Can Urban User Testing Inform Prototyping of Rural BoP Products?

A Pre-Pilot Study of User Centered Design

1: Despite decades of efforts, widespread adoption of improved cookstove technology is still low in India.

The second in a series of briefs that turn action research into learnable experience for those committed to the Base of the Pyramid (BoP).

The Rural Market Insight group at the Centre for Development Finance-IFMR (CDF) conducted a study of rapid prototyping and user testing with seven BoP households in Chennai, Tamil Nadu. The pilot study explored whether the urban user testing concept can be applied to design and prototyping of new rural-targeted BoP products. Sustained successful results yielded actionable design insights and encouraged further research.

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-Dr. Paul Polak, Out of Poverty

BACKGROUND

Getting Improved Cookstoves to Every Household

Improved cookstoves have been globally recognized as a cross-cutting development tool that affects maternal and child health, climate change, sustainable livelihoods and women's empowerment (2010). For nearly six decades, the Government of India (GOI) has distributed energy-efficient cookstoves to vulnerable households across the country.

However, widespread adoption and sustained use of improved cookstoves is still low in India. An estimated 68% of India's 210 million households still use biomass fuels, such as wood, cow dung and agricultural waste, as their primary cooking fuel (NSS 61st round 2004-05). According to the World Health Organization, the smoky fires of traditional biomass-burning stoves [chulhas] cause Indoor Air Pollution (IAP) and lead to respiratory disease among women and children in BoP households (2005). Recent research found that only 65%

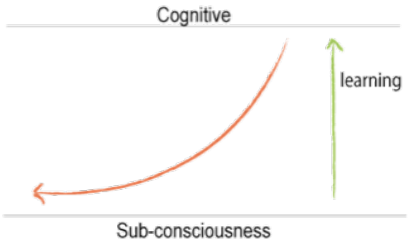
2: Urban sites allowed for testing with diverse participants; the prototype was used for domestic and commercial cooking.

of the 28-32 million improved cookstoves distributed by GOI were in working use (2003) and most improved cookstoves have a lifespan of only 2-5 years.

Recognising Barriers to Cookstove Adoption

In 2009, the Ministry of New and Renewable Energy (MNRE) revamped India's approach to improved cookstove distribution. Recognising significant barriers to cookstove adoption, GOI declared that success depends "on whether the stove design and functionality is well tailored to the local culture, tastes and cooking habits or behaviours" along with accessibility and affordability (2009). MNRE ended the National Programme on Improved Chulhas (NPIC), which ran since 1983, and launched the National Biomass Cookstoves Initiative, which aims to provide subsidized, energy-efficient cookstoves to an estimated 130 million users of biomass fuels.

In contrast to previous approaches, the new initiative aims to put the BoP user at the center of the process. According to Dr. Paul Polak, "the majority of the world's designers focus all their efforts on developing products and services exclusively for the richest 10% of the world's customers. Nothing less than a revolution in design is needed to reach the other 90%." User-centered efforts allow micro-entrepreneurs, private and non-government entities to apply their design and market expertise to make cookstoves more efficient and increase uptake among BoP households.



3. If cognitive behaviour change is required for increased adoption of clean cooking technologies and practices, identifying activities that require active learning will help guide user education.

