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# Investigating the Kangra Valley Tea Industry

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# Investigating the Kangra Valley Tea Industry



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**WPI**



# Investigating the Kangra Valley Tea Industry

An Interactive Qualifying Project  
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degree of Bachelor of Science

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Report Submitted to:

Professors Lorraine Higgins and Ingrid Shockey  
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# ABSTRACT

In recent decades, Kangra Valley tea production has declined by 50% predominately among farms less than a hectare. Our goal was to investigate small-scale tea production and develop suggestions and innovations beneficial to small estates. Tea growers were interviewed and surveyed to identify the vulnerabilities in the region. We designed a mechanical harvester to improve efficiency and reduce the need for labor, and produced recommendations to revitalize the Kangra tea market and modify government policies.

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# EXECUTIVE SUMMARY

## Understanding Tea and its Decline in the Kangra Valley

Tea, the second most consumed drink in the world, is obtained from the *Camellia sinensis* plant. India is the second largest tea producer after China, and grows and processes over a billion kilograms every year pre-eminently in the states of Assam and West Bengal (ITA, 2015). Though less well-known than other tea cultivating states, Himachal Pradesh has 2,000 hectares of land being used for tea agriculture (Figure 1). However, in recent years, Himachal Pradesh noted a significant decline in production.



*Figure 1. Kangra Valley tea estate.*

Most of the state's tea grows in the Kangra Valley, known as "the valley of gods". This Himalayan region produces black orthodox tea and green tea, considered some of the finest in the world (ibid). While Himachal Pradesh boasts a large area of land dedicated to tea estates, only half this land is currently in active production. Numerous challenges over the last century, including changing government policies, declining markets, climate change, and labor problems have burdened the farmers. According to the Tea Board of India, growers find it increasingly difficult to sustain their estates.



These concerns have caught the attention of the Tea Board of India and Indian Institute of Technology Mandi (IIT-Mandi) because tea production in the Kangra valley is closely tied to the economy of Himachal Pradesh. Therefore, the goal of this project was to investigate small-scale tea production in the Kangra Valley and suggest innovations beneficial to these small tea farms. The goal was achieved by first documenting the Kangra Valley tea industry; second, identifying strengths and vulnerabilities in small tea estates and in tea production processes; and third, developing criteria for implementing appropriate technology, and suggesting modification of existing government policies in relation to the tea industry.

## Kangra Tea: History, Scope, and Production

In 1849, Dr. Jameson, the Botanical Gardens superintendent of North West Kangra, planted the first tea seedlings in Northern India. Three years later he established a commercial plantation near Palampur, which sprouted the tea industry in the Kangra region (Guar, 2008). There are currently over 5,000 registered tea growers in Himachal Pradesh, out of which only 1,200 are active according to government records. The majority of farm owners cultivate a hectare or less of land for tea. These tea growers and Kangra tea processing factories still use orthodox methods.

The tea process begins with the cultivation of the tea plant. It takes four years for the tea plant to fully mature before workers can pick the leaves. Once mature, the tea estates harvest the leaves approximately every two weeks. These harvesting periods are called flushes. The first flush, harvested in April, produces the most desirable tea (ibid). To harvest the leaves, workers pluck the tea branch's tip, removing two leaves and the apical bud (Figure 2). This allows the plant to continuously grow buds and ensures the youngest leaves are always picked.



*Figure 2. Freshly picked two leaves and a bud.*

In several large tea estates, automatic harvesters have modernized plucking, but in many cases workers still pluck by hand. Estates owners claim to pay 8 to 15 rupees to workers per kilogram of green leaf, or at a flat rate of about 200 rupees a day. Tea plucking is a time-consuming process and strains farmers and workers physically, introducing musculoskeletal issues in the hands and wrists from repetitive motion (Dihingia & Dewangan, 2012).

After tea harvesters pluck the bushes, the leaves are processed. The orthodox tea method for black tea includes withering, rolling, fermentation, and drying, while the green tea method includes withering, steaming, rolling and drying (Figure 3). The lack of fermentation in green tea preserves the polyphenols, increasing the health benefits and market price (Suzuki, 2012, 88). While packaging tea, workers sometimes combine black with green tea to create a unique blend.

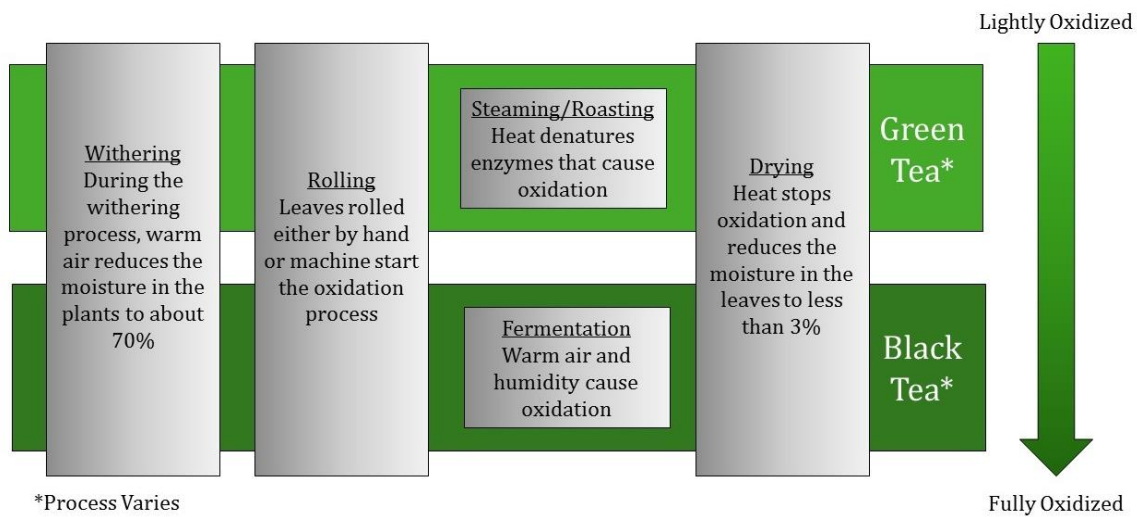


Figure 3. Green and black orthodox tea process.

Unlike large estates and factories that use machines, small growers chiefly process tea by hand. Large estates and processing facilities can afford electric harvesting shears, withering troughs, rollers, and dryers to increase productivity and efficiency. Many factories process thousands of kilograms a day, while small tea estates struggle to produce a fraction of that. For example, factories use machine rollers that evenly apply pressure to the leaves for 30-45 minutes (UPASI, 2014). These machines can roll about 120 kg per load. In comparison, hand rolling requires small estate workers to roll leaves between their hands or to use bamboo mats, capable of producing 500 grams in 15 minutes (Sato, 2007, 1).

Some farmers with under a hectare of land sell their leaves to processing facilities. The facilities grade the quality of the leaves, paying the farmers accordingly. Processing facilities are currently not subject to regulated pricing. When small estates process their own tea, farmers struggle to market their product. Kangra tea is not a well-established brand, and most of the tea goes into auction in Kolkata. Auction prices widely vary, which

makes tea production an unreliable source of income. As a result, some farmers have abandoned their estates or only produce tea for their personal use.

In this project, we took into consideration the background information and problems noted in the cited literature and further explained to us by officials from the Tea Board. Exploring the similarities, differences, and relations of large and small tea estates enabled the team to understand the larger context of the Kangra tea industry before engaging in field work to study the industry in more detail.

## Methodology: Strategies for Investigating the Industry

The goal of this project was to investigate small-scale tea production in the Kangra Valley and suggest innovations beneficial to these small tea farms. In order to accomplish this goal, we established several objectives:

- Documenting tea production and estates in the Kangra Valley
- Identifying strengths and vulnerabilities in small tea estates and in tea production processes
- Develop criteria for implementing technology and policies

We implemented several research strategies to meet each objective (Figure 4).

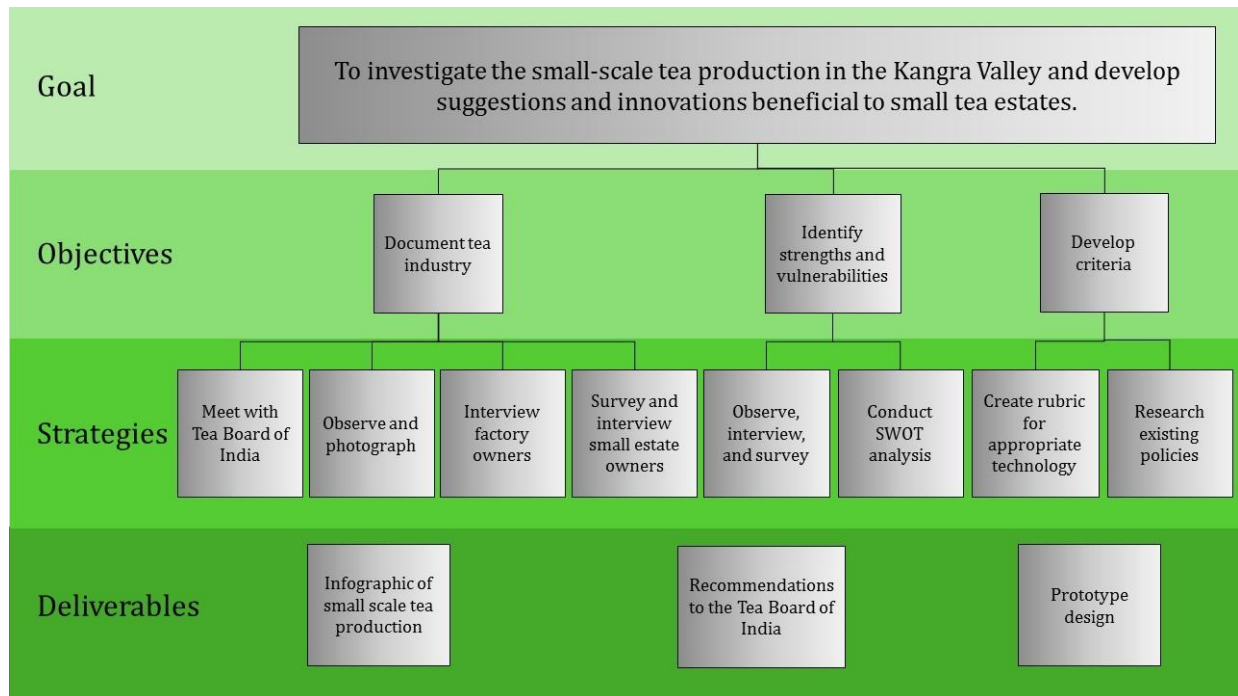


Figure 4. Methodology for project.

