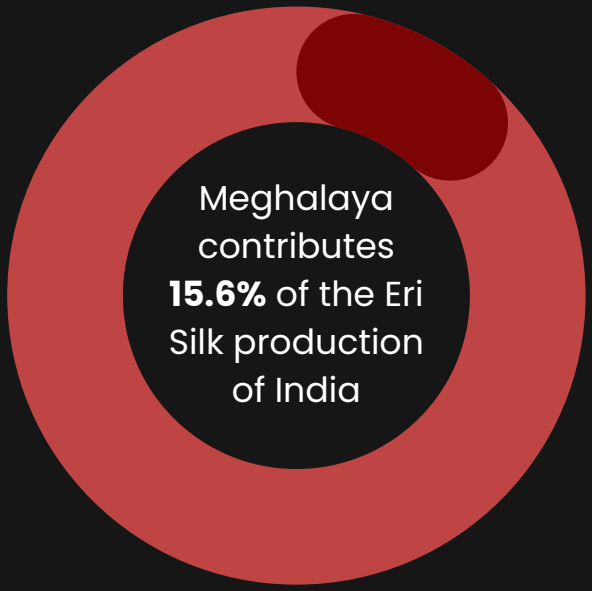
NTFP

Handloom

Sector Profile | Meghalaya

Top Eri Producing District





Production of Eri Cocoons: 12,64,000 kg

Production of Eri Raw Silk: 10,06,000 kg

Segment Profile | Meghalaya

Rural and tribal women who traditionally cultivate and weave silk

Families Engaged in Eri Sericulture (in Nos.): 60,168
8.61% of total households*

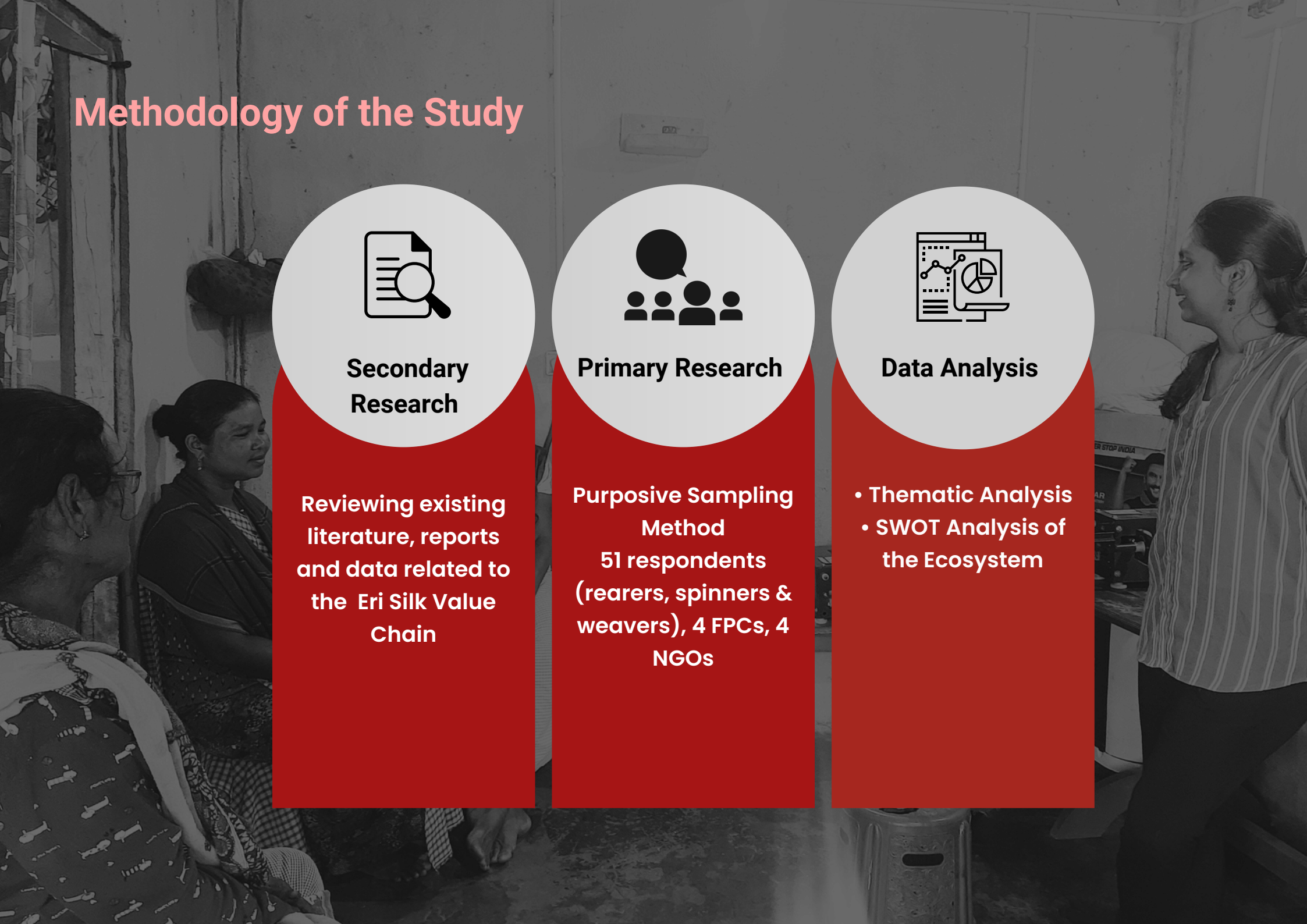
Most practice diversified livelihoods, allowing individuals to adapt to seasonal demands.