IDEA

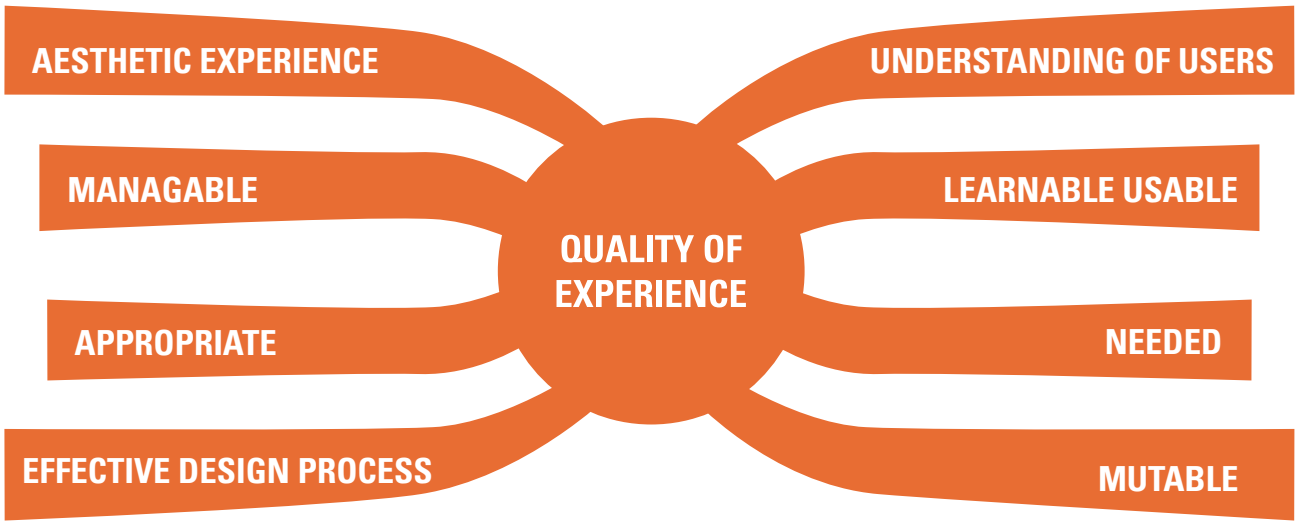
Gaining Relevant BoP User Insights

Gaining relevant insights about BoP cookstove users could help designers develop products that lower the barriers to adoption posed by improved cookstoves. The principles of User-Centered Design (UCD) are increasingly applied in India, China and Africa to design products for the world's BoP markets. UCD focuses on understanding the quality of the user's experience for enhanced design insights. Needs, desires and limitations of first-time users are discovered with 'deep dialogue' and 'deep listening' techniques.

However, reaching the rural BoP user for extensive product testing is demanding, especially for companies with limited time and budgets. Private companies, product designers and researchers targeting BoP consumers need a robust, effective and efficient way to gain relevant initial user insights, while keeping costs low and design on schedule. Can Companies gain rural UCD insights by testing products on urban users?

User Testing in Urban Slums

The concept of product testing with urban BoP users applies UCD principles



4. The quality of experience framework (Alben 1996), originated for technology product development, has been applied to understand first-time BoP user experience with products

as a solution to the real-life constraints of small-to-medium companies. Compared to work in rural villages, designers can collect relevant user insights and meet several design objectives in urban BoP settings. Slums provide a rich, efficient context for rural-targeted product research. In India's growing rural-to-urban migration patterns, many urban BoP households retain their rural conditions and behaviours, such as lacking electricity and cooking with biomass fuels. Of India's urban households, nearly 22% use firewood as the primary cooking fuel. Close proximity to skilled welders, potters and hardware vendors can facilitate rapid prototyping and redesign. Perhaps most importantly, urban testing sites promote frequent and sustained interaction with target users, with minimal interruptions to their daily routines.

Pilot Study Methodology

Building on their pre-pilot research, CDF's Rural Market Insight group conducted a pilot study to explore whether the concept of urban user testing could be applied to rapid prototyping and testing of a rural-targeted BoP consumer energy product. The study addressed the social and design challenges with a low-cost, after-market insert that fits into traditional chulhas and requires minimal behaviour change for BoP households adopting clean cooking practices. The prototype regulator, a metal grate that lifts the fuel-wood off the stove floor, is similar to those found in clean biofuel cookstoves to improve airflow and combustion efficiency.

The hypothesis that urban user testing for rural BoP products can provide actionable design insights for rapid prototyping was developed with the following testable assumptions:

- Urban households are willing and able to test consumer energy products and provide relevant user-feedback
- User insights can be attained on a regular basis
- Select urban households will cook in a manner similar to their rural counterparts
- Urban user product modifications and design feedback will also be similar to rural counterparts
- User insights can quickly be turned into design changes at a low cost

Testing UCD Methods

Several UCD principles were employed in this study. A transect walk provided the method of product observation and participant identification. In weekly semi-structured interviews in the participants' native Tamil language, researchers elicited stories to draw out users' cognitive and sub¬conscious reactions to learning how to use the clean cooking technology. Direct in-home observation tracked product use.