To begin documenting the tea industry, we first met with the Deputy Director of Himachal Pradesh from the Tea Board of India. This representative provided us with an overview of the processes in tea production and helped us establish contact with tea estates and facilities in the Kangra Valley. To collect additional data on the industry, we visited two larger estates and three processing facilities. During the visits to the large estates and factories we conducted semi-structured interviews with the owners and managers regarding the production process, and took photos of the estate and equipment.

We then set a goal to meet with 30 small tea farms (approximately 3% of total growers), and actually met with 34 farmers. Using a directory of small growers provided by the Tea Board, seven villages were randomly selected from four blocks in Kangra district (Figure 5). Then we randomly selected six farmers from each village, allowing us to get a spectrum of representation. We selected more farmers than our goal, assuming some farmers would not be available. We used a survey to record demographic information, data about the farms and practices, and their perceptions on the role of the Indian government in tea production and the challenges they perceived in their work. The team split into small groups to interview the farmers. Interviewers (IIT students) recorded the farmer's answers on a paper survey and later translated for the team. During the documentation and interview process we took photographs of the small-scale tea production processes and the estates. Some of the interviews were audio recorded for reference and later analysis. Data was stored in a safe and secure location during and after the research was completed. During the whole process, farmers were disassociated from the data by using numbers instead of names to protect their identities.

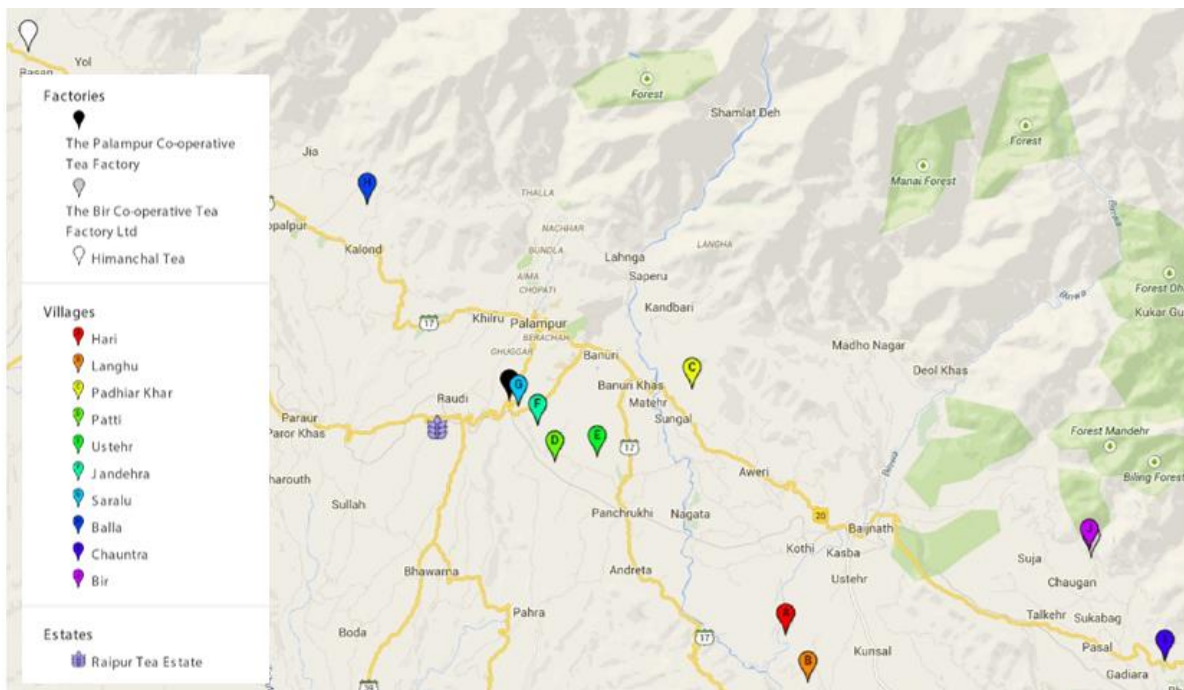


Figure 5. Map of sampled tea estates, factories, and villages.

Data was analyzed based on age, land size, location, and if growers sold or processed tea to see if these factors played a role in the processes they used and vulnerabilities they faced. A SWOT (strengths, weaknesses, opportunity, and threat) analysis of the data was used to identify major strengths and vulnerabilities affecting small tea estates.

Finally, we identified possible technological prototypes that could address these needs, and created a rubric of criteria for the prototypes design based on the above data collection. These criteria included not just practical and technical considerations but socioeconomic ones as well. We also created suggestions for the Tea Board, using the above analysis, policy research, and our insights about the biggest constraints for the growth of the Kangra tea industry.

## **Results and Discussion**

### ***Documenting the Kangra Tea Industry***

The team began documenting the tea industry at two large estates and factories on the Raipur Tea Estate, and one factory in Sidhbari. Each estate was well-maintained and the factories were clean and sanitary. On average, the factories hired 8 workers, and each factory had the capacity to produce 5000 kg of tea a day.

We observed estate laborers harvesting leaves using two methods. To produce a higher quality tea, the laborers hand plucked tea leaves. Hand plucking ensured that the harvested crop primarily consisted of two leaves and the bud. For a lower grade tea, the workers used machine harvesters, which enabled two operators to collect 100 kgs/day. However, the harvester cost 26,000 rupees, was loud, and required fuel. It also gathered waste leaves (Figure 6). To increase processing yield, the factories also bought plucked leaves from local tea farms. For example, the Sidhbari factory bought and transported sacks of leaves from ten separate farms by truck.

All three factories produced green and black tea. The exact protocol varied on the factory and type of tea, but each factory used large machinery to process the leaves. Standard equipment included withering troughs and fans for withering, rolling machines to twist the leaves, and conveyer-belt dryers and wood furnaces to dry the tea. These machines cost several lakh (100,000) rupees, and had a capacity of 125 kilograms per batch.

The factories sold their tea using two different methods. One owner sold to the Kolkata auction, the primary wholesale auction center in India. The owner informed the team his product was blended with tea from other states. The other owners created their own brands, Himalayan Brew and Himanchal Tea, within the past ten years and marketed their tea independently. Himalayan Brew targeted the national and international market, while Himanchal Tea focused on domestic markets. Although the large estates and factories were not included among our stakeholders, touring these facilities gave the team an overview of Kangra tea.



*Figure 6. Workers use machine harvester to gather tea.*

Small tea growers were our primary stakeholders, so data collection focused on field visits to 34 small estates in Hari, Langhu, Padihar Khar, Patti, Balla, Saralu, Jandhera, and Ustehar. Interviews revealed diverse situations. The average garden size was 0.89 hectares, and the range was 0.005 to five hectares. Six out of 34 farms were inactive, overgrown with weeds, and the plants under maintained. Twenty-seven farmers actively harvested tea to produce at home or sell to a factory. While some owners regularly pruned their bushes, others estates lacked consistent maintenance. In several cases, bushes were uneven, making plucking difficult. In one circumstance, an estate leased land to another farmer to maintain and collect leaves. Due to labor and maintenance cost the estate owner did not profit from the lease agreement (Figure 7).

Except for three farmers, tea growing was not the primary source of income. The majority of estate owners were retired mostly from government service jobs, and the mode age was 60 (Figure 8). The majority of owners were over 60. They relied on their family or laborers to tend crops and pluck leaves. Twelve out of the 27 farmers hired laborers to pluck the leaves for an average rate of 9 rupees per kilogram or 230 rupees a day.

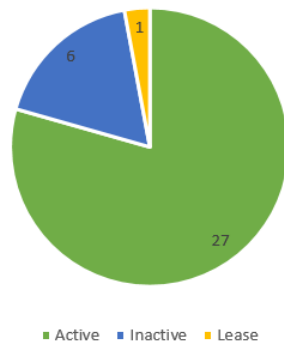


Figure 7. Small-scale estate activity.

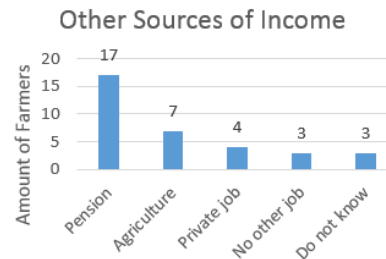
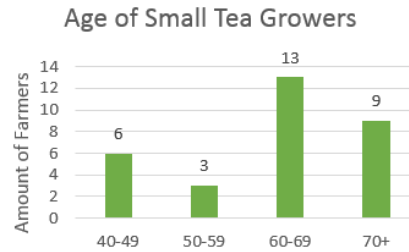


Figure 8. Estate owner demographics.

Every active farmer interviewed produced tea at home in some capacity. Only four produced green tea; however, several farmers expressed interest producing green tea if given educational training. With the help of their families or laborers, the majority of estates plucked the tea by hand. One farmer claimed to use shears to harvest the leaves while another had a diesel-powered harvester he used when he did not hire laborers. The withering process took place inside a cool room or in the shade. After withering, the leaves were hand rolled with cloth or a bamboo mat. In Langhu and Ustehar, several tea growers sent their tea to a nearby factory to have it rolled. The factory charged 175 rupees per batch (70 kg) for rolling and additionally 200 rupees for transport. In many estates, fermenting and drying were simultaneously done. Farmers placed the rolled leaves on a mat on their roof and left the leaves for several hours.