Seasonal Calendar

Livelihoods	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Eri Rearing												
Agriculture												
Animal Husbandry & Other Livelihoods												

*Based on population projection for 2024, with assumption of 5.41 as the average household size.

Methodology of the Study



Secondary Research

Reviewing existing literature, reports and data related to the Eri Silk Value Chain

Primary Research

Purposive Sampling Method
51 respondents (rearers, spinners & weavers), 4 FPCs, 4 NGOs

Data Analysis

- Thematic Analysis
- SWOT Analysis of the Ecosystem

Why this approach?

Secondary Literature Review

- Key processes in Eri Silk Value Chain
- Stakeholder mapping
- Current status of Eri Silk Value Chain

Primary Data Collection

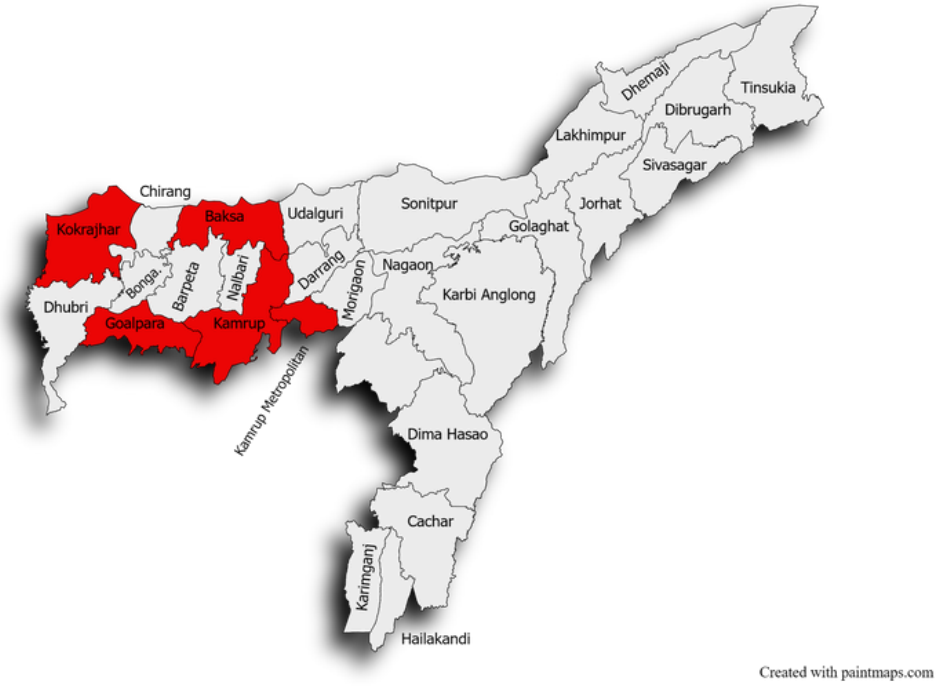
- Key challenges on-ground
- Maturity of the ecosystem for end-users
- Convergence of data from secondary literature

