This August, the Tata sister-center at IITB organized a three-day field trip to various areas in the state of Maharashtra in India. This was part of a week-long orientation for students at both MIT and IITB to observe first-hand the challenges faced by different communities, businesses, and organizations: their way of life, infrastructure, and needs.

The first trip was to a slum called Dharavi in Mumbai. The second trip was to a village called Moravali, located six hours south of Mumbai amidst the lush green Sahyadri mountains. Next, we visited a village called Phaltan, in the same district as Moravali, which appeared to be in a dry spell, leaving farmers without an income. Finally, we stopped by ARTI (Appropriate Rural Technologies Institute) where engineers showcased frugal inventions mostly for agriculture and energy.

These trips were fascinating because they brought me face to face with all the paradoxes and contradictions of India, and thus gave me a firsthand view of the engineering challenges that make sense to invest my time in.

When I read stories reporting how freely distributed malaria nets are being used to guard cattle or fish, rather than protect infants (cont. inside)
or how free and clean cook-stoves are willfully abandoned for traditional smoky ones, I have an existential crisis of sorts with regards to fully committing myself on my own Tata project: Will I be investing two years in building something, only to see it abandoned? Of course, randomized control trials are an effective way to answer this question, but the control trials come after the invention. Is there a way to gauge the end-users’ interest beforehand, and thus not turn my efforts into a fool’s errand? These trips were a unique opportunity to get some answers.

One famous story about Dharavi is from a true incident in the 90’s. At that time the government gave free housing to the slum dwellers, with better space, indoor plumbing, and no leaky roofs. But to everyone’s surprise, the slum dwellers rented out the space instead, and chose to stay in the slums! Stories like these could give a pause to any engineer/scientist. What if he/she works to invent something that can make a difference in these people’s lives, but the people it is intended for don’t value it?

Dharavi is often referred to as a “slum,” but the moniker does little justice to its dynamism. Yes, the place is squalid and unimaginably crowded. In a number of areas of Dharavi, the stench is unbearable. The yearly monsoon only makes things worse, by spreading dark green waters everywhere. But in this “slum” I was surprised to see the abundance of cell-phones, TV antennas, and kiosks well-stocked with consumer goods.

Not a single household had indoor plumbing, but people were seen bathing in public. They pay money to buy soaps and shampoo, but don’t value an indoor facility (or a spacious dwelling, given to them for free) which would give them the convenience to bathe at home. Yet clearly they value lots of things, enough for vendors to set up a marketplace, enough that private cable and phone companies have set up towers and antennas right in the middle of Dharavi.

Apart from consumer goods, Dharavi has numerous industries that operate on a staggering scale, considering the infrastructure they have to make do with.

A vendor showed us plastic pellets which he apparently sources from waste from all over Mumbai and recycles into products. That seemed like a wonderful private-enterprise driven recycling project! Along the way, we stopped by a giant furnace where workers baked puff-pastry. Our tour guide remarked that this pastry is then distributed all over Mumbai, with some distributors choosing to change the packaging to not highlight the fact that it was made in a slum. Then finally we visited the leather tanneries. Here we saw massive heavy-steel machines in operation. By some estimates this industry in Dharavi is worth half a billion US dollars. Next to the tannery was a showroom, clean and air-conditioned, with two walls of shelves exhibiting handbags, belts, and wallets. There was even a refrigerator for the salesman to stock water and sodas (“thandas”) for his guests. All this in a so-called “slum.”

The next three trips were entirely in a rural setting. In Moravali, a resident of the village patiently took us around explaining their way of life, the tools that they use, and their needs. The village had the usual staples - a Panchayat office, livestock and pets running across the streets, small schools, and lots of dry firewood stocked inside the attics of houses.
As we walked back to the tour bus, I asked why the villagers burn agricultural waste, which is a huge source of airborne particulate emissions in India. To my surprise, he said that the villagers believe burning the waste will lead to a bountiful harvest the next year. That left me momentarily speechless. Being a participant in an agricultural waste-to-energy thermochemical project, I could see the uphill battle that such a device would face. Every such device is built on an assumption that waste is a problem taking up real-estate, and more importantly, that it can be obtained for free. If one has to take away the agricultural waste, he/she faces the headwind of a belief system – and it won’t be cheap.