Since tea was generally viewed as unprofitable by small farmers, 41% of active farms produced tea for personal use only, though in the past have sold some tea to auctions. The rest sell the leaves locally for an average rate of 200 rupees/kg.

### **Strengths and Vulnerabilities of Small-scale Estates**

During our fieldwork, the team identified strengths and vulnerabilities that affected small estate owners. An immediately apparent strength was the quality of Kangra tea. The orthodox method for black tea produced a unique flavor and richness, as tasted firsthand at the homes of many farmers. Furthermore, the Kangra green tea process preserves high levels of polyphenols and antioxidants, increasing health benefits.

Although the situations in each village differed, farmers reported consistent vulnerabilities (Figure 9). The farmers most frequently complained about labor costs. Several expressed that they could not afford laborers to maintain and pluck their gardens because the profit margin would be small. Tea growers also often complained about the market. Although some farmers sold to the local market, the biggest market for Kangra Tea

was the Kolkata auction. Auction buyers purchased tea at wholesale price, which rendered small-scale tea production undesirable due to the small quantities.

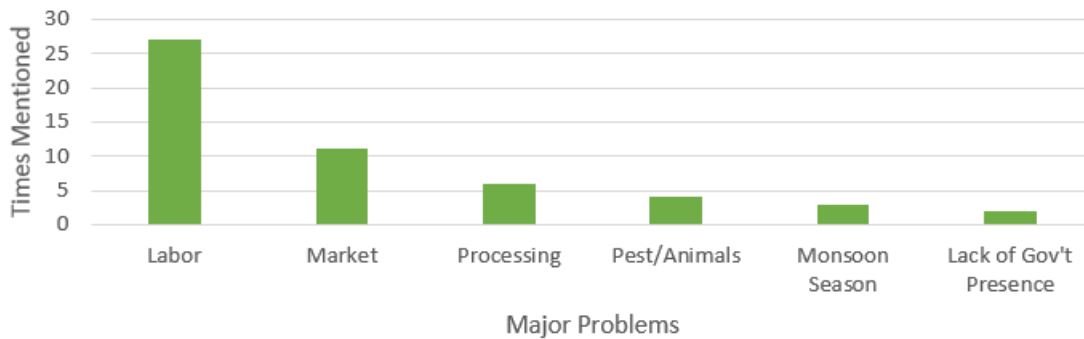


Figure 9. Vulnerabilities in small-scale tea production.

The other major complaints included processing problems and unwanted pests or animals. Withering and drying during the monsoon season is difficult, because farmers rely on sun drying. In this case, farmers are forced to sell the fresh leaves to factories for low prices. Rolling is time consuming and labor intensive when done by hand, producing small batches at a time. With regard to pests, several tea estates did not have fencing, which enables stray animals to eat the tea leaves. Furthermore, all the farms were organic, increasing crop loss to bugs and weeds.

A notable problem was the reported communication between farmers and government. When asked, the majority of farmers suggested that they received limited information from state government regarding schemes beneficial to tea growers. The Tea Board, however, had more positive reviews from farmers, particularly over the past few years with the appointment of a new deputy director for Himachal Pradesh (Figure 10).

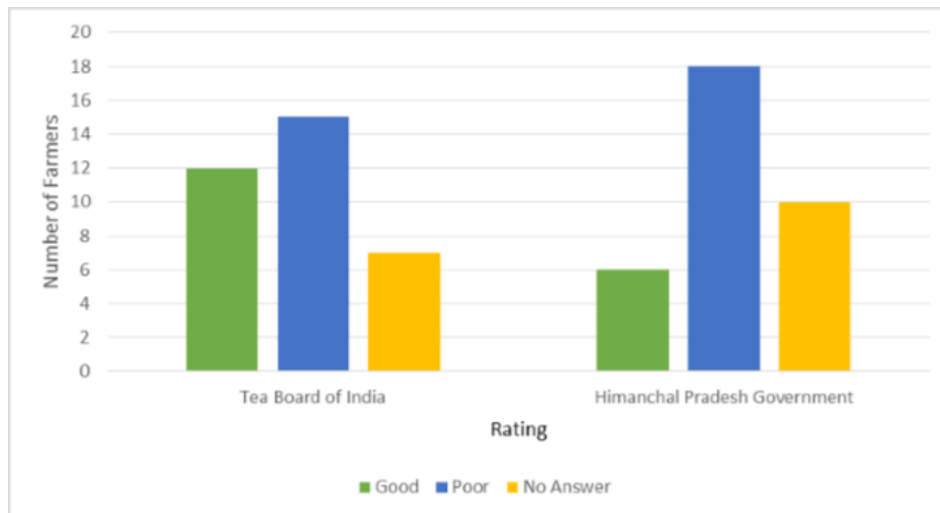


Figure 10. Small-scale farmers rating of existing schemes and government aid.



After identifying strengths and vulnerabilities, the team organized this information into a SWOT chart (Table 1).

Table 1. SWOT analysis.

Strengths	Weaknesses
<ul style="list-style-type: none"> <li>-Taste</li> <li>-Organic, orthodox processed and high quality tea</li> <li>-Active Tea Board</li> <li>-New brands arising from large factories</li> <li>-Available land</li> </ul>	<ul style="list-style-type: none"> <li>-Divided, small-scale estate community</li> <li>-Inactive farms</li> <li>-Poor communication between estates and government</li> <li>-Labor cost and availability</li> <li>-Labor intensive, manual tea plucking and production</li> <li>-Lack of local market and marketing strategy</li> </ul>
Opportunities	Threats
<ul style="list-style-type: none"> <li>-Domestic and International Marketing</li> <li>-Self-help group expansions</li> <li>-Technology for small estates plucking and processing</li> <li>-Government schemes towards self-help groups and technology subsidies</li> </ul>	<ul style="list-style-type: none"> <li>-Unwanted pests and animals</li> <li>-Monsoon season</li> <li>-Aging Farmers</li> </ul>

### **Developing Criteria for Policy and Technology**

Mechanization of plucking was chosen as a focus because 27 farmers mentioned harvesting as a problem and all complained about labor time and cost for collecting leaves. To properly address this issue, we researched and developed an appropriate technology criteria rubric for the small tea estates. We noted criteria related to size, cost, material selection, stakeholder perceptions, human factors, efficiency, and output effect (Table 2).

This criteria rubric informed our design process. We assessed existing plastic shears with an unattached bag and eliminating many existing design features, including the shears. The design needed significant improvements in material selection, efficiency, and human factors because the tool was unbalanced. Additionally, the shears needed more efficient way to toss the collected leaves into a larger container.

Table 2. *Appropriate Technology Criteria Rubric for Small Tea Estates.*

Category	1	1/2	0
<b>Size</b>	Appropriate to site of application.	Size is manageable for site of application.	Size is not manageable or appropriate for site of application.
<b>Material Selection</b>	Locally attainable materials properly chosen to fit role of product.	Materials chosen to fit role of product, may be difficult to obtain for manufacture	Materials chosen have no relevance to role of product, not locally available,
<b>Ease of Maintenance</b>	User can fix and repair by self.	Requires some outside help to repair	Must send to manufacturer to repair.
<b>Usability</b>	Intuitively used by any person.	Requires some instruction to understand.	Lots of instruction and training required to use.
<b>Efficiency</b>	Productivity has gone up. Product is an appropriate use of resources	Productivity remains the same and resources used are somewhat wasted.	Productivity goes down and resources are completely wasted.
<b>Stakeholder Perception</b>	Praise or like product.	Indifferent towards product.	Dislikes product.
<b>Cost</b>	No to low cost for stakeholder.	Subsidized and/or reasonable cost. Manageable expense.	Product is too expensive for stakeholder to purchase and make a profit.
<b>Human Factors</b>	Product has no negative human factors or effects.	Has some negative human factors or effects but none that are severe.	Causes major problems for humans; Although innovation is good device does not reduce negative effects
<b>Effect on Output</b>	Output quantity has increased. Quality is better.	No change in output quantity or quality.	Output quantity or quality has decreased.

### **DISCUSSION: A NEW LEAF FOR SMALL GROWERS**

The Kangra Valley holds immense opportunity for thousands of small tea farms to flourish and produce high quality, organic tea from one of the most beautiful corners of the country. Small-scale production allows for careful control of the process and results in a distinctive product, strengthening the commercial value as well as market demand.

Small growers realize this potential; when asked, 100% replied favorably to the idea of starting a Kangra brand. However, they are not equipped with the financial support or marketing skills that large estates have to do this.

Even if farmers have means for purchasing processing machinery, few inexpensive designs exist for tea production on such a small scale. They also have space constraints. Moreover, the most time consuming part of their business, plucking, has few affordable and ergonomic alternatives to standard shears. If harvesting equipment could be efficient and cost-effective, it would be the first step in boosting production and profits of their exceptional tea.

