Tata Centre
Technology and Design, IIT BOMBAY

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TURNING POINT

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Inside

Collaborating with MIT-Tata Center

The recent TCTD Symposium 2018 saw joint projects taking shape supported by both Tata Centres, at IIT Bombay, and MIT USA

Hindi Shabdamitra: A digital aid for language (Hindi) teaching and learning is the first Education project at TCTD, IIT Bombay, with a collaboration to announce. A research team from MIT-Tata Center will also work with the project team at Tata Centre, IIT Bombay, to bring in tools of machine learning and make the existing Hindi Shabdamitra platform more automated and data-driven.

This collaborative project between Tata Centre, IIT Bombay, and the MIT (Boston) Tata Center aims to develop models, algorithms, and software to assess a novice learner's Hindi language mastery with exceptional detail, efficiency, and accuracy. The software will be piloted alongside the Hindi language teaching tool - Hindi Shabdamitra - here in IIT Bombay. APIs will be developed to allow the software to benefit other applications, not only as a standalone assessment tool, but also as an enabler of more advanced personalized learning technologies and content recommendation systems.

Targeting the digital assessment of Hindi language learners, this joint project has faculty from both Institutes – Prof Malhar Kulkarni, HSS, Prof Pushpak Bhattacharyya, Director, IIT Patna, Prof Preethi Jyothi, CSE, Prof David Simchi-Levi, MIT IDSS and Chancellor Cynthia Barnhart, MIT, and Michael Beeler, research student at MIT – doing collaborative work.

Another joint project, proposed in TCTD Symposium 2018 and now awaiting approval, is the development of an aerogel based solar steam generation system resulting in reducing the cost of sterilization in rural and suburban hospitals. The proposed design is expected to be fabricated and eventually manufactured locally, with the supply of aerogel from MIT, USA.

- Gayathri Thakoor, Project Manager

TCTD Symposium 2018 – A Reflection

TCTD Symposium 2018 was the first annual conclave hosted by Tata Centre for Technology and Design (TCTD) at Victor Menezes Convention Centre, IIT Bombay, on 17th and 18th January, 2018. The theme - Innovate to Transform – had eminent speakers, panellists and faculty members speaking about how science and technology could only bring about prosperity and transformation to society.

Links to the videos on talks and panel discussions, the photo gallery, and a booklet about the symposium have been shared on page 8.

Easing access to information

VMOCSH aims to provide equal access to information in a low-cost and effective way to the underserved and illiterate population

This is an interview with Prof Kameswari Chebrolu from the Department of Computer Science & Engineering, the PI of the project - Voice based Mobile Crowd Sourced Helpline (VMOCSH).

Q. Please give us an overview of the VMOCSH project.

The inability of the underserved, illiterate population population to easily access information through common online sources such as Google, Quora etc. makes them heavily dependent on information that may be outdated, incomplete or irrelevant. We felt that this was a basic need that needed to be fulfilled, and that is what VMOCSH does.

Q. How did your team achieve this objective?

Our team has developed an application (app) that links the tech savvy experts and information hungry consumers through a helpline number. Anyone who wants information can call on the helpline and select the category of their query with an IVR (Interactive Voice Response) assistant. This request is recorded and a task based on the recording is created and forwarded to `expert' volunteers, who have the app installed on their smartphone. Once they have accepted the task, they can anonymously reach out back to the consumer and provide the desired information, either in a single call or in multiple calls. The IVR system also calls back the consumer afterwards to enquire about their level of satisfaction after the help was provided.

Q. How would you rank your solution in terms of its novelty?

Although people have been providing and receiving information for some time, a majority are unidirectional, where pre-recorded information is passed on when they call for enquiry. Our solution moves away through the involvement of `expert' volunteers who are connected to the users through our app. When a request for information is raised, it is converted to a push notification that gets displayed on the volunteers' phones. The volunteers can take up these requests in their spare time and get back to the consumers at their own convenience. Thus, volunteers are not expected to be on call all the time and can carry out with their primary work, handling these requests of information as their secondary tasks in their free time. This reduces the costs significantly, as volunteers can work from their homes, without any dedicated equipment. Moreover, our setup overcomes geographical and language barriers by accepting requests in local languages and routing them to relevant volunteers, who need not be from where the call originated. Our system also helps in preserving the caller's and the information provider's anonymity, thus ensuring privacy for both parties.

Q. Have you tested your product until now?

We've conducted two field trials already, and are in talks with a third collaborator to test our solution with them. The first one was with the Abhyuday group, IIT Bombay, to provide career counselling for students of municipal schools. The other one is Maa & Shishu Poshan helpline that is being carried out with Dr. Rupal Dalal, a pediatrician who's tackling the problem of malnutrition. We are talking to BAIF (Bharatiya Agro Industries Foundation) and will be setting up an agricultural helpline for them.