In his classic treatise “The Diffusion of Innovations” the late Prof. Everett Rogers recounts an episode of social workers who had great difficulty in convincing villagers in Peru to boil water before consumption to prevent disease. The villagers refuse, because in their folklore, boiling water is only for the sick. They don’t buy the germ theory when explained to them, coming up with all sort of retorts like “If the germs are too small to be seen, how can they attack humans,” etc. Prof. Rogers explains the importance of social change for an innovation to get widespread acceptance.

Prof. Rogers’ examples suddenly felt so relevant. If it took great pains to convince people adopt medical practices that demonstrably save lives, I wonder how are we to approach challenges with an invisible enemy – like pollution that has dispersed in the environment, CO2 emissions, and waste that is thrown into rivers or burnt away.

Our last visit was to a rural technology institute (ARTI). Here we were shown extremely low-cost innovations like a cooker that runs on biomass briquettes and cooks rice, clean cook-stoves for households and industrial scale kitchens, solar-heat dryers, biomass pyrolyzers etc. Here we had a very delicious lunch provided to us at the institute canteen. Being inquisitive about recipes I entered the kitchen and was a bit surprised to see that all the cooking was done with LPG in conventional cook-stoves. I asked our guides why they would not use the biomass based cook-stoves which they described to us in great detail. An icy silence answered my question, and I brushed off the issue.

On the flight back to the USA, I pondered the original question – why are certain innovations perpetually difficult? Like inventing a better cook-stove, which has very visible benefits, such as being smokeless. In this trip, we even encountered some designers who did not use their designs in their own kitchen! But in other areas, even slums, we can see a vibrant market. Perhaps innovations work best in India when they are used for businesses, as opposed to those geared for personal use. So cellphones will sell like hot cakes but cook-stoves have difficulty gaining acceptance. That bodes well in fields like agriculture and energy, which are generally used as means to an end. But for fields like housing, environment and healthcare, which impact the consumer directly, innovations may be a tough sell. On the latter, I sincerely hope that the future proves me wrong, for humanity’s sake.

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Student Insights

Dharavi:
• “Many people in India put the well-being of their families above their own (working in terrible conditions in order to bring money back for their family)”
• “Seeing the enormity of the reality of poverty [helped me realize] that there are many different problems and all potential solutions are interconnected”
• Informal settlements showcase “extreme capitalism”

Village Visits:
• “The well-being of individual villages can be highly correlated with location. It seemed that the village in the rainy area lived more comfortably than the village in the drought area”
• “Reliable access to water was a prominent concern for both villages. Access was not difficult only due to technological limitations (pumping, power, storage), but also for political/societal reasons (damming, other communities, etc.)”

ARTI:
• “It seems that the technology already exists to solve many problems that we, engineers in developed nations, are trying to solve, and that the larger challenge is how to ensure technology adoption and how to aid in developing self-sustaining businesses surrounding these technologies”

Calendar of Competitions

Several Tata Center teams have benefited from entering technology and/or business plan competitions, including Eco-BLAC Bricks, Khethworks, NaviChem, and others. Here’s a look ahead at the key competition dates for this academic year.

MIT IDEAS Global Challenge
Oct. 29: First chance to enter
Jan. 14: Second chance to enter
Feb. 18: Last chance to enter globalchallenge.mit.edu

MIT $100K Pitch
Sept 21: Applications open
Oct. 2: Applications due mit100k.org

MIT $100K Accelerate
Nov. 12: Open for entries mit100k.org

MIT $100K Launch
Feb. 20: Open for entries mit100k.org

MIT Clean Energy Prize
Feb. 8: Applications due cep.mit.edu

MIT Water Night
Feb 20: Submit poster abstract
Mar. 5: Water Night event waterclub.scripts.mit.edu

Global Founders’ Skills Accelerator
April 5: Applications due entrepreneurship.mit.edu

Note: Some dates are tentative and may change. Questions? Talk to your postdoc or stop by the Tata Center office.

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