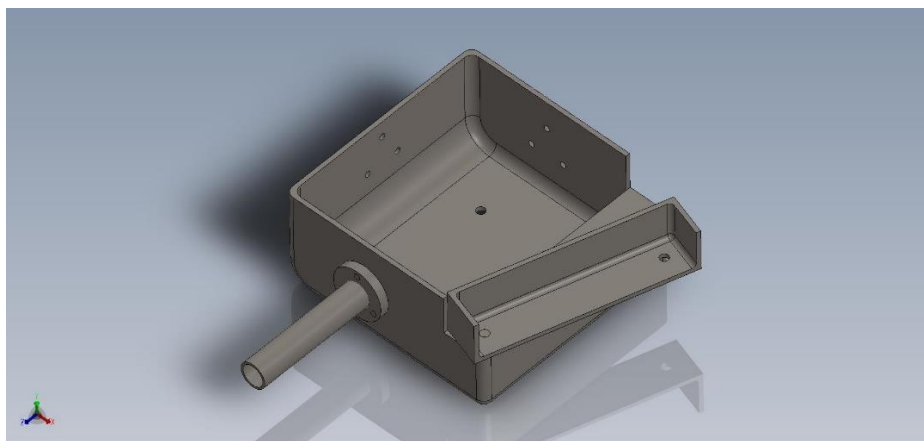
The trend in decline of tea production in Kangra Valley has been dramatic; an alarming number of farms have been abandoned. Because farmers have other occupations, their motivations to continue growing tea are minimal. Without incentives for the farmers, the risk of the small-scale Kangra tea industry disappearing is an actual possibility. There is great opportunity for government involvement, especially from the Tea Board of India. Many extremely beneficial schemes are currently in place, but are primarily targeted at major tea producing states like Assam and are difficult to scale down to Himachal Pradesh. For example, the Tea Board defines a small estate as under 10.12 hectares of land, but nearly all the farms surveyed and those listed in the directory of tea growers were under a single hectare. This indicates that government schemes do not currently take into account the site-specific constraints of these relatively small farms; however, these farms constitute over 98% of farms in Kangra district.

## Project Outcomes

The approach for tackling problems affecting tea production in Kangra Valley can be broken down into four categories: labor, communication, policy modification, and market creation.

### ***Addressing Labor Issues: Prototype Design***

To tackle the labor problem, we developed a prototype using the rubric for appropriate technology (Figure 11). This new design for a plucking tool was designed to speed up the plucking process and reduce labor costs. The tool features a 10 inch square box, which is small enough to handle by a single worker and accurate while plucking the leaves. The prototype could be made out of several locally available materials including metal, plastic or wood. The box design is simple to use, and the few, nonelectric parts would make it inexpensive and easily repairable. Also, the device is expected to be accepted by farmers because several farmers expressed the need for mechanization during the interviews. Currently, the team is unaware how the prototype would affect efficiency, workers, and the crop. Field-testing of existing devices against the proposed prototype needs to occur to understand these factors.



*Figure 11. Prototype design for a manual plucker.*

### ***Communication Improvements***

A mobile-based Agricultural Advisory System (AAS) is currently under development by the IIT-Mandi to address the need for better communication between farmers and the Tea Board. The AAS would function as an online database of tea growers' information, and also operate as a call center to help farmers with concerns or questions. We suggest a few specific features be added. First, a list of processing facilities and their current price listings for green leaves as well as any other services they may offer. This will provide transparency between factories and farmers who choose to sell their fresh leaves. Second, a listing of all available schemes should be put on the AAS website; these are currently difficult to find, and, according to farmers, not advertised effectively. A way for farmers to apply for these schemes online or to begin the process on the phone would be helpful as well.

### ***Policy Change and Market Creation***

Changes to existing schemes could greatly improve the output of the entire Kangra district. Many schemes are available for farmers through the Tea Board of India, but none are tailored to the state of Himachal Pradesh, which is different from other tea growing states. Small farm size, uneven terrain, and lack of local markets provide a specific set of challenges for tea growers in the region. A report of recommendations for the Tea Board of India and tea farmers in Himachal Pradesh has been generated as a supplement to this study to target policy changes and market creation. It includes suggestions to expand personnel, increase the amount of information available online, provide training for green tea production, and most notably modifying of the self-help group (SHG) scheme. The SHG scheme allows at least 20 farmers with a minimum 20 hectares of land to join together to apply for subsidies for farming equipment, and we propose the following changes:

- Decrease the required minimum collective land size.
- Focus subsidies on processing so a group of farmers can produce tea of the same quality.
- Provide programs for green tea processing.
- Provide subsidies for initial marketing to kick-start local brands.

For the survival of Kangra tea, a niche market can be created in order for the industry to prosper. Because the amounts produced are low, the tea should not be sold in auction. The first step is ensuring that enough tea can be produced with the same level of quality to sell under one brand. One strategy that can be utilized is the formation of collectives of farmers who process their leaves in the same place and with identical methods. The tea can be sold in tourist locations through local vendors including Himachal Pradesh Horticultural Produce Marketing and Processing Corporation LTD. (HPMC), an organization that sells local products throughout the state. The HPMC and Tea Board could promote Kangra tea to the public through educational campaigns. Using infographics and advertisement, the consumer could be introduced to the uniqueness of Kangra orthodox tea making it more appealing. Using the SHG scheme is a way to approach better marketing, and tea growers should be encouraged to apply to these programs.

## Conclusion

Problems facing the Kangra Valley small tea estates are multifaceted and complex. The study revealed several processing, socioeconomic, marketing, and policy issues hindering the tea growers from producing tea at full potential. We developed several suggestions to begin addressing the challenges facing the industry. We present a mixture of technological and social deliverables because a single solution is not the answer to the complex situation in the region. Many small steps need to be taken to revitalize the Kangra tea industry, involving a collective effort from tea growers, the Indian government, and the consumers.

The team achieved the project's goal. However, the scope of the study was extremely broad, and further research can be done to enhance each of the respective outcomes. Future ISTPs and IQPs could focus on a single, unique problem pertaining to the Kangra tea industry. For example they might develop a small-capacity and cost-efficient rolling machine or drying mechanism, or they might investigate the implementation and effect of modified government schemes. This project and future projects have great potential to bring lasting change to the region.

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# SUPPLEMENTAL MATERIALS: METHODOLOGY

## ***Fieldwork Interview Questions for Large Estates & Factories***

This trip (March 28th-29th, 2015) will focus on large-scale tea production. It will allow the team to gather a broader sense of tea production, and explore the tea industry in Kangra Valley from all aspects.

### *Goal of these interviews:*

- Fully understand the tea process
- Learn which process is the most time consuming and labor intensive
- Learn about Kangra Valley tea industry and the biggest issues it faces
- Start investigating the creation/encouragement of a green tea market
- Talk with estate workers to see what problems they face with plucking/what innovations exist/what innovations can be explored
- Begin establishing contacts for future field work

### Tea Board

1. What are you looking for as an outcome for the ISTP project (7 weeks)?
2. Why haven't you already implemented existing technology into Kangra Valley?
3. What schemes and subsidies do you provide to large estates and factories? How do they differ from small tea farms?
4. How much interest does the government have in promoting green tea in the Kangra Valley?

### Factory Owners/Management

1. Is the factory privately owned or a cooperative?
2. How old is the factory?
3. What type of tea do you produce? Change/trend in past years?
4. How much tea do you produce annually? Has there been a change/trend in the past years?
5. How much do you pay for a kg of tea leaves?
6. For how much do you sell a kg of processed tea?
7. Do you own your own tea estates or buy tea from an outside source?
8. How many farms do buy tea leaves from?
9. Have you made any recent renovations to your factory? Why?
10. How do you buy your equipment? How much does each machine cost?
11. About how much does each process cost? Cost of upkeep? Labor?
12. How and where do you sell your tea?
13. Have you noticed any changes in the Kangra Valley tea industry in the past decade?

## Factory Workers

1. How many workers are there?
2. Worker demographic
3. Which process is the most time consuming? Labor intensive?
4. How long do you work in a day?
5. How much do you earn?

## Process

Ask for an explanation/description of each process, take photos & notes.  
These questions are a guideline for collecting information.

## Sorting

1. What is the purpose of sorting the leaves?
2. How is the tea sorted?
3. Is it time consuming? Labor intensive?
4. Is different tea leaves used for green tea versus black tea?

## Withering

1. What is the purpose of withering the leaves?
2. How long do you wither the leaves for black tea? Green tea?

## Rolling

1. What is the purpose of rolling the leaves
2. What type of/ how big is rolling machine the factory is using?
3. How long does the process take?
4. How much leaves can the rolling machine roll at one time?

## Fermenting

1. What is the purpose of fermenting the rolled leaves?
2. How does the factory ferment the tea?
3. How long does the process take?
4. What is the ideal temperature and humidity for fermentation?
5. How does the fermentation process differ for green and black tea?

## Drying

1. What is the purpose of drying the leaves?
2. What type of dryer is used?
3. What is the ideal temperature and humidity for drying?
4. How does the drying process differ for green and black tea?

## Packaging

1. How is the tea packaged?
2. Is it an automatic, semi-automatic, or manual process?

### Estate Owners

1. How old is the estate?
2. What is the size? Any changes in land area under tea?
3. How much tea does your estate produce?
4. What is the biggest obstacle to growing/producing more tea?
5. Do you sell to a processing factory or process your own tea?
6. (If they process their own tea) How do you process your tea? Which process in most time consuming? (If they sell the leaves) Which facility do you sell you tea leaves to?
7. For how much do you sell your leaves per kg?
8. Have you created or implemented any tools in the plucking process?
9. Do you see a need for tools or new technology in your farm?
10. How is your current communication with the Tea Board of India?
11. What resources do they provide you and your farm?

### Estate Workers

1. How many workers?
2. Demographic?
3. Wages?
4. When did you start working?
5. How much tea do you pluck in a day?
6. Do you pluck by hand or with a machine?
7. Would you like to have a tool or machine to help with plucking?
8. Do you have any ideas for tools in tea plucking?
9. What is the most difficult aspect of plucking tea?
10. Any other employment?
11. Family size
12. Family employment
13. Where are you from? HP or other state?
14. Where do you live?