Q. How do you develop your target audience for your product?

As a team, we consciously target groups that are already working at grass-root levels. Dr. Dalal has been working with tribal women on malnutrition. Similarly, BAIF works with farmers. Thus, instead of targeting the consumers directly, we target organizations that are directly working with the consumers.

Q. What sort of challenges do you envision going forward?

The number of incoming calls with the Abhyuday helpline is not very high right now. A possible reason could be that the students are busy with their exams right now and would reach out for career related information later. However, it has shown us that having strong ties with the community is of utmost essence for more users.

Another challenge is to design strategies that incentivize people to become volunteers. Currently, we are leveraging trained and dedicated people who are already a part of the system to work as volunteers. Going forward, we would have to recruit many more to widen our volunteer base.

Q. How do you plan to incorporate the learnings from your trials in your future designs?

Based on the feedback, the design has undergone quite a few iterations. However, we still want to incorporate additional technical features. One of the realizations has been the need for supporting outbound calls in our system because there are times where some of the communities want to reach out through surveys to collect information. Another possibility is accepting requests not just via calls but also through texts or WhatsApp. We could potentially link up our system to create tasks based on requests received from such messengers. We have also incorporated a lot of data analytics at our back end to analyze the types of information that are being sought out. This opens up possibilities for creating chat bots that could interface with the consumers and provide information. In case it is not present or the consumer is not satisfied with the information provided, we can then escalate the task to concerned volunteers.

- Jasleen Chhabra, Tata Fellow 2016

Speaking of co-gasification as a preferable option

Dr Sonal Thengane, Tata Centre's Post Doctoral Fellow, presented how biomass gasification has received interest as an alternative to coal gasification, at a recent conference in London

Sonal Thengane, Post Doctoral Fellow at TCTD, IIT Bombay, presented his research work on co-gasification of high ash coal and biomass at the 5th International Conference on Recycling and Waste Management (Recycling Congress 2018) at London, organized by Allied Academies. The conference was scheduled from 5th - 6th March, 2018, in Heathrow, London, with about 40 speakers from different universities and the centres.

This conference provided key insight into the research being carried out in different parts of the world on waste management and recycling with particular emphasis on solid waste.

The idea of integrated waste management proposed by Dr Sonal attracted positive response. Speaking of how co-gasification offers environmental and technical benefits over individual feed gasification, his found it a preferable option for various biomass and coal mixtures. He presented a paper on the effect of mixtures of high ash coal (20 - 35 %) and high ash biomass (e.g. garden waste pellets with 20 - 25 % ash) in different proportions, on the composition of syngas, in a fixed bed downdraft reactor of 5 kg/h capacity. The results of the present study undertaken in this project guided by Prof Sanjay Mahajani, Dept of Chemical Engineering, would successfully establish the optimum operating conditions for stable co-gasification operation for high ash coal and high ash biomass

Dr Sonal also served as the moderator for the conference on Day 1, anchoring the event and managing the sessions on different waste management practices.

- Dr Sonal Thengane,
Post Doctoral Fellow

Walking in their own space

The TCTD experience has been a source of motivation to many young enthusiasts, helping them visualise their dreams

Here are four different voices which have been an integral part of Tata Centre, and have yet managed to walk their own.

The need for technical education and technological innovation to solve social problems has been felt, but what happens when ideas from rural geographies have no facility created to explore them. This is precisely what got Pratik Gadkar, a former project engineer at Tata Centre, started. Wanting to facilitate this interest in the rural areas since there were maker spaces in the urban belts, Pratik and his team have targeted the rural interest by setting up lab facilities and running them too, since September 2016. The challenge all along has been convincing people to give value to technological innovations.

With Technoventor Innovation Pvt Ltd. having offices in Nagpur and Pune, the team of 10 is currently working with the Chhattisgarh government setting up lab facilities in the Dhantewada district. The team is also working with Vigyan Ashram, at Pabal, Pune, which recognises the company as an incubated start-up. After being a part of the Fab Academy and the training sought at Tata Centre, he has just turned achiever having reached the Rs 1 crore milestone.

Pratik's team has set up about six lab facilities already, and is finalising course content to conduct small fabrication workshops. He hopes to create self-sustainable facilities in rural areas where the users have no funds constraints, and self-reliant entrepreneurs emerge.

Zubin Savla, formerly a project technical assistant at the Centre, was inspired by the machines and tools in the machine lab, at Tata Centre. A year's experience at the Lab gave him enough motivation to pitch his ideas to the maker space outside IIT Bombay.

Coming up with the concept of Story of Makers in 2017 where makers from all over India – from kids to grandparents - could be given a platform, Zubin hoped they could showcase their ideas and prototypes. What caught the fancy of many was the chance to create irrespective of degree, age or gender. A huge turnout, 12 out of the 144 teams that had applied were incubated by an industry collaborator, Navneet Education Pvt Ltd. Seed grants, sponsorships and mentoring support to many young teams was a huge advantage that Zubin's young team brought in.