5. Regulator Technology

a: Steel grate in the Envirofit single pot stove

b: Removable steel grate in the Leo double pot stove

c: Prototype of a cottage stove with a steel frame designed by Prakti design

d: RMI designed low-cost, non- invasive regulator insert in a traditional chulha

Urban User Testing: Rapid Prototyping and Deployment in 90 minutes

Meeting participants & taking measurements

Giving measurements to a welding shop close to urban testing site

Fabrication

Quality check

Finished product

Returning to the house & demonstrating how to use the regulator

ACTION

In December 2009 and January 2010, the urban user testing hypothesis was piloted in an urban slum of Chennai, Tamil Nadu through a three-step process: (i) Research (ii) Testing and (iii) Evaluation.

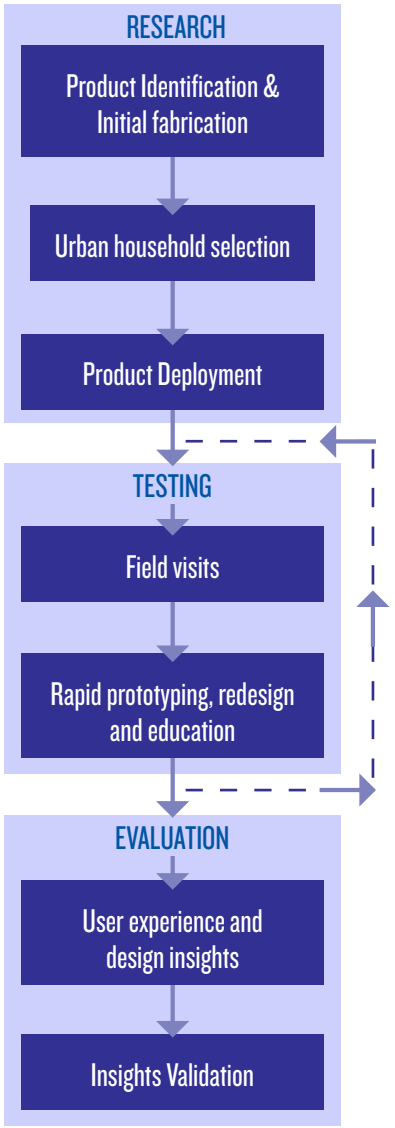
The first rapid prototype fabrication took less than 90 minutes and cost a total of 100 Rupees (USD 2.10). The regulator prototype, made of scrap metal by a local welder, was deployed to a total of seven households for testing.

A product demonstration was given to the participants in Tamil language on how to position the regulator insert in their chulhas and on the importance of removing ash before each use. Households were asked to use the regulator during all cooking activities for an eight-week period, which averaged about four hours per day. The study focused on the quality of the user experience through frequent interviews and direct observation. No incentives were given; participants were allowed to keep the regulator.

Participant Profiles

Participant households had minimal access to electricity, maintained typical south Indian cooking practices and cooked on traditional *chulhas*. All households engaged in domestic cooking twice daily, while two engaged in additional commercial cooking activities. Of the seven households, five cooked indoors and two cooked outside.

6: Study Plan for Urban User Testing of a Rapid Prototype Improved Cookstove Regulator



KEY FINDINGS

User Participation and Access to Resources

In many user testing scenarios, the main unknown is whether participants will use the product as instructed. Six participants integrated the prototype into their daily cooking routines within the first test week. One participant, a food seller with an outdoor chulha, had concerns about how it would change the taste of food. After increased researcher visits, the participant began to regularly use the regulator and reported no change in taste or customer reaction. Frequent visits allowed researchers to quickly resolve concerns and monitor participation.

Urban resources allowed for quick, cost-effective prototyping, modifications and same-day deployment. Three welding shops within a 1km radius of the urban testing site could fabricate to exact specifications in the same day and provide deep discounts on bulk orders. In contrast to rural villages, the urban setting provided a wide range of resources, including skilled trade shops for electronics, carpentry, metal and plastics.

7: Urban user testing facilitated rapid prototyping of a BoP consumer energy product and collecting actionable user feedback.