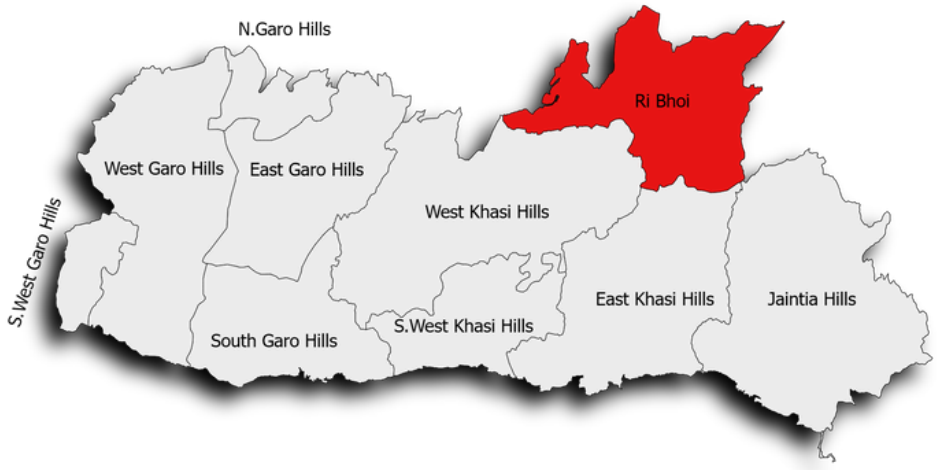
Sample Selection Process

- In collaboration with local partners—Mosonie, Diya Foundation, Grameen Sahara and Sanjog—stakeholders were carefully selected based on their **roles** and contributions across various stages of Eri silk production, from rearing to weaving.

- Districts selected: **Kamrup (R), Goalpara, Baksa, Kokrajhar and Ri Bhoi** in Assam and Meghalaya.

- While these districts may not rank as the primary Eri silk-producing regions, the selection of districts aligns with Selco Foundation's operational footprint and district-blanketing approach.





Key Findings

Key Findings

- Pain points within the value chain
  - Cocoon productivity is low
  - Need for rearing house and host plant cultivation
  - O&M for spinning machines
  - Market linkages for different outputs within the value chain
  - Need to understand the role of traders and their influence
- Need for a diversified livelihood approach
- Policy emphasis on the value chain
  - Monetary support for rearing house
  - Resources for host plant cultivation
  - Training for spinning and weaving activities


Cocoon
Production

Life Cycle of the Eri Silk Worm

Disease-free Layings (**DFLs**) are obtained from **sericulture department** or via individual rearing.

INR 20 for 20 g / barter

Eggs hatch into larvae within a week. Larvae are fed with **tender leaves**.

Larvae feed on **castor**, **kesseru** and/or **tapioca** leaves.

Rs 50 for 1 bunch (lasts 3 days of peak eating)

Larvae spin cocoons, completing this stage in about three days.

INR 600-900/kg

Cocoons are harvested for silk.

INR 400-600/kg

The pupa is extracted for consumption or sale.

Adult butterflies or moths emerge from the cocoon, completing the life cycle.

Cocoons are harvested for silk.

The pupa is extracted for consumption or sale.

Eri Fry

Some spinners first degum the cocoons into ‘cakes’ before the spin the yarn.

Eri Spinning

Upto INR 3000 for 1 kg yarn

Yarns are dyed with natural ingridients like turmeric, onion powder, tea leaves etc.

Weaving is practiced on handlooms and floor looms

Eri is most commonly woven into shawls, stoles and mufflers.

INR 3000-5000 for a shawl
INR 1500-3000 for a stole

Cocoon Rearing | Current Practices

Obtaining DFLs

- From Sericulture Department
- From Individual rearers
- Maintain DFLs from each cycle

Feed for Larvae

- Castor (primary but seasonal)
- Kesseru (perennial)
- Tapioca (perennial)
- Borpat (perennial, in limited regions)

scope for innovation*

Sourcing feed

- Cultivate in their farm
- Cultivate as border to their farms
- Forage in the village
- Buy from the market or neighbours (money or barter)

- **Castor** is the **primary** host plant and Kesseru is utilised when castor is unavailable.
- The use of **Borpat** as feed in **specific regions** provides sustainability, as this tree lasts for 40-50 years.
- **Castor** is considered the best feed, providing **higher cocoon weight** while high **kesseru** feed results in **smaller sized cocoons**.
- A high **Tapioca** feed results in silkworms slipping off the surface which can in turn cause damage to the worm as they are highly sensitive.