## Kangra Valley Tea Farmers Survey

### Demographics

<b>Name</b>											
<b>Address</b>							<b>Mobile</b>				
<b>Age</b>		<b>Community</b>	General	OBC	SC	ST	<b>Gender</b>	M	F		
<b>Total land size/plants for tea</b>							<b>Total annual yield (kgs)</b>				
<b>Other sources of incomes</b>											
<b>Dormant season occupation</b>											

Do you sell your tea to a factory? (Y / N)

If yes, fill out below:

<b>Where</b>										
<b>Amount sold to factory (kgs)</b>				<b>Price/kgs</b>					<b>Is price fair?</b>	Y / N
<b>Part of co-operative?</b>	Y / N	<b>Name of co-operative</b>								
<b>How leaves are plucked?</b>	Self/family	Laborers	<b>Laborer's wage</b>					<b># Of laborers?</b>		
<b>Do you use tools for plucking?</b>	Y / N	<b>If yes, what tools?</b>								
<b>How do you transport your leaves?</b>				<b>Transport cost</b>						
<b>Do you want to make your own tea?</b>	Y / N	<b>Do you want to lease your land?</b>			Y / N					

Do you lease your land? (Y / N)

If yes, fill out below:

<b>To whom</b>											
<b>Amount of land leased</b>				<b>Price/hectare</b>					<b>From which date</b>		
<b>Do you want to make your own tea?</b>	Y / N	<b>Do you want to sell leaves to a factory?</b>			Y / N						

Do you process your own leaves? (Y / N)

If yes, fill out below:

<b>How much did your process last year?</b>				<b>Of black/ orthodox:</b>			<b>Of green:</b>			
<b>Part of co-operative?</b>	Y / N	<b>Name of co-operative</b>								
<b>How leaves are plucked?</b>	Self/family	Laborers	<b>Laborer's wage</b>					<b># Of laborers?</b>		
<b>Do you use tools for plucking?</b>	Y / N	<b>If yes, what tools?</b>								
<b>Where do you wither?</b>				<b>And how?</b>						
<b>Where do you do rolling?</b>				<b>And how?</b>						
<b>Where do you do fermentation?</b>				<b>And how?</b>						
<b>Where do you dry the leaves?</b>				<b>And how?</b>						
<b>Where do you sell the processed tea?</b>				<b>Price/kgs</b>						
<b>Do you want to lease your land?</b>	Y / N	<b>Do you want to sell leaves to a factory?</b>			Y / N					

What are the major problems affecting your farm?

<b>Problems</b>	<b>Suggested solutions</b>

Is mechanization needed for small scale tea production? (Y / N)                      If yes, which areas:

Plant maintenance	Harvesting	Withering	Rolling	Fermenting	Steaming	Drying	Other
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*Please explain why?*

Do you want to continue growing tea? (Y / N)

*Please explain why?*

What is your relationship like with the Tea Board?

Does the local government promote tea growing? In what ways?

What national government schemes have you benefitted from?

Would you be supportive of the creation of a Kangra tea brand? (Y / N)

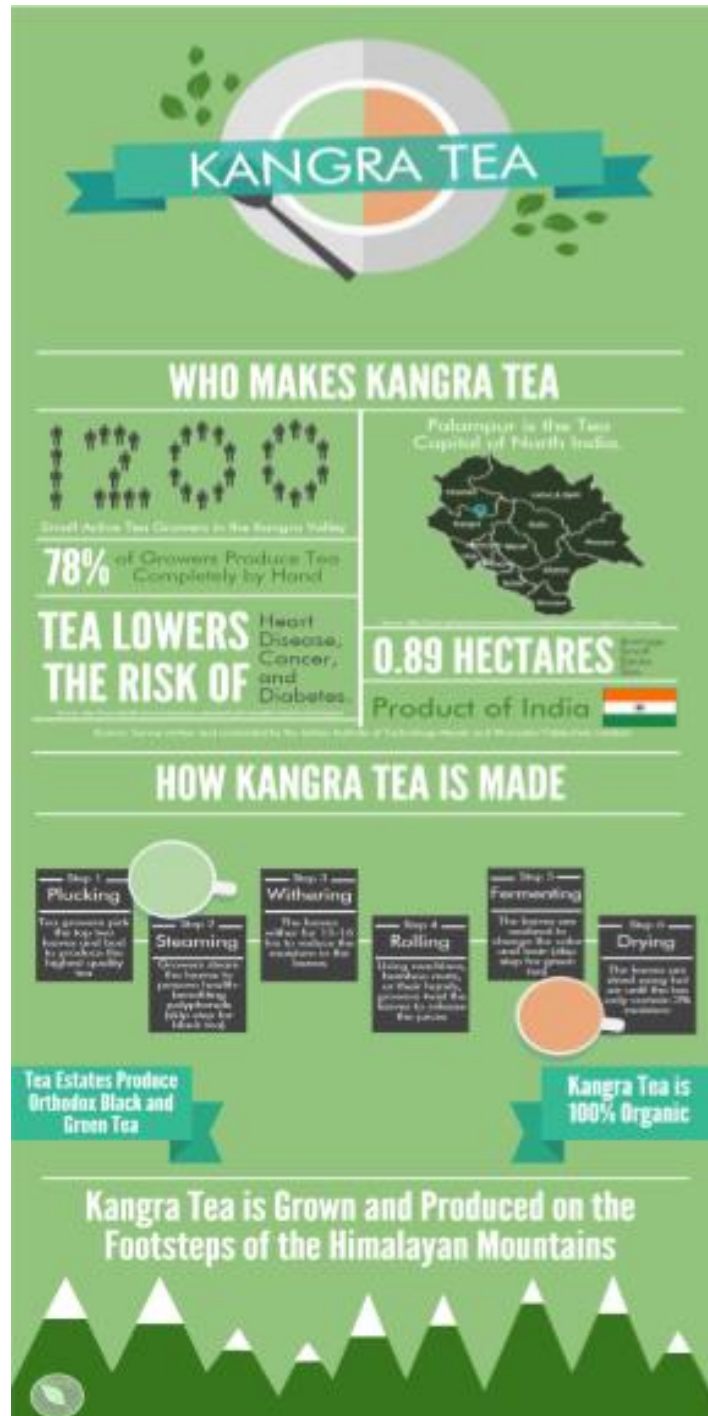
*Please explain why?*

Would you be willing to participate in a plucking prototype testing? (Y / N)

Notes:

# SUPPLEMENTAL MATERIALS: PROJECT OUTCOMES

## Kangra Valley Promotion Infographic

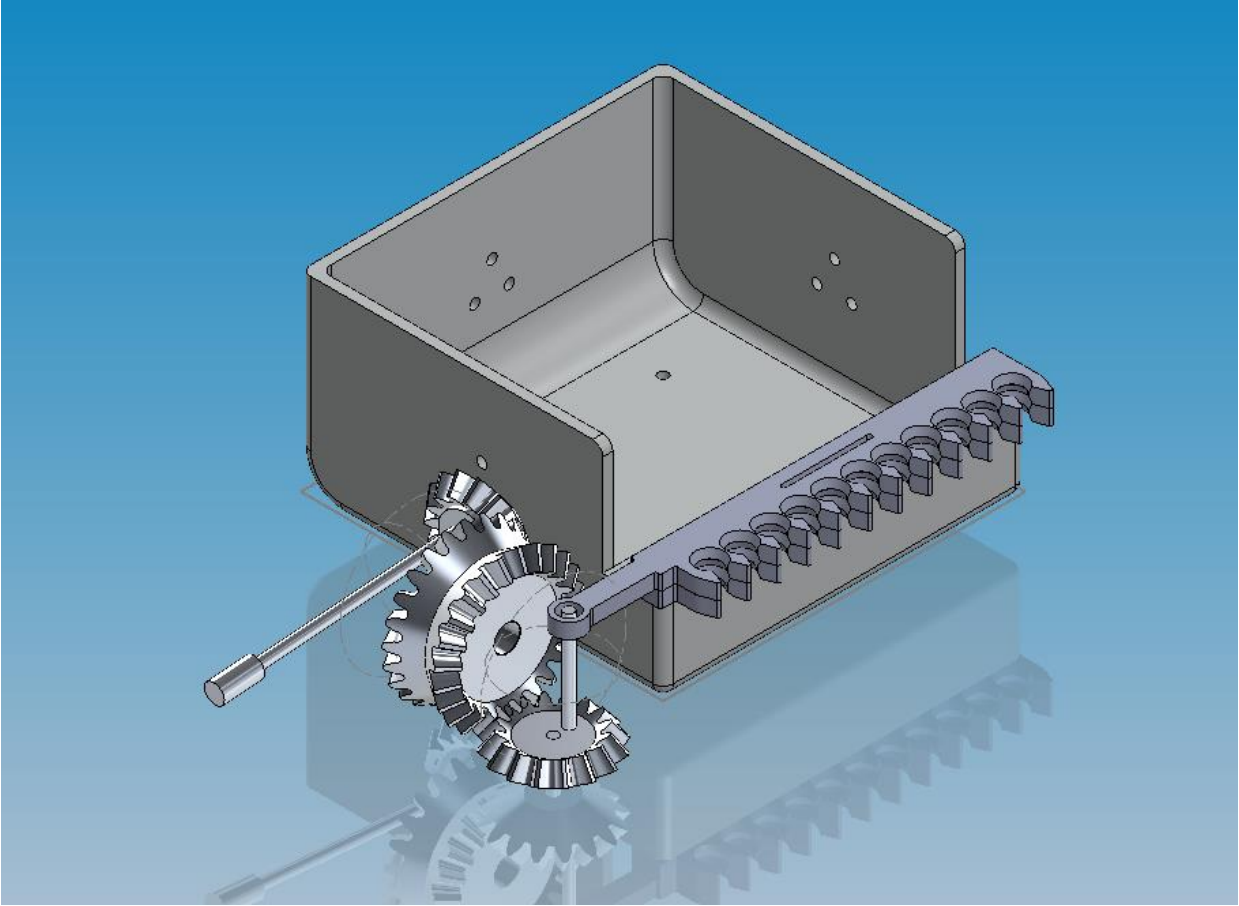


**Solidworks 3D CAD Models**

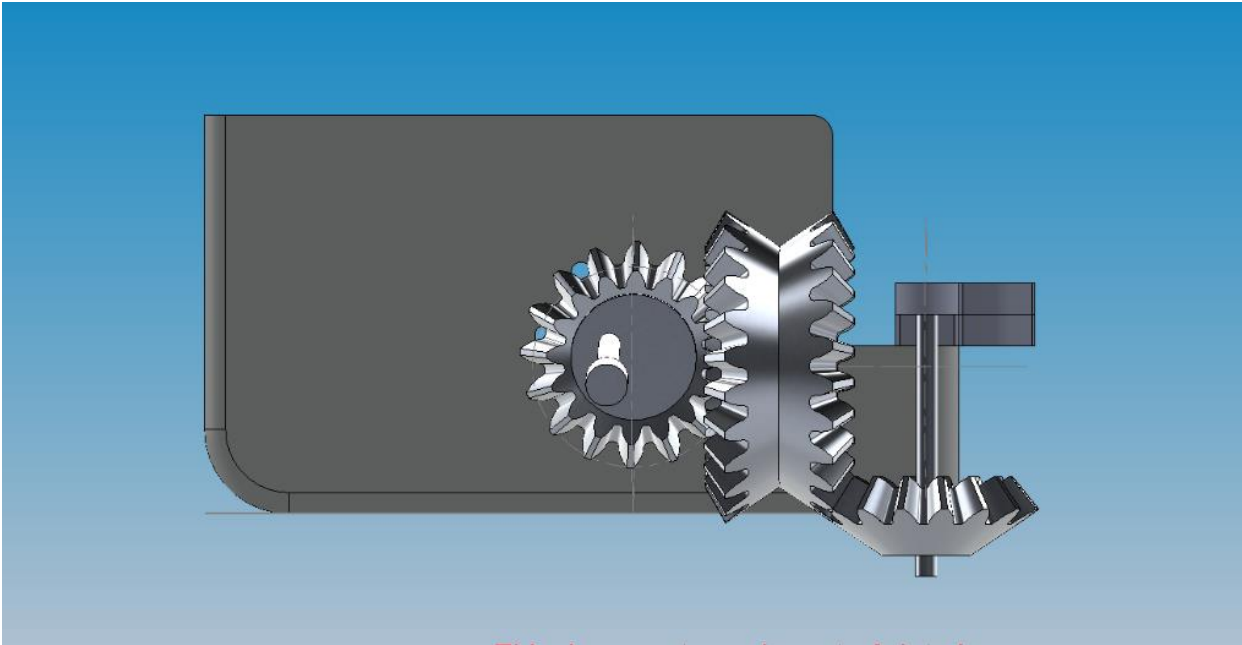
The standard prototype includes a detachable blade, which the operator would move to cut the leaves (Figure 11). This could be upgraded to a mechanical shear unit. A crank would move the shears back and forward to cut the leaves.

**Mechanical Shears Model**

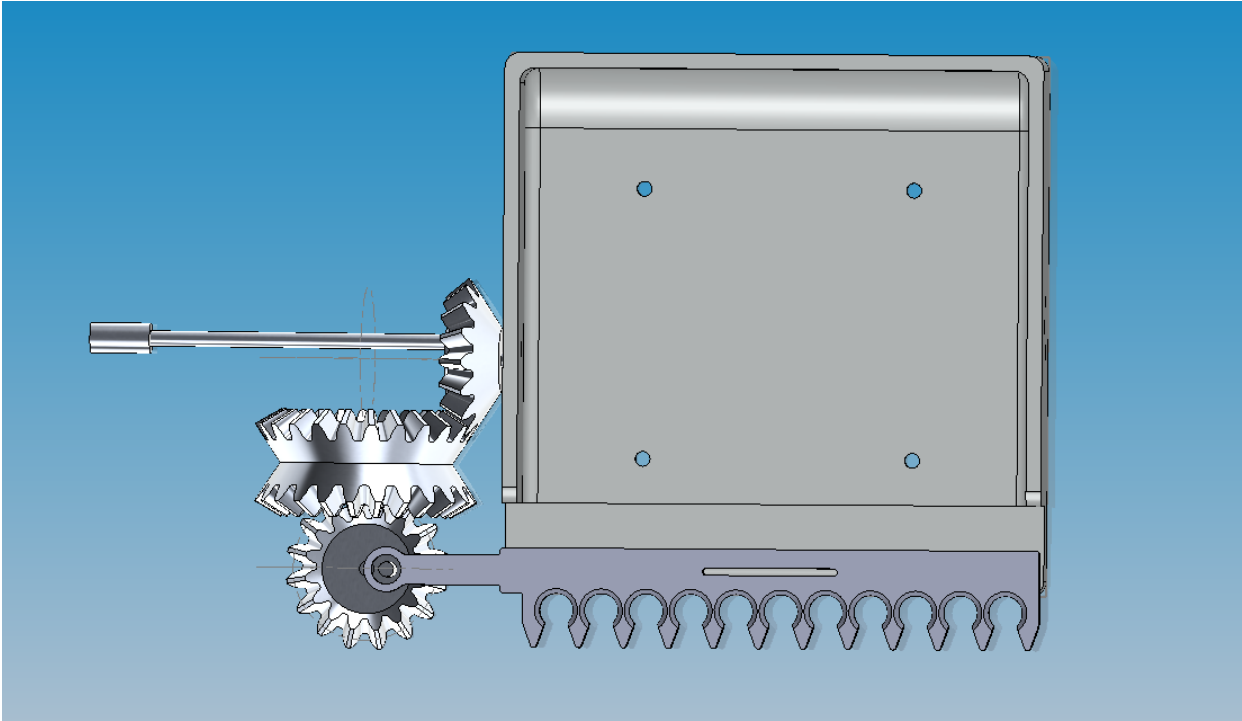
Isometric View:



Side View:



Top View:





## **Report to Tea Board of India**

### **Utilizing the Potential of Kangra Tea: A Need for a New Approach**

Emilia Konert, Vishal Mishra

*Indian Institute of Technology – Mandi*

*Worcester Polytechnic Institute*

#### **Introduction**

The purpose of this report is to utilize data gathered about the Kangra Tea industry and propose a new approach to the process of making tea as well as the sale of tea in the region. It will elaborate on a study conducted by the Indian Institute of Technology – Mandi (IIT-Mandi) with collaboration from Worcester Polytechnic Institute, USA. The tea industry in Himachal Pradesh is different from other tea producing states, and has not been documented or studied as extensively as Assam or Darjeeling, for example. One of the striking features of Kangra district is the dominant presence of small tea growers (STGs), who constitute 98% of the tea growing community. The industry is currently under serious crisis - production and active tea producing land has declined by half since the 1970s, and an increasing number of gardens are being abandoned.

The problem does not lie with the tea, but the manner in which it is being managed, processed, and marketed within India. Kangra orthodox tea and green tea is of high value, grown organically, and processed to result in a distinct, naturally sweet taste. In theory, the industry surrounding tea should be blooming in Kangra Valley. However, this is not the case. This paper aims to investigate why the current system of tea production is failing. It will use the documentation of the region and also explore existing policies in various government

agencies to determine a suggested path of action to the Tea Board, STGs, and consumers.

#### **Challenges in tea cultivation**

STGs in Kangra Valley face many challenges in the cultivation and production of tea. Research from IIT-Mandi found that labour issues and the market were the two biggest obstacles to the success of STGs in the region. A great deal of data collected was surprising, and differed greatly from similar studies of STGs in other tea growing states.

It was discovered that 96% of the surveyed growers produce tea in their homes at some capacity, by hand, with the orthodox method. Only one grower surveyed leased their land; many once sold their leaves to Bought Leaf Factories (BLFs) but have stopped. The majority are not interested in selling their green leaves, complaining that factories do not provide good prices. Another interesting detail was that the majority of growers mentioned they only pluck the first flush of leaves, even though per year there is feasibility of 12 - 15 flushes if plants are properly maintained. This indicates the plants are not being utilized, and is tied to the cost of labour which is high relative to the profit made from small amounts of made tea. On average, STGs pay workers 170 rupees/day, and the average price for made orthodox tea in Kolkata auction is 160 rupees per kilogram. Rolling tea by hand produces

approximately 500 grams per 15 minutes. As a result, many growers do not hire workers, instead plucking and rolling leaves themselves or with their families. There is a clear need for mechanisation in these small farms. However, few inexpensive innovations exist to aid STGs in the tea process. Engineering of small scale production machinery has caught the attention of institutions like the IIT-Mandi, and the creation of “micro-factory” technology is of interest, e.g. A simple plucker mechanism, small capacity roller, small dryer, small steaming system for green tea. If mechanization is made inexpensive and designed to scale for this type of production, then STGs could yield higher amounts of made tea.

A consequence of the declining industry is the decrease in the technical know-how of the STGs. Because the business is becoming unprofitable, the younger generations are losing interest in growing and processing tea. The average age of STGs in Kangra district was found to be 60. As these growers age and if their children are not interested in taking over the gardens, the knowledge of the tea process will not be handed down. This would be a huge loss to the industry – orthodox tea is higher quality than CTC tea and the fact that so many STGs in Kangra Valley manufacture with the process is very unique.

#### *Bought leaf factories*

The trend in India shows BLFs are gaining popularity, and are becoming the primary channel through which STGs sell their crop. Between 1998 and 2004, the number of BLFs nearly doubled, rising from 277 to 477 [Hannan]. This is not the case in Himachal Pradesh. The last co-operative facility opened in 1980, and none have been established since.

Four co-operative government-owned BLFs operate in Kangra district and are located in Baijnath, Bir, Palampur, and Sidhbari. All except Palampur Co-operative have had to stop production many times in the past 20 years, and have reopened within the last decade. Bir and Baijnath factories are leased to the same company from Assam, and now primarily lease land (currently 200 hectares) from growers. Sidhbari reopened this year under private ownership and buys from only 10 STGs. The factory most efficiently functioning in cooperative mode is Palampur Co-operative, with about 400 registered members. However, only 132 of those STGs sold leaf in 2014-2015.

