Improving income levels of rural blacksmiths by replacing the hand cranked blower/traditional bellows with a Solar powered DC blower

Key Words: Livelihoods, Health, Micro-Entrepreneurship, Financial Inclusion, Energy Efficiency, Vulnerability

Household level Copper pipe water purification unit for communities with high instances of microbial and rotavirus recontamination

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1. Improving income levels of rural blacksmiths by replacing the hand cranked blower/traditional bellows with a Solar powered DC blower

Repurposed Application

Key Words: Livelihoods, Health, Micro-Entrepreneurship, Financial Inclusion, Energy Efficiency, Vulnerability

2. Household level Copper pipe water purification unit for communities with high instances of microbial and rotavirus recontamination

Invention

Key Words: Health, Water Purification, Energy Efficiency

3. Copper pipe water purification unit for communities with high instances of microbial and rotavirus recontamination

Invention

Key Words: Health, Water Purification, Energy Efficiency
Replication and Scale
Programmatic Pilot
Testing (technical and financial model)
Design/Prototyping
Replication and Scale

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<th>Identification</th>
<th>In-depth Research</th>
<th>Testing (technical and financial model)</th>
<th>Programmatic Pilot</th>
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<tr>
<td>Before Oct 2016</td>
<td>Secondary and Field research</td>
<td>19 implemented (case study)</td>
<td>40 implementation</td>
</tr>
<tr>
<td>Q1 and Q2 (Oct16-Mar17)</td>
<td>User and Market Research</td>
<td>10 implemented (for new version of the solution)</td>
<td>Handhold and support partners to replicate the model</td>
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<tr>
<td>Q3 and Q4 (April17-Sep17)</td>
<td></td>
<td>5 implementation (for the portable blacksmith)</td>
<td>Handhold and support partners to replicate the model</td>
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<td>Q3 and Q4 (Oct17-Mar18)</td>
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<td>Bridge existing gaps in implementation</td>
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<td>Next Steps</td>
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<td>[Replicate the solution in 1 new state]</td>
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<td></td>
<td>Karnataka + Odisha</td>
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<td></td>
<td>80 implementation Monitoring, Learning and Evaluation Report</td>
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<td></td>
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<td>5 implementations in 2 new states</td>
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Typical Rural Blacksmith Set- Up
Blacksmith using the solar powered efficient DC blower and controller

**Innovation:** Repurposed Application. Solar powered Efficient Blacksmith’s Blower machine with flame control.

**Financial/Process/Model:** Customized technology solution for blacksmiths from various socio-economic backgrounds and access market linkages. Criteria for Assessment of vulnerable blacksmith entrepreneurs.

**Background**
India has well over 200,000 blacksmiths in rural areas, each of these artisans constitute the segment of unorganized sector livelihoods in rural areas that build and modify input tools for agriculture and non agriculture purposes. Blacksmithy is among very few traditional artesanial work that has continued to survive as the Indian rural economy is based on agricultural production and agro processing at a decentralized micro-level. A substantial majority of agricultural production emanates from small and medium land holdings. The preferred designs of hand tools used in agricultural production and pest production very considerably from region to region making it difficult for industrial mass manufacturers to penetrate all areas equally. Almost all blacksmiths in rural areas today fall in very poor or abject poverty categories. Increasing cost of raw material, labour and charcoal, with no significant change in the technique used for producing tools poses a significant threat to the age old profession. Moreover, strenuous physical activities and appalling workplace conditions for blacksmiths give rise to Musculoskeletal disorders (MSDs) (the most common self reported work-related illness).

**The Problem**

- Extreme drudgery and long work hours to make a minimal daily wage: This is largely due to the methods of igniting and keeping the furnace running. Current methods include- large wheels, hand cranked blowers, manually operated large compressors etc that are utilized to maintain and regulate temperatures.
- Increasing costs of labour, charcoal and raw materials do not allow for any savings: Most of the blacksmiths depend on an additional labour to operate the manual blower which takes away significant portion of their income as well as it affects productivity, income & commitment to customers as there is huge labour shortage and the labour don’t turn up regularly.
- Mass manufactured farm equipment coming in for modifications is stiff competition for the traditional skill.
- The simple solution allows for a transformational change in the way blacksmiths have been operating for the past 100 years. Reduction in Drudgery can also lead to an increased market for the technology for rural blacksmiths.

**The Solution**

- A modified high efficient, high quality, powerful blower with a controller for easy and ergonomic flame/temperature control.
- A contraption and design for the efficient blower and controller to be installed.
- As many of the workplaces are in places with no access or unreliable electricity, the above product is powered by a solar system and an optional light.
- The technical solution is combined with affordable financing mechanism via local financial institutions.

**Impact**

- Improved Health and Wellbeing (will be evaluated in Q4)
- Increase in Savings and Incomes (will be evaluated in Q4)
- Highly replicable model - can be replicated across all Indian states, especially UP which is known as the blacksmiths (Ishan) hub of India
- Portable to replicate the model for a wide range of other applications as well - such as corn vendors, goldsmiths, brass workers and silver ornament makers.