"(When we feed more tapioca leaves), the worms fall down and become blind."

- Strimlei Doloi, Warmawsaw

- **Govt emphasis on host plant cultivation (Kesseru)- Problem Statement- Insufficient host plants for eri rearing)**

Cocoon Rearing | Current Practices

Week 1	Week 2-3	Week 4	Week 5	Week 5-6
Kept in newspaper and fed tender leaves	Shifted to bamboo trays or plastic trays and fed tender leaves and then mature leaves	Moved to dry banana leaves, bamboo trays or cloth for cocoon formation	Cocoons left in gunny bags or baskets covered with a cloth for maturing into moths	Moths placed on cloth for laying eggs

Rearing Space

scope for built environment innovation*

- Permanent (pakka) structure or makeshift area within the house
- Bamboo structure (to hang feed)
- Mosquito nets (for keeping flies away)
- Blankets (for maintaining warmth during winters)

- The rearing spaces are cleaned every day; at peak maturity, the rearing space is cleaned thrice a day to ensure there is no dust.
- Regional differences in cocoon colour can be found (usually white, in some areas it is orange, deep red and brown)

*Govt emphasis on construction of rearing house to support rearers impove their cocoon production

A: Week 1 larvae fed tender leaves and kept in a newspaper
B: Week 2-3 larvae fed tender/mature leaves and kept in a bamboo tray
C: Worms left in dry banana leaves for cocoon formation in a makeshift rearing space
D: Week 3 worms feeding on mature leaves in a rearing house
E: Worms covered with a blanket to maintain ideal temperatures.

Cocoon Rearing | Current Practices

Life cycles vary from region to region, individual to individual

Seasonal rearing	Continuous rearing
Engaging in other livelihoods Lack of rearing houses Unavailability of feed Harsh temperature (too cold)	Engaged in other livelihoods but maintaining DFLs for next cycle despite longer rearing cycles during winters

One life cycle (Jul to Oct) = 25-30 days
One life cycle (Nov to Mar) = 40-50 days

- Most activities are carried out between **July and November (4-5 cycles.**
- Many carry out only 2 cycles between **November and May** due to longer cycle lengths.
- On an average, 8-10 kg of cocoon is produced from 100 DFLs.

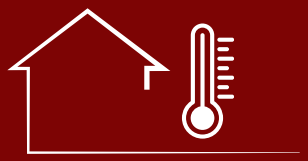
Seasonal rearing --> Continuous rearing: What will it take?

If seasonal rearing, then how can we package other livelihood solutions?

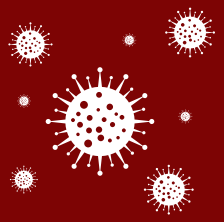
Seasonal Calendar
Assam
Meghalaya

Cocoon Rearing | Challenges

- Despite efforts to increase **host plant cultivation**, rearing households face a significant challenge due to **limited land availability**.