If growers choose to sell their leaves to BLFs, there is no guarantee they will earn profit. Unless the grade of the fresh leaf is extremely high, the margin between labour cost per kilogram and price per kilogram of green leaf is nearly non-existent. This has resulted in a situation where growers abandon their gardens in search of other income, or are forced to lease their land. STGs are paid annually at a flat rate per hectare, and do not have to maintain the tea bushes. However, many growers expressed concerns that the quality of plant maintenance dropped under the care of these factories.

It is clear that the co-operative BLF model is not functioning well in Himachal Pradesh and STGs are not earning profit from the system. Due to the unique characteristics and situation of the region, different options should be explored.

## Exploring the market

### *A unique method for an exclusive tea*

Himachal boasts all the necessary components for the success of the tea industry: acidic soil, plenty of existing land under tea, and great potential for innovation. Small land size is a benefit rather than a deterrence for quality tea, as it can allow for careful control of grading and processing. To ensure the survival of Kangra tea, action must be taken to change the methods of sale. BLFs can still make profit by selling their made tea to public auction, but STGs who produce their own tea and sell to auction make little to no profit. Kangra tea is not differentiated from other orthodox leaf, and brokers focus of buying wholesale bulk rather than small quantities. Growers report that prices they receive from auction vary wildly, ranging from 60 rupees per kilogram to 200 rupees. On the other hand, private companies that market their Kangra tea can make upwards of 5,000 rupees per kilogram.

There are two popular models of how STGs sell tea in Kangra district. (Figure 1) The first is through BLFs which produce two to ten

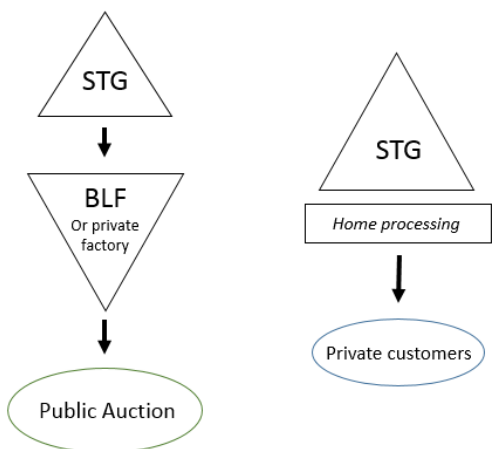


Figure 1. Current models of tea sale in Kangra Valley.

lakh kilogram annually, primarily sold in Kolkata auction. The next is on the scale of a couple hundred kilograms annually, and involves STGs producing their tea at home for personal use or for private customers.

The proposed model for the sale of STG tea in Himachal Pradesh can be seen in Figure 2, producing on the scale of thousands of kilograms annually. It involves a group of STGs producing tea of the same quality in a cooperative fashion, then branding and packaging it for sale.

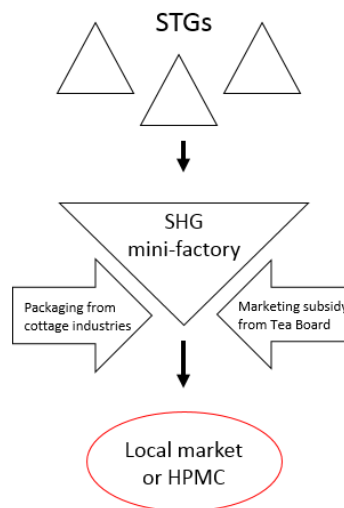


Figure 2. Proposed model for STG-based manufacturing

This model would utilize a current scheme provided by the Tea Board of India, which allows a group of growers from any tea producing state to form a Self Help Group (SHG). Currently the SHG scheme highlights harvesting and maintenance, but if modified, this scheme could focus on subsidies for processing machinery. This would allow SHGs to purchase a roller and dryer per group, and process their green leaves in the same machines under the same conditions and specifications to

create consistent quality. Using one of the many cottage industries in Himachal, a unique packaging could be created with locally sourced materials for a low price. Marketing can be provided by the Tea Board through schemes like the Quality and Product Diversification Scheme (QPDS), especially for the first groups formed. Because so many farms in Kangra district are organic, certification can be provided through this scheme also. Kangra tea should be recognized as a treasure of the valley and sold through local vendors that represent Himachal's excellent products, like the Horticultural Produce Marketing and Processing Corporation (HPMC). Once established as a brand, Kangra tea can be exported internationally where there is higher demand for green tea than in India.

Market creation of this kind will require enthusiasm from entrepreneurial STGs, but if a successful pilot mini-factory is established through efforts of STGs and government agencies, growers will feel more confident in trusting this model of selling tea. There have been attempts at creating factories through SHGs in eastern India. However, these factories were comprised of over 300 members, with goals of producing 15,000 kg of tea per day. In Kangra Valley this could never be the case due to sheer lack of land, but small SHGs can be a strength for production rather than a weakness. Opening a micro-factory with a smaller number of farmers allows for careful control of grading and processing, as well as being able to run without having to hire extraneous staff for management. Production cost per unit will be higher than in a larger facility, but branded orthodox or green tea has potential to sell for a higher value.

A few modifications can be implemented to existing schemes specifically for Himachal Pradesh. The SHG scheme allows a minimum number of 20 growers with 20 hectares of land to apply. Because average land size for Himachal Pradesh is well under a hectare the minimum collective land size as well as number of farmers should be reduced, allowing for easier organization of groups.

### **Convergence with other agencies**

If SHGs are formed and begin the process of setting up micro-factories, they might face a number of challenges. However, the support for these groups does not need to come purely from the Tea Board of India. In recent years, a growing push for convergence among different government initiatives has evolved. Often, different ministries and departments work in silos and are not aware of others efforts. Hence, a part of this present work explores policies and programs of different ministries which could be converged with the existing SHG scheme and supplement the efforts of the Tea Board. Figure 4 outlines the major problems that may affect new SHGs, and how aid can be provided from various government agencies through existing schemes.

#### *Forming the SHG:*

Forming a Self Help Group and sustaining it is a big challenge in itself. It requires the guidance of people with both motivational and organisational experience. The NRLM (National Rural Livelihood Mission, *a flagship programme of MoRD*) has a mandate to establish SHGs and has an extensive network of community mobilizers. The Tea Board can collaborate with block level (*sub-district*) functionaries of NRLM for effective formation of SHGs.

### Starting a micro- factory:

The Tea Board provides a subsidy for starting a micro/mini factory. However, arranging the remaining initial capital requirement of a few lakhs could be a major hurdle for SHGs. In this case, the SHGs can avail benefits from schemes of MSME (Ministry of Micro, Small and Medium enterprises) for example, the PMEGP (Prime Minister Employment Generation Programme).

### Quality Control:

The Tea Board has a mandate to control the quality of made tea produced in the domestically. The SHGs should adhere themselves to the guidelines of Tea Board to ensure the quality of product.

In order to achieve total quality control, each process needs to be standardised, from garden management, leaf plucking, final sorting and grading. As per the *skill development policy* of GoI, (NSDC), *QPs* (qualification packs) and *NOS* (National Occupational Standards) should be developed and training can be funded by central government.

### Packaging of Product:

Packaging of the final product is not only essential for enhancing the shelf-life but also has a strong correlation with consumer choices. It will also give opportunity for cottage industries to bloom around tea factories. The SHGs could apply for different schemes like the *SFURTI* cluster development of KVIC (Khadi Village Industries Commission).

### Marketing:

Marketing has become a crucial component in any type of industry. It would be difficult for Kangra Tea to fetch its optimum

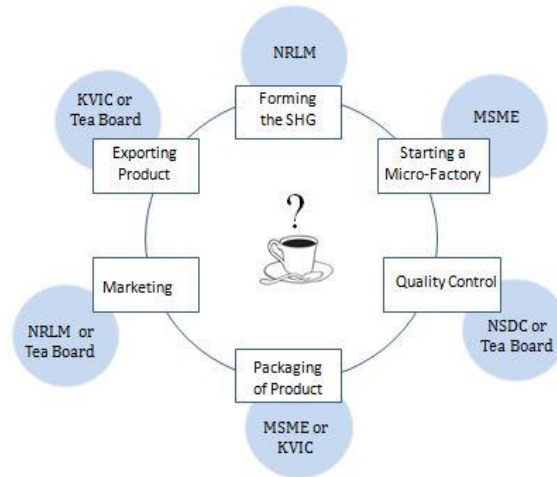


Figure 3. Possible Difficulties in functionality of SHG scheme, and proposed solutions.

value without marketed properly. Often it becomes difficult for a start-up entity to put money in marketing and promotion unless and until it is making a good profit. The SHGs can get financial assistance from Tea Board as well as NRLM for promotional and marketing activities.

### Exporting Product:

It is a well-known fact that Kangra Tea had a very high value in international markets in past times. The present study also found few examples where it is sold abroad. The SHGs should exploit international market for a better return. The export promotion schemes of Tea Board and KVIC could assist in establishing initial market presence.

## Conclusion

The present situation of Kangra tea is quite alarming with steadily declining production, and prospects are bleak if corrective actions are not taken immediately. The tea industry in Kangra needs a new and refreshed approach in order to thrive. The region has vast potential, and is currently extremely underutilized. The STGs have faced many challenges with their gardens but many remain steadfast in their cultivation of tea, taking pride in their excellent product. In fact, when asked in surveys, 100% of the STGs responded favorably to the notion of creating a widespread brand for Kangra tea.

Co-operative BLFs have struggled to succeed and also could not play important role for sustenance of STGs and failed to provide remunerative prices for green leaves to the STGs in face of rising plucking wage. The situation also offers unique opportunity to research institutions like IIT Mandi, to develop low end technological solutions for different processes involved in tea processing.

Many schemes are already in place that could aid in the formation of the proposed model of micro-factories. The SHG scheme of Tea Board of India, if modified slightly, could revitalize STGs in the region. Complimenting this scheme with those of other agencies like MSME, KVIC is necessary to create a functioning system of STG-based manufacturing. This will also create livelihood opportunities in other sectors like, cottage based packaging industries etc. The situation also offers unique opportunity to research institutions like IIT Mandi, to develop low cost technological solutions for different processes involved in tea processing.