Lowering barriers to adoptions

The regulator insert introduced traditional chulha users to improved cooking technology while allowing them to maintain their traditional cooking practices on their existing stoves. Frequent in-home visits with participants uncovered two insights about clean cooking technology that require BoP user behaviour modifications: the need to remove ash before each use and the restricted fuel use in the chulha.

In southern India, ash is commonly allowed to build up in the stove for 2-4 uses. However, piled ash reduces airflow underneath the fire and compromises stove efficiency. Users of improved cookstove technologies must remove ash from the stove before every cooking session. With targeted education and demonstration of ash removal, it took fully two weeks for study participants to modify their cooking habits to include ash removal before each meal.

Second, participants reported that the addition of the regulator prototype limited the amount of fuel wood that could fit inside their chulhas. Although it may not seem to be a drastic behavior modification, reducing fuel quantities was considered by some users as an interference with their cooking practice.

Perceived Benefits of Clean Cooking Technology

Participants reported that their stoves were easier to light while using the regulators. All households reported their chulhas emitted less smoke with the regulator inserts than before the eight-week study. Gauging smoke with visible indicators, the five indoor cooking participants reported less dust and soot on the walls and in cobwebs around the stove.

The seven urban BoP households that participated in the study demonstrated a strong willingness and ability to test consumer energy products without incentives. Follow-up interviews five months after the pilot study revealed that five of the seven households were still using the test regulators daily. The remaining two regulators had broken and the participants asked for replacements.

Insights from Urban User Testing

- Low cost
- 90-minute prototyping
- Frequent participant interaction
- Continued product use after study
- Less perceived smoke

INSIGHT

Low-cost, High-contact User Testing

Urban BoP user testing minimized the logistical and financial constraints associated with user testing and rapid prototyping. This study provided actionable insights that informed not only future design improvements, but also on the need for user education for BoP consumer energy products. UCD methods allowed researchers to establish trust with participants, through frequent visits and minimal interruptions to their daily routines. Close proximity to participants allowed for low-cost, high-contact interaction and continuous tracking of user behaviours that would have gone unnoticed with less contact. Additionally, the urban space is home to

8: Deeper understanding of BoP users' needs, wants and behaviours can yield actionable design insights for clean energy technology

skilled local resources, such as experienced welders and repair shops, that assist in turning design into rapid prototyping for deployment at a very low cost.

Implications for BoP Product Design Companies

The realities of life in urban slums undoubtedly influence the quality of user experience. However, the insights from urban user testing have strong implications for go-to-market strategies of rural-targeted BoP consumer energy products. While it will always be necessary to conduct testing with rural users, urban BoP user testing sites can facilitate early-stage product design, prototyping and user testing before extensive rural testing is considered. Urban design and testing labs can help researchers collaborate and create prototypes on a large scale. The sites offer a wide variety of resources, which can quickly turn user insights into manufactured design changes at minimal cost. Urban user testing economizes the budgets, time and logistical effort required by early-stage rural product design testing.

Deepening Impact for Improved Cookstove Users

The new user-centered approach of government schemes, such as the National Biomass Cookstove Initiative, encourages further research into BoP user experience. Deeper understanding of BoP users' needs, wants and behaviours can yield actionable design insights for clean energy technology. Design that lowers the barriers to adoption can increase the likelihood of the sustained use of energy-efficient, health-improving products among India's BoP households.

This study was conducted by Selvan Thandapani and Richard Woodbridge, researchers with CDF's Rural Market Insight team.

For more learnable action research by Rural Market Insight, check out more briefs in this design series:

- Can Urban User Testing Reveal Relevant Insights for Rural BoP Consumer Energy Products?
- Can Urban User Testing Labs Evaluate Rural Solar Lighting Solutions?

Additional Resources

Global Alliance for Clean Cookstoves www.cleancookstoves.org
Ministry of New and Renewable Energy www.www.mnre.gov.in
Ministry of Statistics and Programme Implementation www.mospi.nic.in/Mospi_New/site/home.aspx
National Biomass Cookstove Initiative www.web.iitd.ac.in/~nbci/Objectives.html
World Health Organization www.who.int/indoorair/en

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