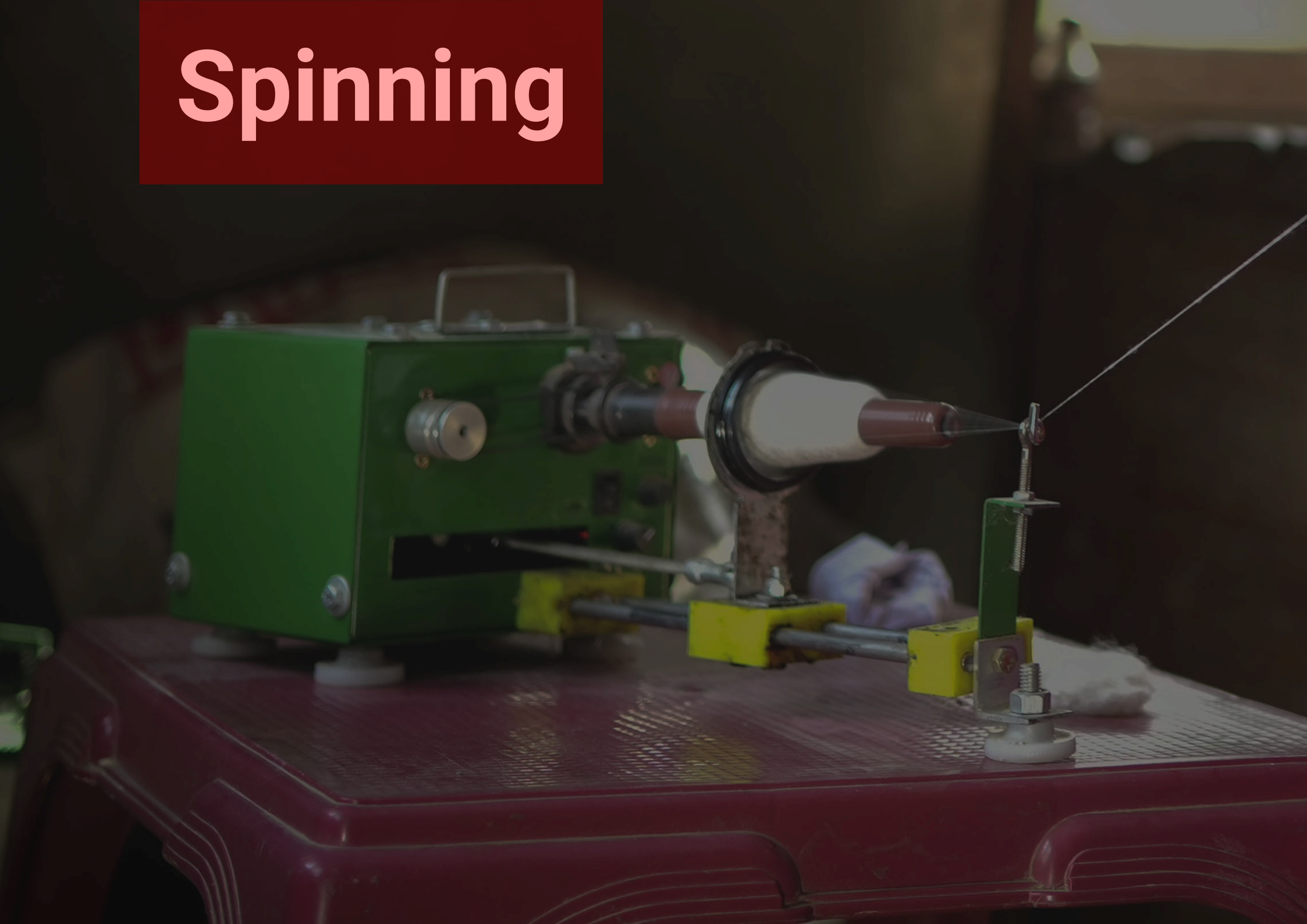
- The **lack of rearing houses** is a common challenge. **Temperature-controlled rearing houses** are deemed essential for maintaining optimal conditions.



- **Poor ventilation** and **excess moisture** results in diseases such as grasserie, flacherie, etc. Damp, shady place and foggy conditions in winter results in deaths of worms due to muscardine.

- The **quality of DFLs** influences the quality of cocoons. Some rearers face challenges in procuring DFLs, impacting the continuity of their rearing activities.

Spinning



Spinning | Current Practices

Source of Cocoons

- Individual rearing
- From the market
- Through associated organisations

Role of intermediaries

NGOs and FPCs supply cocoons to spinners. The spinners are paid for their service, the approximate wage is INR 2000-2500 per kg yarn.

Processes for Spinning

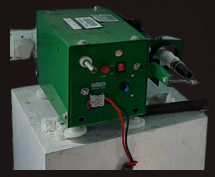
Boil the cocoons in hot water to soften the sericin (silk protein)
The softened cocoons are carefully opened and spread as cakes
The cakes are laid on wall for sun-drying
The dried cakes are used to for spinning

Dip the cocoon in water
Start spinning with the wet cocoon

Spinning | Current Practices

Hand spinning is a common practice, where skilled artisans use traditional handheld spindles (takli) to create yarn from the extracted silk fibre.

15g to 30g / day



Solar-powered and electrical spinning machines are utilised, offering higher production capacity and efficiency during blackouts.