There is no doubt that if all the stakeholders come together to work in a holistic manner, *Kangra Tea* could regain its glory of olden days.

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# SUPPLEMENTAL MATERIALS: PHOTOS

## Project Presentation Poster



### WPI

## Investigating the Kangra Valley Tea Industry

Students: Devang Bacharwar (B12059), Rahul Bhujade (B12071) Matthew Garcia, Emilia Konert, and Hannah Robinson  
Advisors: Dr. Lorraine Higgins, Dr. Arti Kashyap, and Dr. Ingrid Shockey

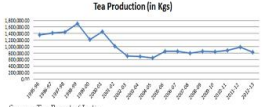


### Abstract

In recent decades, Kangra Valley tea production has declined by 50% predominately among farms less than a hectare. Our goal was to investigate small-scale tea production and develop suggestions and innovations beneficial to small estates. Tea growers were interviewed and surveyed to identify the vulnerabilities in the region. We designed a mechanical harvester to improve efficiency and reduce the need for labor, and produced recommendations to revitalize the Kangra tea market and modify government policies.

### Background: The Kangra Tea Industry

- Most of the Himachal Pradesh's tea grows in the Kangra Valley.
- 1,200 active tea growers in the Kangra Valley
- In recent years, Himachal Pradesh noted a significant decline in production
- The majority of farm owners cultivate a hectare or less of land for tea
- Kangra tea is processed using orthodox methods



Source: Tea Board of India


### Stakeholders

The Project focused on the following groups and government organization:


- Small Tea Estate
- Tea Board of India
- Consumers

### Background: The Kangra Tea Industry

**Methods Chart**



**Sampling Map**




### Goal: To investigate small-scale tea production in the Kangra Valley and suggest innovations beneficial to these small tea farms

### Results and Analysis

#### Findings

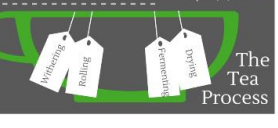
A closer look at Kangra Tea



**Major Problems**

- Labor
- Market
- Processing
- Pests/Animals
- Monsoon Season
- Lack of Govt

The majority of farmers complained about the cost and availability of workers. 78% of farmers produce tea completely by hand.



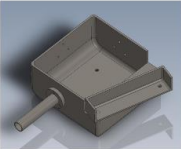
#### SWOT Analysis

Strengths	Weaknesses
<ul style="list-style-type: none"> <li>Organic, orthodox processed and high quality tea</li> <li>Active Tea Board</li> <li>New brands arising from large factories</li> <li>Available land</li> </ul>	<ul style="list-style-type: none"> <li>Divided small-scale estate community</li> <li>Inactive farms</li> <li>Poor communication between estates and government</li> <li>Labor cost and availability</li> <li>Lack of local market and marketing strategy</li> </ul>
Opportunities	Threats
<ul style="list-style-type: none"> <li>Domestic and international marketing</li> <li>Self-help group expansions</li> <li>Technology for small estates plucking and processing</li> <li>Government schemes towards self-help groups and technology subsidies</li> </ul>	<ul style="list-style-type: none"> <li>Unwanted pests and animals</li> <li>Monsoon season</li> <li>Aging Farmers</li> </ul>


### Prototype

Specifications:

- 10" x 10" x 4"
- Estimated Production cost- less than 1000 Rs.
- Replaceable steel blade
- Lightweight aluminium body
- Rapid manual operation
- Ergonomic design



### Recommendations



- Agricultural Advisory System**
  - Tea Farmer profiling
  - IVR system for communication between Tea Board and farmers
  - Providing assistance to tea farmers by experts
- Our additions**
  - Include green leaf price list
  - Incorporate schemes

**Policy Modification: Self-help Groups**

- Decrease minimum collective land size
- Provide green tea processing programs
- Provide subsidies for processing equipment and marketing

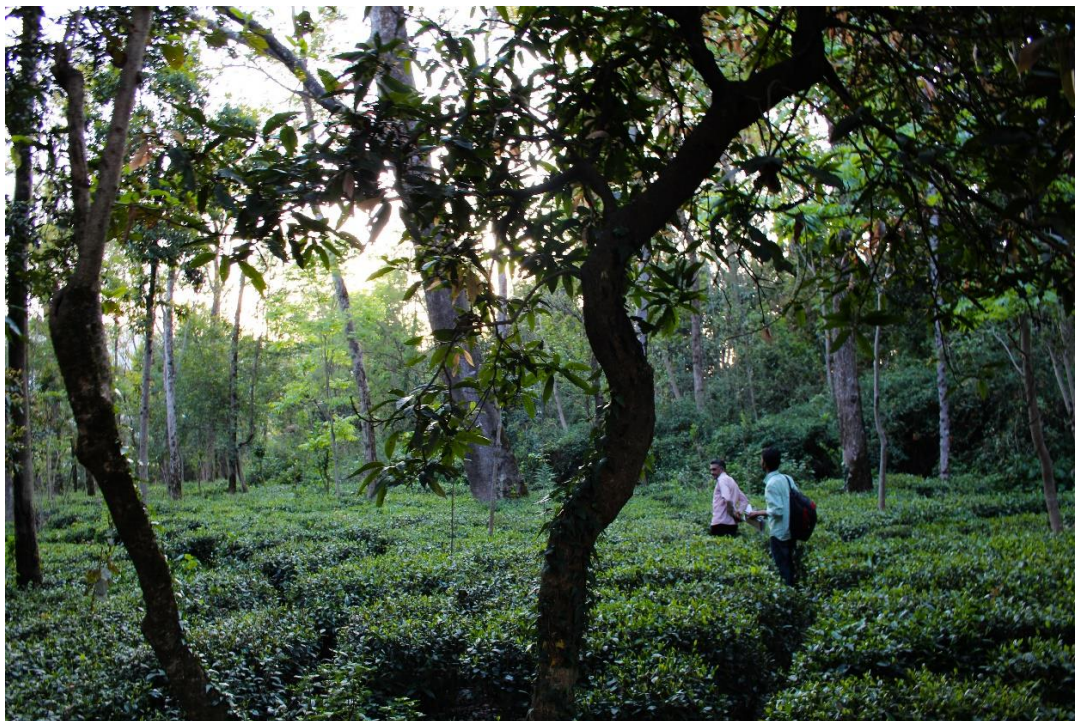
Acknowledgements: Dr. Arti Kashyap, Dr. Lorraine Higgins, Dr. Ingrid Shockey—Our advisors, Mr. Vishal Mishra—Our project engineer, Dr. Timothy Gonсалves—Director IIT-Mandi, Dr. Gagnesh Sharma—Deputy Director Tea Board of India, Himachal Pradesh. All the tea farmers interviewed.



**Fieldwork Photos**



*Large estate consisting of several hectare of tea bushes.*



*A well maintained small tea estate.*

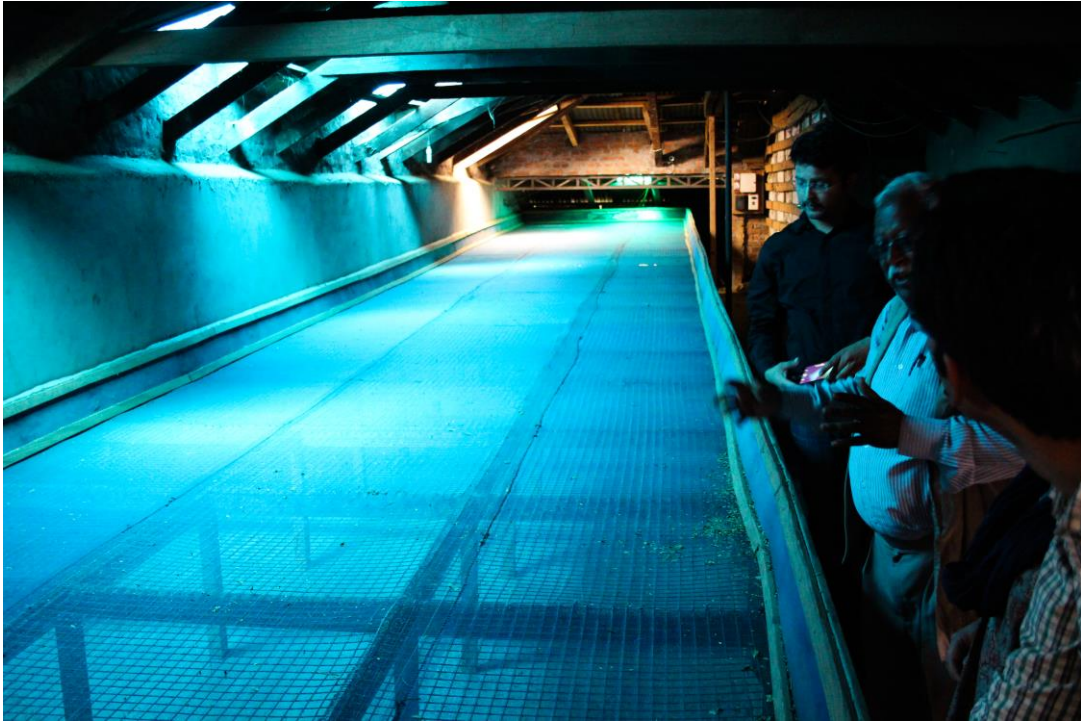




*Workers pluck tea leaves by hand.*



*A farmer showing us his harvest.*



Withering troughs are used to wither tea in large quantities and decrease withering time.



*Small estates traditionally wither leaves at home on the floor.*



*Factories use large rollers to roll several kilograms of tea per batch.*



*Leaves immediately after machine rolling.*



*Factory workers place leaves on the fermentation floor.*



*Factories used large capacity dryers fuelled by wood furnaces.*



*The final product bagged for storage and distribution*



*Comparison tasting of hand made and machine processed teas.*



*A cup of Kangra green tea.*