

Sustaining livelihoods by community-based manufacturing of high quality face masks

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Background

Following Covid-19, two major themes emerged

1) **Mask Shortage:** Wearing of masks, hand hygiene, social distancing were recommended by the WHO as part of the infection prevention and control advisory. This advisory, resulted in an **unprecedented demand for N95** and surgical masks and led to a severe shortage of good quality masks around the world-wide. The problem was compounded in LMICs because of limited production capacities and import dependency.

2) **Lost livelihoods:** In response to Covid-19, several countries around the world imposed stay-at-home/lockdown orders. In LMIC's, people lost jobs and **lost their sources of livelihood**. As Covid-19 demonstrated, the impact of crises are never gender neutral and women lost livelihoods faster than male counterparts.

Tech engagement: Our team converged on these needs and constraints and worked with our **technology partner**, Parisodhana, on testing mask designs, repurposing of materials and machinery along with work force to manufacture good quality face masks for both front line health workers and for general public.

Community engagement: Simultaneously, we engaged self-help groups and women artisans to understand constraints pertaining to work-flow, physical mobility during strict stay-at-home, work-place restrictions, availability and shipping of raw material.

Objective

- To develop a face mask for general use and address the prevalent shortage
- Create a process for manufacturing that would allow local self help groups to 1) create high-quality masks 2) earn livelihoods amidst very restrictive stay at home orders.

Materials and Methods

Ideation: Using an empathetic design approach we matched the two societal needs in the setting of prevailing constraints.

Filter development and testing: Several filter designs, configurations and shapes were tested for ensuring breathability, filtering capability and other testing criteria established by testing bodies.

Mask Design: A cloth mask with an embedded filter was iteratively designed. This is a hybrid multiply facemask which integrates the filtration performance of N95-masks with 100% pure cotton cloth sourced from local weaving community.

Community Partners: Self Employed Womens Association (SEWA), Selco Foundation, Abhihaara, Sankalpa Rural Development Society, Tata Power Community Development Trust (TPCDT) were engaged and the manufacturing know-how was transferred. Orders for masks were regionally addressed by each community partner.

Results and Outcome

Filter Performance: Several filter designs were evaluated for technical performance (**Figure 1**) demonstrating superior performance during tests by accredited labs

	STANDARD	SHG95 RESULT
SPLASH RESISTANCE	(ASTM 160 mm Hg F1862/F186 2M-13)	PASS
BACTERIAL FILTRATION EFFICIENCY	ASTM F2101	>99%
PARTICULATE FILTRATION EFFICIENCY	ASTM F2299/F2299 M-03 (2010) 0.3 micron	>97%
DIFFERENTIAL PRESSURE	IS 16289:2014 Annex C	38 Pa/cm ²
FLAMMABILITY	16 CFR PART 1610	CLASS 1

Figure 1 | Excellent technical performance of the filter with > 95% particulate filtration efficiency.

Results



Figure 2 | Design of the cloth-based mask with embedded filter.

Community engagement: Over 100 artisans, from across India were trained extensively to ensure excellent quality of manufacturing and minimize variation. Over 1,30,000 high-quality masks have been manufactured and sold in India and the US. The entire process has impacted the livelihoods of over 500 families created over 40,000 hours of labor. The program has had excellent reception and sustained uptake with strong demand for customized masks.

Lessons learned

- During this entire exercise, none of the core team members and community partners met in person but were able to execute this project very efficiently.
- The collaborative spirit, the scientific temper and the drive to demonstrate a positive impact is the most everlasting spirit that exists.

Conclusions, Recommendations & Next steps

- The livelihood of **over 500 families** is being supported by using this innovative model of collaboration.
- Over 1,30,000 high-quality masks** have been made by women-led, self help groups.
- Over 40,000 hours** of labor were generated and artisans made 2.5 times more than the average artisan.
- Our team continues to expand this initiative and explore additional opportunities to combine technology and community engagement to ensure last-mile delivery.

Acknowledgement

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Figure 3 | Artisans at work at the peak of Covid-19. The community business model ensured women artisans were compensated 2.5 x regular compensation



Figure 4 | Use of custom, locally-sourced fabric to suit individual needs.