This experience brought him onto the current idea of creating a small space – Library of Everything – which houses books, tools and toys. With open access to all, this space plans to give hands-on learning courses and introduces personalised education. The same 22-member team is active on this project, with Zubin.

Next on the agenda is to set up a 2,000 sq ft maker space where anything can be fabricated by hand. The team is looking for funds and spades to build the maker space culture in a small way.

With a strong background in microbiology and research in basic sciences, Chandrakala Sharma started with TCTD as a research assistant, meeting the challenges in remote areas. She had several solutions in mind and tested some of them in the lab. As project manager of the food and agriculture domain thereafter, she has taken on the problem of livelihood generation through oyster mushroom cultivation.

This problem has been identified for the farmers with the challenge of maximising the resources at hand. Chandrakala ensured that after a protocol had been deployed at Modgaon in Palghar district and Ghodegaon in Pune district, with TCTD and the Integrated Tribal Development Programme - a scheme run by the Ministry of Tribal affairs, Govt of India - this project will be benefiting 150 tribal women in both the districts.

Her work brought out the fact that a transfer of the technology solution to the population was just not the answer. Instead, handholding them from the cultivation to market process would ensure that all the entities in the innovation ecosystem were linked. If that meant bringing in ITDP with the funds, TCTD with the technology, her own proposed start-up for the outreach of the product and collaborating with distributors and end consumers like celebrity chefs for demand, the entire network had to be knitted together.

Chandrakala is working on building a system where each SHG of 10 women, turns self-reliant and sustainable in 4-5 years. Having dedicated time and effort, Chandrakala hopes she can make waves with the new product in the form of innovation and market creation.

Vishwambhar Patil had always been curious about research and development in IIT Bombay, and he explored this completely in the jaggery project that he has been working with, under Prof Sanjay Mahajani. A research staff person in the Dept of Chemical Engineering, he felt that this product innovation could have substantial social impact. As an outcome of his quest for research in the lab, the opportunity to run the jaggery plant at Warananagar, in Kolhapur, came along.

Helping the department to run the plant since the past year, there have been several innovative products on display: the crystallizer, mould and dryer. What Vishwambhar has been satisfied with is delegating responsibilities, upgrading the plant processes, and looking for collaborations. Given a choice, he would like to run the plant on his own with collaborations after the 2018 season, once the challanges are overcome.

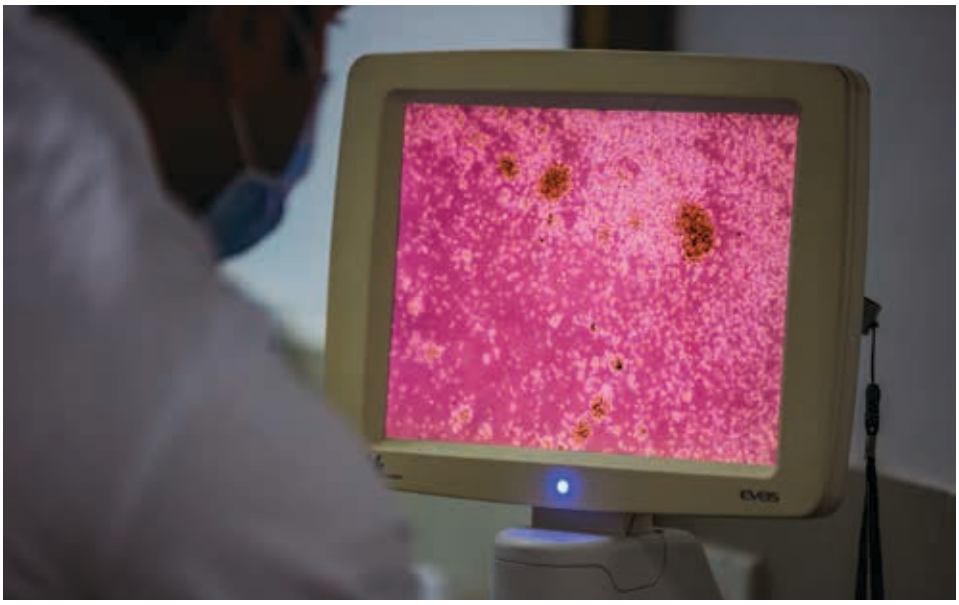
With limited research conducted in jaggery, trials are constantly on and development is not taken as seriously. Changing the mindset of the investors, collaborators and the jaggery plant operators for newer and innovative processes is a big challenge for Vishwambhar. He is actively identifying funding agencies which can offer R&D support and materials support.