**Partners**

- Technical: Emays, Alpa precision, Ramakrish Achari (Local Blacksmith, Munyal)
- Financial: Syndicate Bank, Karnataka Gramin Vikas Bank, SKDRDP
- Implementation: SELCO India, Rural Womens Upliftment Society
As the energy requirement for solar powered blower is about 92% lower than the conventional motorized blowers available in the market there is a significant improvement in cost and productivity. The initial research led to discovering the pressing need for motorized blowers for blacksmiths due to labour issues (irregularity, not being able to meet customer requirement), low productivity and incomes. Motorized blowers available in the market are highly inefficient (with 0.25 hp induction motor) and there was no proper mechanism for control of air flow. They are improperly designed for blacksmith application and required instead in high charcoal requirement.

An efficient DC blower with air flow, static pressure and rpm specification as per the requirement for blacksmith forge was identified. The blower consumes 20 W making the solar solution efficient and affordable. As a custom made PWM based speed controller to control the air flow of the DC blower was built along with a specially designed (preferred) pipe design for mounting the fan. Through the speed controller to control the air temperature/pressure blacksmiths can adjust the fuel burning rate as per the size of the work piece thus achieve fuel efficiency. The pipe design is built by a local blacksmith.

The solution can be designed for 4 or 8 hours of backup for blower operation, under- fuel efficiency. The pipe design is built by a local blacksmith.

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The model can also be useful in institutional set up.

The solution has been implemented across various places within Karnataka. It is being further improved upon for ease of installation. This however cannot be standardised due to the varied nature of furnace designs and individual blacksmiths own ability to tweak and result instead in high charcoal requirement.

Challenges and Learnings

• The Market size of blacksmiths is much bigger than expected due to the of small land holding farmers across India. There is a high density of blacksmiths, at least 1-2 in every town or village.

• Access to appropriate finance for high risk blacksmiths is a challenge (for example blacksmiths that have severe health issues in the family, deaf and mute blacksmiths or physically challenged blacksmiths are completely dependent on the trade and are barely surviving). In such cases margin money subsidies, interest subsidies or part subsidies go a long way in unlocking local capital and ensuring financial inclusion while maintaining ease of work and/or improved incomes.

• To identify blacksmiths in the village or area, the enterprise or entity implementing/ replacing the solution must have very strong local connections and reputation built within the region. Making a sale will require demonstrations. Choosing a strong champion blacksmith in the region tremendously helps in convincing other blacksmiths, as seeing is believing.

Financial Details

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Amount</th>
<th>Particulars</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Charcoal (1 kg 50 lpg)</td>
<td>300</td>
<td>New Products (Min, 1 day)</td>
<td>300</td>
</tr>
<tr>
<td>Wooden pieces for handles (Rs. 10 per piece)</td>
<td>200</td>
<td>Repair of old products (Min)</td>
<td>200</td>
</tr>
<tr>
<td>Labour Expenses (250 per day, 1 lamp)</td>
<td>1500</td>
<td>New Products (Max 5 days)</td>
<td>450</td>
</tr>
<tr>
<td>Food Expenses for Labour (Rs. 70 per piece)</td>
<td>420</td>
<td>Repair-of-old-products (Max-S)</td>
<td>300</td>
</tr>
<tr>
<td>Total</td>
<td>3250</td>
<td>Net Profit (4250-2520)</td>
<td>1730</td>
</tr>
<tr>
<td>Monthly Profit (1730x4)</td>
<td>6920</td>
<td>After Installation of Blower</td>
<td></td>
</tr>
<tr>
<td>No Labourer required - hence savings for day wage and food expenses (1500-420) per week.</td>
<td>1920</td>
<td>Increase in Monthly Income (1920x4)</td>
<td>7680</td>
</tr>
<tr>
<td>Net Profit per month (7680+4920)</td>
<td>14600</td>
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</table>

The solution has been implemented across various places within Karnataka. It could be replicated in other states as well. Within Karnataka:

Data was collected via secondary, market and field research. Initially 5 blacksmiths of different socio-economic backgrounds were partnered with and provided the system on a demo and testing basis for feedback, all 5 wanted to purchase the system and were willing to pay SELCO Foundation team worked closely with the champion blacksmiths to design and develop the solution. All 5 blacksmiths have been financed through rural banks. Through feedback of all stakeholders, further developments are being made. However the solution in its current form is ready to go into a programmatic pilot phase.

Scope for further development

• The efficiency of the blower can further be improved, however access to a high quality, more efficient fan with good warranties and servicing will be key to decreasing the cost of the blower.

• Many blacksmiths do grinding manually and many have also shifted to using power tool of 600-800W for grinding. This is extremely challenging and expensive to run due to erratic and insufficient power quality. The efficiency of the grinding tool itself needs to be worked upon in order to be feasibly solar powered.

• A high number of demand in the entire North Karnataka region has come from nomadic blacksmiths and blacksmiths whose work place is very far from their homes. A portable version with lighter lithium ion battery is being worked upon as the next version of the DC blacksmith blower.

• The contraption for installation (which is currently locally built by one of the champion blacksmiths) is being further improved upon for ease of installation. This however cannot be standardised due to the varied nature of furnace designs and individual blacksmiths own ability to tweak and customise it for themselves.

Technical Details

As the energy requirement for solar powered blower is about 92% lower than the conventional motorized blowers available in the market there is a significant improvement in cost and productivity. The initial research led to discovering the pressing need for motorized blowers for blacksmiths due to labour issues (irregularity, not being able to meet customer requirement), low productivity and incomes. Motorized blowers available in the market are highly inefficient (with 0.25 hp induction motor) and there was no proper mechanism for control of air flow. They are improperly designed for blacksmith application and required instead in high charcoal requirement.

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