Up to 200g / day

Automated spinning machines used by large-scale enterprises, such as Rudrasagar Silk Pvt Ltd., produce exceptionally fine and thin eri silk yarn. These machines contribute to the production of yarn with consistent thickness and a delicate texture.

Yarn Quality

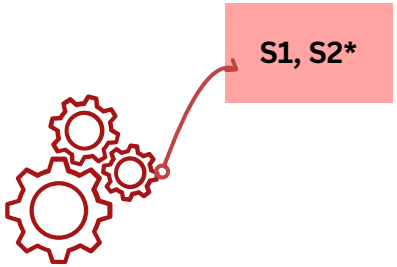
- Most Takli spun yarn is of 12 S -15 S and machine spun yarn is of 15 S -18 S.
- However there are **no grading machines** to qualify Eri yarn quality. They are graded by visual examination.
- Grading affects the price the spinners receive for the yarn.

The twsit count/thickness and quality of the yarn depend on the spinner's expertise.
Twist count determines whether the yarn is used for weft or warp during weaving.
According to the Sericulture department (Assam), wet spinning is used to produce yarn suited for warp purpose

Traditional Hand Spinning - Generational knowledge
Modern Spinning Machine - Need for training - by Silk Board, through Master Trainers

New spinners, inspired by the growing demand for Eri yarn and the potential for livelihood, **undergo specific training programs** to operate solar-powered and electrical spinning machines.

Spinning | Challenges



- Spinners face a **learning curve** when **transitioning** from traditional handheld spindles (takli) to spinning machines.
- **Mastery** of the machine **increases production capacity** significantly, but the **initial transition period demands time and effort.**

- Solar spinning machines encounter **operational and maintenance challenges**.
- Entrepreneurial **end users** have shared **resourceful solutions** to address these issues.

- The **unavailability of good-quality cocoons** results in the **stoppage** of spinning activities.
- This was reported by women associated with Grameen Sahara PC and Diya Foundation.
- **Availability** of cocoons during the **winter** is **low** as rearers cant control the temperature in their makeshift rearing rooms.

- Spinners reported market linkage as an issue. They **retained spun yarn when there are no traders** visiting the villages or demand in the market.

"When she (Mrs Klymdeit) faces any issue with the machine, she tries to resolve it on her own. There was an alignment issue because of which the ring would get stuck; she placed a piece of cardboard. Now the machine runs fine."

- Konila Mayong, Diwon

"The pin on cardboard boxes is heated and transformed into a ring. This ring is then used to replace the broken ring in the machine."

- Margaret, MOSONiE (referring to another end user)

Dyeing

Dyeing | Current Practices

Dyeing the yarn

- Natural dye
- Practised more in Meghalaya
- Roots, leaves, flowers, fruits and even seeds are used to dye the Eri yarn
- Natural Mordant (Soh Khu in Meghalaya) is used to set the dye on the yarn.

Regional differences

- Dyeing ingredients vary based on locality; in Assam's Mappakai FPC, purple is extracted from teak, while Meghalaya avoids teak.
- In Diwon, weavers at Kiniho use plain water for washing the yarn, while those at the Design Resource Centre use soap nuts.
- In Bhoirymbong, weavers reported that yarn procured from Assam (machine-spun) requires to be dyed twice, whereas yarn spun within the community needs to be dyed only once to obtain the colour of choice.

Processes for Dyeing

scope for built environment innovation*

Large, heavy vessels are utilised for boiling ingredients and yarn, requiring the collaborative effort of 3 or 4 women to lift them.

The heat source is typically firewood, exposing the artisans to smoke inhalation during the process.

Soap nuts are employed for washing dyed eri silk yarn instead of commercial soaps, reducing the risk of colour erosion.

Some ingredients used for dyeing are turmeric, hibiscus, onions, teak wood, tea leaves, Anatto seeds etc.

Dyeing | Challenges

- **Procuring high-quality** dyeing ingredients poses a persistent challenge.
  - This affects the colours of the fabric.
- **Colour consistency** remains a challenge. Variations in colour can impact the overall aesthetics of the final fabric.
  - Artisans address this by **consulting clients** to confirm colour preferences before proceeding with weaving, showcasing the importance of **client-artisan communication**.
- The process of dyeing is **drudgery-driven** and requires intervention for reducing the time and effort.