Amidst several enquiries about how the design of the old plant has turned anew, he is focusing on an array of jaggery products - cubes, powder and moulds. While the food certification is just around the corner and also a partnership with a local marketer, Vishwambhar knows his plans will work.

- Gayathri Thakoor, Project Manager

Fighting cancer the CAR-T way

This Tata Centre project aims at developing the CAR-T cell platform for cancer immunotherapy



Acute lymphoblastic leukemia (ALL) is the most common type of cancer in children, affecting B-cells or T-cells of the immune system. This weakens the immune system, making children more prone to infections. Prof. Rahul Purwar and his team, from the Dept of Biosciences and Bioengineering, have been working on CAR-T (Chimeric Antigen Receptors) cell technology- a combination of cell and gene therapy, to fight these cancer cells. The technology involves genetically engineering the body's immune cells (using lentiviral particles as gene delivery vehicles) in the lab and re-infusing them into the patients' body to kill off the cancerous cells.

While the technology has been proven abroad in long-term remission of cancer patients through multiple clinical trials, no such technology currently exists in the country. The prohibitively high costs associated with the CAR-T cell treatment have so far restricted its application on a wider scale. However, the team has worked tirelessly along with Dr. Gaurav Narula at Tata Memorial Centre (TMC), to indigenously develop the technology for cost-effective and affordable treatment of B ALL individuals.

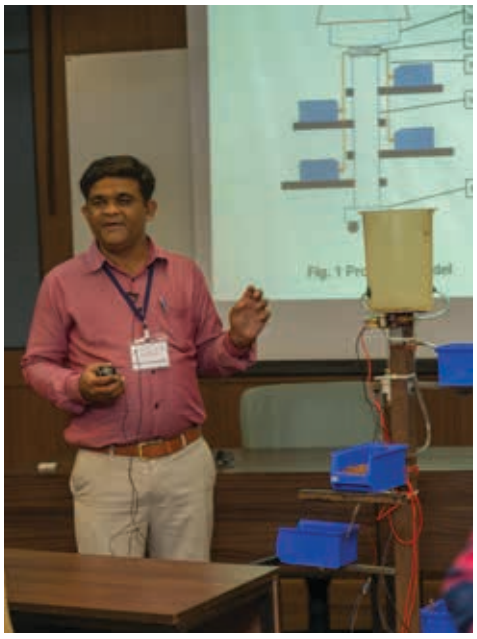
Overcoming the lack of trained staff and state-of-the-art infrastructure, the team has made significant progress and is presently at the cusp of establishing a state-of-the-art clinical infrastructure for GMP (Good Manufacturing Practices) type of work. The team has developed the technology at the laboratory scale and has even filed two patents during this process. The next step is taking this technology to the clinical level. However, lack of infrastructure at the clinical sites is one major hurdle. Since this would also be the first-in-human clinical trial with a genetically engineered product in India, the team has collaborated with National Cancer Institute, USA, to get clinical training and acquire the skill set for the clinical work. The team is expecting the clinical trials to start within the next 1 - 1.5 years.

- Jasleen Chhabra, Tata Fellow 2016

Continuing courses in innovation

The Continuing Education Programme (CEP) course on End to End Innovation is a part of the Centre's outreach initiative to encourage innovation in the academic circles of the country

Tata Centre got back to its lesson plan of conducting courses in End to End Innovation in the academic circles outside IIT Bombay. As a part of the Continuing Education and Quality Improvement Programmes at IIT Bombay, the Centre organised a five-day course which was a combination of lectures, case studies, project exercises and lab sessions put together. The challenges involved in designing and implementing technology solutions for identified needs, and eventually reaching them to the end consumer, was brought out in an interactive manner through this course. With 24 participants from Basaveshvar College of Engineering, Bhagalkot, Karnataka, the course had its sessions spread across five days.



The topics covered included building a culture of innovation, institutional collapse, an Indian perspective on taking an idea to incubation, need finding and identification, participatory technology development, nature borne innovation, value innovation and reverse innovation, and on unanimous request – intellectual properties and patents. Case studies based on the Centre's projects in food and agriculture, education, waste management and healthcare, were presented to help the participants understand the various aspects in the innovation process.

Structured as a theory-cum-practical course, the uniqueness was the lab component. While there were lectures based on case studies and lessons in innovation in the mornings, the afternoons were power-packed with hours of building prototypes in the Tata Centre's Lab. This meant that the participating faculty members got involved in hands-on fabrication.

A portable vertical vegetable growing system, a micro hydro power generator for a multi-storeyed building, a thermo-syphon air cooling system, a neem seed collector and a robotic seed sowing device were some of the applications that these participants developed over those five days. There is interest for these faculty members to continue working with the Centre on several of these projects and to also send their students in the ensuing months.

- Gayathri Thakoor, Project Manager

TCTD Symposium 2018 – A Reflection

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Video Link https://goo.gl/iqFwTC

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