Photos sourced from Kiniho

"Dyeing the fabric is very hard. Four of us have to lift the vessel together, and we have to stand around it, inhaling firewood smoke while stirring it."
-Kong Wis Mallai (Kiniho), Diwon Village


Weaving

Weaving | Current Practices

Processes for Weaving

The spun eri silk yarn is wound onto bobbins. This prepares the yarn for the subsequent weaving process. Wooden winding tools are used.

The warp is prepared by aligning and winding the yarn on a warping reel or drum. This step ensures that the threads are evenly spaced and ready for the looming process.

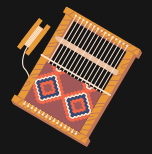
The prepared warp threads are threaded through the heddles and reed of the loom.

Weft threads run horizontally across the fabric and are introduced through the shed created by the lifted heddles.

This process is done manually by interlacing the weft threads with the fixed warp threads to create the woven fabric.

Preparing the loom

- Maintaining proper tension during yarn preparation is essential. **Inconsistent tension** can lead to weaving issues, such as **uneven fabric texture or breakage**.
- **Traditional handlooms or floor looms** are used.
- The warp yarn is characterised by higher twist counts and tensility, while the weft is softer with a lower twist count.



Weaving | Current Practices

Weaving and its intricacies

- Weavers pay attention to the tension in the warp and weft threads and make adjustments based on pattern intricacies or fabric density.
- **Weavers in Assam** are renowned for their expertise in weaving intricate designs, while those in Meghalaya excel in the art of **dyeing**.
- Weavers experiment with yarn, by mixing cotton and mulberry to explore market demand for different price range and for design needs. Mixing with cotton yarn reduces the price of the fabric, while mixing with mulberry yarn gives the fabric the shine that consumers associate with the word “Silk”.
    - Cotton and mulberry are used for warp threads, and Eri silk, both hand-spun and machine-spun, is used for weft threads.

Weaving | Challenges

- Meeting **market demands for diverse designs and colours** requires adaptability.
- Eg.: Eri Weave wants to provide training to its network of weavers in designing, while weavers associated with Grameen Sahara wish to learn more about dyeing.

- Establishing and **maintaining effective market linkages** is a challenge for independent weavers.
- Some of the independent weavers have **dismantled their looms** because of **low demand** and some have taken up weaving cotton fabric.

- Weavers face challenges in **accessing consistent supplies of high-quality eri silk yarn.** The quality of yarn directly impacts the final product.

What data tells us?

What data tells us

Market Linkage and Production of yarn

Those who have traders visiting their homes to collect yarn have a higher production capacity than those who find their own customer base.

Traders buy cocoons and yarn.

Training built the capacity of users to utilise machines and thereby improved the yarn quality and quantity.

What data tells us

Weaving

Approach 1: Organisations like Diya Foundation, Grameen Sahara PC, Mapakkai FPC **procure woven fabric** from their network of weavers.

Approach 2: Organisations like Kiniho, AVA Creation, EriWeave, Zong-hi-i and Nangcwa Textile procure yarn (hand-spun and machine-spun) and have **in-house weavers** to produce different kinds of fabric.

Approach 2 allows for **creative inputs from designers and marketers** who consider **demand estimation**. This opens up new market avenues for Eri fabric.

What data tells us

Government schemes enabling production

Government schemes (Bodoland Sericulture Mission) are currently focused on **pre-cocoon activities**, which include cultivating host plants for Eri, constructing rearing houses and providing DFLs.
This **enables users to increase their production** as most of them restrict their production due to the unavailability of feed and space.

Role of champions

Champions **take ownership** of the technology they have and learn to carry out **basic servicing and rectify issues** (if and when they emerge)

Champions also take up the **role of trainers**, which motivates others in the community to take up tech solutions.
Eg. Ms Philim Makri from Warmawsaw has trained over 50 women in utilising Eri Spinning machines.

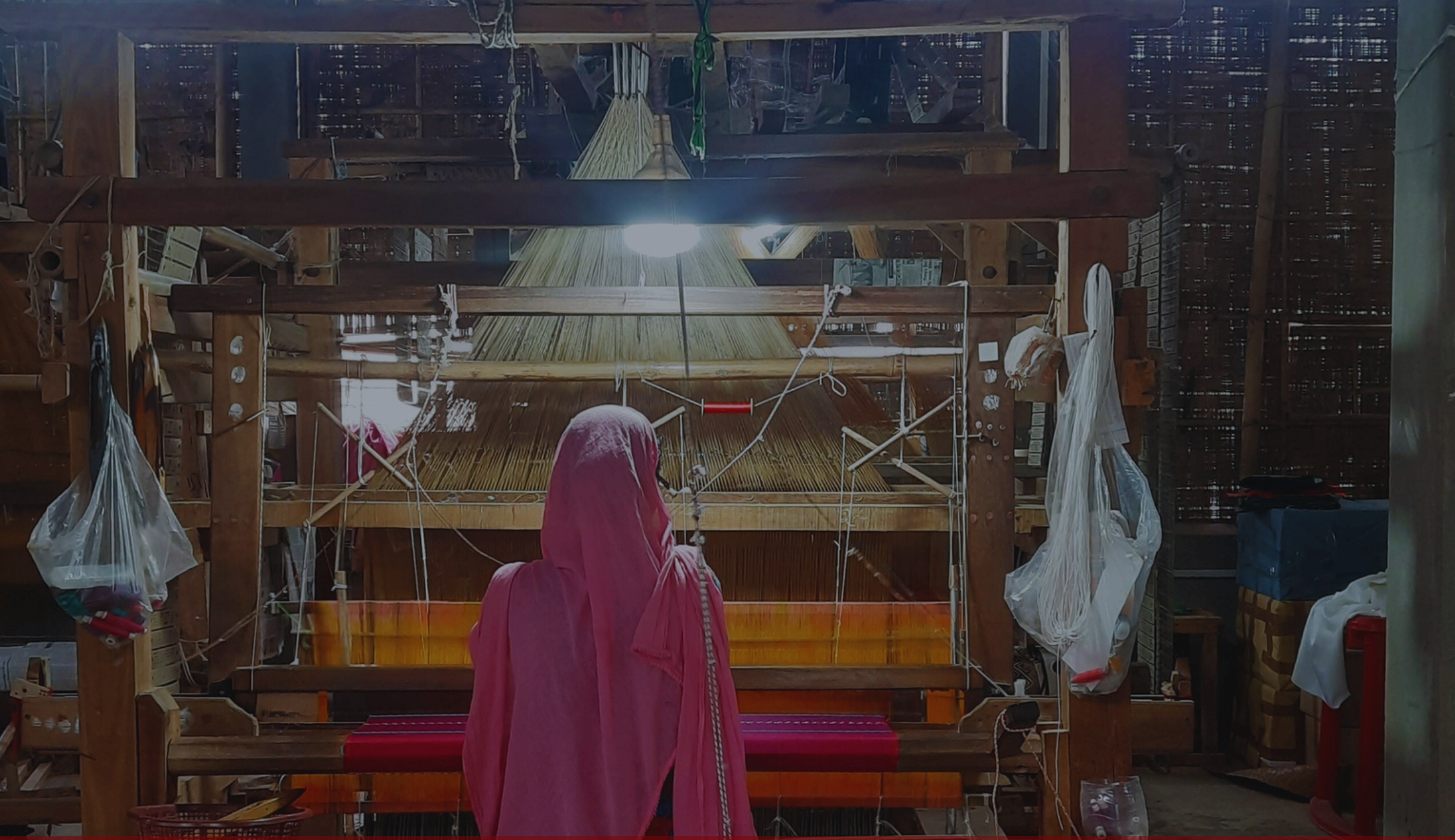
Building awareness that technology allows for higher productivity in a shorter span of time motivates users to take up the tech and another livelihood activity.
Eg. Ms Jacinta has taken up sewing clothes as using a spinning machine has freed up more time in the day for her.

SELCO Foundation’s Impact in the Eri Spinning Space

Implemented over 300 eri spinning solutions across Assam, Meghalaya, and Mizoram.

Currently piloting rearing houses to tackle the challenges identified in our study, including limited rearing space and temperature control issues.

Continuing to innovate and support sustainable livelihoods in the eri silk ecosystem through decentralized renewable energy (DRE) solutions.



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